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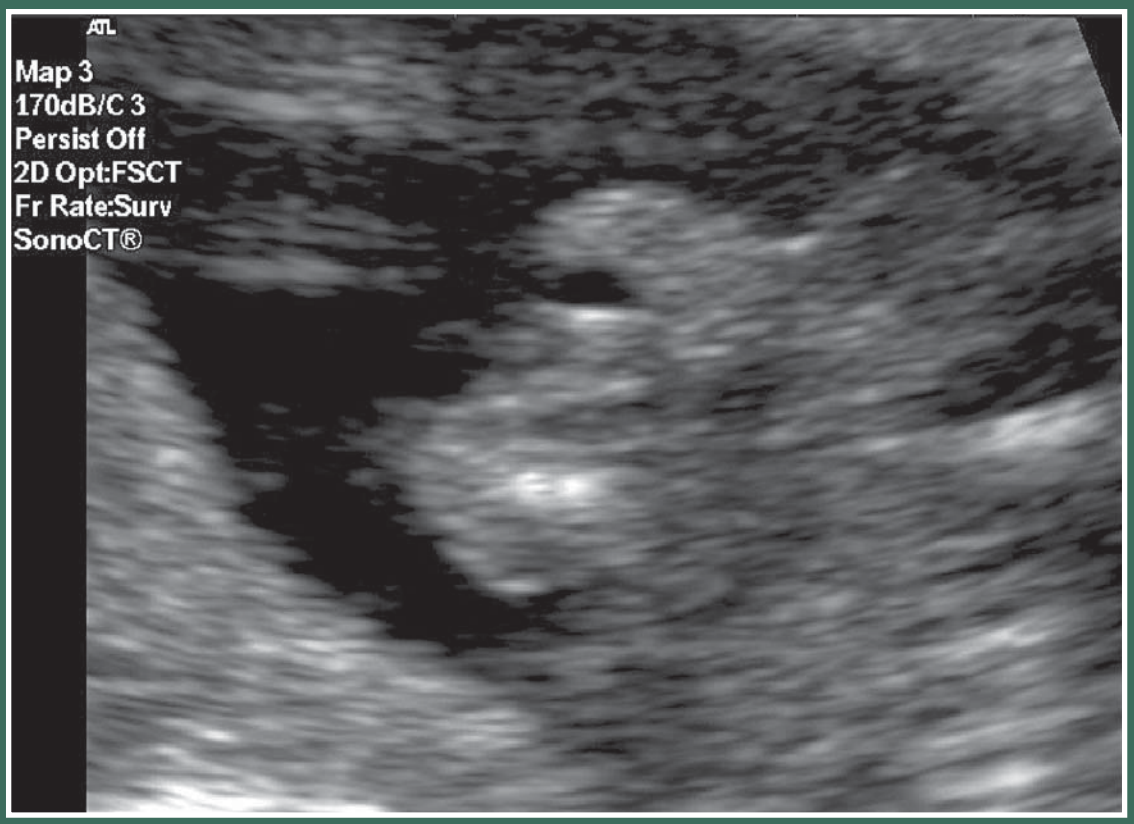
Ultrasound Bulletin

Journal of the Australasian Society for Ultrasound in Medicine



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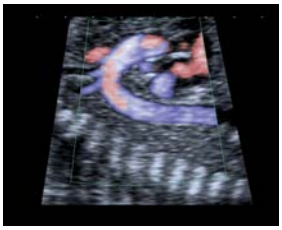
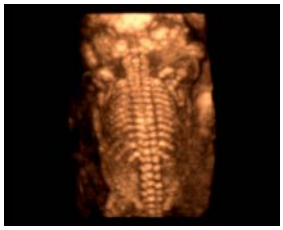


Aortic arch



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Australasian Society for Ultrasound in Medicine

Ultrasound Bulletin

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Original research, case reports, quiz cases, short articles, meeting reports and calendar information are invited and should be addressed to The Editor at the address below

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EDUCATION

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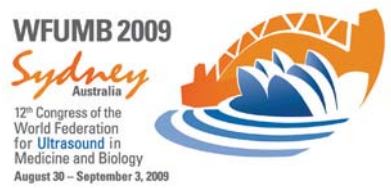

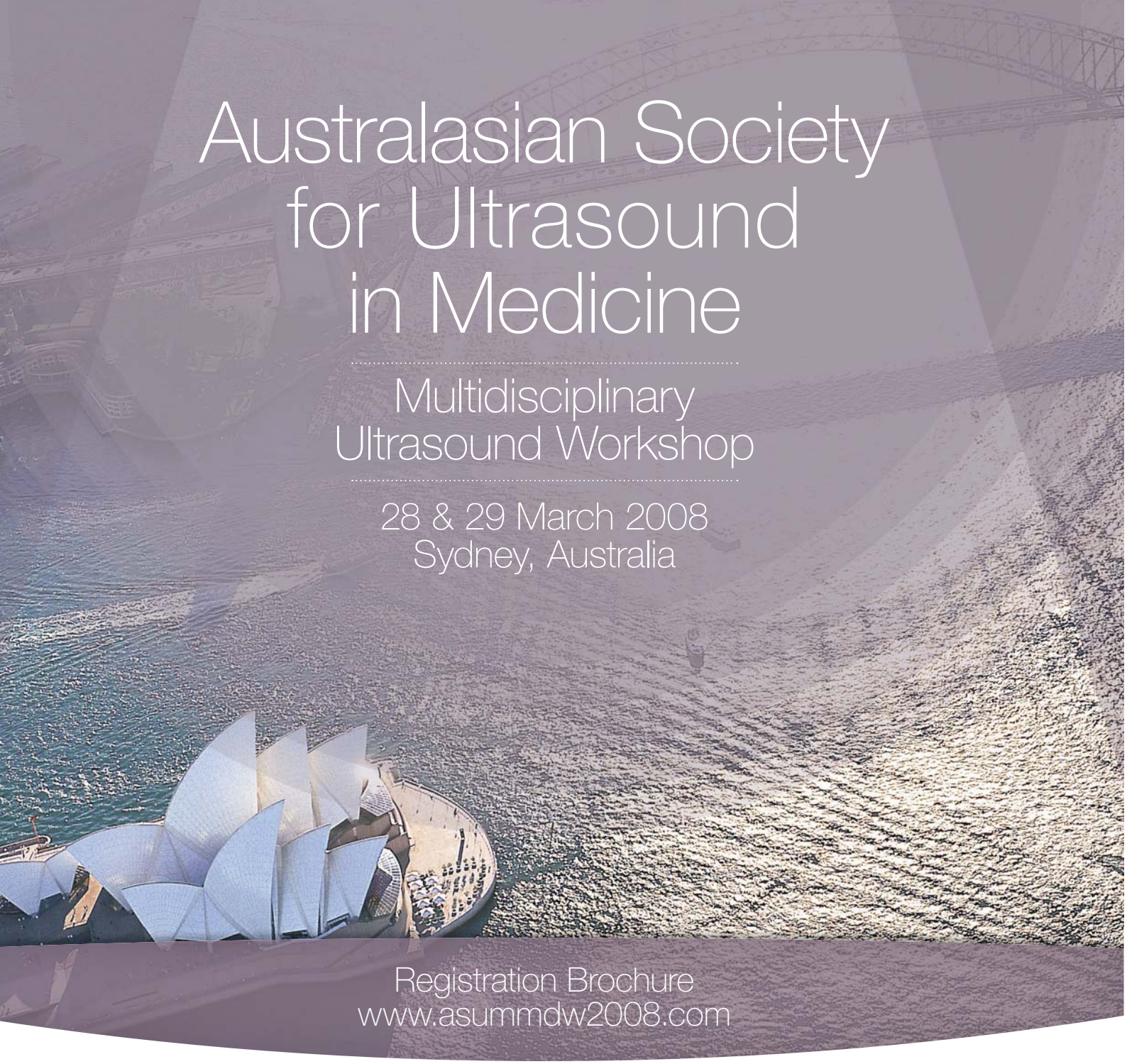

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Dr Andrew McLennan
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The program is subject to change at any time without notice.

** Please indicate on your registration form which concurrent session you will be attending.*

Wednesday 26 March 2008

DMU Preparation Courses and DDU Technical Seminar

- Physics

Faculty : Mark Bryant, Roger Gent & Rob Gill

Thursday 27 March 2008

DMU Preparation Courses and DDU Technical Seminar

- Physics

Faculty : Mark Bryant, Roger Gent & Rob Gill

Nuchal Translucency

Course organised by Ann Robertson (RANZCOG)

Course convenor: Andrew McLennan

Faculty : Jon Hyett, Andrew McLennan, Vanessa Pincham, Ann Robertson

Friday 28 March 2008

DMU Preparation Courses

Vascular

Cardiac

General & Obstetrics

Obstetrics & Gynaecological Ultrasound Symposium

- Neonatal Spine
- Ultrasound Guided Paediatric Interventions
- Obstetric Ultrasound: When? Why? How?
- First Trimester Anomaly Detection
- Thoracoabdominal abnormalities
- Fetal Ocular Pathology
- Multiple Pregnancy and Fetal Therapy
- Early Pregnancy Complications

Faculty : Ron Benzie, Alan Cameron, Danny Challis, Terry Chang, George Condous, Hans Peter Dietz, David Elwood, Jon Hyett, Greg Kesby Simon Meagher, Ashley Robinson, John Smolinec

Format : Lecture Sessions

General Ultrasound

- Paediatric Hip/Spine, Renal and Abdomen
- Upper limb neuro
- Fetal Heart
- Calf/thigh muscles
- Renal
- Interventional Ultrasound
- Salivary Glands
- Thyroid
- Forefoot pain
- Hip/groin
- Testes

Faculty : Matthew Andrews, Stephen Bird, Roger Gent, Jo Lennox, David McCauley, Neil Simmons

Format : Live Scanning Workshops, Lecture Sessions

Vascular Ultrasound

- Cerebrovascular Disease Clinical Perspectives
- Is there a High Risk Plaque for Stroke and what's the current Status of Carotid Stenosis Grading?
- Carotid Endarterectomy vs Carotid Stenting
- Duplex follow-up after Carotid Stenting
- Peripheral Arterial Disease Clinical Perspectives
- Ankle Brachial Indices – are they relevant?
- Current Status of SFA angioplasty/ stenting
- Importance of a Surveillance Program following Infrainguinal Bypass Grafting
- Pre & Post operative Imaging for Haemodialysis Access
- Carotid Duplex
- Lower Extremity Vein Graft Imaging
- Upper Limb Arteries & Veins
- Aorto-iliac & Lower Extremity Arteries

Faculty : Bernard Bourke, Alan Bray, Alison Burnett, Deb Coghlan, Jenifer Kidd, Virginia Makeham, Elizabeth Pluis, Philip Walker

Format : Live Scanning Workshops, Lecture Sessions

Saturday 29 March 2008

DMU Preparation Courses

Vascular

Cardiac

General & Obstetrics

Obstetrics & Gynaecological Ultrasound Symposium

- Fetal Brain Development: Systerna Magna and Cerebellar Vermis Development and Anomalies
- Ultrasound in the Delivery Suite
- Fetal Therapy Update
- Pediatric Surgical Overview of Thoracoabdominal abnormalities
- Uterine Anomalies: Role of 3D/4D
- Evaluation of Endometriosis
- 3D/4D and Surgical Practic
- Updating Clinicla and Molecular Genetics
- Ultrasound and Infertility

Faculty : Ron Benzie, Alan Cameron, Guy Henry, Glenn McNally, Simon Meagher, David Mowett, Andrew Ngu, Ashley Robinson

Format : Lecture Sessions

General Ultrasound

- Hip/groin
- Paediatric head
- Common Pitt falls
- Shoulder
- Fetal Heart
- Abdominal vasculature
- Neck/Salivary
- Wrist/hand/elbow
- Scrotum
- Forefoot Pain
- Hernias
- Abdomen – Biliary Tree
- Ankle

Faculty : Stephen Bird, Roger Gent, Rob McGregor, Delwyn Nicholls, Ann Quinton, Neil Simmons, Robin Tantau

Format : Live Scanning Workshops, Lecture Sessions

Vascular Ultrasound

- Aneurysmal Disease Clinical Perspectives
- Evolution and Current Status of Aortic Grafts for Repair of AAA
- Duplex Ultrasound for Endoleak Detection and Aortic Endograft Assessment
- Renal and Mesenteric Disease
- Renal and Mesenteric Imaging – Optimisation is everything
- Venous Disease Clinical Perspectives
- What's new in DVT management and follow up
- Varicose veins and perforator disease – What the surgeon needs to know
- Upper Extremity Venous Thrombosis – U/S Diagnosis and follow up
- Aortic Stent Graft Imaging
- Renal & Mesenteric Artery Imaging
- DVT Imaging
- Venous Incompetence Imaging

Faculty : Alan Burnett, Kathryn Busch, Deb Coghlan, Debbie Hamilton, John Harris, Jenifer Kidd, Andrew Lennox, Philip Walker

Format : Live Scanning Workshops, Lecture Sessions

Sunday 30 March 2008

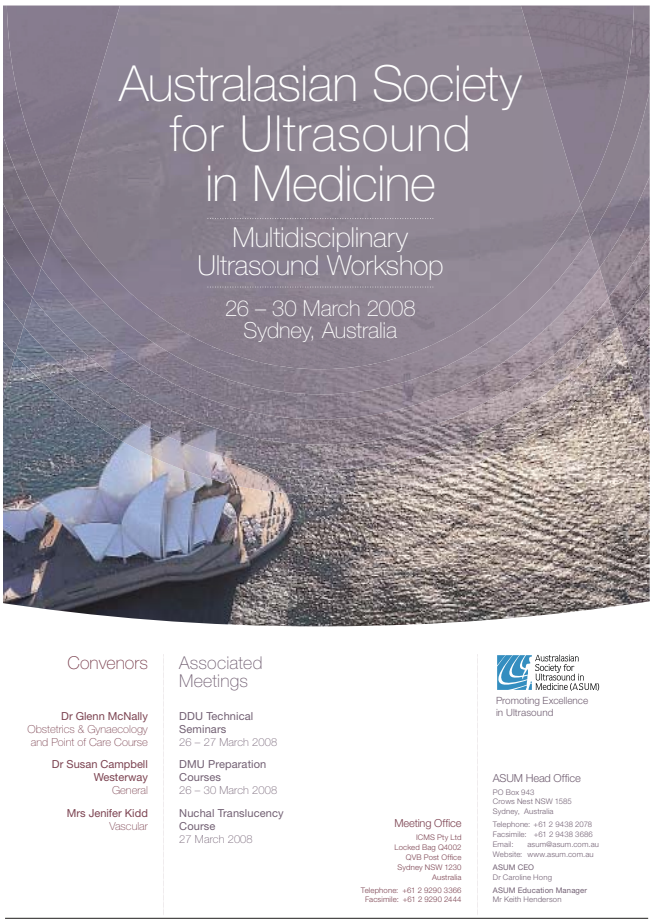
DMU Preparation Courses

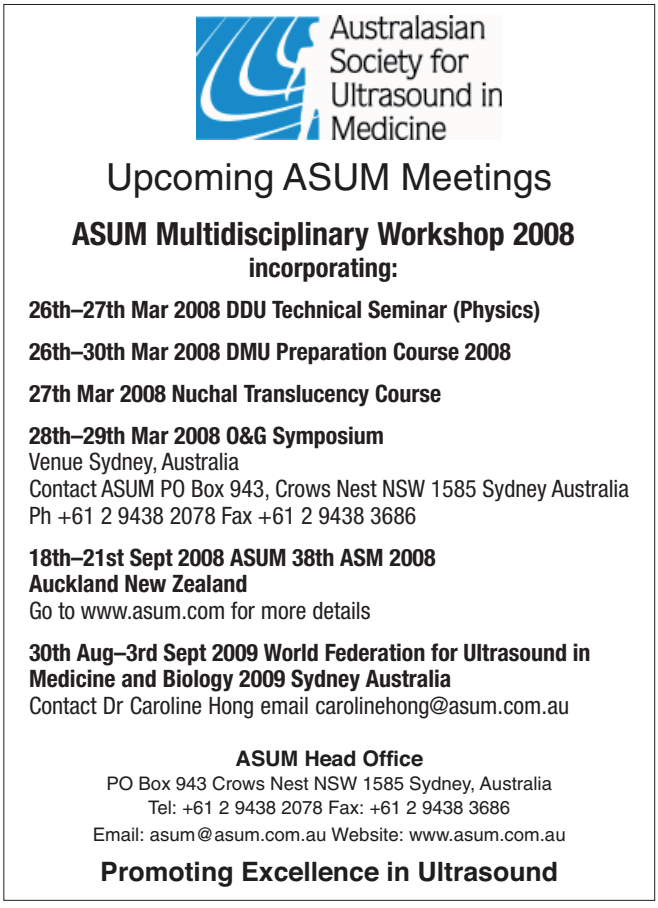
Vascular

Cardiac

General & Obstetrics

ASUM extends a warm welcome to you at upcoming ASUM meetings





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Forever curiously testing new opinions


Prof Ron Benzie

The complete quote by W Pater (1839–1894), where the heading is from, is 'What we have to do is to be for ever curiously testing new opinions and courting new impressions, never acquiescing in a facile orthodoxy of Comte, of Hegel or of our own'.

In this issue, you will find two articles containing opinions which may arouse your curiosity. Dr Lachlan de Crespigny presents the case for a complete fetal anatomy scan at the nuchal translucency screen at 12 weeks gestation. In an ideal world we could be doing this, but in areas of the country where it is difficult to find a sonographer let alone a sonologist, it will be more problematic. We would like to hear your opinion on the feasibility of the fetal morphology scan being done in the first trimester. How much more training would it involve? How would we inform our patients? What about the prenatal diagnosis of neural tube defects? Would we continue doing the 18–20 week morphology scan?

Elsewhere, Prof Jack Wall, a leading thyroidologist, makes no bones about being less than impressed by the thyroid scan reports from radiologic colleagues. Is he right? Let us know your thoughts please. Ultrasonographic sub-specialisation seems to be extending its reach well beyond the cardiac, the vascular and musculoskeletal areas. Is this inevitable? As in so many fields of medicine is the generalist becoming an endangered species?

From opinions to facts. Dr Jackie Cartmill highlights the 'elephant trunk' sign in the prenatal diagnosis of a fetus with a rare anomaly. Even if you never see the abnormality in question, you are bound to remember the pachyderm's proboscis sign! And the cover picture will, we hope, reinforce that. Jackie won the best poster award at ASUM's 37th Annual Scientific Meeting with another case, which we hope to bring you in a subsequent issue.

We also welcome the article by Prof David Evans of the Chair of Medical Physics, University of Leicester, UK on the detection of cerebral embolus using Doppler ultrasound. He gave a lecture on this topic at the recent annual ASUM conference in Cairns and we acknowledge the timely receipt of his manuscript prior to the meeting.

Finally, we wish to extend thanks and a welcome to our new local editorial board members whose expertise will add to the quality of the Bulletin's content. They are Dr S Barnett, scientist and a past President of ASUM, Dr G Larcos, Head of Nuclear Medicine at Westmead Hospital, Sydney and Dr S Cooper, Paediatric Cardiologist, The Children's Hospital, Westmead, Sydney. We appreciate the time these volunteers will give to the Bulletin. As you know, ASUM relies on the services of the willing. With only 22 months till WFUMB 2009, hosted by ASUM, volunteers will be of the essence.

Prof Ron Benzie

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Future direction of ultrasound

Matthew Andrews

As all ASUM members are well aware, ultrasound is being utilised in an ever-increasing range of medical applications. Technological advances are providing machines that are less expensive, more compact, portable and provide better images, spearheading innovative uses by multiple medical craft groups.

The challenge that we, who are involved in the provision of ultrasound services, face is to ensure that ultrasound studies are appropriate and are adequately performed. Improved patient outcomes should always be the aim of any medical service and ultrasound is no different. Just because ultrasound can be performed, doesn't necessarily mean it should be. No test should be performed unless its result impacts positively on patient management. A test should always be optimised to ensure its maximum potential is attained.

Ultrasound applications range from increasing numbers of clinicians using it as an extension of their clinical examination and procedures to referred ultrasound performed by ultrasound specialists. The latter category is further divided into ultrasound performed by specialists specific to their specialty, such as obstetricians and vascular surgeons, and medical imaging specialists such as radiologists, who use ultrasound as one of their range of imaging modalities. The imaging specialist groups may or may not provide their services in conjunction with sonographers. Thus, an ultrasound practitioner can range from the clinician who uses an ultrasound machine for one specific purpose to a diagnostic imaging specialist who performs a wide range of examinations covering all body systems.

It is clearly in the interest of the patient that, when ultrasound is performed, the practitioner is competent in its use and is capable of extracting maximum advantage from the test. Any medical practitioner using ultrasound should be appropriately trained and qualified for the manner in which he or she uses ultrasound.

ASUM's charter obliges the Society to provide education and qualifications to medical practitioners and sonographers. The range of ultrasound practice provides a logistical challenge to ensure targeted and specific training and certification is provided for each type of practice.

The Diploma of Diagnostic Ultrasound (DDU) has traditionally been ASUM's non-specific ultrasound qualification for ultrasound specialists. There has been nothing for non-specialist practitioners and also for specialist clinicians who use ultrasound as part of their clinical practice. ASUM has recognized this new direction of ultrasound and has responded by developing the Certificate of Clinician Performed Ultrasound (CCPU), which will be awarded in a number of categories of medical practice.

As I have mentioned in previous Presidential messages, the CCPU has been driven largely by the considerable efforts of Dr Glenn McNally and the ASUM Secretariat that has gone into developing the structure of the CCPU and organising the courses that support it. There has also been considerable support and contribution from ASUM members. Even at this infant stage the CCPU is attracting a large number of enrolees. It will soon pose significant organisational challenges, which ASUM is keen and ready to meet. The CCPU is attracting clinician members to ASUM, thus it is adding to the diversity and knowledge base of the Society.

I would like to acknowledge and thank the considerable number of dedicated personnel, including specialist sonologists, sonographers, corporate members, the ASUM secretariat, and clinicians utilising ultrasound, who have contributed to ASUM's ability to embrace, support and advance this new direction in medical ultrasound.

These efforts are ensuring that the Society remains at the forefront of contemporary ultrasound practice and is the peak ultrasound body in Australasia.

Matthew Andrews
President

ASUM 2007 ASM Photographic Competition. First prize: Simon Southern – Granite Beach

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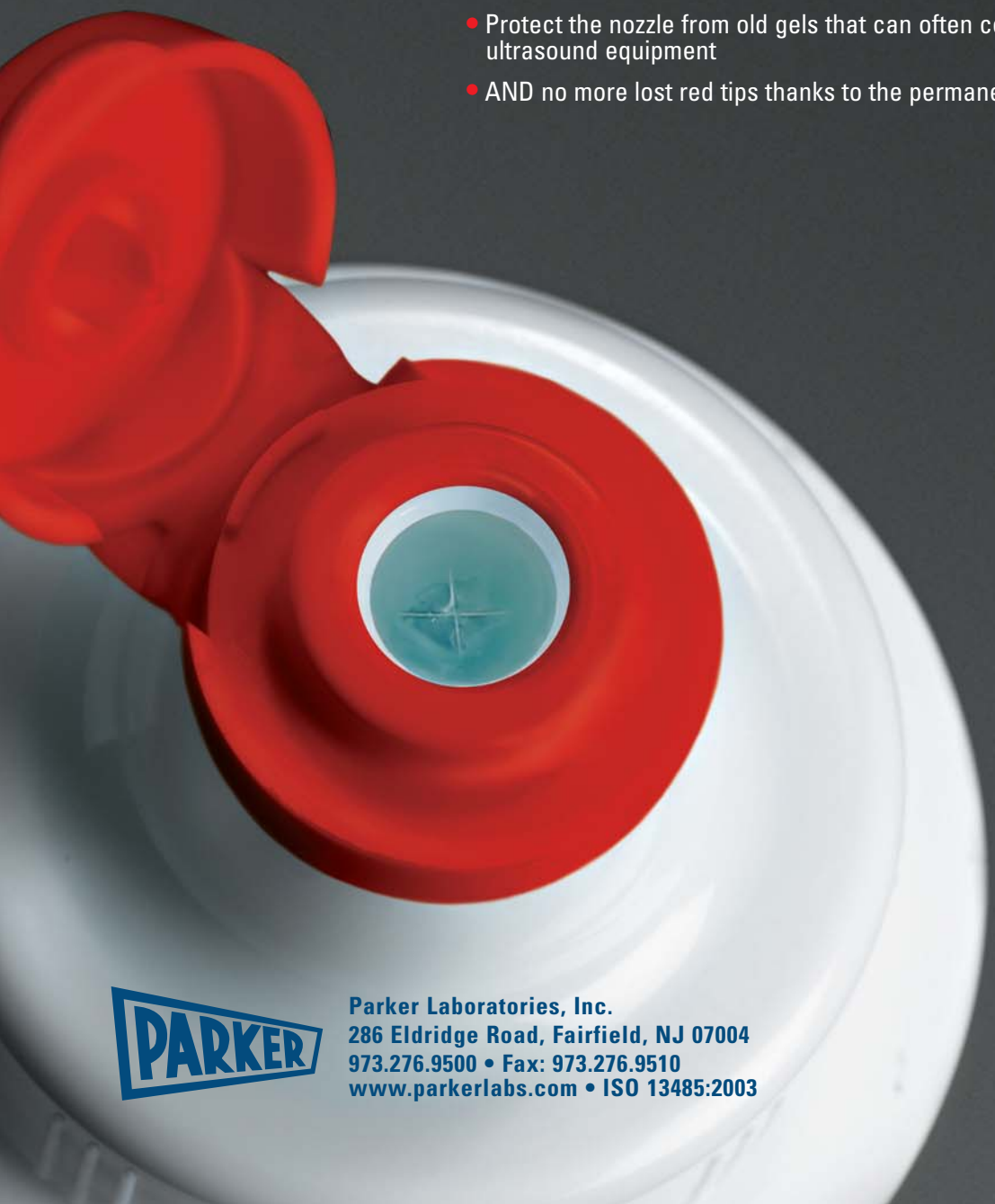

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CEO's message

Dr Caroline Hong

Success at the ASUM 2007 Cairns ASM

What a meeting! More than 350 people gathered in Cairns at the Cairns Convention Centre from 13th to 16th September for this wonderful, high quality ASM.

ASUM showcased the best in the Skills Day workshops on Thursday, the Scientific Program on Friday, Saturday and Sunday and at the magnificent exhibition.

The success of the meeting would not have been possible without the high quality presentations and workshops delivered by the invited international and local speakers.

We are grateful to the international speakers, Dr Joseph Polak (USA), Dr Eugene McNally (UK), Dr David Evans (UK), Prof Torben Lorentzen (Denmark), Dr Carlo Martinoli (Italy), Dr Yves Ville (France), Dr Tom Stavros (USA) and Dr David Nyberg (USA), all of whom travelled long distances to deliver a high quality program. The Australian and New Zealand speakers were also all of international reputation and, overall, the meeting received rave reviews.

The meeting would not have been such a success without the strong support and presence of the Gold sponsors, Toshiba, GE Healthcare, Siemens and Philips. We are indebted to the co-convenors, Deborah Moir and Liz Carter, Skills Day coordinator, Sue Davies, and the team of volunteers who worked tirelessly behind the scenes.

ASM prizewinners

ASUM extends congratulations to the prize winners recognised at the ASUM 2007 Cairns meeting. They are:

Chris Kohlenberg Teaching Fellowship Martin Necas (Regional NSW) sponsored by GE.

Beresford Buttery Teaching Fellowship George Condous (NSW and Vic) sponsored by GE.

Gulia Franco Teaching Fellowship Elvie Haluszkiewicz (NT and Regional Nth Qld) sponsored by Toshiba.

Anthony Tynan Award for Best Clinical Presentation Award Kerry Thoirs. Sponsored by Siemens, value $1000.

Best Research Presentation Award Peter Coombs. Sponsored by Siemens, value $1500.

Best Sonographer Research Presentation Award David Fauchon. Sponsored by Philips,value $2000.

Best Poster Award Jackie Cartmill. Sponsored by ASUM. Valued at $1500, made up of free registration to ASUM meeting 2008 Auckland and $500 spending money.

UI/UL Plenary Award recipient Assoc Prof Jon Hyett.

Honorary Fellows Rosina Davies and Mary Young.

Toshiba – first Major Sponsor for WFUMB 2009

We are pleased to announce the support of Toshiba's commitment as the first Major Sponsor for the biggest project to be undertaken by ASUM, hosting the WFUMB 2009 Sydney World Congress at the Sydney Convention and Exhibition Centre from 30th August to 3rd September 2009.

Toshiba's main contact for ultrasound is:
Louise Archer
National Sales and Marketing Manager
Ultrasound Toshiba (Australia) Pty Limited – Medical Division
Tel +61 (2) 9887 8041
Mob +61 (0) 417 251 479
Email larcher@toshiba-tap.com

We are indebted to Louise Archer for working with ASUM to achieve this commitment from the Global Toshiba Head Office in Japan. Toshiba has been a long-standing loyal and strong supporter at many ASUM meetings and workshops throughout Australia and New Zealand. Toshiba has supported ASUM as a Gold Sponsor at the Annual Scientific Meetings for many years. Toshiba also sponsors the Guilia Franco Traveling Fellowships each year.

Thank you to Dr David Rogers and Dr David Davies-Payne

The ASUM Council thanked Dr David Rogers and Dr David Davies-Payne, both of whom retired from Council at the outgoing Council Meeting on 15th September in Cairns. I have had the pleasure of working with Dr David Rogers in his capacity as Councillor for many years and again when he was President from 2004–2006. Both Davids have contributed enormously to ASUM over the years and have given their time generously, in particular, when they were Chairmen of the Education Committee, in succession. They will be sorely missed on Council.

New councillors and officers

The ASUM Council welcomes two new members to Council, Dr Simon Meagher and Dr Monica Pahuja, both of whom were elected for a three-year term from 2007 to 2010. All Councillors generally hold responsibility for a portfolio or committee. Dr Meagher was appointed as Chair of the Standards of Practice Committee and Dr Monica Pahuja was appointed as Chair of the Education Committee.

Prof Ron Benzie was unanimously elected as President Elect. He will become President of ASUM for a two-year term commencing September 2008.

Honorary Fellows

ASUM Council unanimously approved the appointment of two Honorary Fellows in 2007. You will read about Rosina Davies and Mary Young elsewhere in this issue. Both have given a lot to the ultrasound profession and community and deserve public recognition by the Society.

Mary Young started her career in 1962. She was among the early users of the Octoson ultrasound machine in the 1970s and was an active contributor to the founding of the Victorian Branch of the ultrasound education group.

Rosina Davies also started her ultrasound career in the 1970s and over the years, moved up the ranks of Toshiba to become General Manager. Throughout her career, she has been a supporter and contributor to ASUM and the ultrasound profession.

CADUCEUS meets at the ASM. Prof Torben Lorentzen, Dr Caroline Hong and Dr Matthew Andrews

CADUCEUS

The Collaborative Australasian Danish Undertaking for Continued Excellence in UltraSound Memorandum of Agreement between ASUM and the Danish Society for Diagnostic Ultrasound (DSDU) was signed in 2005. The primary purpose of the agreement is to promote a high standard of professional practice in medical ultrasound and also to promote a mutual exchange of information on or relating to education and training in medical ultrasound. The signatories to this memorandum were Dr David Rogers, then ASUM President, Dr Caroline Hong, ASUM CEO and Company Secretary, Dr Christian Nolsøe, DSDU President and Dr Michael Bachmann Nielsen, Chairman of the DSDU Education Commitee.

Dr Nolsøe was the exchange speaker at the ASUM meetings in 2005 in Adelaide and in 2006 in Melbourne. Prof Torben Lorentzen was the DSDU exchange speaker at our ASUM meeting in Cairns in September this year.

Dr David Rogers and Dr Roger Davies were the exchange speakers at the DSDU interventional radiology meeting in Copenhagen in 2006. Prof Ron Benzie will be the exchange speaker, representing Dr Matthew Andrews in 2008 in Copenhagen.

Training placement exchange programs from DSDU have included Christian Brushoj in 2004 in Melbourne, Morten Boesen in 2006 in Melbourne and we are now progressing with the placement of Akram Dakhil in Adelaide with Dr Neil Simmons.

The other training placement exchange programs from ASUM in Copenhagen have been Mary Langdale in 2006 and Robert Zeigenbein in 2007.

The CADUCEUS program is thriving and we expect to see a large delegation from Denmark at future ASUM meetings and WFUMB 09. The friendship is already strong, so we will welcome our Danish colleagues in a special way when they visit or attend our meetings and the congress.

ASUM members are encouraged to write to the CEO with your expressions of interest and a copy of your CV, to be considered for the CADUCEUS scholarship sponsored by ASUM for one–two weeks stay in Denmark for ultrasound training and experience. Enquiries can be directed by email to carolinehong@asum.com.au. Applications for 2008 close on 30th March 2008.

UI/UL Plenary Award

The UI/UL Plenary Lecture was established in 2002 to commemorate the contribution made by the Ultrasonics

Institute (Dept of Health) and the Ultrasonics Laboratory (CSIRO). This year, the honour was bestowed on Assoc Prof Jon Hyett. Past recipients of this award have been Prof David Ellwood, Prof Rob Gibson, Dr Rita Teele, Prof John Newman and Assoc Prof Albert Lam.

BMUS ASUM 2007 relationship – Harrogate UK

The BMUS-ASUM exchange program is thriving. Our President Dr Matthew Andrews will be attending the BMUS annual scientific meeting in Harrogate in December 2007. Past exchanges from ASUM have included Dr Stan Barnett in 2002, Dr Glenn McNally in 2004, Dr David Rogers in 2005. We look forward to welcoming Dr Kevin Martin from BMUS to the ASUM 2008 Auckland meeting in September next year. Past exchanges from BMUS have included Dr David Pilling and Dr Grant Baxter. The exchange program now operates on alternate years for each society.

ISUOG 2007

ASUM sent Dr Glenn McNally as the Council's representative to Florence on 7th October to attend the meeting of the safety committees of WFUMB and ISUOG with invited stakeholders from ultrasound societies, regulatory bodies and industry.

ASUM's Position Statement on the Appropriate Use of Diagnostic Ultrasound Equipment was included in this meeting. Drs S Barnett and J Abramowicz chaired an open forum for WFUMB and ISUOG on 8th October. Topics discussed included bioeffects and safety risk, epidemiology, ethical issues, medico-Legal implications and others.

Congratulations

ASUM congratulates Dr Kurosh Parsi, President, and the Council of the Australasian College of Phlebology on its inauguration ceremony at the University of Sydney. The ceremony celebrated the achievements and contributions of individuals to the science and practice of Phebology in Australasia. The ASUM President and CEO sent congratulatory messages on behalf of the Society.

ASUM also congratulates Dr Ron Shnier, President of the Australian Diagnostic Imaging Association (ADIA) on the launch of the Informed Financial Consent website and 1800 Hotline by the Hon Tony Abbott, Minister for Health and Ageing, on 30th October at the St George Private Hospital. Senator Concetta Fierravanti-Wells represented the Minister. Many prominent representatives of the medical professions attended the event, ASUM was represented by the CEO.

The Cairns Convention Centre

The website was developed with the support of the AMA and is a major initiative of ADIA. It will provide patients with greater certainty of their out of pocket expenses. More than 200 hospitals are listed on the website and for those who cannot access the web, there is the 1800 hotline number service.

Visit the website at www.adiaifc.com.au. The Hotline number is 1800 244 442.

Department of Health and Ageing issues

The Commonwealth Department of Health and Ageing conducted a national forum for stakeholders on 5th September, regarding the mandatory accreditation of diagnostic imaging services under Medicare.

Dr Fergus Scott and Dr Glenn McNally represented ASUM. They put a strong case for ASUM's policies and standards in ultrasound within the framework of diagnostic imaging services and Medicare. More than 20 colleges, societies and associations participated in the forum.

RANZCR – QUDI

ASUM has been consulted by the RANZCR for input into the document *Ultrasound Scan – Consumer Information*. ASUM, being the peak body representing medical specialists, sonographers and corporate members, is obviously the ideal body to provide input in the document as part of the QUDI program. Information about QUDI is available at www.ranzcr.com.au.

WFUMB 2009 Sydney Congress planning is on track

The Congress is progressing in accordance to its planning schedules. ICMS Pty Ltd has been appointed as the conference agent to provide support and logistics.

ASUM has been working with ICMS since the ASUM 2002 Annual Scientific Meeting, which was held on the Gold Coast. This was the first meeting for which ASUM used a professional accredited conference agent. It was also the first time that the financial and policy decisions of the meetings became the responsibility of the Finance Committee and the ASUM CEO, working with the conference agents in monitoring the expenses and budgets. The pleasant part of organising the scientific program and sourcing and inviting speakers became the task of the Organising Committee and Convenor.

Running the WFUMB 09 Congress has been cited by many members of ASUM to be like organising another ASUM meeting, except that it will be on a much larger scale, with a broader perspective and will target a wider international audience.

Plans are underway to run a workshop jointly with the WINFOCUS World Congress. This is scheduled on the last day of the WFUMB Congress and prior to the WINFOCUS Congress.

ASUM is pleased to announce that discussions are underway with several more potential major sponsors of the WFUMB 09 Congress. We are confident that this Congress will be the best ever ASUM meeting and will be a showcase for the Australian ultrasound profession.

Some of the topics in the program will cover point of care, cutting edge ultrasound practice and technology, safety and quality assurance, medico-legal issues, 3D and 4D ultrasound, echocardiography, ultrasound contrast, therapeutic applications, hands-on workshops and live-demonstration sessions, pediatrics, obstetrics and gynecology, musculoskeletal, vascular, emergency room and veterinary and other non-medical applications of ultrasound.

There will also be a huge exhibition to enable delegates to meet with exhibitors. Suppliers of diagnostic, interventional and therapeutic equipment, supplies and services will be displaying their newest and most innovative products.

Dr Stan Barnett, Convenor of WFUMB 2009 Sydney, will be writing a series of articles about WFUMB in the lead up to 2009.

DDU, DMU, DMU (Asia),CCPU

ASUM continues to rely on the work of a dedicated team of volunteer members who lead and make it possible for ASUM to maintain high standards in ultrasound practice.

ASUM takes great pride in the quality and high standard of the professional qualification that it awards candidates who have successfully completed the requirements for the Diploma or Certificate.

Dr Chris Wreidt continues as Chair of the DDU Board of Examiners. Mrs Margaret Condon has been appointed as Chair of the DMU Board of Examiners. Dr Andrew Ngu is the Chair of the DMU (Asia) Board of Examiners, and Dr Glenn McNally is Chair of the CCPU Certification Board.

ASUM welcomes new members

Once again, I urge all ASUM members to encourage and invite your collegues to join ASUM and to attend our future workshops and meetings. People keep coming back each time as we work hard to improve the quality of our workshops and annual scientific meetings, taking into account the needs of our delegates as well as our corporate sponsors and exhibitors. You can view all of our updates on the website at www.asum.com.au.

Dr Caroline Hong
Chief Executive Officer
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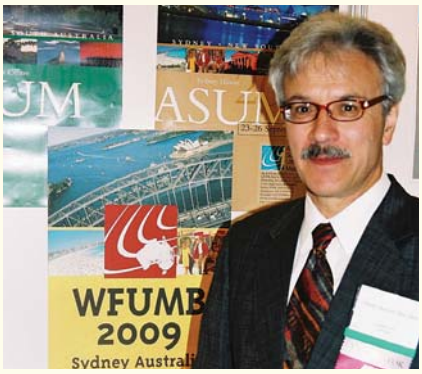
Invitation to a global ultrasound event, Sydney WFUMB 2009!

Whether you are a primary user of ultrasound, or a medical specialist with an interest in learning more on the subject, please make sure that you mark your professional calendar for WFUMB 20089 the most important event in the sonography world's calendar. The dates to record are 30th August to 3rd September 2009. The venue is the Darling Harbour Conference and Convention Centre in the heart of Sydney. This is the major scientific congress that combines ultrasound imaging in all of its aspects with new developments in therapeutic applications.

The program emphasises such areas as interventional radiology and sonology, ultrasound contrast agents, point-of-care applications in emergency medicine, fetal echo-cardiology, early first trimester Doppler imaging of fetal ductus venosus, and volume imaging in 3D and 4D. The congress



Dr Stan Barnett

program will also include opportunities for colleagues in developing economies through support for the established WFUMB Centres of Excellence.

With less than two years until the congress, it is time to start planning both your scientific contribution and your associated cultural and travel program. Please take advantage of this rare opportunity to visit one of the most sought-after tourist destinations in the world while also gaining knowledge and improving skills in the use of ultrasound in medicine. This will be only the second occasion in 24 years for the WFUMB World Congress to be held in Australia, so take care not to miss out. The scientific program has many opportunities for both ultrasound end-users and the corporate members, our industry partners. There is a high level of interest and support from the global ultrasound industry.

Please refer to the website www.wfumb2009.com for further information and spread the word to your colleagues in related disciplines about this great opportunity to visit down-under.

On behalf of the WFUMB and the local host society, the Australasian Society for Ultrasound in Medicine, I would like to welcome you to share our event in Sydney in 2009.

Dr Stan Barnett
Convenor
12th World Congress WFUMB 2009
www.wfumb2009.com

Should a nuchal translucency scan include a detailed fetal anatomy assessment?

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Introduction

A nuchal translucency (NT) scan should include as full an assessment of fetal anatomy as can be reasonably achieved. A thorough fetal anatomical evaluation should receive the same emphasis as risk evaluation for Down syndrome. When a fetal anomaly is detected at the midtrimester scan that was not seen at the NT scan we should ask ourselves: 'Why was the anomaly not seen?'

Beautiful fetal anatomical images can be obtained at a scan at 12–13 weeks. Data collected about a decade ago and published in 1999 reported that: 'The majority of fetal structural and chromosomal abnormalities can be detected by sonographic screening at 11–14 weeks'[1].

In 2006 there were 77 093 Medicare claims for NT scans – item number 55707[2] – this is nearly one-third of the 255 000 live births in Australia per year. This does not include NT scans performed in the public system. Women are stampeding to take the opportunity for early diagnosis of chromosome abnormality, yet even now in 2007, sonographers and sonologists commonly place little emphasis on the early diagnosis of structural abnormalities.

Although the majority of anomalies diagnosed at a 19 to 24 weeks scan can be detected at a NT scan, more will be diagnosed at a midtrimester scan. Reasons include:

1 Views at a NT scan may be poor despite a careful transabdominal plus transvaginal scan e.g. when an anteverted uterus is sitting high above the pelvis (limiting transvaginal views) in a woman who is overweight (limiting transabdominal views).
2 Fetal position is a potentially limiting factor, as always with ultrasound. Best views are achieved using a transvaginal scan with the fetus facing the transducer, enhancing heart, face and limb views.
3 Some abnormalities can evolve between 12 and 19 weeks. These include defects involving growth such as microcephaly and some types of dwarfism; excessive enlargement of organs, particularly fluid filled organs, as in hydronephrosis and ventriculomegaly.
4 There may be intervening failure of development (such as agenesis of the corpus callosum).

Guidelines

The Medicare Benefit Schedule designates the fee for item number 55707 is for an ultrasound scan where 'nuchal translucency measurement is performed to assess the risk of fetal abnormality'[2]. There is no requirement to assess fetal anatomy.

The *ASUM Guidelines for the Performance of First Trimester Ultrasound* (Revised July 2005) presents potentially conflicting messages. It reads that: 'A vaginal transducer should always be available and a transvaginal scan should be offered to the patient when it is anticipated that this would result in a more diagnostic study'. This could be interpreted as indicating that a vaginal scan should be offered if this would improve anatomical assessment. On the other hand, it could be argued that anatomical assessment is not part of a 'diagnostic study' in the first trimester.

It is stated later in the policy that: 'The following list of gestational ages at which various fetal structures may be visualised is not intended to provide a complete list of what should be examined. However, using high resolution equipment (often only with a vaginal transducer) the following structures can commonly be seen: 11 weeks: stomach, spine, ossified cranium, four-chamber heart; 12 weeks: mid gut herniation no longer present, kidneys, bladder'. The policy could be interpreted as meaning that this superficial check is of interest only; it certainly does not clearly advocate a full fetal anatomical assessment.

What can be seen?

Some authors have argued against a careful first trimester anatomical assessment. Rustico, *et al*. deemed routine early cardiac assessment ill advisable, because of high costs in terms of time, equipment and involvement of operators, combined with a low sensitivity in detecting congenital heart disease[3]. The contrary view is taken by Bronshtein and Zimmer[4] who believe that '… depiction of the heart anatomy is easier in early pregnancy compared with advanced gestation… The technique of transvaginal scanning is not difficult to learn and sonographers can adopt it in a short time period of a few months. It is therefore our belief that in the future an

early detailed fetal cardiac examination should be performed in all pregnant women'.

It is well recognised that fetal anatomy can be assessed in detail at the NT scan. For most women, this assessment is more thorough with a transvaginal ultrasound examination. Modern equipment, however, frequently allows a very detailed assessment even with transabdominal ultrasound.

Lombardi, *et al.* have reported that at 12–13 weeks in at increased risk women, a cardiac scan was performed successfully in 456 (75%) using a 15 MHz linear transducer transabdominal ultrasound alone, and the additional use of a 6 MHz transducer allowed diagnostic images to be obtained in a further 152[5]. Normal cardiac anatomy was assessed confidently within 10 min in 517/608 (85%) pregnancies.

This figure would be expected to be higher, and the scan quicker, if transvaginal ultrasound was included. Yet transvaginal ultrasound is uncommonly considered to be part of the assessment at the time of the nuchal translucency scan. Since the nuchal translucency is usually best assessed transabdominally, all sonographers and sonologists do not routinely offer transvaginal ultrasound. In other words, common practice is that this scan is primarily for aneuploidy screening and that careful assessment of fetal anatomy is not essential.

It is worth looking at the depth of anatomy that Lombardi, *et al.* examined in their study. It shows what is possible at a NT scan. It was more detailed than often done in a midtrimester scan. In summary, the operator looked for the following fetal cardiac anatomy[5]:

1 Abdominal situs with the aorta to the left of the spine and the inferior vena cava anterior and to the right of the spine; the heart lying on the left side angled at 45° from the midline, occupying one quarter of the chest;
2 The four chambers of the heart with the left atrium in front of the spine and the right ventricle just below the sternum; atrial appendages; atrioventricular valve offsetting;
3 The aorta arising centrally in the heart from the left ventricle and the pulmonary trunk arising from the anteriorly placed right ventricle and crossing to the fetal left side over the ascending aorta;
4 Interventricular septum: aortic continuity in the left outflow view; and
5 The anteriorly positioned ductal arch and the transverse aortic arch on the left side, converging towards the fetal spine and being equal in size.

Studies on detection of fetal structural abnormalities at the time of the NT scan have tended to focus on cardiac abnormalities[3–7]. This may be because these are both common but also usually the most testing anomalies to detect. Data on detection of other abnormalities however shows that high detection rates for other anomalies are very achievable[1,8,9].

Why diagnose fetal abnormality early?

Women's preference

The NT scan is considered primarily to be for Down syndrome screening, gestational age assessment and the diagnosis of multiple pregnancies. The midtrimester ultrasound is for assessment of fetal anatomy. It might be suggested that assessing fetal anatomy at the first trimester is unnecessary since it will be done more effectively at the midtrimester scan and that such an assessment merely adds a second fetal anatomy examination when one would be just as effective.

There are several reasons why such an approach should be rejected. First, it ignores the well documented demand of women for early diagnosis. The importance of early diagnosis was seen in the introductory phase of chorionic villus sampling (CVS) when the risk of the test was many times that of amniocentesis. Yet from the outset, large numbers of women chose CVS to avoid late diagnosis following amniocentesis.

The same pattern was seen more recently for trisomy 21 screening. Midtrimester serum screening has been available for decades, but in Australia the take up was very poor except in South Australia. Yet when NT screening, and particularly when the first trimester combined test, became available early Down syndrome screening became standard practice. In Victoria, for example, about 80% of pregnant women now have screening (Genetic Health Services Victoria figures).

Women go to great lengths to have screening early – we should support them. Increasingly, they are expecting fetal anomalies to be detected in the first trimester. When an abnormality is found in the second trimester, they commonly ask: 'Could this abnormality have been detected at the earlier scan'. The answer is often yes. Doctors should not have to explain that no diligent attempt was made to make the diagnosis.

Scanning issues

Optimal midtrimester fetal visualisation is more likely to be obtained if the ultrasound examination is delayed to 19–20 weeks, and sometimes beyond. Delaying the scan to improve fetal assessment can be done with more confidence if fetal anatomy has been carefully assessed at the NT scan. Indeed for some women, such as very obese women, the best assessment of fetal anatomy can be a vaginal scan at 12–13 weeks, fetal views may be compromised at 20 weeks and beyond on transabdominal assessment.

Medical factors

Medical reasons to prefer earlier versus later abortion include the fact that early abortion is safer. In addition, surveys show that obstetricians are prepared to offer termination for more abnormalities early in pregnancy

than they are later in pregnancy[10]. Pregnant women, their doctors and Australians in general, more often oppose later abortion. It is therefore in women's interest to strive for early diagnosis to enhance their management options – women are more likely to be denied abortion later in pregnancy.

A recent survey of Melbourne obstetricians showed that they have become more reluctant to offer abortion after the diagnosis of fetal abnormality, even prior to 20 weeks, because of concerns about unclear laws and recent adverse press[11]. Early abortion is perceived to reduce these risks, hence early diagnosis enhances women's choices.

Legal factors

Abortion law, and the way doctors interpret it, limits access to later termination of pregnancy in many Australian jurisdictions, particularly from 20 weeks[12]. In Western Australia, for example, abortion is available from 20 weeks only on the approval of an anonymous committee. Careful early assessment of fetal anatomy reduces the risk that women will have an abnormality diagnosed in the midtrimester of pregnancy for which they will seek pregnancy termination.

We have legal and ethical responsibilities to carry out a state-of-the-art fetal anatomical assessment at 18–20 weeks. Such responsibilities should also apply at 13 weeks – a thorough fetal assessment can be offered to most women at this time with the expectation that a high detection rate of fetal abnormalities will be achieved in the first trimester.

Objections to fetal abnormality screening at the NT scan

What arguments might be raised by those that believe that a detailed fetal anatomical assessment at 12 weeks should not be a major focus?

Cost

Problem: The rebate figure for first trimester nuchal translucency scanning is so low that it is difficult to see how this figure could be charged if state-of-the art equipment was used to do an appropriate nuchal translucency assessment, let alone include a fetal anatomical assessment as well.
Response: Doctors have no role in unilaterally limiting valuable medical services that are wanted by patients. It is, however, unreasonable to expect ultrasound practices to carry the financial cost of a more prolonged first trimester assessment. Sadly, the government has eroded the ultrasound Medicare fee, particularly in the first trimester, to the detriment of pregnant women from all socio-economic groups. In most capital cities, ultrasound practices already charge a fee well above the Medicare schedule for pregnancy scans. Detailed fetal anatomical assessment may necessitate some providers raising fees.

Time and resources

Problem: Already obstetric ultrasound practices are stretched; this applies particularly in the public sector where few institutions offer NT assessment. Prolonging the NT scan to carefully assess fetal anatomy will magnify service provision problems.
Response: Our responsibility is to offer a state of the art service to patients whom we examine. It is not our role to unilaterally deny a complete examination to women because of practice time and resource issues. It is no more acceptable to use this argument to limit fetal assessment in the first trimester than it would be in the second trimester.

Limits of diagnosis

Problem: First trimester fetal anatomical assessment may be limited by fetal position, maternal body habitus, etc.
Response: This is true. It is also true at any other time of pregnancy – including the midtrimester. This is not an argument to limit the examination, but it is a reality of ultrasound examinations.
Problem: First trimester anatomical assessment may raise concerns about an abnormality where no problems exist: for example, a possible exomphalos, or hydrocephaly.
Response: This is also true at other times in pregnancy, although the uncertainties may be more common in the first trimester. This is no justification for providing a limited ultrasound examination in the first trimester, just as it is no justification at other times in pregnancy. It is an argument for cautious interpretation of possible abnormalities, for sensitive explanation to women and for timely review of the findings.
Problem: If an abnormality is diagnosed and abortion requested, fetal autopsy is limited or impossible.
Response: This also is true. It puts additional onus on sonologists to be cautious in offering a certain diagnosis of abnormality in the first trimester. A second opinion may be necessary, or alternatively, early rescan at 14 or 15 weeks rather than 18–20 weeks. In addition, specialist pathological expertise is available to obtain maximal information from early autopsy.

Vaginal ultrasound

Problem: A vaginal scan is often necessary to obtain optimal first trimester views. This is usually not needed for the NT measurement, which is the prime focus of the examination. Women prefer to avoid vaginal ultrasound.
Response: A vaginal ultrasound examination should be a woman's choice in the first trimester, just as it is at any other time. It should not be considered routine. In the first trimester, women should understand that the

vaginal scan is usually not required for NT assessment, but it will usually enhance anatomical assessment. Most, but not all, informed women choose to accept the offer of vaginal ultrasound to improve the chance of early anomaly detection.

Equipment

Problem: Good equipment is needed for anatomical assessment.
Response: Yes it is. It is also needed for NT assessment.

Training

Problem: First trimester scanning skills requires sonographers to have new and more extensive training.
Response: It does require training to look at the detailed anatomy of first trimester fetuses. The training is not dissimilar to that required for second trimester screening. Those doing second trimester assessment can readily adapt. This includes learning transvaginal scanning skills which are essential for all trained obstetric scanners.

Conclusion

There is no reason to deny women state-of-the-art effective prenatal diagnostic services in the first trimester or at any other time of pregnancy. A careful fetal anatomical assessment, including giving women the option of a transvaginal scan if that would enhance imaging, should be a standard part of a 12–13 week scan. Long gone is the time that doctors can unilaterally limit effective prenatal tests without disclosing this to women before the scan.

If a limited scan is planned, doctors should disclose this to allow women the option of going elsewhere to have a more complete examination.

A 12–13 weeks scan should allow the detection of most structural abnormalities diagnosable in the second trimester, including most structural heart abnormalities. This is not to advocate all women should be offered a first trimester scan for fetal anatomy assessment only, but if a scan is performed for another reason, such as NT, fetal anatomy should be considered an integral part of the assessment. Anatomical assessment at 12–13 weeks does not replace a mid-trimester scan.

Proposal

We are abdicating our responsibilities to patients if a NT scan does not include a careful fetal anatomical assessment. Offering a transvaginal scan should be routine at a 12–13 week scan when that might enhance fetal anatomical views. NT scans are best performed at 12–13 weeks because fetal structural detail is better than at 11 weeks.

References

1 Whitlow BJ, Chatzipapas IK, Lazanakis ML, Kadir RA, Economides DL. The value of sonography in early pregnancy for the detection of fetal abnormalities in an unselected population. *BJOG* 1999; 106: 929–36.

2 NT Medicare item. Medicare Australia. Available online at: www.medicareaustralia.gov.au [verified September 07].

3 Rustico MA, Benettoni A, D'Ottavio G, Fischer-Tamaro L, Conoscenti GC, Meir Y, *et al*. Early screening for fetal cardiac anomalies in an unselected population: the role of operator experience. *Ultrasound Obstet Gynecol* 2000; 16: 614–19.

4 Bronshtein M, Zimmer EZ. The sonographic approach to the detection of fetal cardiac anomalies in early pregnancy. *Ultrasound Obstet Gynecol* 2002; 19: 360–65.

5 Lombardi C, Bellotti M, Fesslova V, Cappellini A. Fetal echocardiography at the time of the nuchal translucency scan. *Ultrasound Obstet Gynecol* 2007; 29: 249–57

6 Becker R, Wegner RD. Detailed screening for fetal anomalies and cardiac defects at the 11–13-week scan. *Ultrasound Obstet Gynecol* 2006; 27: 613–18.

7 Rasiah SV, Publicover M, Ewer AK, Khan KS, Kilby MD, Zamora J. A systematic review of the accuracy of first-trimester ultrasound examination for detecting major congenital heart disease. *Ultrasound Obstet Gynecol* 2006; 28: 110–16.

8 Kang A, Struben H, Holzgreve W, Lapaire O, Doht S, Tercanli S. Detection of fetal anomalies in the first and second trimesters. *Ultrasound Obstet Gynecol* 2006; 28: 365.

9 Johnson SP, Sebire NJ, Snijders RJ, Tunkel S, Nicolaides KH. Ultrasound screening for anencephaly at 10–14 weeks of gestation. *Ultrasound Obstet Gynecol* 1997; 9: 14–16.

10 Savulescu J. Is current practice around late termination of pregnancy eugenic and discriminatory? Maternal interests and abortion *J Med Ethics* 2001; *27*: 165–71.

11 de Crespigny L, Savulescu J. Women wanting to be pregnant: the forgotten people in the abortion debate (submitted for publication).

12 de Crespigny L, Savulescu J. Abortion: time to clarify Australia's confusing laws. *MJA* 2004; 181: 201–3.

What do clinical users of ultrasound know about safe use in pregnancy?

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Professional medical ultrasound societies share a common goal to ensure the safe and effective use of diagnostic ultrasound to an accepted standard of clinical practice. ASUM has published guidelines for safety and standards of practice and has issued policy statements that are in accordance with other international organisations. In practical terms, the safe and appropriate use of ultrasound is the responsibility of the sonologist/sonographer. In recent decades, the regulation of ultrasound acoustic output (as applied by the Food and Drug Administration (FDA) Centre for Devices and Radiological Health) has been relaxed for most applications in comparison with the original intensity limits imposed on each application[1,2]. The rationale for this relaxation of applied intensity limits was that the ultrasound user should be able to assess the risk of causing ultrasound-related biological effects or potential adverse effects, based on information provided by the manufacturer in the form of equipment output displays.

The concept of using an output display to moderate the application and output conditions during an ultrasound examination allows the clinician to dictate the level of exposure received by the patient, rather than having arbitrary acoustic output limits imposed by regulatory authorities. In essence, this would appear to be an ideal situation, with the clinician being responsible for making decisions of any potential risk in a given exam application. In fact, the concept has been used by some industry groups in the USA to apply pressure to the FDA to reduce further, or eliminate entirely, all restrictions on output. However, for this situation to work effectively, it assumes that a number of basic conditions apply. In order for the clinician/user to make such an assessment, essential elements are assumed, including the following:

1 Awareness of potential, or actual bioeffects that might result from a particular ultrasound application (the level of risk differs for different applications, early pregnancy presenting the greatest risk);
2 Understanding the basic concepts of the Output Display Standard; and
3 Ability to interpret information provided in the equipment output display.

The recent publication by Sheiner, *et al.*[3] clearly shows that the above assumptions are incorrect. This paper describes findings in a study that was part of a PhD thesis. The study set out to determine the clinical end-users' knowledge of safety aspects of diagnostic ultrasound during pregnancy. End-users' attitudes towards the use of ultrasound in low risk pregnancies were assessed in a questionnaire of 130 physicians and obstetricians attending review courses.

Remarkably, approximately 80% of these physicians were unaware that an output display of acoustic indices appeared on the sonographic monitor during the examination, or had no idea where to find such vital information. Interestingly, almost 70% of respondents disapproved of keepsake, or entertainment, scanning. This may be due to the recent increased publicity within the news media. While approximately 20% of these physicians were familiar with the term 'mechanical index', only 4% described it properly. The authors concluded that ultrasound end-users are poorly informed regarding safety issues during pregnancy. They also, quite correctly, state in the discussion section that 'Obviously, if professional end-users show such poor knowledge of safety issues, one cannot expect end users in shopping malls, performing souvenir ultrasound exams, to have a better understanding of safety topics.'

Clearly, these are major issues to do with standards of practice and ethical and appropriate use of a medical specialty. Some professional ultrasound organisations have published opinion and official policy on the subject of souvenir ultrasonography. The World Federation for Ultrasound in Medicine and Biology (WFUMB) has embarked on an international project, in collaboration with the International Society of Ultrasound in Obstetrics and Gynecology (ISUOG) to assess the scientific background and stake-holder opinion with the purpose of creating a set of international guidelines. Professional ultrasound societies, including the ASUM, have been invited to send representatives to participate in the workshop, to be held in Florence in October 2007.

The paper by Sheiner, *et al.* has reiterated concerns held by the scientific community that has been dealing with ultrasound standards for some years. This publication offers clear evidence that the substantial efforts over decades to educate end-users of diagnostic ultrasound about the output display standard[4] has been somewhat less than successful or effective than anticipated. It would be a very interesting exercise to submit a similar test as part of ASUM's education practice.

References

1 Barnett SB. Key issues in the analysis of safety of diagnostic ultrasound. *ASUM Ultrasound Bull* 2003; 6 (3): 41–3.

2 Barnett SB, ter Haar G. Guidelines and recommendations for the safe use of diagnostic ultrasound: the users' responsibilities. In: ter Haar, G and Duck, F editors. The Safe Use of Ultrasound in Medical Diagnosis. London: BMUS/BIR Publications; 2000. pp. 102–12.

3 Sheiner E, Shoham-Vardi I, Abramowicz JS. What do clinical users know regarding safety of ultrasound during pregnancy? *J Ultras Med* 2007; 26: 319–25.

4 Abbott, JG. Rationale and derivation of MI and TI – A review. *Ultras Med Biol* 1999; 25: 431–41.

Cerebral embolus detection using Doppler ultrasound

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Abstract

Cerebral embolism is a common occurrence during many operative procedures including carotid endarterectomy, cardiac by-pass surgery and bone fracture repair. It may also occur during the course of everyday life and embolism from the carotid artery or heart is known to be a major cause of stroke. Transcranial Doppler ultrasound can be used to detect cerebral emboli as they propagate through the major cerebral vessels. The detectability of an embolus is determined by many factors including its size and composition, the ultrasound frequency, the size of the Doppler sample volume, the embolus trajectory and its interaction with the ultrasound beam. In general, even relatively small gas bubbles will be detected, but some larger solid emboli may be missed. With regard to size and composition, several techniques have been suggested as being useful for characterising composition and while, in general, considerable progress has been made in this direction, there are still many challenges in distinguishing between large particulate emboli and small gaseous emboli.

Introduction

A significant proportion of strokes are caused by emboli from distal sites blocking vessels in the brain. The discovery that emboli of various types can be detected using Doppler ultrasound as they are carried through the major cerebral arteries[1,2] has led to a new field of study, which has considerable potential. The basic principle of detection is extremely simple: if an embolus backscatters more power than the surrounding blood in which it is moving, then the transient increase in Doppler power can be detected and measured. Questions that arise from this principle surround the circumstances under which such power increases can be detected, and whether the size and composition of the embolus can be inferred from such measurements.

The standard transcranial Doppler ultrasound (TCD) methodology for embolus detection consists of fixing a single element pulsed Doppler probe, with a frequency of around 2 MHz, over the temporal bone and adjusting its position, orientation and sample volume depth to obtain a good signal from the blood flow in the ipsilateral middle cerebral artery (MCA). Most frequently, micro-embolic signals (MES) are 'detected' subjectively, although there have been several attempts to automate the process[3,4,5]. Doppler audio signals from emboli are described as sounding like a 'snap', a 'chirp', or a 'moan'[6] and appearing on the Doppler sonogram as a short-duration unidirectional high-intensity signal within the Doppler flow spectrum, occurring at random within the cardiac cycle[7,8]. More objectively, they may be described as short-duration (usually between 8 and 80 ms) amplitude modulated sine waves that exceed the level of the background blood flow signal by between 3 dB and 60 dB[9]. Some signals also exhibit significant frequency modulation[9,10]. An example of an MES that is approximately 9 dB higher than the background blood signal is shown in Fig. 1.

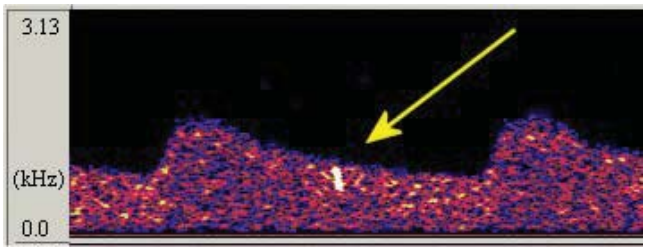

Fig. 1: Example of a sonogram of a Doppler signal recorded from the MCA of a patient in the recovery room following carotid endarterectomy. The MES appears as a region of increased Doppler power as indicated by the arrow.

Basic principles

The scattering of ultrasound by microemboli was first explored in detail by Lubbers and van den Berg (1976)[11], who calculated the scattering from gaseous microemboli, red blood cell aggregates (RCAs), and fat emboli flowing in blood. Their equations show that the backscatter cross-section (BSC) is a function of embolus size, ultrasound frequency, and the composition of both the embolus and its surrounding medium. It is not possible to measure the absolute power scattered by an embolus from within the body as the attenuation of the ultrasound by the tissue between the embolus and the transducer is unknown, and therefore it is necessary to compare the signal from the embolus with a known scatterer such as blood, if calibrated measurements are to be made. With this in mind, Moehring and Klepper (1994)[12] introduced the concept of 'embolus-to-blood ratio' (EBR), which they defined as:

(Equation 1)

$$EBR = \frac{\sigma_B + \sigma_E}{\sigma_B} = 1 + \frac{\sigma_E}{V\alpha}$$

where σ_E and σ_B are the BSCs of the embolus and flowing blood within the sample volume respectively; V is the volume of flowing blood within the sample volume; and α is the volume backscatter coefficient of blood. Equation (1)

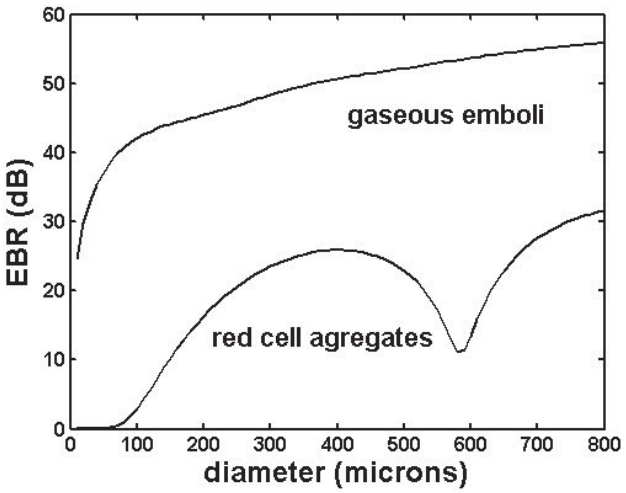

Fig. 2a: EBR power ratios for air and red cell aggregate emboli plotted as a function of embolic diameter (it has been assumed that the blood vessel diameter is 3 mm, the sample volume 10 mm in length, the transmission frequency 2 MHz, and the haematocrit 45%).

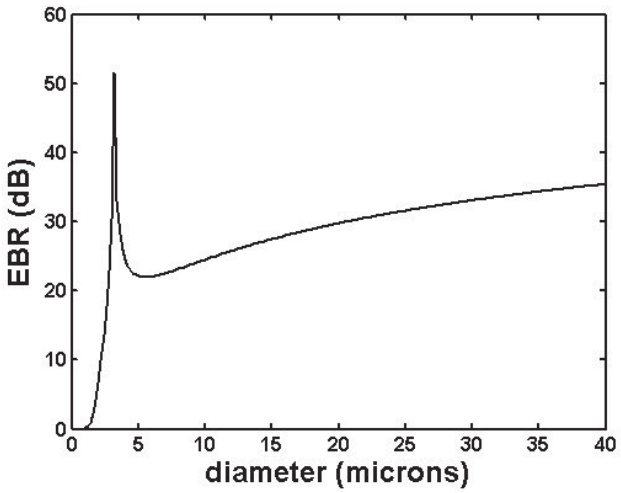

Fig. 2b: Detail of EBR power ratios for small gaseous emboli.

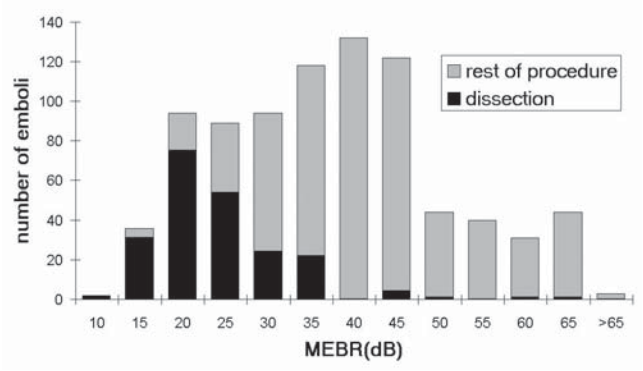

Fig. 3a: Distribution of the MEBR values of 849 embolic signals recorded during 17 carotid endarterectomies. Dark shading indicates emboli detected during dissection, which can only be particulate in nature. Light shading indicates emboli detected during other phases of the operation where the emboli may be either solid or gaseous.

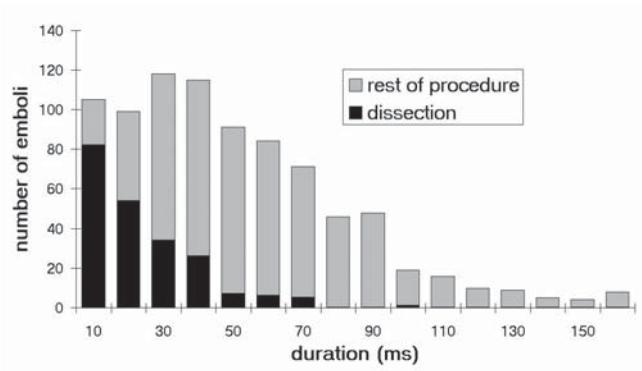

Fig. 3b: Distribution of the durations of the signals from the same 849 emboli.

has been evaluated as a function of embolic diameter for emboli consisting of RCAs and of air, for a typical geometry found in TCD studies[13] and the results plotted in Figs. 2a and 2b to illustrate a number of points relevant to detection of emboli. First, gaseous emboli always backscatter more power than similarly sized solid emboli, but very small gaseous emboli may backscatter similar amounts of power to large solid emboli. Second, it is possible to detect gaseous emboli with diameters as small as about 2 microns, but solid emboli do not backscatter significantly greater power than the surrounding blood unless they have diameters of the order of 80 to 120 microns. Third, backscattered power does not rise monotonically with size.

Practical considerations

Ideally, Doppler ultrasound studies would provide the clinician with information about embolus prevalence, composition and size, but there are difficulties both in making accurate measurements on MES and also in the interpretation of such measurements. In this section we discuss some of the practical difficulties of making measurements.

The first thing to note about Doppler embolic signals is that they are unlike typical Doppler signals from blood flow – in particular they exhibit very high dynamic ranges (a small solid embolus may exceed the background blood signal by only 6 dB, but a moment later a gaseous embolus may produce a signal 50 dB higher), and that they have very short durations (often of the order of 10 to 20 ms). Fig. 3 shows typical values of the measured EBR (MEBR) and durations from 849 embolic signals recorded during the course of 17 carotid endarterectomies[14]. More recently we have published a more detailed study of the characteristics of embolic signals observed during the recovery phase of carotid endartectomy[15].

MES dynamic range

In general the instruments used for TCD work are relatively simple and cannot adequately cope with the large dynamic ranges involved, especially where gaseous emboli are present. Emboli with large BSCs cause overloading, particularly in the audio frequency stages of Doppler instrumentation and leads to several problems, which include the impossibility of estimating EBR, and the difficulty of distinguishing MES from artifact signals. Clearly, steps must be taken to avoid this problem if accurate measurements are to be made[16].

MES duration

The short duration of embolic signals also poses some

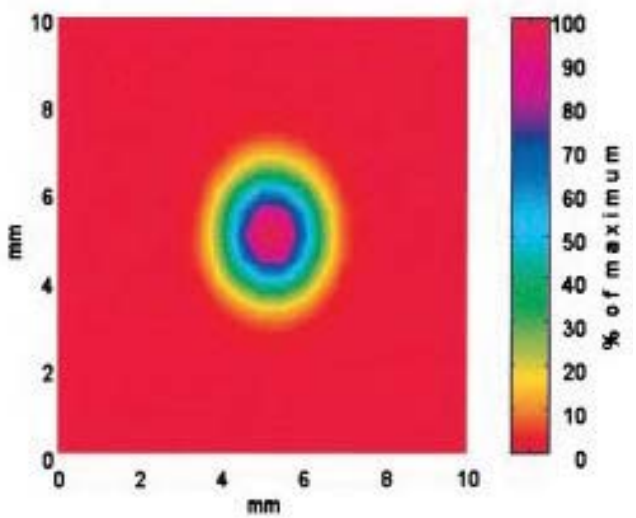

Fig. 4a: Received field beam sensitivity of a Scimed TCD transducer plotted at an axial distance of 5.0 cm from the transducer face for a beam path through water.

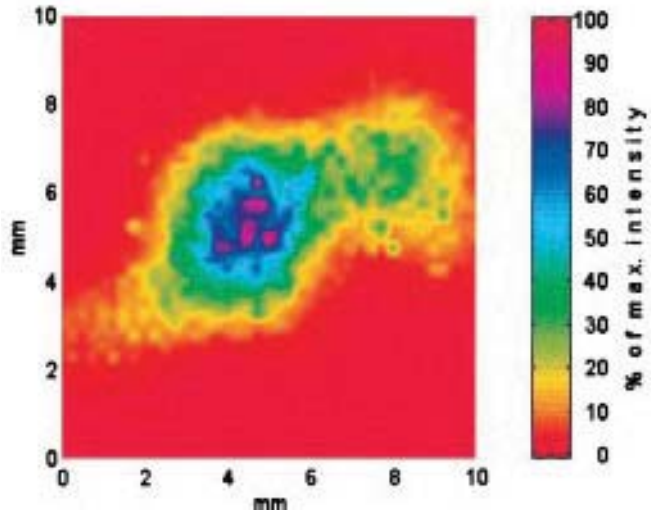

Fig. 4b: Received field beam sensitivity of a Scimed TCD transducer plotted at an axial distance of 5.0 cm from the transducer face for a beam path through human temporal bone.

difficulties for measurements made using conventional FFT spectral analysis systems. Since some embolic events last less than 10 ms it is desirable to be able to make temporal measurements with a resolution of 2.5 ms or better, which implies a frequency resolution of only 400 Hz. Since the Doppler frequencies involved are of the order of only 2 kHz, this is clearly inadequate. To overcome this limitation we and other groups have used time-frequency analysis to achieve high temporal resolution measurements without sacrificing frequency resolution[16].

Measurement limitations

The concept of EBR is extremely valuable, but is defined in terms of the BSCs of blood and emboli, which cannot be measured directly. In practice, what is measured is the relative powers of the signals from the Doppler sample volume in the presence and absence of embolic events, which is therefore perhaps better called 'measured EBR' or MEBR to distinguish it from the more theoretical quantity. MEBR is influenced by many factors, but perhaps the most important are the size of the MCA, the shape of the ultrasonic beam, the embolic trajectory through the artery and the interaction of these parameters. Even if the free-field ultrasonic beam is sufficiently uniform to provide uniform insonation over a large sample volume, the shape of the skull, with its convoluted inner surface, leads to very non-uniform ultrasound fields within the brain[17,18]. Figs. 4a and 4b show the effect of one sample of human temporal bone on the field shape of a commercial transducer. Because of the non-uniformity of the ultrasound beam, the amount of power backscattered by an embolus will be dependent on the particular trajectory it follows through the MCA. The power backscattered by the blood will depend on the ultrasonic beam shape and the diameter of the blood vessel, neither of which will be known, and the angle of insonation, which also may not be known. In a study from our laboratory, in which simulations were performed using ultrasound beam shapes measured through temporal bone and likely geometrical configurations; the effects of embolus trajectory, likely insonation angles, and plausible vessel misalignments introduced uncertainties in MEBR values of up to 12dB[19].

Information from micro-embolic signals

Ideally, embolus-monitoring systems would detect all micro-embolic events and would be able to determine the size and composition of the causative embolus. Although much progress has been made in this direction, many challenges remain.

Detection of emboli

It will be clear from the previous section that there is a considerable degree of uncertainty in measurements on MES and this must influence the sensitivity of event detection. Furthermore, most embolus detection systems rely on subjective decisions made by an operator and therefore, in addition to variability due to physical factors, some intra-observer and inter-observer variability must be expected. Although there is a high probability that emboli with large BSCs (relative to BSC of the blood in the sample volume) will be detected, there is also a high probability that a significant percentage of emboli with small BSCs will be missed. Fortunately, clinical experience suggests that quite large numbers of solid emboli which produce signals close to the detection threshold are necessary to cause any measurable damage to the brain. Thus, while individual events may well be missed, the presence of significant numbers of emboli will not.

Artifact rejection

One of the difficulties of embolic event detection is that of distinguishing between signals due to true events, and those due to non-embolic events. There are many mechanisms that produce transient high intensity signals, many of which have similar characteristics to true MES. Any movement of the Doppler probe, either intentional or accidental, or of the underlying tissue such as that caused by head movement, speech, snoring or talking, can produce signals not dissimilar to MES.

The most common method of rejecting artifacts is still subjective assessment of a candidate signal by comparing it with a set of standard criteria. One commonly used set is that published as a result of a consensus meeting[6]. Another approach to artifact rejection is to use more than

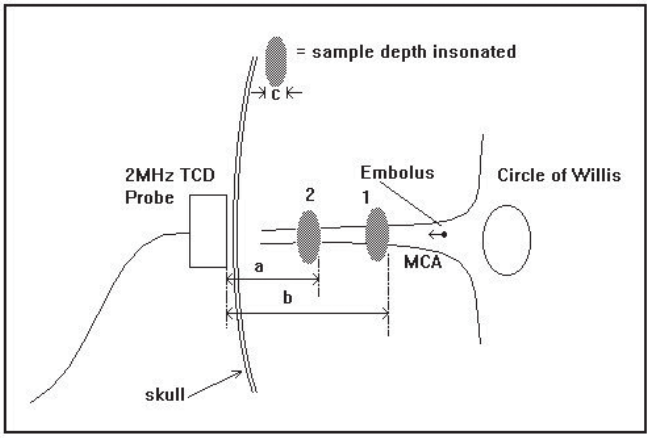

Fig. 5a: Schematic diagram of dual-gated TCD configuration insonating a middle cerebral artery (MCA). Sample depths 1 and 2 are positioned along the artery as shown (although in practice the sample volumes will overlap).

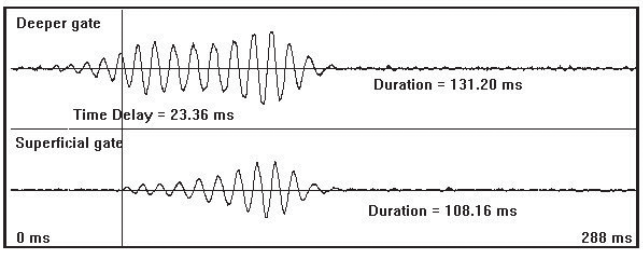

Fig. 5b: Time-domain display of the Doppler signals from an embolus passing through the two gates. The signal appears in the deeper gate approximately 23 ms before it appears in the superficial gate. In the case of an artifact the two signals would appear at the same time.

one Doppler sample volume in an attempt to track the movement of an embolus through the circulation[20,21,22]. The method consists of placing two or more sample volumes at different positions along the arterial tree, and monitoring the signal from each gate for transient increases in power (Fig. 5a). If such transients are due to an embolus, then since it is flowing with the blood, it will enter the distal sample volume (SV1) before it enters the proximal sample volume (SV2), and therefore the resulting increase in power from SV1 will occur before that from SV2 (Fig. 5b). The time difference will be given by the velocity of embolus propagation divided by the distance between the leading edges of the two sample volumes[23] (very approximately – see Smith, *et al.* 1997). If, on the other hand, the transient increase in power is not due to an embolus, it is likely that either the increase in power will occur only in one sample volume or in both simultaneously. This technique has been shown to be quite reliable for MES with relatively high MEBR, but is unfortunately less useful for MES with low MEBR which is when it is most difficult to distinguish MES from artifacts using standard criteria.

Embolic composition

It is important to know the nature of any embolus for several reasons, but most importantly because solid emboli are believed to be more hazardous than small gaseous emboli. Even if emboli of different types produced similarly sized MES this would be important, but it is particularly so since small gaseous emboli produce similar signals to large solid emboli.

Power based methods

The most obvious characteristic of MES that can be used to discriminate between solid and gaseous emboli is the EBR. Reference to Figs. 2a and 2b shows that if EBR exceeds about 30 dB then the embolus is likely to be gas, while if EBR is less than 20 dB the embolus is likely to be solid. For values in between there is a region of uncertainty, but in itself this is probably not of too great a concern, it is more a question of how to estimate EBR directly or indirectly with sufficient accuracy to use this property for classifying emboli. Some of the difficulties of making accurate measurements of EBR and associated quantities have been described earlier; where it has been seen there are considerable uncertainties. If it were not for these uncertainties it is likely that methods based on power estimation would be adequate for distinguishing between solid and gaseous emboli in most circumstances.

Partial gas pressure manipulation

There has long been a controversy over whether the very high numbers of microemboli detected in patients with prosthetic heart valves are solid or gaseous. One school of thought has it that they cannot be solid, otherwise the patient would show significant clinical effects, while the opposite school maintains that even if gas bubbles were generated in the heart, they would dissolve before reaching the brain. To some extent this controversy has been resolved by studying the effect of oxygen ventilation and of hyperbaria on these patients[24,25]. The result of oxygen ventilation is to dramatically decrease the number of MES, while the effect of hyperbaria is to increase the counts, implying that at least a significant proportion of the emboli are gaseous. While techniques like these cannot help to classify individual emboli, where there is a chronic source of emboli it can provide useful information.

Sub-harmonic and ultra-harmonic emissions

Gas bubbles behave in a non-linear manner when at, or near resonance, while solid particle scatter in a linear manner irrespective of frequency. It is possible that this property could be used to classify emboli. Palanchon, *et al.*[26] have explored this property *in-vitro* using low ultrasound frequencies (130 kHz and 250 kHz) and showed that scattering takes place at the second and third harmonic frequencies when bubbles sizes are approaching resonance, and at even higher harmonic frequencies when their sizes are very close to resonance. They subsequently showed that by using properties of sub-harmonics, ultra-harmonics, and harmonics, bubbles around the resonance size, and around twice the resonance size can be detected from the surrounding medium[27]. While this technique has obvious attractions, it remains to be seen if it can be made to work *in-vivo*.

Frequency modulation

For reasons as yet unknown, it appears that gaseous emboli are much more likely to generate frequency modulation in the Doppler signal than solid emboli. Indeed, while as many as 43% of gaseous emboli appear to generate rapid frequency modulation, few if any solid emboli exhibit this behavior[10]. It is not known if this provides additional information when compared to power based methods.

Embolic size

An ultimate goal of embolus detection work would be to estimate the size of each embolus. To date there has been little progress towards this goal. The most obvious quantity to measure with sizing in mind would be MEBR, but there are two difficulties with this. The first is that, for solid emboli (for example RCAs), EBR does not increase monotonically with power and therefore any one value of MEBR could correspond to two or three embolus sizes. The second is that the variation in EBR with size is not large compared with the errors in estimating MEBR. One technique that has shown some promise *in-vitro* is to make use of more that one transmitted frequency. The principle behind this is that since the pattern of variation of EBR with diameter is frequency dependent, it should be possible to combine independent information from measurements made at different frequencies[28,29]. Even *in-vitro* however, beam refraction causes considerable difficulties, and at present the *in-vivo* problem is far from being solved.

Summary and conclusions

It is relatively easy to detect both solid and gaseous microemboli traveling in the major cerebral arteries, but great care is needed in the interpretation of the resulting MES. Most emboli can be classified as 'gaseous' or 'probably solid' solely on the grounds of the amount of Doppler power they backscatter, but there is an overlap between the size of the signals from small gaseous and large solid emboli. Solid emboli are likely to be more dangerous than gaseous emboli, but unfortunately they are the most difficult to detect. Power measurements on emboli have a high degree of variability associated with them due to unknown factors such as the shape of the ultrasound field inside the brain, the size of the artery, and the vessel/ultrasound beam configuration. Work is continuing on new techniques for characterising and sizing emboli, and on automating their detection.

References

1 Padayachee TS, Gosling RG, Bishop CC, Burnand K, Browse NL. Monitoring middle cerebral artery blood velocity during carotid endarterectomy. *Br J Surg* 1986; 73: 98–100.

2 Spencer MP, Thomas GI, Nicholls SC, Sauvage LR. Detection of middle cerebral artery emboli during carotid endarterectomy using transcranial Doppler ultrasonography. *Stroke* 1990; 21: 415–23.

3 Cullinane M, Reid G, Dittrich R, Kaposzta Z, Ackerstaff R, Babikian V, *et al.* Evaluation of new online automated embolic signal detection algorithm, including comparison with panel of international experts. *Stroke* 2000; 31: 1335–41.

4 Fan L, Evans DH, Naylor AR. Automated embolus identification using a rule–based expert system. *Ultrasound Med Biol* 2001; 27: 1065–77.

5 Fan L, Boni E, Tortoli P, Evans DH. Multigate transcranial Doppler ultrasound system with real–time embolic signal identification and archival. *IEEE Trans Ultrason Ferroelec Freq Contr* 2006; 53: 1853–61.

6 Ackerstaff RGA, Babikian VL, Georgiadis D, Russell D, Siebler M, Spencer MP, Stump D. Basic identification criteria of Doppler microemboli signals: Consensus committee of the 9th International Cerebral Hemodynamics Symposium. *Stroke* 1995; 26: 1123.

7 Georgiadis D, Grosset DG, Kelman A, Faichney A, Lees KR. Prevalence and characteristics of intracranial microemboli signals in patients with different types of prosthetic cardiac valves. *Stroke* 1994; 25: 587–92.

8 Spencer MP. Detection of cerebral arterial emboli. In: Newell DW, Aaslid R, editors Transcranial Doppler. New York: Raven Press; 1992. pp 215–30.

9 Evans DH, Smith JL, Naylor AR. Characteristics of Doppler ultrasound signals recorded from cerebral emboli. *Ultrasound Med Biol* 1997; 23: S140.

10 Smith JL, Evans DH, Naylor AR. Analysis of the frequency modulation present in Doppler ultrasound signals may allow differentiation between particulate and gaseous cerebral emboli. *Ultrasound Med Biol* 1997; 23: 727–34.

11 Lubbers J, van den Berg JW. An ultrasonic detector for microgas emboli in a bloodflow line. *Ultrasound Med Biol* 1976; 2: 301–10.

12 Moehring MA, Klepper JR. Pulse Doppler ultrasound detection, characterization and size estimation of emboli in flowing blood. *IEEE Trans Biomed Eng* 1994; 41: 35–44.

13 Evans DH. Ultrasonic detection of cerebral emboli. In: Yuhas DE, Schneider SC, editors. Proc. 2003 Ultrasonics Symposium. Piscataway: IEEE; 2003. 316–26.

14 Evans DH. Detection of microemboli. In: Babikian VL, Wechsler LR, editors. Transcranial Doppler Ultrasonography 2nd edn. Boston: Butterworth Heinemann; 1999. pp 141–155.

15 Chung EML, Fan L, Naylor AR, Evans DH. Characteristics of Doppler embolic signals observed following carotid endarterectomy. *Ultrasound Med Biol* 2006; 32: 1011–23.

16 Smith JL, Evans DH, Fan L, Thrush AJ, Naylor AR. Processing Doppler ultrasound signals from blood borne emboli. *Ultrasound Med Biol* 1994; 20: 455–62.

17 White DN, Curry GR, Stevenson RJ. The acoustic characteristics of the skull. Ultrasound Med Biol 1978; 4: 225–52.

18 Deverson S, Evans DH, Bouch DC. The effects of temporal bone on transcranial Doppler ultrasound beam shapes. *Ultrasound Med Biol* 2000; 26: 239–44.

19 Angell EL, Evans DH. Limits of uncertainty in measured values of embolus–to–blood ratio due to Doppler sample volume shape and location. *Ultrasound Med Biol* 2003; 29: 1037–44.

20 Georgiadis D, Goeke J, Hill M, König M, Nabavi DG, Stögbauer F, *et al.* A novel technique for identification of Doppler microembolic signals based on the coincidence method. In vitro and in vivo evaluation. *Stroke* 1996; 27: 683–86.

21 Smith JL, Evans DH, Fan L, Bell PRF, Naylor AR. Differentiation between emboli and artefacts using dual–gated transcranial Doppler ultrasound. *Ultrasound Med Biol* 1996; 22: 1031–36.

22 Evans DH. Multigate emboli detection. In: Hennerici MG, Meairs SP, eds Cerebrovascular Ultrasound: Theory, practice and future developments. Cambridge: Cambridge University Press; 2001. pp 360–73.

23 Smith JL, Evans DH, Naylor AR. Signals from dual gated TCD systems: Curious observations and possible explanations. *Ultrasound Med Biol* 1997; 23: 15–24.

24 Georgiadis D, Wenzel A, Lehmann D, Lindner A, Zerkowski HR, Zierz S, Spencer MP. Influence of oxygen ventilation on Doppler microemboli signals in patients with artificial heart valves. *Stroke* 1997; 28: 2189–94.

25 Baumgartner RW, Frick A, Kremer C, Oechslin E, Russi E, Turina J, Georgiadis D. Microembolic signal counts increase during hyperbaric exposure in patients with prosthetic heart valves. *J Thorac Cardiovasc Surg* 2001; 122: 1142–46.

26 Palanchon P, Bouakaz A, Van Blankenstein JH, Klein J, Bom N, De Jong N. New technique for emboli detection and discrimination based on nonlinear characteristics of gas bubbles. *Ultrasound Med Biol* 2001; 27: 801–8.

27 Palanchon P, Bouakaz A, Klein J, De Jong N. Subharmonic and ultraharmonic emissions for emboli detection and characterization. *Ultrasound Med Biol* 2003; 29: 417–25.

28 Moehring MA, Ritcey JA. Sizing emboli in blood using pulse Doppler ultrasound I: Verification of the EBR model. *IEEE Trans Biomed Eng* 1996; 43: 572–80.

29 Moehring MA, Ritcey JA, Ishimaru A. Sizing emboli in blood using pulse Doppler ultrasound II: Effects of beam refraction. *IEEE Trans Biomed Eng* 1996; 43: 581–88.

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Use of real-time thyroid ultrasonography by endocrinologists – a work in progress

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Key words: cysts, differentiated thyroid cancer, fine-needle aspiration biopsy, Graves' disease, nodules, thyroid ultrasonography, thyroiditis.

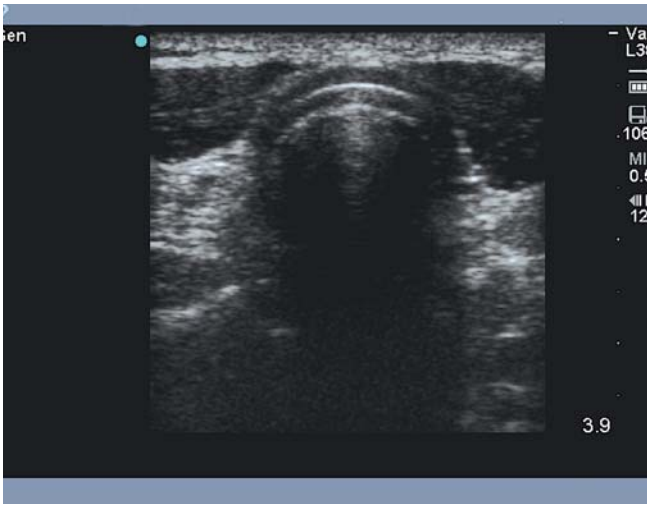

Fig. 1: Thyroid agenesis. Black spaces where the thyroid lobes and isthmus should be, in a 15-year-old hypothyroid boy born without a thyroid gland.

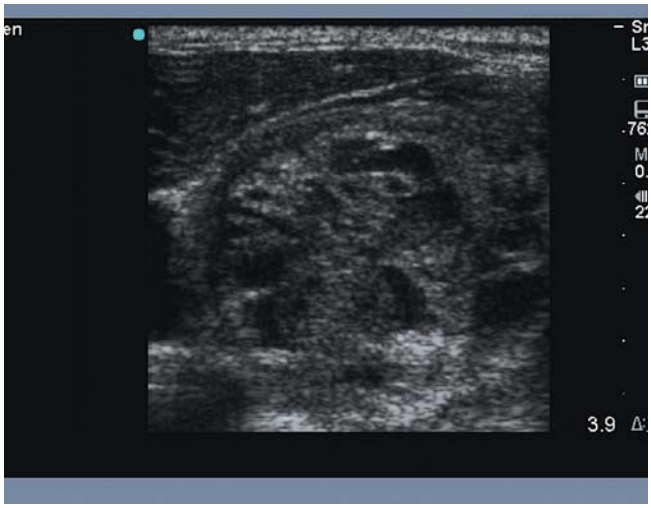

Fig. 2: Large hypo echoic thyroid nodule with speckled intra nodular calcification and an irregular edge suspicious for differentiated thyroid cancer.

Introduction

There is growing recognition among endocrinologists that it is not possible to be a 'thyroid specialist' without having one's own ultrasound machine, i.e. to use real-time ultrasonography as a diagnostic and management aid. For most of us hospital-based thyroid specialists, this means a portable machine. In private practice, groups of thyroidologists might consider the purchase of a larger machine with greater capabilities in the context of their business plan. The author's practice comprises approximately 80% patients with thyroid disease on whom he performs about 1000 high-resolution conventional thyroid ultrasounds per year. His machine is a Titan Sonosite portable, incorporating a small parts transducer probe with colour flow to assess vascularity, but not Doppler. He is a thyroid specialist who, for 25 years in North America, restricted his practice to patients with thyroid problems. The author is one of very few endocrinologists in Australia who routinely performs real-time ultrasonography and ultrasound guided fine needle aspiration (FNA) biopsy in a largely thyroid-based practice. He is mainly self-taught and is still learning to assess lumps and swellings outside the thyroid gland such as enlarged lymph nodes and parathyroid adenomas. While the use of real-time thyroid ultrasonography is limited in this country, it is state-of-the-art in Europe and in the USA. Real-time thyroid ultrasonography is not used by endocrinologists in Canada because there is no scheduled fee for an endocrinologist to perform ultrasound in either the hospital or private office setting. You can do it, but you won't get paid for it. In Canada, FNA biopsy of thyroid nodules is carried out by palpation, i.e. without ultrasound guidance, for which there is a fee, or by 'ultrasonographers' (radiologists, nuclear medicine physicians etc.) and pathologists under ultrasound guidance. In Australia, there is no Pharmaceutical Benefit Scheme (PBS) reimbursement for performing FNA, even by palpation. Thus, endocrinologists who do not have an ultrasound machine must refer their patients to imaging departments for ultrasound and then to pathologists to carry out biopsy by palpation or under guidance, for which they are paid a fee. However, 'imagers' who perform thyroid ultrasonography without knowledge of the patient's medical history and laboratory results often misinterpret what they see on ultrasound, or at least this is the impression that many thyroid specialists have.

Although there are many uses for thyroid ultrasonography, its main use is to assess thyroid nodules, and therein lies the problem; thyroid nodules and cysts are very common, being found by palpation in about 5–8% of adults[1] and by ultrasonography in up to 60% of adults[2,3]. Even though the prevalence of thyroid cancer in adults appears to be increasing, especially in white adult males[4], only about 8–10% of nodules are malignant[5,6]. Indeed, the author used to say to his patients in Canada, 'I have never ordered a thyroid ultrasound' (because if you do, you are then obliged to deal with all the nodules and cysts that are found). However, once the decision to have an ultrasound is made there is no turning back. Every

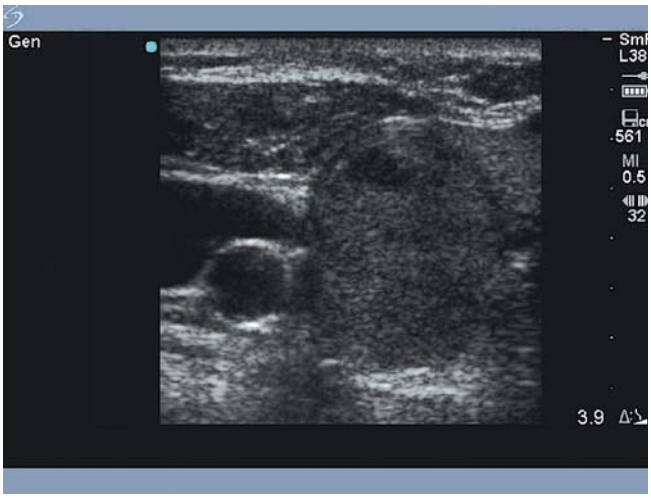

Fig. 3: Large hypo echoic nodule with an irregular edge in a patient with established papillary thyroid cancer.

Fig. 4: Large benign thyroid cyst with a small amount of solid material around the periphery.

Fig. 5: Benign looking, oval shaped, thyroid isthmal nodule with halo.

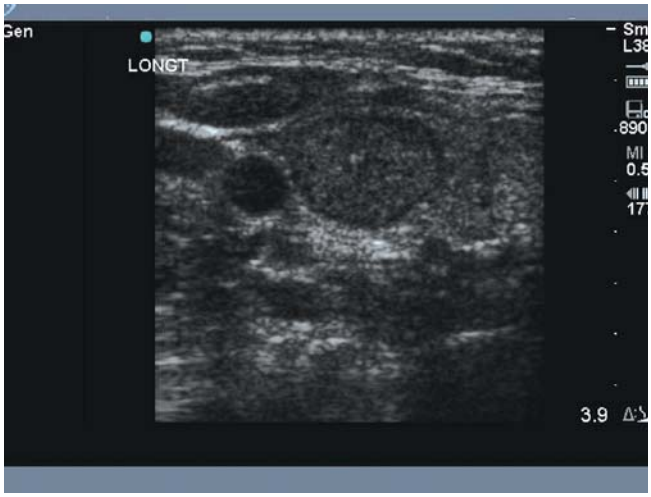

Fig. 6: Small hyper echoic thyroid nodule with a smooth sharp surface, likely a colloid nodule.

nodule, cyst, lump and lesion must be assessed in respect to its characteristics, size and change in size, shape or nature over a period of time, and decisions made about what to biopsy and when and when to refer the patient to a thyroid surgeon for 'open biopsy'. This does put a big load on practicing thyroidologists who find themselves responsible for the management of large numbers of patients.

In this country, there is an increasing interest in the use of thyroid ultrasound by general endocrinologists, particularly those with a focus on thyroid disease. Courses have been arranged, mainly through the American Thyroid Association, and more endocrinologists are purchasing ultrasound machines for use in their office or in the hospital setting. This review will focus on the current use of thyroid ultrasonography by the thyroid specialist in assessing and managing patients with various thyroid disorders, particularly nodules, multinodular goitre, differentiated thyroid cancer and thyroiditis.

The normal thyroid

With experience, normal thyroid size, texture (echoicity) and overall appearance is well understood and the abnormal more easily recognised. Thyroid size varies with age and in old age the gland atrophies somewhat and nodules and cysts are more often found. The thyroid gland descends with age to a partly or largely retrosternal position. Thyroid ultrasonography can be used to localise the thyroid in patients with suspected retrosternal goitre or ectopic thyroid and to confirm its absence in thyroid agenesis. In the latter case, the empty tissue spaces (where the thyroid lobes and isthmus should be) can be clearly seen as an interesting way to confirm hypothyroidism (Fig. 1).

Thyroid nodules and cysts

The main challenge that confronts the thyroid specialist is that, of all the nodules noted on thyroid ultrasonography, he or she must identify the approximately 10% that are cancerous. The overall risk for differentiated thyroid cancer (DTC) does not increase proportionally to the number of nodules but certain characteristics of individual nodules make the overall chance of thyroid cancer greater[6–11]. In the evaluation of thyroid nodules the following characteristics are looked for; regularity of margins, halo sign, intra nodular calcification, so-called pseudo-calcification with 'comet tail' or vascularity and evidence for invasion of the thyroid capsule and surrounding tissues. As well, nodule size and degree of echoicity (hyper-, hypo-, iso-echoic) are determined. Features which are suspicious for DTC include; hypoechoicity (Fig. 2), speckled intra nodular calcification (Fig. 2), intra nodular vascularity, an irregular margin with

Fig. 7: Single, benign looking, iso echoic thyroid nodule with a halo and regular surface that was shown to be autonomous ('hot') on technetium scan.

Fig. 8: Calcified nodule in a patient with end stage Hashimoto's thyroiditis. Peripheral ('egg shell') calcification, reflecting chronic inflammation and scarring, is seen.

absence of a halo (Fig. 3), taller than wide, size, and increase in size by >20% over a 6–12 month period. Nodules can be classified as low, medium, or high risk for malignancy on the basis of nodule characteristics found on ultrasonography[12]. An individual nodule has a greater chance of being malignant in patients who received head and neck irradiation as a child[13,14]. Thyroid cysts, even large ones (Fig. 4), are almost always benign, but the solid part of a complex solid/cystic nodule, which can be measured at regular intervals to monitor its growth, may be cancerous. The typical benign nodule is <1–2 cm in all three measurements, isoechoic, has a clear sharp halo and is round (Fig. 5). Others have the same features but are hyper echoic (Fig. 6).

Ultimately, however, the thyroidologist must make management decisions based on all of the ultrasound findings and salient clinical features such as the hardness of a gland, whether or not the nodule is functioning on technetium or 123I scan – 'warm' or 'hot' nodules (Fig. 7) are rarely malignant – and whether there is associated neck pain or hoarseness. Benign nodules are treated conservatively, i.e. by follow-up with repeated ultrasounds in the long term, thyroid function testing and FNA biopsy if necessary, although some patients eventually seek definitive treatment by total thyroidectomy simply because of the inconvenience of repeated visits and tests[15].

Thyroid calcification

Calcification of various types is commonly seen in the thyroid. While speckled micro calcification within a nodule is a suspicious sign of thyroid cancer (Fig. 2), more solid, linear or capsular ('egg shell') calcifications often accompanied by 'comet tails' are commonly seen features of chronic thyroid inflammation, especially Hashimoto's thyroiditis (Fig. 8).

Use of FNA biopsies of thyroid nodules

The use of FNA biopsy of thyroid nodules complements ultrasonography and, used together, greatly enhances the sensitivity and specificity of detection of DTC[8,9,16–18]. FNA biopsy by palpation and/or under ultrasound guidance is performed on all suspicious nodules regardless of size, dominant nodules in a multinodular goitre[5] and, where possible, under ultrasonography guidance, the solid component of a mixed solid/cystic lesion, if it has any suspicious signs. Typically, in a multinodular goitre, the biggest three or four nodules would be biopsied.

Information derived from FNA is critical to the assessment of nodules and the basis on which surgical and other therapy is planned. Unfortunately, there is some variability in reporting FNA biopsy results by the pathologists, who are not necessarily expert thyroid cytopathologists. Also, the terminology used by different pathologists varies. Generally, results are given as; 'benign' (usually a colloid nodule), haemorrhage into a cyst or nodule, papillary cancer (the most common form of differentiated thyroid cancer), follicular 'neoplasm' (since it is not possible to characterise a follicular lesion as malignant unless features of invasion are seen), 'suspicious' for papillary thyroid cancer, 'atypical' (usually on the basis of a hypercellular specimen), 'indeterminate' or 'non-diagnostic' (i.e. not enough follicular cells seen to make a definitive diagnosis). Other less common cytological diagnoses are; Hurthle cell tumours, which can be benign or malignant, medullary thyroid carcinoma and anaplastic carcinoma. Recently, attempts have been made to standardise the way in which FNA biopsies are reported[19] and that promises to make management of thyroid nodules more rational.

Multinodular goitre

Difficulties arise in the assessment of large or overlapping nodules, which is quite common in multinodular goitre. Since it is difficult to measure individual nodules, any change in size with time cannot be easily determined. Moreover, it is also difficult under these circumstances to identify hypoechoicity, intra-nodular calcification and intra-nodular vascularity. Indeed, many patients with multinodular goitres are eventually referred for thyroidectomy, simply because it is too difficult to assess their nodules.

Other patients are referred for thyroidectomy because of development of hyperthyroidism, obstructive symptoms, or, more often, patients' concerns about needing repeated ultrasound testing and FNA biopsies, usually after about 12 months. Otherwise, the management of benign nodular disease is conservative and thyroidologists can prevent many patients from having unnecessary thyroid surgery.

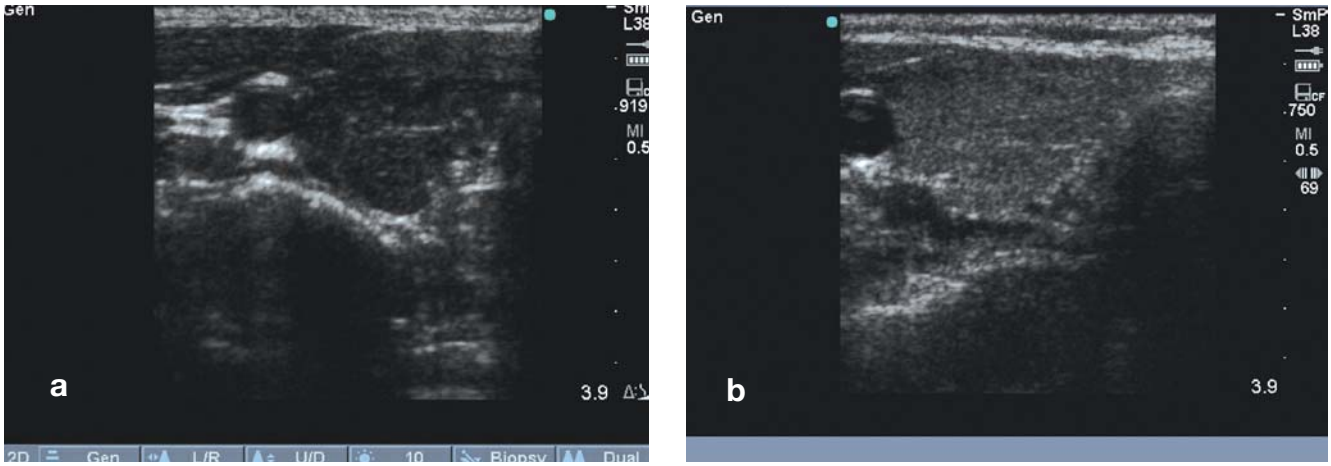

Fig. 9: Sub acute thyroiditis during the early hyperthryoid phase a), showing enlarged inflamed-looking patchy thyroid and on recovery b), showing filled in spaces and overall normal, iso echoic, appearance throughout.

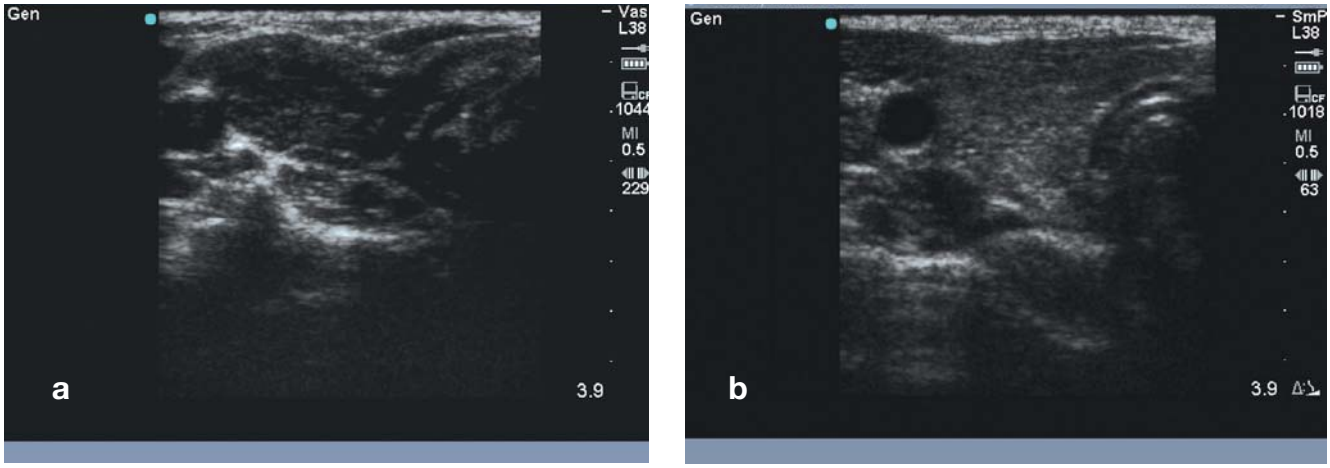

Fig. 10: Inflamed thyroid gland in a 11-year-old euthyroid female with Hashimoto's thyroiditis at the first visit when serum fT4 and TSH were normal (a) and, 13 months later when end stage (b). The thyroid now appears empty and 'moth eaten'.

Thyroiditis

The use of real-time thyroid ultrasonography allows the thyroid specialist to follow the stages of transient – sub-acute, silent and postpartum – and progressive (Hashimoto's) thyroiditis. During the early hyperthyroid stage of post viral sub acute thyroiditis the gland is 'inflamed' and vascular with scattered patches that reflect diffuse inflammatory infiltration (Fig. 9a) while later, when the thyroid cells are damaged, it appears 'empty' before recovering to normal after a few weeks (Fig. 9b). In the case of Hashimoto's thyroiditis, inflammation is progressive; following an early inflammatory stage characterised by a tender enlarged thyroid gland, lymphocytic infiltration and increased vascularity (Fig. 10a) the thyroid tissue is slowly eliminated, being replaced by scar tissue and patches of linear or encasing (egg shell) calcification to a final end-stage when the whole gland takes on a 'moth eaten' appearance (Fig. 10b). Patients can be followed with fT4 and TSH levels and ultrasonography and told precisely when they are 'end stage' and need life long thyroxine replacement therapy.

Graves' disease

In Graves' disease, the thyroid gland is hyperplastic due to the stimulatory action of TSH-receptor antibodies, diffusely enlarged (Fig. 11) and the blood supply is markedly increased. These features are easily recognised at baseline thyroid ultrasonography. With antithyroid treatment, the thyroid gland

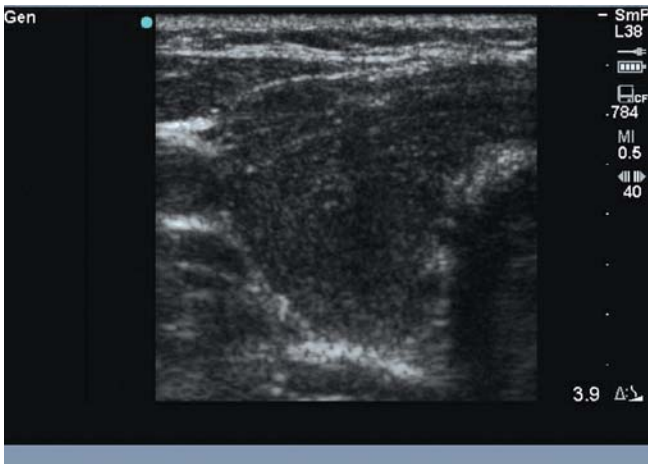

Fig. 11: Diffusely enlarged thyroid gland in a patient with untreated Graves' hyperthyroidism. The thyroid has a patchy, inflamed, appearance.

decreases in size and one characteristic of increased chance of long-term remission is a small goitre at the end of a 12 month treatment period. One can also follow changes in size, echoicity and vascularity of the the nodules that are commonly seen in older people with so-called 'nodular Graves'' disease.

Thyroid cancer

The main use of real-time thyroid ultrasonography is to assess thyroid nodules for features of DTC and, in those who

turn out to have thyroid cancer, to quantify the disease burden at the time of diagnosis based on the size of the cancer, any extension into adjacent neck tissues and the number and size of any involved lymph nodes. The baseline assessment helps the surgeon to plan therapy which is typically total thyroidectomy, removal of the central lymph nodes and any other lymph nodes which are seen to be enlarged, and treatment with 100–150 mCi of radioiodine 3–4 weeks later when the patient is hypothyroid. The use of thyroid ultrasonography to assess the initial cancer burden is of importance because it is now recognised that the first intervention is the best opportunity to cure DTC. On follow-up after thyroidectomy, ultrasound is used to identify any new thyroid tissue and enlarged neck lymph nodes. These findings are correlated with serum levels of thyroglobulin which in the absence of functional thyroid cells, is undetectable.

Because there is an increased prevalence of differentiated thyroid cancer in patients with Hashimoto's thyroiditis[20], nodules are of a particular importance in this common group of patients. The prevalence of thyroid cancer is not increased in patients with Graves' disease or transient thyroiditis.

Hyperparathyroidism

Endocrinologists, who are largely self-taught, find it more difficult to assess lymph nodes and parathyroid glands. We are good inside the thyroid gland, but still learning outside. Patients with suspected hyperparathyroidism display increased serum and urine calcium, increased serum parathyroid hormone and normal serum vitamin D. The diagnosis is confirmed by correlating ultrasound findings with nuclear imaging. The ability to localise the presumed parathyroid adenoma allows the surgeon to plan limited neck surgery, which is attractive to the patients[21]. Parathyroid adenomas are usually single, located in one of the four parathyroid glands, are about the same size as lymph nodes, are round and hypoechoic and situated behind one or other pole of the thyroid. Experience is needed to identify parathyroid adenomas, especially when they are not in their expected position behind the thyroid. It is not clear whether normal parathyroid glands can be visualised by neck ultrasonography, so its use in the diagnosis of primary and secondary (post thyroidectomy or radioiodine ablation) hypoparathyroidism is speculative.

Research applications of thyroid ultrasonography

The author's primary research interest is in thyroid-associated ophthalmopathy, or 'poppy eyes'[22–24]. Large thyroid size, as a measure of the severity of the 'thyroiditis', may be a risk factor for the development of eye changes. We are presently measuring isthmus diameter, as a surrogate for overall thyroid volume, in patients with newly-diagnosed hyperthyroidism and eye signs at baseline or on follow-up. There will be other research applications for the thyroidologist with research interests as well.

Some tricks of the trade

It is often said by thyroidologists who use real-time ultrasonography that reports from imaging departments are often inaccurate or unhelpful. With experience, the thyroid specialist becomes the 'expert'. Some things that he/she finds that might be missed, or not recognised as providing helpful clinical information by those with less experience, include; lateral or oblique views of thyroidal blood vessels which are misreported as 'cysts', the various stages of sub-acute thyroiditis (as described above), return to normal size of Graves' thyroid after anti-thyroid drug treatment, areas of lymphoid infiltration or lymphoid nodules in Graves' or Hashimoto's thyroid that are misinterpreted as 'cysts' or 'nodules' and the end stage of long standing Hashimoto's thyroiditis which is often reported as showing nodules that might even be considered 'suspicious' if associated with micro calcification.

Summary

Because the use of thyroid real-time ultrasonography as a routine diagnostic tool for patients with various thyroid and parathyroid disorders is new, its role is still being assessed. It is likely that additional subtle abnormalities will be recognised in cancerous thyroid nodules, thereby helping to differentiate the 10% of nodules that are malignant from the 90% that are not in an adult population in whom as many as 60% will have one or more nodules or cysts on ultrasonography. Subtle thyroid abnormalities will also be noted in patients with transient or progressive thyroiditis that may help plan early intervention and long term management. There will also be new ways to assess whether treatment with antithyroid medication would be indicated in patients with Graves' hyperthyroidism, or whether initial treatment with radioactive iodine or by thyroidectomy might be more logical. Finally, as a thyroidologist interested in 'Graves' ophthalmopathy', use of ultrasonography to differentiate eye muscle enlargement from orbital connective tissue inflammation, is, with experience, possible and may offer a new clinical aid for the early diagnosis and even prevention of the eye disorder. There will also be many research applications of thyroid and neck ultrasonography.

References

1 Vander JB, Gaston EA, Dawber TR. The significance of non toxic thyroid nodules. Final report of a 15-year study of the incidence of thyroid malignancy. *Ann Intern Med* 1968; 69: 537–40.

2 Ezzat S, Sarti DA, Cain DR, Braunstein GD. Thyroid incidentalomas. Prevalence by palpation and ultrasonography. *Arch Intern Med* 1994; 154: 1838–40.

3 Brander A, Viikinkoski P, Nickels J, Kivisaari L. Thyroid gland: US screening in a random adult population. *Radiology* 1991; 181: 683–87.

4 Larson SD, Jackson LN, Riall TS, Uchida T, Thomas RP, Qiu S, Evers BM Increased incidence of well-differentiated thyroid cancer associated with Hashimoto thyroiditis and the role of the PI3k/Akt pathway. *J Am Coll Surg*. 2007; 204: 764–73.

5 Frates MC, Benson CB, Doubilet PM, Kunreuther E, Contreras M, Cibas ES, *et al.* Prevalence and distribution of carcinoma in patients with solitary and multiple thyroid nodules on sonography. *J Clin Endocrinol Metab* 2006; 91: 3411–17.

6 Tae HJ, Lim DJ, Baek KH, *et al.* Diagnostic value of ultrasonography to distinguish between benign and malignant lesions in the management of thyroid nodules. *Thyroid* 2007; 17: 461–66.

7 American Association of Clinical endocrinologists and Associazione Medici Endocrinologi medical guidelines for clinical practice for the diagnosis and management of thyroid nodules. *Endocr Pract* 2006; 12: 63–102.

8 Cooper DS, Doherty GM, Haugen BR *et al.* Management guidelines for patients with thyroid nodules and differentiated thyroid cancer. *Thyroid* 2006; 16: 109–42.

9 Kim EK, Park CS, Chung WY, *et al*. New sonographic criteria for recommending fine needle aspiration biopsy of non palpable solid nodules of the thyroid. *AJR Am J Roentgenol* 2002; 178: 687–91.

10 Waters DA, Ahuja AT, Evans RM, *et al.* Role of ultrasound in the management of thyroid nodules. *Am J Surg* 164: 654–57.

11 Nam-Goong IS, Kim HY, Gong G, Lee HK, Hong SJ, Kim WB, Shong YK. Ultrasonography-guided fine-needle aspiration of thyroid incidentaloma: correlation with pathological findings. *Clin Endocrinol (Oxf)* 2004; 60: 21–8.

12 Kioke E, Noguchi S, Yamashita H, *et al.* Ultrasonographic characteristics of thyroid nodules: prediction of malignancy. *Arch Surg* 2001; 136: 334–37.

13 Zheng R, Dahlstrom KR, Wei Q, Sturgis EM Gamma radiation-induced apoptosis, G2 delay, and the risk of salivary and thyroid carcinomas – a preliminary report. *Head Neck* 2004; 26: 612–18.

14 Nikiforov YE Radiation-induced thyroid cancer: what we have learned from Chernobyl. *Endocr Pathol* 2006; 17: 307–17.

15 Hermus RA, Huysmans DA, Treatment of benign nodular thyroid disease. *New Engl J Med* 1998; 338: 1438–47.

16 Carmeci C, Jeffrey RB, McDougall IR, Nowels KW, Weigel RJ. Ultrasound-guided fine-needle aspiration biopsy of thyroid masses. *Thyroid* 1998; 8: 283–9.

17 Frasoldati A, Pesenti M, Gallo M, Caroggio A, Salvo D, Valcavi R Diagnosis of neck recurrences in patients with differentiated thyroid carcinoma. *Cancer* 2003; 97: 90–6.

18 Livolski V. Thyroid nodule FNA and frozen section: partners or adversaries. Proceedings of the *AAES Annual Meeting,* 2007 Tuscon AZ, Apr 29–May 1, (abstract).

19 Ogilvie JB, Piatigorsky EJ, Clark OH. Current status of fine needle aspiration for thyroid nodules. *Adv Surg* 2006; 40: 223–38.

20 Laurberg P. Remission of Graves' disease during anti-thyroid drug therapy. Time to reconsider the mechanism? *Eur J Endocrinol* 2006; 155: 783–86. Review.

21 Pisanu A, Piu S, Cois A, Uccheddu A. Coexisting Hashimoto's thyroiditis with differentiated thyroid cancer and benign thyroid diseases: indications for thyroidectomy. *Chir Ital* 2003; 55: 365–72.

22 Simonella G, Massaccesi E, De Marzi C, Staffolani P, Falco A, Morosini P. Minimally invasive surgery versus bilateral neck exploration for primary hyperparathyroidism: controlled prospective study. Role of intraoperative rapid parathyroid hormone assay and radiological preoperative detection of adenomas. *Recenti Prog Med* 2005; 96: 483–87

23 Tani J, Wall JR. Analysis – Can the development of thyroid-associated ophthalmopathy be explained by autoimmunity against eye muscle antigens? *Can Med Assoc J* 2006; 17: 239–41.

24 Gopinath B, Musselman R, Adams C, Tani J, Beard N, Wall JR. Study of serum antibodies against three eye muscle antigens and the connective tissue antigen collagen XIII in patients with Graves' disease with and without ophthalmopathy – correlation with clinical features. *Thyroid* 2006; 16: 967–74.

25 Tani J, Gopinath B, Nuygen B, Wall JR. Immunological mechanisms for the eye muscle and orbital connective tissue reactions of thyroid-associated ophthalmopathy. *Expert Reviews in Clin Immunol* 2007; 3: 299–311.

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The 'elephant trunk' sign and prenatal diagnosis of cloacal exstrophy

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Fig. 1: Transverse view of omphalocoele at 13 weeks four days gestation.

Fig. 2: Sagittal view of omphalocoele at 13 weeks four days gestation.

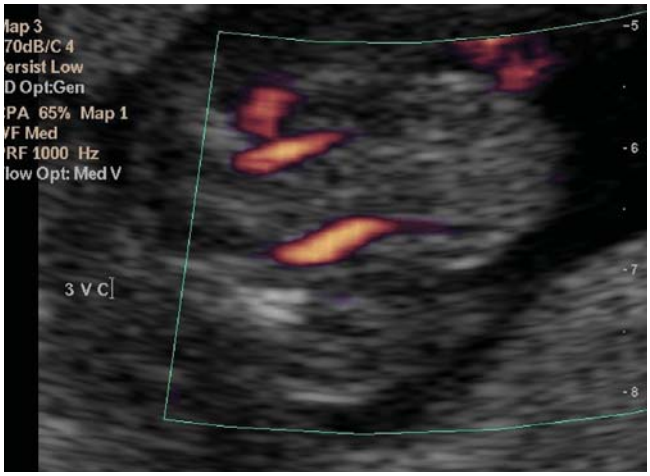

Fig. 3: Omphalocoele and absent bladder at 16 weeks three days gestation.

Introduction

The ultrasound diagnosis of fetal anterior abdominal wall defects is generally straightforward, however, unusual appearances may signify a more complex underlying anomaly. Multiple examinations of the fetus may be required to monitor development and to visualise normal physiological functions such as bladder filling. This case report describes how an abdominal wall defect detected in the first trimester necessitated a series of scans extending into the second trimester, in order to make a definitive prenatal diagnosis of cloacal exstrophy.

Case report

A 31-year-old woman in her second pregnancy was referred to our centre for further assessment following detection of a fetal omphalocoele at a nuchal translucency (NT) scan performed at 11 weeks four days gestation. The NT measured 1.3 mm and when combined with biochemistry gave an adjusted Down syndrome risk of 1:491 and adjusted trisomy 13 or 18 risk of 1:16 755. The patient was reviewed at 13 weeks four days gestation and a transvaginal scan was performed. There was evidence of an echogenic anterior wall mass in association with the cord origin, measuring 12 x 11 x 8 mm. It extended towards, but stopped short of the perineum. The contents appeared to be entirely bowel and the liver appeared to be intra-abdominal. The mass was well circumscribed and appeared encapsulated, consistent with an omphalocoele (Figs. 1 and 2) Transabdominal chorionic villus sampling (CVS) was performed and demonstrated a normal male (46 XY) karyotype.

The patient was seen in our department for a detailed morphology scan at 16 weeks three days, which demonstrated an omphalocoele with a superior cord insertion, containing bowel. The liver, gallbladder and stomach appeared to be normally sited. It was difficult to visualise the region between the omphalocoele and the perineum and normal bladder and genitalia could not be adequately identified (Fig. 3). We also noted a structure of similar echotexture to fetal bowel, that appeared to be protruding from the omphalocoele and was of uncertain significance (Fig. 4).

A further ultrasound performed at 17 weeks five days

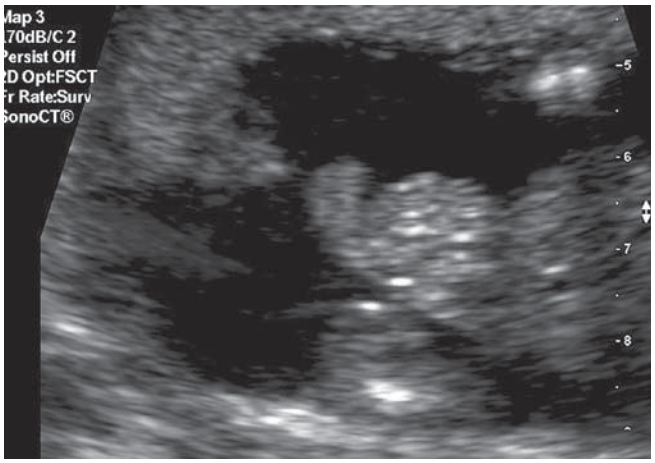

Fig. 4: Omphalocoele with unusual appearance at 16 weeks three days gestation.

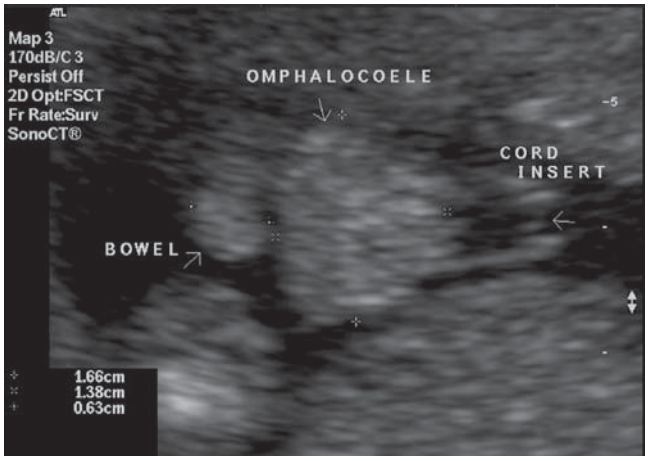

Fig. 5: Coronal view of superior cord insertion at 17 weeks five days gestation.

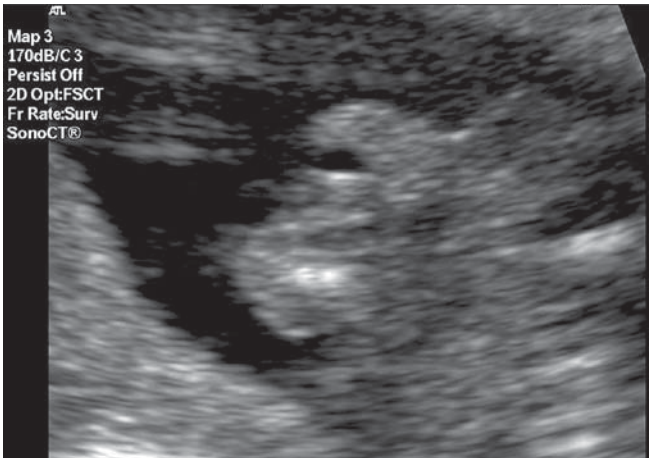

Fig. 6: Elephant trunk sign.

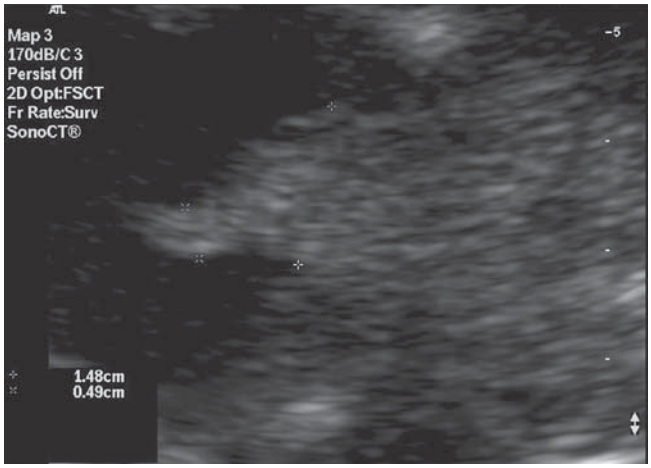

Fig. 7: Elephant trunk sign.

gestation demonstrated features highly suggestive of cloacal exstrophy. The bladder could not be visualised and there was a large infraumbilical exomphalos. The elongated protrusion seen previously was felt to correspond to the 'elephant trunk' sign. This sonographic appearance represents the prolapsed terminal ileum and was first reported by Hamada, *et al.* in 1999[1,2] (Figs. 5–7). The remainder of the scan, particularly the spine and lower limbs, appeared normal. The patient was counselled regarding the findings, likely diagnosis and outcome. She requested termination of pregnancy, which was performed with Cervagem vaginal pessaries.

The patient gave consent for post-mortem examination of the fetus, which confirmed cloacal exstrophy with omphalocoele and imperforate anus, most likely representing omphalocoele-exstrophy-imperforate anus-spinal defects (OEIS) complex[3].

Discussion

Cloacal exstrophy is a rare, complex anomaly, occurring in approximately 1/200 000 births with a reported female sex preponderance[4]. It is caused by a defect in the formation of the urogenital septum, which results in the persistence of a common cloaca receiving ureters, ileum and a rudimentary hindgut, in association with a wide range of urogenital tract anomalies, spinal dysraphism and imperforate anus. Over 85% also have an omphalocoele[5] and most patients have a single umbilical artery.

This case demonstrates how an omphalocoele with unusual sonographic features may represent a more serious underlying defect with a less favourable prognosis. Prenatal diagnostic criteria for cloacal exstrophy have been devised, and categorised as major and minor, based on frequency of occurrence rather than severity[6] (Table 1). In addition to these criteria, another ultrasonographic feature has previously been reported. A segment of soft tissue protruding from the infraumbilical anterior abdominal wall resembling the trunk of an elephant has been shown to represent the

Table 1: (Modified from Austin, *et al.* 1986) Prenatal ultrasound diagnostic criteria in cloacal exstrophy.

Major criteria
Absence of bladder
Large midline anterior wall defect with cord insertion superiorly or cystic anterior structure (persistent cloacal membrane)
Omphalocoele
Myelomeningocoele
Minor criteria
Abnormality of lower extremities
Renal tract anomalies
Ascites
Widened pubic arches
Narrow thorax
Hydrocephalus
Single umbilical artery

prolapsed terminal ileum[1,2]. Indeed, it was this elephant trunk feature, in conjunction with non-visualisation of the bladder and the finding of a large infraumbilical anterior abdominal wall defect, which assisted us in making the diagnosis of cloacal exstrophy.

Survival rates with cloacal exstrophy have been reported to be as high as 90%[7], due mainly to improvements in neonatalogy, anaesthesia, nutrition, antibiotics and surgical reconstructive techniques. However, there are still concerns regarding quality of life and psychosocial issues[6], particularly in regard to gender reassignment in patients who are genetically male but who lack phallic tissue from which to build a satisfactory penis[8].

In conclusion, this case highlights the importance of paying attention to detail when scanning fetal abdominal wall defects, such as the position of the cord insertion in relation to the defect and the presence or absence of a bladder. Accurate prenatal diagnosis of cloacal exstrophy ensures that patients receive appropriate information and counselling, and also provides an opportunity for multidisciplinary management strategies to be implemented.

References

1 Hamada H, Takano K, Shiina H, Sakai T, Sohda S, Kubo T. New ultrasonography criterion for the prenatal diagnosis of cloacal exstrophy: elephant trunk-like image. *J Urol* 1999; 162: 2123–24.

2 Monica MD, Nazzaro A, Lonardo F, Ferrara G, Di Blasi A, Scarano G. Prenatal ultrasound diagnosis of cloacal exstrophy associated with myelocystocele complex by the 'elephant trunk-like' image and review of the literature. *Prenat Diagn* 2005; 25: 394–97.

3 Carey JC, Greenbaum B, Hall BD. The OEIS complex (omphalocele, exstrophy, imperforate anus, spinal defects). *Birth Defects* Orig Artic Ser XIV 1978; 6B: 253–63.

4 Martinez-Frias ML, Bermejo E, Rodriguez-Pinilla E, Frias JL. Exstrophy of the cloaca and exstrophy of the bladder: two different expressions of a primary developmental field defect. *Am J Genet* 2001; 99: 261–69.

5 Gearhart JP, Jeffs RD. Exstrophy-epispadias complex and bladder anomalies. In campbell's Urology (7th ed) 1998, Walsh PC, Retnik AB, Vaughan ED, Wein AJ (editors). Philadelphia; WB Saunders. pp 1939–90.

6 Austin PF, Homsy YL, Gearhart JP, Porter K, Guidi C, Madesen K, Maizels M. The prenatal diagnosis of cloacal exstrophy. *J Urol* 1998; 160: 1179–81.

7 Hurwitz RS, Manzoni GM, Ransley PG, Stephens FD. Cloacal exstrophy: A report of 34 cases. *J Urol* 1987; 138: 1060–64.

8 Lund DP, Hendren WH. Cloacal exstrophy: A 25-year experience with 50 cases. *J Pediatr Surg* 2001; 36: 68–75.

B2 Guidelines for Disinfection of Intracavitary Transducers

May 1996, Reaffirmed September 1999, Revised July 2005, September 2007

Every patient must be regarded as a potential source of infection and appropriate precautions should be taken to prevent cross-infection between patient and operator. These are known as 'Universal Precautions' and are promoted throughout all health care institutions. Particularly important is the washing of hands both before and after direct patient contact[1]. Other precautions will include use of personal protective equipment (PPE) where appropriate and correct handling and disposal of waste and maintenance of a clean working environment.

Potential sources of infection associated with vaginal ultrasound scanning include those organisms transmitted by blood and genital secretions such as HIV, HBV, HCV, Cytomegalovirus, *Neisseria gonorrhoea*, *Chlamydia trachomatis*, *Trichomonas vaginalis*[1] and Human Papilloma Virus. It should be remembered that some organisms, including some viruses, can remain infectious for days outside the body, particularly if kept moist in blood or serum.

All sterilisation/disinfection represents a statistical reduction in the number of microbes present on a surface. Meticulous cleaning of the instrument is the essential key to an initial reduction of the microbial/organic load by at least 99%[2].

The following protocol is recommended for the cleaning and preparing of intracavitary transducers between patients. These will include transvaginal, transrectal, transoesophageal and endoscopic transducers. The principles are the same for any transducers that may come into contact with body secretions.

1 Cleaning

After removing the cover from the transducer, all gel and any extraneous material should be removed from the transducer, preferably under running water. The transducer should then be cleaned with soap and water (dishwashing liquid may be used), rinsed thoroughly and dried with a paper towel.

2 Disinfection

The cleaning of the transducer is the main disinfection process. However, high-level disinfection with a chemical agent is necessary for further statistical reduction in the number of infective agents on the transducer, particularly because of possible rupture of the transducer cover. A high-level instrument grade disinfectant should be used for this purpose. It is recommended that the manufacturer of your ultrasound equipment be consulted before using a specific chemical agent on a transducer.

Currently the only available high-level instrument grade disinfectant is glutaraldehyde, which requires special facilities for safe handling. Where the use of glutaraldehyde is precluded, and other high-level instrument grade disinfectants are not available, hypochlorite solution or ortho-phthalaldehyde solution might be used.

Recommendations for the use of disinfectants:

a) Glutaraldehyde 2% Soak the transducer in the glutaraldehyde for 20 minutes followed by rinsing under running tap water then drying.

Note: Buffered glutaraldehyde as a cold disinfectant has a broad spectrum of activity with rapid microbiocidal action. It is non-corrosive to most materials, including metals and rubber. 'Aidal Plus' is a satisfactory glutaraldehyde preparation and is available from Whiteley Industries Pty Ltd, PO Box 785, Rosebery, NSW 2018 (tel: 61 2 9700 9799). Because of potential irritant effects of glutaraldehyde extreme care must be taken with its use, and manufacturers' instructions on usage should be followed strictly. Spent glutaraldehyde solutions disposed of to the sewer should be flushed with copious amounts of water[3].

b) *Sodium hypochlorite diluted to 500 ppm.* Soak the transducer in the sodium hypochlorite for two minutes followed by rinsing under running tap water and drying.

Note: Hypochlorite solution requires changing daily as it deteriorates rapidly. It can be made up with 50 ml of 'Milton' solution (1% sodium hypochlorite) in one litre of tap water. Hypochlorites have bactericidal, fungicidal and virucidal activity. Their decomposition is accelerated by the presence of metals, sunlight and heat. Some water supplies, particularly in remote areas, may contain oxidisable (e.g. organic) materials that could reduce the amount of free chlorine available. If the quality of the water supply is uncertain the free chlorine should be measured with a high range test kit such as those manufactured by Hach, Lovibond or Palm, or deionised water should be used.

c) *Ortho-phthalaldehyde 0.55%.* Soak the transducer in the solution for a minimum of 10 minutes at 20 degrees Celsius (20°C), or higher, followed by rinsing under running tap water then drying. Ortho-phthalaldehyde has a broad spectrum of activity with rapid microbiocidal effects, with the exception of some bacterial endospores; it is non-corrosive to most materials including metals and rubber. Cidex OPA is a satisfactory preparation available from Johnson and Johnson Medical Pty Limited, 1–5 Khartoum Road, North Ryde NSW 2113, Australia. Usual precautions must be taken with its use with regard to protection from irritant effects. Regular testing needs to be performed to ensure a minimal effective concentration with the use of test strips. Spent solutions disposed of to the sewer should be flushed with copious amounts of water.

Other products may be used to disinfect intracavity transducers provided that they have TGA approval.

3 Transducer covers

The transducer should be covered before intracavitary insertion with an appropriate barrier where thickness is at least 38 microns. This may include plastic surgical drapes, other purpose specific probe covers or surgical gloves. Prior to the use of a transducer cover, specific enquiry should be directed towards latex sensitivity. Covering the transducer without prior cleaning and disinfecting is inadequate because there is an incidence of perforation of any transducer cover.

4 Appropriate technique

The operator must wear a disposable (non-sterile) glove on the hand used during passage of the transducer. Care must be taken to ensure that contaminated gloves do not contact the ultrasound machine's control panel or exposed transducer cable. The transducer cover should be removed and disposed of carefully to prevent contamination of surroundings by bodily fluids/secretions. At the completion of the procedure, gloves should be removed and hands washed thoroughly with soap and water.

Important notes

i) Compliance with the National Guidelines on Disinfecting and Sterilising Pre-useable Medical and Surgical Instruments – Australian Standard (AS) 4187 – is recommended. The ASUM guidelines should be read in conjunction with that Standard, which is available from Standards Australia.

ii) Infection control guidelines will only be useful if they are followed and form part of an overall approach to Universal Precautions in minimising infection risk. The ASUM guidelines are provided as a mechanism to assist you in the development of appropriate risk management compliance processes.

iii) The use of sodium hypochlorite is not recognised by the NHMRC.

iv) Gel used can be a potential source of infection. For some procedures the use of sterile gel should be considered.

References

1 Garland SM and de Crespigny L. Prevention of infection in obstetric and gynaecological ultrasound practice. *Ultrasound Obstet. Gynaecol* 1996; 7: 1–4.

2 American Institute of Ultrasound in Medicine. Report for Cleaning and Preparing Endocavity Ultrasound Transducers Between Patients *AIUM Reporter* 1995; 11: 7.

3 National Industrial Chemicals Notification and Assessment Scheme (1994). Priority Existing Chemical No.3. glutaraldehyde. Full Public Report. ISBN 0 644 34875 1. Australian Government Publishing Service, Canberra.

Book reviews

Echocardiography – The Normal Examination and Echocardiographic Measurements
Author Bonita Anderson
Publisher Blackwell Publishing
ISBN 0646391399

Bonita Anderson is a well-known figure in echocardiography and is highly regarded for her expertise as an exponent and teacher. This impressive second edition of her book improves on the tradition set by the first edition of 2000 by providing a concise yet comprehensive text on the theory and practice of echocardiography today.

This book uniquely fulfils a great need within the echocardiographic community for resource material which focuses on the basic, although not simple, theoretical and practical aspects of the contemporary echocardiographic examination.

This carefully and thoroughly crafted work is obviously a lot more than a handbook. In 15 chapters and 337 pages, Bonita Anderson has developed on the first text by updating many areas. Notably, she has added excellent sections on 2D and Doppler artefacts, Doppler tissue imaging and strain and strain rate imaging.

This edition has a new, vastly improved look, featuring an attractive hard cover. Many quality colour figures and illustrations are placed liberally throughout the text.

A strong appeal is the generous use of tables and figures as well as the provision of an exhaustive set of normal values for the many measurements that can be made. The appendices at the end of the book are invaluable in this regard. Potentially confusing equations are methodically outlined and carefully explained. A detailed reference list after each chapter points to more information if required.

For a book of this type, there is no equal. In this excellent publication, Bonita Anderson displays her supreme expertise as an educator and her capacity for thorough and careful work. Sonographers and physicians who work in this discipline should familiarise themselves with the many concepts expounded in this book, even if they will not be expected to employ them all in each routine examination.

I strongly recommend this book to all who practice echocardiography, the novice and the experienced practitioner alike, as a highly effective instructional reference text. For those who want to purchase just one book on echocardiography, there is no doubt that his book should be it.

Dr Christopher Choong
Senior Staff Cardiologist
Royal North Shore Hospital

The Fetus in Three Dimensions
Authors Asim Kurjak, Guillermo Azumendi
Publisher Informer UK Ltd
ISBN-10: 0415375231

In the past 50 years, gray scale imaging, real-time and Doppler ultrasound were the important technological breakthroughs in ultrasound. Today 3D and 4D ultrasound is the new frontier. The literature is now dominated by results of innovative clinical investigations and a new collection of normal values and tables is available. It is truly an international endeavour to define the world of 3D and 4D sonography in obstetrics and gynaecology. The authors of this book and its contributors have been leaders in this field.

The content is very comprehensive as the book consists of 27 chapters. It starts of with a good chapter on how to use the 3D technology to the neophite.

Chapters 2–9 deal with the basic embryology and anatomy, normal and abnormal developments in the first trimester of pregnancy. The additional information possibly obtainable using 3D sonography in the detection of fetal abnormality is illustrated from chapters 10–18.

Chapter by chapter the book deals with the 3D findings in major anatomical systems. Chapter 19 is devoted to assessment of fetal well being in an IUGR fetus.

The area of fetal behaviour is very eloquently presented in chapters 21–26. It concludes with the final chapter on the safety of 3D and 4D sonography.

It is a well-written text book, easy to read with appropriate illustrations. It contains adequate basic anatomy, physiology, and appropriate up to date data to direct the readers to the current and relevant clinical use of three dimensional and four dimensional sonography in obstetrics.

This is a very useful, comprehensive text book on the clinical relevance of three dimensional and four dimensional sonography in obstetrics. It is of great value to all sonologists who care for obstetric patients.

Dr Andrew Ngu
Obstetrician
East Melbourne Ultrasound

Scanning the journals

Cognitive function in young adults following intrauterine growth restriction with abnormal aortic blood flow

Tideman E, *et al. Ultrasound Obstet Gynaecol* 2007; 29; 614–18.

The group working at Lund University in Sweden are well known for their work on fetal vascular flows in IUGR. This however is their first follow up on intellectual function 18 years after an *in-utero* diagnosis of IUGR and abnormal aortic flows. They compared 19 IUGR patients' cognition with a control group of 23 patients of the same age who had had normal blood flow and weights. Using standard psychological tests they clearly demonstrated significantly lower cognition at 18 years in the IUGR group, which is yet another reason for us to be on the look out for growth restriction *in-utero*.

Population-based study of antenatal detection of congenital heart disease by ultrasound examination

Chew C, *et al. Ultrasound Obstet Gynaecol* 2007; 29: 619–24.

This Victorian study between 1993–2002 of 4897 cases of congenital heart disease (CHD) collected from the Victorian Perinatal Data Collection Unit and Birth Defects Registry is of enormous interest.

They found that the overall antenatal detection rate of CHD was 52.8%. As we might expect, hypoplastic left heart was the most diagnosed antenatally with only15% not being diagnosed. The lowest pick up antenatally was for simple transposition of the great arteries where 83% were missed.

At a time when a body of opinion is to make a cardiac anomaly diagnosis at the NT scan, it is a concern that even at 16–22 weeks, we only pick up just over half of all cardiac anomalies. It could be argued that we need to improve cardiac diagnosis in the second trimester before pursuing the holy grail of first trimester diagnosis. ASUM has a major role in such skills development.

Diameter of the normal fetal thymus on ultrasound

Cho JY, *et al. Ultrasound Obstet Gynaecol* 2007; 29: 634–38.

This will be a good article to refer to for normal data on the transverse diameter of the fetal thymus from 19–38 weeks. Thymic hypoplasia can occur with 22q11.2 deletion as well as Ellis-van Creveld syndrome, chondrodysplasia punctata, alcohol exposure and severe immunodeficiency, so the prediction of impaired immunologic function postnatally might be possible. They were able to measure the ***transverse*** diameter in 94% of their 376 fetuses. The diameter of the thymus in mm is equal to the AC in cm in the second trimester. We don't measure the thymus routinely of course but this article assures us if we ever have to, the transverse diameter is easy to measure. The next article suggests another reason for checking it too.

Fetal thymus size as a predictor of chorioamnionitis in women with preterm premature rupture of membranes

Yinon Y, *et al. Ultrasound Obstet Gynaecol* 2007; 29: 639–43.

This study of only 13 patients suggests that finding a small fetal thymus may (measuring the perimeter) be useful in the early diagnosis of PPROM and chorioamnionitis. Using the previous papers and normative data a nice study could be done on a larger sample size to investigate the potential of thymic measurements.

Sonographic findings of groin mass

Yang DM, *et al. J Ultrasound Med* 2007; 26: 605–14.

Radiologists and sonographers need to be aware of the variety of groin lesions that are detectable by ultrasound. This well illustrated review article from Korea will serve as a reminder. Even though biopsy may be needed for tissue diagnosis, sonography can be useful although CT is more specific for lipomas, haematomas and abscesses.

Color Doppler imaging and 3-dimensional sonographic findings of urinary bladder leiomyoma

Sherer DM, *et al. J Ultrasound Med* 2007; 26: 667–70.

Leiomyomas of the bladder are more common in women than men. This is the first description of the 3D sonographic findings of a urinary bladder leiomyoma. The prevalence of bladder tumours in postmenopausal patients is said to be 1.07%. Sooner or later we may expect to see one and this case of a non-gynaecologic pelvic abnormality, although rare, shows that 3D ultrasound can be helpful.

What do clinical users know regarding safety of ultrasound during pregnancy?

Sleiner E, *et al. J Ultrasound Med* 2007; 26: 319–25.

The results of this American study of 130 ultrasound users are a worry. The authors conclude that ultrasound end users are poorly informed regarding safety issues during pregnancy. The terms 'thermal index' and 'mechanical index' were unknown to the majority of responders! It would be interesting to see this study repeated in Australia. There is always a need to keep in mind the possible bioeffects of ultrasound and to pay attention to the on-screen information on acoustic output indices.

Sonographic femur length to trunk cross-area ration: prediction of fetal outcome in 30 cases in which micromelia was suspected

Arahori H, ***et al***. *J Obstet Gynaecol Res* 2007; 33(Mo.3): 248–53.

This retrospective Japanese study found in 30 cases with a presumptive diagnosis of micromelia, that the ratio of femur length / trunk cross area (FL/FTA) was a useful parameter to help differentiate fetuses with non-lethal skeletal dysplasias from normal fetuses with either constitutionally short limbs or IUGR. The FL/FTA ratio is significantly lower in non-lethal skeletal dysplasia than in the others. But ascites and hepatomegaly for example would cause the ratio to be lower so as a screening test it is not useful.

The Gleaner

Abstracts 37th Annual Scientific Meeting Cairns, 2007

201 Tissue engineered vascular and urogenital grafts

Julie H Campbell, University of Queensland, Australia

Objectives

To tissue engineer autologous grafts for smooth muscle-walled organs using the peritoneal cavity as a bioreactor.

Insertion of tubing of various lengths and diameters into the peritoneal cavity of dogs, rabbits, rats or mice induces the formation of a tissue capsule over 2–3 weeks. The capsule consists of myofibroblasts and the collagen matrix they produce covered by a single layer of mesothelial cells. The myofibroblasts are of bone marrow (monocyte/macrophage) origin as demonstrated by *in situ* hybridisation studies in irradiated chimeric mice and FACS analysis of capsules produced in c-fims EGFP mice.

Tubes of tissue harvested from the dog are 1.5 mm thick with bursting strength in excess of 2500 mmHg and suture holding strength of 11.5 Newtons. The tissue has been successfully grafted by end-to-end anastomoses into the femoral artery of the same animal in whose peritoneal cavity it was grown, replacing segments of natural artery. The grafts are patent for at least 6 months, and the tissue doubles in thickness due to development of an adventitia containing vasa vasora. Elastic fibres form within the media and the myofibroblasts differentiate further into smooth muscle-like cells. These cells respond to vasoconstrictor agents and undergo endothelium-dependent relaxation in response to acetylcholine.

Other smooth muscle organ grafts such as bladder, vas deferens and uterus have been similarly grown in the peritoneal cavity of rats and rabbits using appropriately shaped moulds. Patency and function after autologous grafting to replace an excised segment of the appropriate organ is at least 14 months.

202 Liver abscesses: imaging and treatment guided by ultrasound

Torben Lorentzen, Herlev Hospital, Denmark

Objective

To review clinical and imaging aspects of liver abscesses (LA) with focus on ultrasound imaging and ultrasound guided intervention for diagnosing and treatment.

Abstract

The major forms of LA, classified by etiology, are as follows: Pyogenic abscess, which is most often polymicrobial, accounts for 80% of hepatic abscesses cases in the United States. Amoebic abscess due to Entamoeba histolytica accounts for 10% of cases. Fungal abscess, most often due to Candida species, accounts for less than 10% of cases. Furthermore, Hydatid disease and Schistsomiasis can cause LA.

Biliary tract disease is the most common source of pyogenic LA. Obstruction of bile flow allows for bacterial proliferation. Biliary stone disease, obstructive malignancy affecting the biliary tree, stricture, and congenital diseases are common inciting conditions. With a biliary source, abscesses usually are multiple, unless they are associated with surgical interventions or indwelling biliary stents. In these instances, solitary lesions can be seen. Other entryways to the liver are via the portal vein (pyophlebitis) in patients with appendicitis or diverticulitis. Finally, an arterial entryway is seen in patients with osteomyelitis or endocarditis.

CT evaluation with contrast and ultrasonography remain the radiologic modalities of choice in diagnosing liver abscesses. However, the final diagnosis is established with a ultrasound (or CT) guided puncture confirming pus.

Treatment with a combination of iv antibiotics and percutaneous drainage (needle drainage or catheter drainage) carries a high success rate.

Typically diagnostic and interventional images (ultrasound and CT), case stories, and differential diagnoses will be presented.

203 Upper limb intervention

Eugene G McNally, Nuffield Orthopaedic Centre, United Kingdom

Ultrasound is an ideal method for guiding interventional musculoskeletal procedures. This presentation will discuss the indications, rationalisation and technique of the common interventional musculoskeletal procedures in the upper limb. Technical points will include target identification, puncture point location and tips for aspiration and injection. Procedures at the shoulder will include subacromial subdeltoid bursal injection, management of calcific tendonopathy by barbotage, guided joint injection including acromioclavicular and glenohumeral joint. In the elbow joint injection including ultrasound arthrography, and management of epicondylar enthesopathy using corticosteroid injection, dry needling and autologous blood injection. Procedures at the wrist include identification and injection of the numerous small joints around the wrist including the distal radioulnar joint, radiocarpal joint, mid carpal joint, pisiform triquetral joints and basal joint of the thumb. A safe approach to guided tendon injection is important to avoid complications of tendon rupture.

204 Brachial plexus ultrasound

Carlo Martinoli, Enrico Capaccio, Alberto Tagliafico, Nunzia Pignataro, Universita di Genova, Italy
Nicola Stagnaro, Italy, Stefano Bianchi, Fondation des Grangettes, Switzerland

Objectives

- Describe the standardised technique of US examination of the brachial plexus.
- Teach and familiarise sonologists with the anatomic landmarks and the US aspects of the roots, trunks, divisions and cords of the plexus.
- Recognise the utility of this technique in the traumatic setting.
- Emphasise the role of US in the management of brachial plexus lesions to further delineate the nature and extent of the process.

Abstract

US is a promising alternative to MR imaging for direct imaging of the brachial plexus. In adults, US has proved capable

to follow in a spatially continuous manner the out of plane course of the nerves in this anatomically complex area as well as to detect lesions of traumatic, compressive, neoplastic and inflammatory nature affecting the plexus nerves. US provides useful information regarding the lesion site, extent and anatomic relationships and can be helpful in surgical planning. The advantages of US are mainly related to its ability to directly visualize the nerves, providing fine details such as nerve disruption, demarcation of changes in nerve size and fascicular echotexture. In brachial plexus injuries, US examination performed in an acute setting may help the clinician to better orient the treatment strategy (conservative vs. surgical) as well as to help the surgeon to evaluate the length of the abnormal segments for nerve graft planning. With respect to MR imaging, US involves less discomfort to the patient and is more cost effective. On the other hand, US has limitation in evaluating the costoclavicular space.

205 Sports medicine

Shane Brun, James Cook University, Australia

This presentation will be a two-part fairly relaxed discussion on the role of interventional sports and musculoskeletal medicine. The latest evidence will be provided regarding common sports injuries and musculoskeletal conditions including appropriate investigations and management techniques.

206 Peripheral vascular disease- lower extremity imaging including stents and grafts

Deb A Coghlan, Queensland Vascular Diagnostics, Australia

Objective

The aim of this presentation is to discuss how ultrasound of the native lower extremity arteries, bypass grafts and stent surveillance, plays a crucial role in vascular surgery practices. Techniques, criteria and pitfalls of scanning native arteries, grafts and stents will be presented.

Abstract

Non-invasive vascular studies have traditionally been utilised to confirm the presence of clinically suspected lower extremity peripheral vascular disease. The improved resolution of duplex imaging has made ultrasound a suitable alternative to contrast angiography in an increasing number of patients. A significant advantage of ultrasound is its ability to detect anatomic and blood flow information, providing an assessment of the haemodynamic effect of arterial occlusive lesions.

Duplex arterial mapping for operative planning before infrainguinal bypass is also performed routinely, and ultrasound can accurately identify suitable runoff vessels for bypass grafting.

Duplex surveillance of arterial bypass grafts has become increasingly important and has an important role in prevention of graft failure. Identification and correction of vein defects prior to the occurrence of graft thrombosis are critical since most vein grafts do not maintain long-term patency after mechanical thrombectomy or graft thrombolysis.

Techniques of minimally invasive endovascular surgery for the treatment of lower extremity chronic ischemia have expanded rapidly in recent years. Percutaneous transluminal angioplasty, stenting and subintimal angioplasty, are now common place in most surgical practice and duplex examinations have become increasing important for the surveillance of these procedures.

Clinicians have come to rely on duplex scanning for post procedural evaluation of surgical and interventional procedures.

207 Doppler Ultrasound in the functional assessment of the cerebral circulation

David H Evans, University of Leicester, United Kingdom

Objectives

To describe the use of transcranial Doppler ultrasound as a tool for studying cerebral haemodynamics. To discuss its strengths, weaknesses and applications.

Abstract

Doppler ultrasound is becoming an increasingly important tool for studying cerebral haemodynamics in conditions as diverse as prematurity, birth asphyxia, orthostatic hypotension, stroke, dementia, and head injury. As with most Doppler ultrasound techniques it has the advantages of being totally non-invasive and of having excellent temporal resolution. There are also a number of limitations of the method. In order to penetrate the skull it is necessary to use a relatively low transmitted frequency, which leads to poor spatial resolution and relatively weak scattering by the blood, and the transmission through the skull leads to distortion of the ultrasound beam shape. Also Doppler measurements are often made without concomitant imaging so that insonation angles are unknown. Finally there is evidence that under some circumstances the diameters of major cerebral vessels can change over relatively short time periods. Despite these difficulties the method has much to offer and has many applications. During this talk we will discuss the use of Doppler ultrasound to measure cerebral blood velocity, cerebral blood flow, cerebrovascular resistance, pressure autoregulation and cerebrovascular reactivity.

208 Duplex and the surgeon: great expectations

Roxanne Wu, Cairns Private Hospital, Cairns, Australia

This lecture will address the needs of the vascular surgeon from complex vascular ultrasound with particular reference to complex varicose veins and dialysis fistulas. Discussion will centre around the main aspects of what the surgeon is looking for and will be illustrated with clinical cases.

209 Sonographic assessment of extent and aggressiveness of malignant breast nodules

Thomas Stavros, Radiology Imaging Associates, United States

Appropriate staging of breast cancer is essential to minimising 'positive margins' and the number of surgeries necessary and also in minimising 'local recurrences' which are really not 'recurrences', but unrecognised unresected malignant disease persisting from the time of initial treatment.

MRI is the gold standard for staging, not sonography. However, the quality and availability of breast MRI varies greatly. When adequate breast MRI is not available, ultraound may be our best staging tool.

Sonographic staging can be performed in any patient who has a suspicious or malignant solid nodule. The normally targeted exam can be extended to the whole breast bilaterally and to the ipsilateral axilla – to best detect multifocal and multicentric and contralateral disease, and to detect metastatic lymph nodes.

For the index lesion, two different concepts of maximum diameter exist – prognostic diameter, the maximum diameter of the invasvie part of the lesion (hard suspicious findings) and total diameter of the lesion, including the invasive and DCIS components (hard and soft suspicious findings. The prognostic maximum diameter is related to

survival, while total diameter is related to the ability to locally resect the lesion with adequate cosmesis.

Morphologically abnormal lymph nodes (LN) can be biopsied with core or FNA techniqes. A positive biopsy obviates sentinel LN procedure, enabling the surgeon to proceed directly to axillary dissection. A negative ultrasound or negative biopsy of an abnormal lymph node does not prevent sentinel node procedure, so a positive LN biopsy is more valuable than a negative biopsy.

211 Scrotum ultrasound

Stephen Bird, Benson Radiology, Australia

Sonography remains the most effective imaging modality for assessment of scrotal pathology. This paper will explore the applications of ultrasound in a variety of clinical settings. Acute pain, chronic pain, palpable lumps, scrotal swelling, trauma, cryptorchidism and infertility assessment will be explored. A variety of potential pitfalls as well as some interesting normal variants and benign intra-testicular masses are considered. A protocol for extending sonographic assessment of varicoceles beyond the scrotum, particularly in the setting of infertility is presented. Many recent clinical cases are used to demonstrate the sonographic appearances of a comprehensive range of scrotal conditions.

212 What thyroid nodules need FNA according to the SRU Consensus Panel?

Thomas Stavros, Radiology Imaging Associates, United States

In 2004, a multidisciplinary panel of radiologists, cytopathologists, endocrinologists and surgeons met to offer guidelines about which nodules should be biopsied.

FNA is the method of choice for biopsying thryoid nodules, not core biopsy.

Size correlates poorly with the risk of thyroid cancer.

In a gland with multiple discrete nodules each nodule carries a lower risk than does a solitary nodule, but the cumulative risk for all of the nodules is similar (10–13%) to that of a solitary nodule. In a multinodular gland that contains a malignant nodule, the largest nodule will be malignant only two-thirds of the time.

Nodules found incidentally at imaging carry the same risk as do nodules that are palpable.

An almost completely solid texture has the highest sensitivity and microcalcifications have the highest positive predictive value for cancer. Findings such as hypoechogenicity and hypervascularity were not chosen for the FNA criteria. A >75% cystic component and colloid crystals were the only findings carrying enough negative predictive value to avoid biopsy.

Recommendations for FNA in solitary nodules

1) Solid nodules of 1 cm or more that have microcacifications
2) Solid nodules with coarse calcifications or without calcifications of 1.5 cm or more
3) Complex cystic nodules with mural nodules of 2 cm or more
4) Growing nodules

Recommedations for no FNA

1) Almost entirely cystic lesions
2) Presence of colloid crytals (minority opinion that I share)

Recommendations for gland with multiple nodules – subject each nodule to above criteria

For insufficient FNA – repeat FNA

213 Salivary gland ultrasound

Stephen Bird, Benson Radiology, Australia

CT and MRI remain the most effective modalities for assessment of head and neck malignancy. In particular, CT and MRI have the advantage of providing panoramic images allowing appreciation of the full extent of the disease process and accurate staging information. Despite the strengths of CT and MRI for tumour staging, sonography has an important role to play in the assessment of salivary gland pathology. The advantage of ultrasound remains its dynamic nature and ability to tailor each examination to the particular clinical presentation. As an initial imaging test ultrasound can provide the required information in the majority of cases.

This presentation will discuss the sonographic technique, key landmarks, anatomical appearances and pathological processes involving the parotid, submandibular and sublingual salivary glands.

215 Lower limb interventional procedures

Eugene G McNally, Nuffield Orthopaedic Centre, United Kingdom

Musculoskeletal interventional techniques in the lower limb cover a myriad of procedures useful in clinical practice. The anatomy, rationale and techniques of the most important of these will be discussed. Pelvic procedures include sacroiliac and symphyseal joint injections as well as guided nerve blockade. Procedures at the hip include bursal injection, with differentiation of the trochanteric from the subgluteus medius and subgluteus minimus bursa. Joint injection and aspiration, especially in children, and management of the snapping hip. Procedures around the knee joint include diagnostic joint injection including the proximal tibio-fibular joint, identification of the bursal spaces around the knee and dry-needling techniques for patellar tendonopathy. At the ankle & foot, management of Achilles tendonopathy, plantar fasciitis and Morton's Neuroma will be emphasised.

216 Ultrasound of ankle tendons

Carlo Martinoli, Alberto Tagliafico, Enrico Capaccio, Nunzia Pignataro, Universita di Genova, Italy, Nicola Stagnaro, Italy, Stefano Bianchi, Fondation des Grangettes, Switzerland

Objectives

Teach and familiarize sonologists with the normal and US anatomy of ankle tendons. Learn to differentiate between the most common pathologic conditions affecting these structures.

Abstract

In the ankle and foot, US has become increasingly important in the assessment of tendon abnormalities. In the anterior ankle, US is able to identify either the rupture or the distal tendinopathy of the tibialis anterior tendon. In the lateral ankle, injuries to the peroneal tendons are commonly encountered in clinical practice and include tenosynovitis, tendinosis, rupture and instability.

The US diagnosis of peroneal tendon instability is based on detection of the tendons lateral to the distal lateral malleolus, instead of posterior to it. Dynamic examination with both dorsiflexion and eversion of the foot can help to detect cases of intermittent subluxation.

When the peroneus brevis is split longitudinally, it can assume a horseshoe shape at US examination with the

peroneus brevis that partially envelops the longus. In the medial ankle, the tibialis posterior is the most commonly injured. The instability of the tibialis posterior tendon relative to the medial malleolus is rare. Stenosing tenosynovitis of the flexor hallucis longus occurs as either the result of focal areas of synovitis or fibrosis within the tendon sheath or in association with the os trigonum syndrome. There being many tendons to be examined in the ankle joint, the US examination should be focused on the basis of clinical findings in an attempt to save time and increase the efficacy of the study.

217 US in small joint arthritis

Eugene G McNally, Nuffield Orthopaedic Centre, United Kingdom

With the increasing trend for early treatment with powerful disease modifying antirheumatic drugs, radiographic detection of bony erosions is increasingly considered as being a stage too late in the diagnosis of arthritis. It is also recognised that many patients with apparent monoarthritis have clinically occult synovitis elsewhere which potentally reclassifies them as oligo or polyarthritis. MRI has played a leading role in the earlier detection of occult synovitis and erosions. As a practical clinical based tool, ultrasound also has much to offer. This presentation will focus on a systematic approach to the diagnosis of small joint arthritis, focusing primarily on small joint arthritis of the hand and wrist. Learnng points will include imaging technique, definitions and classification of synovitis and erosion, methods for assessing and classification of synovial activity and limitations of ultrasound compared with other imaging techniques.

218 Carotid intima-media thickness (cIMT)

Joseph F Polak, Tufts University School of Medicine, United States

Objectives

This session will review how carotid intima-media thickness (cIMT) is a measurement useful in cohort studies of atherosclerosis intervention. Data will be presented on why the adoption of cIMT as a diagnostic test will require a paradigm shift: the clinical indications for the ulrasound test will be different and the type of ultrasound imaging will change.

Abstract

Carotid intima-media thickness cIMT is used as a surrogate measurement of atherosclerosis in epidemiological studies and drug interventions. cIMT is a measurement of the carotid artery wall that is specific to ultrasound imaging. cIMT includes the layer of the carotid artery wall between the lumen-intima interface (the boundary of the artery wall) and the media-adventitia interface (the external elastic membrane).

Epidemiological studies have shown that individuals with large cIMT values are more likely to have cardiac and cerebrovascular disease. Large values predict the risk of subsequent stroke or myocardial infarction. Drug interventions that lower cholesterol levels decrease cIMT. Drug interventions that alter the risk of heart attack are associated with changes in cIMT. The protocols for cIMT measurements vary but most use the common carotid artery and the internal carotid artery. cIMT measurements require specialized software with training and certification of both cIMT sonographers and cIMT readers taking up to three months. Continued quality assurance is needed in order to maintain consistency in cIMT measurements.

Clinical application of cIMT will likely target individuals less than 65 years of age who are at intermediate risk for heart disease.

219 Upper extremity vascular disorders/imaging

Deb Coghlan, Queensland Vascular Diagnostics, Australia

Objectives

The aim of this presentation is to discuss pathophysiology and clinical presentation of vascular disorders that affect the upper extremity, and how ultrasound plays an important role in diagnosis.

Abstract

Atherosclerosis and complications of diabetes mellitus are the most common causes of lower extremity ischemia. However, the etiology of upper extremity ischemia includes not only atherosclerosis, but arteritis, blood dyscrasias, drug-induced occlusions, occupational trauma, thoracic outlet syndrome, trauma, aneurysms, and complications of renal dialysis fistula. In order to accurately diagnose the disorder, it is important to identify both the location of the obstruction and its nature, and to document whether the process is proximal or distal to the brachial artery.

Ultrasound examination should begin with the measurement of segmental arterial pressures. Duplex scanning is then performed and provides anatomic information, locates stenotic or occlusive lesions and evaluates their extent and severity. Ultrasound identifies collateral pathways, and defines the patency of arteries distal to an occlusion.

With the improvement in ultrasound equipment, and the skill levels of the sonographer, duplex scanning is rapidly replacing many of the more traditional imaging methods, especially when the information required is largely anatomic. All major arteries of the arm, forearm, wrist, and hand are readily identified, and even those of the digits can be imaged. Absence of colour in an artery clearly visualised by B-mode imaging is diagnostic of total occlusion, and an increase in velocity identifies stenotic sites.

Ultrasound is an important tool for diagnosis and management of upper extremity vascular disorders.

220 Ultrasonic detection of cerebral emboli

David H Evans, University of Leicester, United Kingdom

Objectives

To provide an overview of the current state of the art of detection of cerebral emboli with transcranial Doppler, including methods for distinguishing embolic signals from artefacts, of distinguishing between particulate and gaseous emboli, and of sizing emboli.

Abstract

Many strokes are caused by emboli from distal sites blocking vessels in the brain. The discovery that emboli of various types can be detected using Doppler ultrasound as they are carried through the major cerebral arteries has led to a new field of study, which has considerable potential. The basic principle of detection is extremely simple: if an embolus backscatters more power than the surrounding blood in which it is moving, then the transient increase in power can be detected and measured. Questions that arise from this principle surround the circumstances under which such power increases can be detected, and whether the size and composition of the embolus can be inferred from such measurements.

The detectability of an embolus is determined by many factors including its size and composition, the ultrasound frequency, the size of the Doppler sample volume, the embolus trajectory and its interaction with the ultrasound beam. In general even relatively small gas bubbles will be detected, but some larger solid emboli may be missed. With regard to size and composition, several techniques have been suggested as being useful for characterizing composition, and whilst in general considerable progress has been made in this direction there are still many challenges in distinguishing between large particulate emboli and small gaseous emboli.

221 Cerebral embolism research in Leicester

David H Evans, University of Leicester, United Kingdom

Objectives

To describe the use of Doppler ultrasound as a method for detecting cerebral emboli, and provide an overview of some of the clinical and technical research on this technique carried out in Leicester.

Abstract

The Medical Physics and Surgery Departments in Leicester have had a major research interest in cerebral embolism over the past 15 years, and the main investigational tool has been Doppler ultrasound. Initially research focused on embolic events occurring during carotid artery surgery, but has expanded to include interest in emboli occurring post carotid surgery, during cardiac surgery, during aortic and carotid stenting, and in a variety of other clinical situations. A major strength of this research has been the very close collaboration between physicists, engineers and clinicians. This talk will concentrate on technical aspects of the research, on the Doppler techniques used, the way in which the Doppler signals are interpreted, and some new approaches to embolus detection, but will also describe the very significant reduction in the incidence of peri-operative strokes that have occurred, in large part due to embolus monitoring.

222 Diabetic foot in Tropical North Queensland: The Cairns High Risk Foot Service – 10 years on

Christina Steffen, Cairns Base Hospital, Australia

Ethnic, climatic, economic and cultural factors have resulted in an epidemic of diabetic foot disease in tropical north east Australia. Cairns, population 135,000, situated on the east coast at 17 S is the referral centre for surrounding rural districts plus the sparsely populated Cape and Torres districts further north. Cairns Base Hospital averages 2–5 acute surgical admissions per week for diabetic foot problems. Many are from remote indigenous communities.

In 1996, a High Risk Foot Service was established at Cairns Base Hospital. The service enlisted existing resources of general/vascular surgeons, public health physician, podiatrist, diabetes educators and nursing staff.

Combining chronic and acute management strategies including assessment, basic podiatry, surveillance, education, outreach services and rapid intervention for acute problems the High Risk Foot Service has been important in delivering effective outpatient surveillance and treatment, reducing frequency and length of hospital stay and the extent of surgical intervention. The policy of preservation of foot elements, wherever feasible, has also resulted in improved attendances at clinics and earlier presentations with acute problems.

Major amputation represents the end-point in diabetic foot disease, indications being inoperable vascular disease, failed vascular intervention and uncontrollable sepsis. Despite large population increases and an exponential rise in the prevalence of diabetes in all groups between 1995 and 2005 in this region of Australia a comparable increase in major amputations has not eventuated. We attribute this to the systematic chronic disease management and prompt response to acute surgical problems that the multidisciplinary High Risk Foot Service has been able to provide.

223 Recent developments in Doppler ultrasound

David H Evans, University of Leicester, United Kingdom

Objectives

To survey some of the more recent developments in Doppler ultrasound.

Doppler ultrasound is an extremely valuable technique for detecting and measuring blood flow and other movements within the body, however it still suffers from a number of limitations. Three of these limitations, together with possible solutions will be discussed.

1) The vector problem. All Doppler ultrasound instruments measure the component of velocity towards or away from the transducer. In many situations this is not an issue, but where complex flow patterns are present may give misleading information. Solutions to this limitation include vector Doppler systems, transverse Doppler systems, speckle tracking systems, and where volumetric flow only is important, C-mode Doppler techniques.
2) The frame rate problem. In general Doppler frame rates are much lower than imaging frame rates because in order to get a reliable estimate of velocity it is necessary to sample each region of interest several (often between 8 and 16) times, whereas to generate a pulse-echo image it is only necessary to sample once. One potential solution to this is to use synthetic aperture techniques which greatly speed up image acquisition.
3) Axial resolution. The axial resolution of some Doppler systems is limited by the transmitted pulse length. A solution which has previously been applied to pulse echo systems is to use coded excitation. It now appears that a similar solution can be used for Doppler signals without introducing the serious artifacts that might be anticipated.

224 Abdominal aortic aneurysm (AAA) screening

Joseph F Polak, Tufts University School of Medicine, United States

Objectives

To present data on why ultrasound imaging is a robust and reliable approach for the detection of abdominal aneurysms, monitoring their growth and following the patient after intervention. To review the technical aspects of abdominal aorta imaging

Abstract

Abdominal aortic aneurysms reach a prevalence of close to 10% in men aged more than 65 years. The rupture of an aneurysm is a catastrophic event almost always leading to death. The United States health care system has implemented abdominal aneurysm screening for all individuals reaching 65 years of age.

The diagnostic imaging test is an elective test. The

imaging protocol needs to include documentation of the upper, middle and distal parts of the abdominal aorta as well as the iliac arteries. Measurements are made in the transverse plane, outer wall to outer wall. Longitudinal images are used to characterize the aneurysm. Aneurysm surveillance is modified as a function of the size of the aneurysm. Expansion rates are typically less than 2 mm/year.

Continued surveillance is done until the aneurysm reaches 5.5 cm in size. At that point, aneurysm repair, either open or with stent graft, is performed. After aneurysm repair, ultrasound imaging can be used to confirm the success of the intervention. Following open surgery and graft placement, integrity of the anastomotic sites can be confirmed. Following stent-graft placement, stabilization of aneurysm size and even shrinking can be confirmed. Endoleaks can also be detected.

225 US of the shoulder

Eugene G McNally, Nuffield Orthopaedic Centre, United Kingdom

This presentation will outline a systematic approach to the ultrasound examination of the rotator cuff. Emphasis is placed on identifying the key anatomical relationships, particularly around the anterior interval where many abnormalities of the rotator cuff begin, and a stepwise approach to the diagnosis of cuff tears. Learning points will include how to acquire and interpret static images, how movement plays a key role in facilitating the diagnosis of cuff and bursal disease and imaging algorhythmns for biceps and subscapular injury.

226 Ultrasound of entrapment neuropathies of the upper extremity

Carlo Martinoli, Alberto Tagliafico, Enrico Capaccio, Nunzia Pignataro, Universita di Genova, Italy, Nicola Stagnaro, Italy, Stefano Bianchi, Fondation des Grangettes, Switzerland

Objectives

Provide an overview of the US aspects of the most common entrapment neuropathies of the upper extremity. Describe the US anatomy of the median, ulnar and radial nerves. Emphasize the role of US in the management of these lesions to further delineate the nature and extent of the process.

Abstract

The refinement of transducers has enhanced the potential of US to evaluate entrapment neuropathies in the upper extremity, including the spiral groove area for the radial nerve, the supinator tunnel for the posterior interosseous nerve and the radial styloid area for the superficial sensory branch of the radial nerve, the cubital and Guyon tunnel for the ulnar nerve, the proximal forearm for the anterior interosseous nerve and the carpal tunnel for the median nerve.

As regards the impact of US as a complement of clinical examination and nerve conduction studies, it may, as a result, be informative in patients with absent motor or sensory responses when it is difficult to localize the site of compression. US can assess the status of the involved nerve and surrounding tissues that could help in determining the causes and modalities of nerve compression. We believe that the main advantages of US over MR imaging include higher spatial resolution, availability, lower cost and the ability to explore long nerve segments in a single study. US allows continuous imaging of nerves across the joints during joint movements. This evaluation takes the advantage, as opposed to MR imaging, to better recognise intermittent impingement and snapping syndromes.

227 Ultrasound of the ankle

Eugene G McNally, Nuffield Orthopaedic Centre, United Kingdom

The ankle and foot is the most common area examined using ultrasound in our centre. It is particularly valuable when focal rather than diffuse symptoms are present. This presentation will use a clinical approach to discuss conditions other than the tendon disorders. Techniques, normal anatomy and pathology of the lateral, deltoid and spring ligaments, fascial injuries and impingement syndromes will be included. A compartment approach to mass lesions of the foot can be a useful aid to diagnosis. Although generally, ultrsound is limited in the assesment of bone disease, some lesions such as stress fractures and coalition can be suggested. Advantages and limitations of ultrasound comparedwith MRI will be discussed.

228 Pelvic floor ultrasound – the basics

Hans Peter Dietz, University of Sydney, Australia

Diagnostic imaging is rapidly gaining in importance in urogynaecology, largely due to increasing availability of ultrasound and magnetic resonance imaging equipment. As a result of cost and access problems, MRI has been of limited clinical use in the evaluation of pelvic floor disorders, and slow acquisition speeds have until very recently precluded dynamic imaging. Ultrasound, on the other hand, is almost universally available and provides for real- time observation of manoeuvres. The last 10 years have seen rapid advances in the capabilities of diagnostic ultrasound, and several are of major relevance to pelvic floor imaging. 3D/ 4D ultrasound may be of limited use to general Obstetric and gynaecological applications, but in urogynaecology it has markedly enhanced our capabilities.

As of 2007, pelvic floor ultrasound has reached the spatial resolution of MRI in any arbitrarily defined plane, and is far superior to MRI in temporal resolution.

This talk will cover indications for pelvic floor ultrasound, basic technique as well as the most common findings on 2D pelvic floor imaging.

230 Pelvic floor trauma

Hans Peter Dietz, University of Sydney, Australia

Recent advances in pelvic floor assessment have led to the rediscovery of a form of maternal birth trauma, which was first described in 1907 but currently is absent from modern textbooks. Avulsion of the pubovisceral muscle from the pelvic sidewall seems to occur in 15–30% of vaginally parous women. Its prevalence is probably on the rise as the likelihood of trauma increases with higher maternal age at first delivery. Levator avulsion appears to be a significant part of the missing link between vaginal childbirth and prolapse and is likely to be the root cause of many cases of recurrence after prolapse surgery. As of now, no techniques exist for the surgical repair of resulting defects.

This talk will discuss the diagnosis of levator trauma on clinical examination as well as US and MR imaging. It will also cover prediction of trauma and potential approaches for primary and secondary prevention.

231 The Day 1 renal transplant Doppler assessment

Alan M Williams, Auckland City Hospital, New Zealand

Evaluation of a renal allograft should include a detailed B-mode and Doppler investigation. Transplant dysfunction and complications can be classified as parenchymal, i.e. acute

tubular necrosis (ATN), acute rejection or both; vascular occlusions; obstruction; haemorrhage; urinary leak; collections; infection and; drug toxicity related to the antirejection therapy itself.

From a historical perspective, qualitative grey-scale assessment of renal morphology and peritransplant collections has an invaluable role to play. On the other hand, colour and power imaging provides an instantaneous global impression of allograft perfusion while spectral Doppler and Resistive Index measurements serve as a useful quantitative parameter for demonstrating changing arterial waveforms that may occur with renal disease.

Numerous articles published in the last decade have investigated the potential and reliability of Doppler resistive index measurements as a useful indicator of renal dysfunction. Unfortunately, however, Doppler sonography has not been able to reliably differentiate intrinsic parenchymal disease and it is clear from the results of research to date, further investigation on the topic is to be encouraged.

This presentation will highlight, with demonstrative images, the role of grey-scale and Doppler ultrasound in its assessment of early post renal transplant. The trends of Day 1 transplant RI values obtained from patients at Auckland City Hospital, with reference to recent literature will be discussed.

232 High frequency ultrasound for the measurement of oedema in chronic venous disease

Antonina I Volikova, Sue E Hoskin, Lorraine Linacre, Gail Brunt, Fremantle Hospital, Perth, Hilary J Wallace, Jan Edwards, Michael C Stacey, University of Western Australia, Australia

Objectives

To assess dermal thickness in patients with venous leg ulcers using high-frequency ultrasound, to compare this with age-matched controls and to determine if compression therapy has a significant impact on dermal thickness.

Abstract

Oedema is an early sign of venous insufficiency and is commonly present in advanced venous disease. Currently oedema is assessed by clinical appearance and leg volume. Oedema increases dermal water content and leads to an increase in dermal thickness.

Seventeen patients with venous leg ulcers but not receiving compression therapy, and 17 age-matched healthy controls, were entered into the study. Dermal thickness was measured 7.5cm above the medial malleolus with a 17 MHz linear probe and a B-Mode ultrasound scanner (Philips).

In patients with venous ulcers, leg volume was also measured. Dermal thickness and leg volume were reassessed in the ulcer patients after 1 week of compression.

Prior to compression therapy, dermal thickness in patients with venous leg ulcers (median 0.228 cm) was significantly greater than the dermal thickness of the control subjects (median 0.134 cm, $P < 0.0005$). After 1 week of compression the dermal thickness in patients with venous ulcers reduced significantly (median 0.185 cm, $P < 0.0005$). Leg volume also reduced significantly after 1 week of compression ($P < 0.001$).

Dermal thickness using high-frequency ultrasound provides an objective measure of skin oedema in patients with venous leg ulcers. This may be a useful non-invasive technique to evaluate the treatment of chronic venous disease with compression therapy and to assist in the early detection of venous disease (e.g. post-thrombotic syndrome).

233 Reference values for sonographic measurements of the ulnar nerve at the elbow

Kerry Thoirs, Marie Williams, Maureen Phillips, University of South Australia, Australia

Objectives

Sonographic measurements of the ulnar nerve at the elbow have been reported to differentiate individuals with and without ulnar nerve entrapment at the elbow (UNEE). The aim of this study was to investigate the value of using sonographic measurements of the ulnar nerve in an Australian population using a reliable and valid measurement protocol, and to compare the results against international studies which have used similar measurements.

Methods

A parallel group design compared two Australian sample populations (asymptomatic sample; $n = 108$ limbs, symptomatic UNEE sample; $n = 22$ limbs) using identical measurement protocols. Rank ANCOVA tests were performed to determine if significant differences existed for sonographic measurements between the symptomatic and asymptomatic limbs. A comparative analysis compared data between this study and previous studies.

Results

Two measurements of the nerve differed significantly between people with and without UNEE; maximum diameter (UNEE 0.44 ± 0.1 cm vs. No UNEE mean 0.38 ± 0.09 cm) and cross-sectional area (No UNEE 0.08 ± 0.03 cm vs. UNEE 0.12 ± 0.05 cm). Gender, weight, body mass index, age, measurement site, and elbow position were found to significantly confound measures of the ulnar nerve at the elbow. Significant differences existed between the mean values of similar measurements between this and previous studies.

Conclusions

Sonographic measurements of ulnar nerve size can be used to discriminate between nerves affected and unaffected by UNEE. Reference data derived from specific sample populations is unlikely to accurately reflect alternate populations.

234 Turning astronauts into sonographers: assessing the clinical utility of ultrasound on board the International Space Station (ISS)

Marilyn Zelesco, Royal Perth Hospital, Robin Hart, AION-diagnostics, Paul Lombardo, Monash University, Australia

Human spaceflight (HSF) is a major component of the National Aeronautics and Space Administration (NASA) mission. The health, safety and required human performance levels of the crew must be maintained for mission success. Humans are the most fragile components of the entire system, and medical emergencies require quick diagnosis and treatment. The only form of medical imaging on board the ISS is ultrasound. However, ultrasound is highly operator dependent and presently there are no sonographers in the astronaut corps.

Objectives

This talk summarises a study undertaken to assess the feasibility of the use of ultrasound by astronauts to diagnose nine medical conditions identified by NASA as high risk, high impact and high likelihood. Ultrasound protocols were developed for each condition, and their usefulness for medical support in a terrestrial analogue of a spaceflight situation was assessed.

Five non-medical, inexpert ultrasound operators undertook an ultrasound quiz to assess their ability to identify normal and abnormal images in conjunction with images demonstrating technical artefacts. The same operators trialled two protocols and the resultant images were assessed for diagnostic value using visual analogue scales (VAS) by five sonographers. These two protocols were revised following operator feedback, and then re-trialled. Subsequent experiment analysis indicated a significant improvement in both the operators' confidence levels and the diagnostic quality of images.

Conclusion

Sixty nine percent of images were classed as diagnostically useful, indicating the feasibility of non-medical, inexpert ultrasound operators to acquire clinically effective ultrasound images in environments where expertise is unavailable.

235 The outcome of pregnancies of unknown location according to the mother's age and gestational age

Ben Van Calster, Dirk Timmerman, Sabine Van Huffel, Katholieke Universiteit Leuven, Belgium, George Condous, University of Sydney, Australia, Emma Kirk, Tom Bourne, University of London, United Kingdom

Objectives

We aimed at investigating the way in which the mother's age and maternal age influence the outcome of a pregnancy of unknown location (PUL).

Abstract

856 PULs were investigated at St Georges Hospital, London. There were 460 failing PULs, 330 intra-uterine pregnancies (IUP), and 66 ectopic pregnancies. Using multicategory kernel logistic regression, the mother's age was used to predict the PUL outcome. Kernel logistic regression is a flexible nonlinear method.

In a second step, both age and gestational age were used to predict the outcome. The analysis of the mother's age indicated that the probability of a failing PUL increased with age while the probability of an intra-uterine pregnancy decreased with age. This increase, respectively decrease was stronger after the age of 35. Before the age of 23, the chance of an IUP is between 45% and 60%, while that of a failing PUL is between 40 and 45%.

After the age of 23, failing PUL is more likely than an intra-uterine pregnancy. Ectopic pregnancy appears most likely at the age of 29 years (11%). The analysis of both the age and gestational age suggested that mothers of around 22 years with a gestational age around 4 weeks have the highest chance of an intra-uterine pregnancy (89%). Mothers of around 43 years with a gestational age around 8-9 weeks have the highest chance of a failing PUL (>95%).

236 What measurements are needed to predict pregnancy outcome in pregnancies of unknown location: does measuring hCG suffice?

Ben Van Calster, Dirk Timmerman, Sabine Van Huffel, Katholieke Universiteit Leuven, Belgium, George Condous, University of Sydney, Australia, Emma Kirk, Tom Bourne, University of London, United Kingdom

Objectives

We aimed at investigating what information is sufficient for making a good prediction of the outcome of pregnancies of unknown location (PUL).

Abstract

856 PULs were investigated at St Georges Hospital, London. There were 460 failing PULs, 330 intra-uterine pregnancies (IUP), and 66 ectopic pregnancies. Mathematical diagnostic models were constructed (a) using only hCG information, (b) using hCG and progesterone information, and (c) using an optimal set of measurements based on variable selection.

The method used was multicategory logistic regression. Models were trained on a training set and evaluated on a test set using the area under the receiver operating characteristic curve (AUC). This was repeated 100 times in each of which the data were split randomly into training and test sets. The 100 resulting test set AUCs were summarised by their median.

Three AUCs were computed each time: one for each outcome. Model (c) used hCG and progesterone information, the level of vaginal bleeding, and age. The median test set AUCs to predict failing PUL were 0.982 (a), 0.987 (b), and 0.987 (c). To predict IUP, we obtained 0.979 (a), 0.983 (b), and 0.984 (c).

To predict ectopic pregnancy, we obtained 0.884 (a), 0.916 (b), and 0.931 (c). Thus, detection of failing PUL and IUP was easy using hCG information. Predicting ectopic pregnancy was more difficult. Mainly progesterone information but also age and the level of vaginal bleeding improved the prediction. The use of more advanced methods (support vector machines, kernel logistic regression) yielded similar conclusions.

301 Novel first trimester markers for Down syndrome

Jon Hyett, Royal Brisbane and Women's Hospital, Australia

First trimester screening for Down syndrome with a combination of nuchal translucency assessment and biochemical screening (fBhCG and PaPP-A) has been shown to be highly sensitivity in several prospective studies. New markers, both from a biochemical and ultrasound perspective continue to be described and may be useful in terms of further improvements in the sensitivity of screening and also in reducing the false positive rate associated with screening. These markers will be reviewed, together with an assessment of how they may best be incorporated in routine practice.

302 Labour ward ultrasound – what, when and why?

David Ellwood, The Australian National University Medical School, Australia

Labour ward ultrasound is a specialised sub-section of obstetric ultrasound that requires special skills and training. It is now commonplace for moderate and larger-sized maternity units to have an ultrasound machine either permanently located within the labour ward, or at least for a machine to be readily available to use at any time. It is also now a requirement of training in obstetrics and gynaecology in Australia and New Zealand that trainees have exposure to at least 200 hours of ultrasound training, including transvaginal work.

This should mean that O&G specialists of the future will be more competent and confident in using ultrasound to guide their practice in all settings including dealing with acute labour ward problems. Despite this and the expanding uses of labour ward ultrasound, there is little evidence available in the scientific literature to look at the effectiveness of the various

uses, and the improvement, if any, in perinatal outcome.

This presentation will look at all the possible uses of labour ward ultrasound including the diagnosis of abnormal presentation and placentation, malpositions of the fetal head, assistance with delivery of the second twin and the management of post-partum haemorrhage and retained placentae. Specific examples will be given of where ultrasound can facilitate management and potentially improve outcome. Directions for future research will be discussed.

303 Increased nuchal translucency with normal karyotype

Yves Ville, Université Paris, France

Background and objective

Screening for fetal aneuploidy is routinely offered to pregnant women and nuchal translucency (NT) thickness measurement is widely used as part of this screening. Around 1% of all fetuses should show increased nuchal translucency above the 99th centile for gestational age in an unselected population. Data on prospective follow-up assessment are needed to counsel couples following prenatal diagnosis. The objectives of this study were to describe the prevalence of developmental abnormalities as well as the relationship between nuchal translucency thickness and neonatal and pediatric outcome following first trimester measurement of NT >99th centile with normal karyotype .

Population and methods

We conducted a cohort study in a large unselected pregnant population undergoing first trimester ultrasound screening for fetal aneuploidy in a single health authority. All patients gave oral consent to undergo follow-up. The local ethics committee approved the study. Fetuses with NT measurement >99th centile adjusted for gestational age were included in this long-term follow-up study.

A detailed ultrasound examination was performed in all chromosomally normal fetuses at between 16 and 18 weeks of gestation to follow-up changes in nuchal translucency thickness and to rule out major fetal anatomical defects including fetal echocardiography. This was repeated at between 22 and 24 weeks of gestation. In cases with persistent increased nuchal fold, parents were counselled that the risk of worsening in utero or delivering a baby with a severe abnormality was higher than in the general population.

Pediatric clinical examination aimed at assessing postnatal growth, psychomotor skills and speech as well as interaction with the child. This was completed by serial questionnaire to be answered by the parents. Moreover, our study population was compared to an external control group. This control group was made of the 370 full-term control children from a French national population-based cohort study designed in 1997 to investigate the consequences of very preterm birth.

Results

Routine first-trimester ultrasound screening was performed in 21 149 unselected pregnant women between 1st January 2001 and 31st December 2003, including nuchal translucency measurement at 11–14 weeks.

248 fetuses (1.2%) had NT >99th centile for CRL. Neonatal outcome was completed in 162 live-born children. Two children (1.2%) were lost for follow-up at between 12 and 24 months.

The prevalence of an adverse prenatal outcome in chromosomally normal fetuses increased 2.4-fold with each mm of NT thickness (OR = 2.4/mm 95% CI [1.68–3.44]).

Among 160 children born alive, 29 (18.1%; 95% CI [15.4–30.5%]) had an ASQ (Ages and Stages Questionnaire) 2 SD below the mean score in at least one domain. Although close to statistical significance threshold, there was no significant association between the prevalence of an abnormality and NT thickness (OR = 1.35/mm 95% CI [0.88–2.06]) or between deviant ASQ scores at two years of age and NT thickness (OR = 1.37/mm 95% CI [0.93–2.01]). The prevalence of children with at least one abnormal element at paediatric clinical examination was not associated with increased NT thickness (OR = 1.39/mm 95% CI [0.64 –2.99]). Furthermore development at the age of two years was similar to that of the controls.

Clinical implications

After a first trimester measurement of nuchal translucency >99th percentile with normal karyotype, parents should be informed that when the fetus is shown to be normal by ultrasound at 22–24 weeks of gestation the risk of adverse neonatal outcome or developmental delay in early childhood is not increased.

305 The outcomes of pregnancies referred with preterm prelabour rupture of membranes (PPRoM)

Jon Hyett, Royal Brisbane and Women's Hospital, Australia

Preterm prelabour rupture of membranes is defined as the rupture of amniotic membranes for >1 hour before labour occurs in a pregnancy <37 weeks gestation and occurs in approximately one-third of all preterm births. In addition to the risks of prematurity, PPRoM is associated with other significant risks of morbidity and mortality such as the risk of maternal and neonatal infection as well as the risk of umbilical cord prolapse/compression and of placental abruption. Rupture of membranes prior to 24 weeks gestation has typically been associated with poor fetal prognosis as the loss of amniotic fluid at this stage can affect lung development and result in pulmonary hypoplasia.

This presentation will review the role of ultrasound in the diagnosis of preterm prelabour rupture of membranes and its potential contribution to further management. The use of ultrasound and amniocentesis in the prediction of chorioamnionitis and the likelihood of imminent delivery will also be examined.

307 The prenatal diagnosis of genetic syndromes

Jon Hyett, Royal Brisbane and Women's Hospital, Australia

The introduction of a routine 18–20 week anomaly scan over the last 20 years has led to the diagnosis of a substantial proportion of fetuses that have major structural abnormalities. Despite this, many conditions that have an underlying genetic basis are difficult to detect using ultrasound unless the sonographer has a high level of suspicion.

The implications and plans for follow-up, of sonographic anomalies such as increased nuchal translucency, the short femur and hyperechogenic bowel will be discussed.

In addition, the application of molecular genetics to the prenatal diagnosis of genetic disorders – a rapidly expanding and changing field, will be discussed.

308 Sonography of the sacrotuberous ligament

Neil Simmons, Australia

Objectives

To demonstrate the anatomy of the sacrotuberous ligament,

scanning technique and relevent clinical conditions.

Abstract
The sacrotuberous ligament has a broad attachment to the sacrum, sacroiliac joint and posterior iliac bone. It narrows as it passes to the ischium, spiralling slightly. Its superficial fibres are in continuity with the biceps femoris and thus link with the hamstrings. Gluteus maximus attaches to its posterior surface as may piriformis, superior and inferior gemellus and obturator internus. A variable membranous reflection of the distal ligament (the falciform ligament) runs along the ischial ramus towards the obturator fascia with which it may fuse.

The ligament runs parallel and medial to the sciatic nerve, with which it may be confused. It is echogenic, as is the nerve and is of similar size. If confused, trace the structure back to the ischial tuberosity. The sciatic nerve passes lateral to the tuberosity and the ligament attaches to its superficial aspect.

The pudendal nerve lies immediately anterior to the ligament. Entrapment of the nerve can cause a large number of clinical complaints. Ultrasound guided injection of cortisone and local anaesthetic through the mid to distal ligament may relieve symptoms and is thus also a useful clinical test.

Irritation of the ligament at the junction with the hamstrings can cause localised pain. Swelling, reduced echogenicity and focal tenderness are noted. Ultrasound guided injection can easily be performed.

Avulsion of the ischial tuberosity epiphysis in mid to late teen sportsmen and women can have severe consequences. The role of the ligament will be examined.

309 Sonography of retinacula and other fascial structures

Neil Simmons, Australia

Objective
To highlight the importance of fascia and retinacula in the function of the musculoskeletal system. Sonographic features of common pathological conditions will be demonstrated.

Abstract
Fascia, from the Latin for band or tether, refers to sheets of fibrous tissue which help hold the body together. It surrounds and supports muscles, bones and joints. It provides attachments to muscles and acts as a pathway for nerves and vessels.

Retinacula are essentially focal thickenings of fascia with more complex histology. The histology varies slightly depending on the function of the retinaculum. Retinacula act as pulleys, guiding tendons and restraining them in position.

Pathological conditions affecting fascia include degeneration, proliferation tears and infection. Nerves may be entrapped as they pass through or beneath fascia.

Retinacula are subject to high loads during tendon movement. They can become thickened and/or inflamed. Tendons passing beneath them may become entrapped. Constant strain can cause retinacular stretching, resulting in tendon subluxation. Trauma can tear retinacula within their substance or at their bony attachments.

310 Diagnostic test algorithms in carotid disease

Joseph F Polak, Tufts University School of Medicine, United States

Objectives
This session will review how carotid artery disease can be evaluated by many different diagnostic tests. To show why carotid ultrasound remains the most cost-effective approach in the majority of patients.

Diagnostic evaluation of the extracranial carotid artery can be made with very different imaging modalities. These include carotid ultrasound, carotid arteriography (CA), magnetic resonance angiography (MRA) and computed tomographic angiography(CTA).

Doppler carotid ultrasound is a flow sensitive technique that measures the physiological effect of the alteration in blood flow velocity caused by a stenosis. Time-of-flight MRA does the same.

Both techniques have been combined as a replacement for diagnostic arteriography in most patients with significant stenoses of the internal carotid artery. Measurement of luminal narrowing by arteriography is the gold standard but the riskiest of the techniques used. It measures the residual lumen of the artery. Gadolinium enhanced MRA does the same, with the added technical limitation of artifacts due to bolus timing and patient motion. CTA can give an image of the carotid artery lumen as well as some anatomic information on the character of the artery wall. Correlative studies and quality assurance issues require side-by-side review of the selected imaging test used in the evaluation of a given patient.

Knowledge of the strengths and limitations of the imaging modalities affects the selection of a given technique in a patient. Technical limitations affecting the quality of the carotid ultrasound examination is the most common indication for obtaining another diagnostic test.

311 Ultrasound-guided RF-ablation of liver tumours

Torben Lorentzen, Herlev Hospital, Denmark

Objectives
Introduction to RF technique with special focus on ultrasound (US) as diagnostic, procedure guiding and follow-up modality.

Abstract
Radiofrequency (RF) ablation is receiving increasing attention as treatment for primary and metastatic liver cancer. RF ablation can be performed percutaneously, during open surgery, and laparoscopically. An electrode is introduced into the liver tumor and RF energy is applied. Tissue surrounding the electrode heats up and is killed above approximately 60°C, where tissue coagulation occurs. Current devices can create coagulation zones up to 5 cm diameter. For large tumors multiple sequential applications are often required. Current limitations include inadequate imaging modalities, uncontrolled shapes and size of coagulation zones, and inability to reach adequate temperatures close to large vessels.

The role of US is essential in RF ablation. Preprocedure and postprocedure, US combined with a contrast agent can distinguish metastatic lesions from benign lesions and coagulated areas from areas with viable tumor tissue, respectively.

Because of the real time nature, US is ideal for guiding placement of the RF electrode. During the procedure, the RF heating creates microbubbles in the tumor area that temporary obscure the visibility of the tumor. Follow up is performed at standardised intervals with (PET) CT, US and blood tests including carcinoembryonic antigen and alpha fetoprotein. In case of a recurrence, the patient is offered another RF treatment. RF treatment is often combined with chemotherapy.

Disclosure
Torben Lorentzen has a royalty agreement with TYCO

Healthcare on his patent US No 5,951,546 covering the Cool Tip RF Electrode.

312 Simplifying the ultrasound of post-endovascular intervention for aneurysmal disease

Brendan Cramp, Peninsula Vascular Diagnostics, Australia

Objectives

The objectives of this presentation are to demonstrate the potential accuracy and usefulness of ultrasound in the routine follow-up of endovascular intervention for aneurysmal disease; and provide useful techniques and considerations which can be applied to the ultrasound of any region of the body post EVAR, which will aide the general sonographer in obtaining information critical to the vascular surgeon.

Background

The UK Small Aneurysm Trial has shown that infrarenal abdominal aortic aneurysms with diameters of greater than 5.5 cm, demonstrate a significantly increased risk of rupture. Findings from recent multicentre randomised trials (EVAR-1 and -2) and voluntary registries (EUROSTAR) investigating the outcomes of using endovascular aneurysm repair (EVAR) or conventional open repair (OR) to treat abdominal aortic aneurysms (AAA) of greater than 5.5cm indicate the following practices:

1) EVAR is most appropriate for high operative risk patient with anatomical feasibility.
2) OR is most appropriate for younger patients with low operative risk and long life expectancy.
3) Medical treatment alone is most appropriate for those with marginal anatomic suitability and high operative risk.

Further analysis of these registries indicates EVAR treatment of small AAA (<5.5 cm) demonstrate a lower all cause mortality and aneurysm related death rate than EVAR treatment of large aneurysm (>5.5 cm) at 3 years.

There have been inadequate long-term studies to determine suitability of EVAR to treat aneurysmal disease of visceral, upper and lower limb aneurysms. Early results, however, indicate that cumulative secondary patency rates of EVAR achieve patency rates similar to OR. Patient selection for EVAR repair still represents a fundamental consideration.

Due to the minimally invasive nature of EVAR, improved hospitalisation stays and patency rates approaching OR, EVAR will continue to play a significant role in the management of patients with aneurysmal disease. At present, computerized tomography (CT) and ultrasound are used as the diagnostic test of choice for follow up studies. Ultrasound has been criticised because of its inter-observer variability and poor reproducibility.

The general sonographer who only images the EVAR graft infrequently may feel overwhelmed and daunted. However, the increasing prevalence of EVAR procedures necessitates the need for increased general sonographer training in this area. A summary of significant post EVAR ultrasound findings applicable to any aneurysm repair anywhere throughout the arterial tree includes:

Residual aneurysmal sac changes document size

- Shrinking of sac indicates success.
- Enlargement be very suspicious of the presence of endoleak.
- Asymmetry of residual sac may also indicate the presence of endoleak.
- Flow outside the graft in the aneurysmal sac indicates endoleak.

Endoleak document type and location

- Type 1 and 3 require intervention as does Type 2 if it is associated with sac enlargement.
- Type 2 with no sac enlargement requires monitoring
- Low flow (<100cm/sec) Type 2 endoleaks or Type 2 endoleaks with a to-and-fro waveform may have a higher incidence of spontaneous sealing.

Integrity of stent graft

- Stent deformation, bowing and compression may indicate the presence of increased sac pressure and endoleak.
- Migration and dislocation of graft associated with endoleak.
- Incorporation of stent.
- Kinking of stent.
- Stenosis and occlusion of stent requires intervention.

The high operator dependency of post EVAR ultrasound surveillance can be minimized with sonographer training and a standardised protocol. At Peninsula Vascular Diagnostic, the use of ultrasound to assess patients with endoluminal grafts has given excellent information comparable to other modalities.

313 Carotid IMT (cIMT): protocols and approaches

Joseph F Polak, Tufts University School of Medicine, United States

Objectives

To review the protocols used to measure carotid intima media thickness (cIMT) in epidemiological studies and drug trials. To present data on the technical requirements of cIMT image acquisition and analysis.

Abstract

cIMT is a measurement of two layers of the carotid artery wall that is specific to ultrasound imaging. cIMT protocols for image acquisition are completely dependent on gray scale images. Standard image acquisition sites are used in the distal common carotid artery (CCA), the common carotid artery bulb (Bulb; effectively the internal carotid artery sinus) and the proximal internal carotid artery (ICA; beyond the flow divider).

Variations on this theme are as follows: common carotid artery only; CCA, Bulb and ICA as three separate sites; and CCA with a combined bulb/ICA measurement. cIMT measurements are normally made of the far wall only but near wall measurements are often included. Images are acquired at end-diastole as identified either by the R-wave of an EKG or mechanical end-diastole. cIMT values increase with age; there is therefore more inherent variability with larger cIMT values.

Technical factors that can affect image acquisition are sonographer skill, imaging device, imaging probe frequency and spatial resolution. Factors that cannot be controlled are patient body habitus, age, gender and race.

cIMT measurements require specialised software. In epidemiological studies and drug trials cIMT sonographers and cIMT readers can take up to three months to be certified. Continued quality assurance is needed in order to maintain consistency in cIMT measurements.

314 Sonography of lower limb nerve entrapments

Neil Simmons, Australia

Objectives

Demonstrate the sonographic features of common nerve entrap-

ments in the lower limb and some of their clinical presentations. Relevent less common pathologies will be demonstrated.

Abstract
The sciatic nerve and its branches supplies power and sensation to most of the lower limb.The femoral nerve supplies the anterior thigh and lesser nerves also contribute to the groin and proximal thigh.

Common entrapment sites for the sciatic nerve itself are in the buttock and adjacent to the hamstrings origin. Tears of the hamstring muscles and some of their consequences (scarring and calcification) can also cause sciatic nerve entrapment in the thigh.

The two divisions of the sciatic nerve are the common pereoneal and tibial nerve.

The common pereoneal can be entrapped as it winds around the proximal fibula and the proximal tibio-fibular joint. One of its terminal branches, the medial branch of the deep peroneal,can be entrapped in the dorsal foot. This is known as the anterior tarsal tunnel syndrome. This is more common than the literature would suggest and representative cases will be shown.

Most tibial nerve entrapment occurs in the tarsal tunnel, postero-medial to the medial malleolus. Branches of the tibial nerve, the interdigital nerves of the toes, can be entrapped by degenerative tissue between the metatarsal heads. These so-called Morton's neuromata are difficult to demonstrate without a dedicated technique. Examples will be shown.

Superficial sensory nerves can be entrapped as they pierce fascia or run in exposed positions. Some examples will be demonstrated.

315 Shoulder ultrasound beyond the rotator cuff

Carlo Martinoli, Enrico Capaccio, Alberto Tagliafico, Nunzia Pignataro, Universitia di Genova, Nicola Stagnaro, Italy Stefano Bianchi, Fondation des Grangettes, Switzerland

Objectives
Describe typical US findings of the most common non rotator cuff disorders of the shoulder. Teach and familiarize sonologists with abnormalities of the shoulder other than rotator cuff pathology. Learn to differentiate between these pathologic conditions. Recognise the utility of this technique not only for rotator cuff disease.

Abstract
There are a number of shoulder abnormalities other than rotator cuff pathology that are amenable to US examination. They can mimic rotator cuff tears clinically and may involve a variety of structures around the shoulder, including the deltoid and pectoralis muscle, the glenohumeral joint and its recesses, the bone and cartilage, the subacromial subdeltoid bursa, the labrum and some nerves (suprascapular and axillary).

Acromioclavicular joint lesions (i.e. osteoarthritis, instability, posttraumatic osteolysis of the clavicle) can mimic rotator cuff disease because of the proximity of this joint to the cuff. In acute phases, fractures of the humerus (greater tuberosity, lesser tuberosity, Hill-Sachs type, McLaughlin type) may be radiographically occult and these patients may be referred to US to look for a rotator cuff tear. Although US is not used either when the clinical suspicion of fracture is high or for the evaluation of patients with shoulder instability, fractures can be detected with this technique.

Compression of the suprascapular nerve can present as nonspecific shoulder pain. At US, a paralabral cyst may be seen centered at the level of the supraspinous and spinoglenoid notch. The axillary neuropathy is usually secondary to fibrous bands or stretching injuries at the quadrilateral space.

316 Sonography of bursae

Neil Simmons, Australia

Objectives
To highlight the number and position of the numerous bursae of the musculoskeletal system,their function and the sonographic signs of malfunction. To demonstrate the usefulness of ultrasound guided injections.

Bursae are sacs that are positioned in the body in places of friction, to reduce the friction. A thin film of lubricating fluid within each bursa allows gliding of the bursal walls upon each other.

Bursae are situated in many different positions – between skin and bony prominences (e.g. prepatellar, olecranon and superficial Achilles' bursae); at tendon insertions (e.g. Achilles', deep infrapatellar and gluteus medius); as tendons cross bones or joints (e.g. iliopsoas at the hip joint and gluteus maximus as it crosses the lateral aspect of the greater trochanter); tendon/ligament interfaces (biceps femoris and lateral ligament of knee) and tendon/muscle (subdeltoid between rotator cuff and deltoid muscle).

Some bursae communicate with nearby joints and some with each other. Some develop secondary to repetitive trauma (adventitial bursae).

Pathological conditions are usually due to either acute or chronic inflammation. Less common causes include autoimmune disorders, synovial hypertrophic conditions, haemorrhage and infection.

Sonography of common [and some less common] bursal conditions will be demonstrated. The role of ultrasound-guided injections will be emphasised.

318 Intrauterine CMV infection, prognosis and perspectives for treatment

Yves Ville, Université Paris, France

Objectives
To retrospectively evaluate:
1) The prognostic value of ultrasound abnormalities, fetal thrombocytopenia and elevated plasma levels of liver enzymes in fetal blood of fetuses infected by CMV.
2) The possibility of intrauterine treatment with oral valaciclovir.

Methods
We analysed retrospectively data collected prospectively in 73 fetuses infected by CMV with a positive CMV PCR in amniotic fluid. Fetal blood sampling was performed for evaluation of platelet count, aminotransferases level and gammaglutamyltransferase plasma levels, presence of viremia and presence of specific IgM.

Targeted ultrasound examination was performed every fortnight. Ultrasound findings were categorised into three groups: normal examination, ultrasound abnormality of the fetal brain, and other ultrasound abnormalities. Primary outcome measure combined histological findings after termination of pregnancy and evidence of cytomegalic inclusion

disease at birth when pregnancies were continued. Clinical symptoms at birth or histological lesions attributable to CMV were considered as poor outcome.

Pregnancies with confirmed fetal cytomegalovirus infection were treated with oral VACV (8g/day). Fetal viral load and drug concentration were monitored in amniotic fluid and in fetal blood.

Results

In univariate analysis, only thrombocytopenia and the presence of any ultrasound abnormality were associated with a poor outcome (p <10-4 for both abnormalities). In the multivariate analysis, both thrombocytopenia and presence ultrasound abnormalities remained significant independent predictors of a poor outcome. Based on univariate logistic regression, odds ratio for a poor outcome was 1.24, 7.2, 22.5 and 25.5 for a 10000/mm^3 decrease in platelet count, a non-cerebral ultrasound abnormality, any ultrasound abnormality and a cerebral ultrasound abnormality respectively.

Twenty pregnancies including 21 fetuses were treated at 27.4 ± 3.2 weeks (range: 22 to 34) for 6.3 ± 3.5 weeks (range: 1 to 12). Ten infants are developing normally at between 1 and 5 years of age. Two infants (both 2 years) have severe unilateral deafness. One neonate presented with microcephaly and severe deafness but was also diagnosed with incontinentia pigmenti. Six out of seven cases that eventually requested termination of pregnancy had evidence of in-utero progression of the disease with worsening cerebral lesions. One fetus died in utero. Therapeutic VACV concentrations were achieved in maternal and fetal blood. The viral load in the fetal blood decreased significantly after 1 to 12 weeks of treatment (U Mann Whitney $P = 0.006$).

The outcome of 14/24 (58.3%) untreated symptomatic infected fetuses was poor, with either TOP, IUFD or severe congenital infection disease of the neonate.

Conclusions

The prognosis of CMV infected fetuses relies on both targeted ultrasound examination and fetal platelet count. The prognostic value of platelet count was therefore justifying fetal blood sampling in infected fetuses even in the absence of ultrasound features of brain involvement. Intrauterine treatment of fetal CMV infection may be possible with maternal oral administration of valacyclovir. Our results suggest that in cases where termination of pregnancy is declined, a randomised controlled study to further study this treatment option may be warranted.

321 Ultrasound and the pelvic floor surgeon

Hans Peter Dietz, University of Sydney, Australia

Clinical examination is generally regarded as sufficient for the assessment of pelvic organ support in urogynaecology and female urology. Most colleagues do not see any need to employ modern imaging methods in the investigation of women with urinary incontinence, pelvic organ prolapse and recurrent urinary tract infections. We use the Baden-Walker grading or, at best, the POP-Q Pelvic Organ Prolapse grading system, to describe surface anatomy. There have been attempts in the past to introduce imaging methods into the clinical practice of pelvic floor surgeons. Recently, ultrasound has found widespread acceptance, whether transvaginal or introital/ transperineal/ translabial.

Ultrasound can be of great help to the pelvic reconstructive surgeon. This talk will focus on two examples – the differential diagnosis of posterior compartment prolapse and the issue of levator trauma. In both instances, information derived from pelvic floor imaging is very likely to influence surgical management and has the potential to improve outcomes.

322 Ultrasound in nephrology

Torben Lorentzen, Copenhagen University Hospital af Herlev, Denmark

Objective

To review the use of ultrasound in the nephrologic patient with the focus on normal anatomy and variations, renovascular hypertension, the uraemic patient, the transplanted kidney, and peritoneal dialysis.

The normal kidney is about 11 x 5 x 2.5 cm, however the right kidney is smaller than the left. Renal length correlates with body height and renal size decreases with advancing age. Anatomic variations are parenchymal junction defects, hypertrophy of the column of Bertin, lobulation of the left kidney, and dilatation of the left renal vein.

A patient with acute or chronic renal failure should undergo ultrasound to exclude urinary obstruction due to prostatic disease, bladder stones, pelvic mass, or solitary kidney. Furthermore, congenital anomalies as agenesia, hypoplasia, ectopia (pelvic kidney or thoracic kidney), horseshoe kidney, or renal duplex / ureterocele / UPJ obstruction should be excluded. Diminished kidneys are seen in diabetic nephropathy, chronic pyelonephritis (often reflux), hypertensive nephropathy, and renal artery stenosis. Other parenchymal diseases are polycystic kidney disease, nephrocalcinosis, and glomerulonephritis. In the latter case, the kidney on US can be swollen and diffusely echogenic due to oedema, however, often the kidney looks normal and the diagnosis rest upon a US-guided biopsy.

Using B-mode and Doppler the renal artery can be investigated for a stenosis. On the direct technique, the renal artery close to the aorta is examined for high velocity flow. On the indirect technique, the intrarenal arteries (segmental) are examined for a parvus-tardus flow pattern causing decrease in acceleration time and decrease in resistance index.

323 Diagnosis of fetal CNS anomalies using a combination of ultrasonic and magnetic resonance

Guowei Tao, Shaoping Liu, Tao Gu, Xinfeng Zhan, Lin Chen, Chuanfu Li, QiLu Hospital of Shandong University, China

Objective

To diagnose fetal central nervous system (CNS) anomalies combining ultrasonography (US) with magnetic resonance (MR).

Methods

From 2005 to 2007, 56 pregnant women underwent MR for fetal CNS evaluation within 24 hours after an abnormal CNS was found by ultrasonography. MR was performed on 3.0T MR units, using T2WI SSFSE sequences and T1WI SPGR sequences. US was performed with HDI 4000 equipment. Gestational age ranged from 26–40 weeks with a mean of 33 weeks. Prenatal US and MR imaging findings were compared with postnatal diagnoses.

Results

The gyrus, sulcus, corpus callosum, thalamus, cerebellum

and brainstem of the fetus were shown more clearly on MR images than ultrasound. MR demonstrated the region of sonographic abnormality in all cases, correctly provided additional information to the US-determined diagnosis in 11 cases and correctly changed the US diagnosis in 6 cases.

In the ventriculomegaly cases, we found MR is more valuable for the diagnosis of the ventriculomegaly cases and posterior fossa abnormity in the third trimester than US.

Conclusion

Ultrasound continues to be the screening modality of choice in the evaluation of fetal anomalies. MR imaging as an adjunct to prenatal US may provide valuable information that could add to the prenatal evaluation of fetal anomalies, particularly those involving the central nervous system.

324 Ultrasound assessment of the effects of smoking in pregnancy on endothelial function

Ann E Quinton, Colleen M Cook, Michael J Peek, University of Sydney at Nepean Hospital, NSW, Australia

Introduction

Pregnant women who smoke have increased perinatal morbidity but a decreased incidence of preeclampsia. An association has been demonstrated between endothelial dysfunction and preeclampsia. Further, smoking has been shown to cause endothelial dysfunction in non-pregnant studies.

Aim

To compare the effects of smoking on endothelial function in pregnant women who smoke with non-smoking pregnant women.

Method

Pregnant women (28–32 weeks gestation) who daily smoked 10 cigarettes were recruited and compared with pregnant non-smokers. The smokers were asked to refrain from cigarettes from midnight. Endothelial function was assessed by the ultrasound technique of flow-mediated dilatation (FMD). FMD is the percentage increase in brachial artery diameter as measured by ultrasound, caused by reactive hyperaemia after blood-pressure cuff deflation. After the first test, all the women had a 10–15 minute break during which time the smokers had a cigarette. The FMD test was then repeated in the same manner on all volunteers.

Results

Forty-one women were enrolled (21 smokers; 20 non-smokers). The first test FMD was significantly different (P <0.001) at 4.0 ± 2.3 (smokers) vs 9.7 ± 4.0, (non-smokers). This difference was unchanged at the re-test (smokers 4.4 ± 2.5 vs non-smokers 9.6 ± 3.8, P <0.001) (mean ± SD) despite smokers having a cigarette.

Conclusion

First, the FMD for non-smokers was the same as the women in our previously reported normal study whereas the FMD of the women who smoked was markedly lower, indicating endothelial dysfunction. Second, using this test-retest method, this endothelial dysfunction was shown to be constant.

325 Prenatal sonographic diagnosis of aberrant fetal sulcation

Peter R Coombs, Monash Medical Centre, Australia

The essential formation of cerebral cortex occurs early in fetal life. Four developmental stages provide the distinctive sulci/gyri evident in the human brain. Arrested or aberrant formation in these stages can cause marked alteration to cerebral development. Prenatal diagnosis is important as abnormal sulcation with a very poor prognosis. Detailed fetal cranial ultrasound evaluation provides the opportunity to make this diagnosis in selected high-risk pregnancies.

Objectives

This paper describes cerebral sulcation in detail and uses this to identify the major sulci and gyri seen on prenatal ultrasound. These are the:

- Parieto-occipital fissure
- Calcarine fissure
- Cingulate sulcus
- Central, postcentral, superior temporal sulci
- Sylvian fissure/insula[1]

Anatomical animation, ultrasound and correlative fetal MR will be used to demonstrate the anatomical and sonographic changes of the sulci/gyri through the prenatal period. The standard planes in which the sulci/gyri are imaged will be described. Patient selection, potential pitfalls and the considerable value of 3D/4D will be also considered.

The major example in this paper is failed sulcation demonstrated by lissencephaly ('smooth brain'). This is derived in the genetic syndromes, Miller-Dieker and Walker-Warburg or may be a complication of early cerebral hypoxia and infection. The paper will briefly consider other possible more subtle diagnoses in this area.

Sonographic diagnosis of altered cerebral development is a new horizon, which presents opportunities for a better understanding of fetal prognosis and more informed counselling for parents.

Reference

1 Ghai S, *et al*. Prenatal US and MR findings of lissencephaly. *Radiographics* 2006; 26: 389–405.

326 Does postnatal cerebellar growth predict developmental outcome at two years of age in very preterm infants?

Sheryle R Rogerson, J Cheong, Royal Womens Hospital Melbourne, Australia, Kelly Howard, Peter Anderson, Murdoch Institute of Medical Research Melbourne, Australia, Rod Hunt, Lex Doyle, Royal Womens Hopsital, Australia

Background

MRI measured cerebellar volume at term-equivalent is not associated with adverse outcome. Data relating postnatal cerebellar growth to neurodevelopmental outcome are limited.

Aims

Does serial transcerebellar diameter (TCD measurments relate to two-year developmental outcome?

Subjects and Setting

Infants born at the Royal Women's Hospital, Melbourne, in 2001 <30 weeks gestation or <1250 g birthweight who were followed to two years of age were eligible. TCD was measured on all infants with a GE Logic 500 with an 8 MHz curvilinear probe on days 1, 3,7, 28 and 60. Measurements were plotted on a fetal centile chart for TCD. Suboptimal cerebellar growth (SCG) was defined as a TCD that fell through centile channels and remained lower than the original birth centile channel. The remainder were considered to have optimal cerebellar growth (OCG). Infants were assessed with the Bayley Scales of Infant Development - 2nd

Editions at two years of age, corrected for prematurity, by psychologists blinded to knowledge of the TCD.

Results

Forty-four patients were enrolled; 16 had SCG and 28 had OCG. There were no substantial differences between the groups on the Mental Developmental Index (MDI) or the Psychomotor Developmental Index (PDI) (Table 1).

Table 1. MDI and PDI related to cerebellar growth

	SCG $n = 16$	OCG $n = 28$	Mean difference	P value
MDI	83.0 (19.3)	82.0 (19.4)	-1.05 needs 95% CI	0.86
PDI	88.9 (19.5)	85.0 (15.7)	-3.8 needs 95% CI	0.48

Conclusions

SCG does not correlate with long-term developmental outcome. This is consistent with results from MRI volumetric studies at term.

327 Fetal anatomy assessed by three-dimensional ultrasound at 11–13 + 6 weeks gestation, correlated with the 18–20 week scan and postnatal outcomes

David EV Fauchon, University of Sydney, Australia, Ron J Benzie, University of Sydney, Australia, Deborah A Wye, Nepean Hospital, Australia

Objectives

To correlate the fetal anatomy observations at 11–13 +6 weeks gestation obtained by a single 3D sweep with fetal anatomy at 18–20 weeks gestation and postnatal outcomes.

Methods

A retrospective review to obtain the information at the fetal anatomy scan and the postnatal outcomes of all 273 fetuses scanned at 11–13 + 6 weeks gestation with three-dimensional ultrasound.

Results

In the first 209 patients followed, 4 had a fetal anomaly. There was 1 chromosomal abnormality (47XXX), a hyperplastic left heart, an abnormal left hand and a duplex renal collecting system. There were 4 stillbirths all with normal phenotypes. The chromosomal abnormality had a normal nuchal translucency measurement but the patient's age and serum biochemistry resulted in a high risk for aneuploidy. The diagnosis was confirmed by amniocentesis. The cases with the hyperplastic left heart, the abnormal left hand and the duplex renal collecting system were diagnosed at the 18-20 week ultrasound.

Conclusions

This review confirms two findings from other studies. The first is that a single transabdominal three-dimensional sweep between 11–13 + 6 weeks gestation provides appropriate views of the fetus for evaluation of both anatomy and nuchal translucency in the vast majority of cases. Second, the recommendation still stands that a fetal anatomy scan be performed in the second or third trimester as the first trimester 3D sweep must not be expected to diagnose all anomalies.

330 Early pregnancy failure – the role of assessment units

David Ellwood, The Australian National University Medical School, Australia

Complications of early pregnancy such as vaginal bleeding, early pregnancy failure and ectopic pregnancies are relatively commonplace. Indeed, as the average age at first pregnancy increases, it may be that as many as 1-in-3 or -4 pregnancies will either miscarry, or present in the first trimester as non-viable. Apart from extra-uterine pregnancies, these complications of early pregnancy are neither clinically urgent, nor do they usually pose a significant risk to maternal health. However, they are of great emotional significance to the woman and their management requires both expediency and compassion.

Over the last two decades, there have been many different models developed of early pregnancy assessment units. These have been driven by several factors. First, the availability of rapid and accurate quantitative HCG assay, and access to high-resolution transvaginal ultrasound has enabled earlier and more accurate diagnosis of both site and viability of early pregnancies. Second, there has been the realisation that Emergency Departments are not the best place to manage women who are emotionally vulnerable yet with a relatively non-urgent clinical problem. The third factor has been the emergence of data showing that many early pregnancy complications can be managed non-surgically, requiring an efficient follow-up mechanism.

This presentation will look at the needs of the woman who is experiencing an early pregnancy complication, and the way that early pregnancy assessment units can best serve them.

402 Managing monochorionic twin pregnancies

Jon Hyett, Royal Brisbane and Women's Hospital, Australia

The prevalence of multiple pregnancies has increased over the last 20 years. This is in part related to the trend of advancing maternal age for pregnancy, but is also related to the increased use of assisted reproductive technologies. Twin pregnancies are associated with a 5-fold increase risk of neonatal mortality and an 8-fold increase in risk of adverse neurodevelopment outcome. Vascular accidents related to monochorionicity and preterm delivery are the major factors causing this morbidity.

Chorionicity is best determined in the first trimester of pregnancy. At the routine 12-week (NT) scan, the membrane inserts into the placenta in a 'T' shape whereas in the dichorionic situation, where a peak of placental tissue rises between the membranes, this is an 'l' shape. A statement of chorionicity should be made in all routine first trimester scans and should lead to differential management of monochorionic and dichorionic pairs.

The longitudinal follow up of a cohort of monochorionic twin pregnancies has shown that the periods of high risk for mortality occur between 16–24 and after 32 weeks. The main cause of mortality appears to be twin-twin transfusion in both of these situations. In the second trimester, this is best monitored by serial ultrasound with scans every 2 weeks from 16 weeks of gestation, continuing to 24 weeks. In the third trimester early delivery (at 34–36 weeks) by caesarean section may reduce risk – although there is little prospective data to support this.

Recent studies have looked at improving the prediction of poor outcome (twin-twin transfusion syndrome or intrauterine fetal death) using first trimester markers. To date, a 20%

discrepancy in NT and absent/reversed flow in the ductus venosus have both been shown to be associated with poor outcome: with positive and negative LRs of 2.0/0.67 and 2.5/0.67 respectively. The findings of NT discordance and an abnormal DV increase the risk of poor outcome by 3.0 whilst normal ultrasound findings decrease the risk by a factor of 2.

404 Fetal brain examination

Yves Ville, Université Paris, France

Evaluation of the fetal CNS can optimally be obtained in the second and third trimesters of pregnancy. In late gestation, visualisation of the intracranial structures is frequently hampered by the ossification of the calvarium. Most basic examinations can be performed with 3-5 MHz transabdominal transducers. Fetal neurosonography frequently requires transvaginal examinations usually performed with transducers between 5 and 10 MHz. The targets of the routine CNS examination are: head shape, lateral ventricles, cavum septi pellucidi, thalami, cerebellum, cisterna magna and spine. Three-dimensional ultrasound may facilitate the examination of the fetal brain and spine.

The appropriate axial planes are:

1) The transventricular plane demonstrating the anterior and posterior portion of the lateral ventricles.
2) The transcerebellar plane demonstrates the cerebellum and posterior fossa.
3) A third scanning plane, obtained at an intermediate level is also frequently used in the sonographic assessment of the fetal head, and is commonly referred to as the transthalamic plane or biparietal diameter plane. The anatomical landmarks include, from anterior to posterior, the frontal horns of the lateral ventricles, the cavum septi pellucidi, the thalami and the hippocampal gyruses. The most frequent of the severe spinal abnormalities, open spina bifida, is usually associated with abnormal intracranial anatomy. However, a longitudinal section of the fetal spine should always be obtained because it may reveal, at least in some cases, other spinal malformations including vertebral abnormalities and sacral agenesis.

Coronal planes include:

1) The transfrontal plane obtained through the anterior fontanelle and depicts the midline interhemispheric fissure and the anterior horns of the lateral ventricles on each side.
2) The transcaudate; and
3) The transthalamic planes.

Three sagittal planes are also usually studied: the midsagittal and the parasagittal of each side of the brain.

Three types of scanning planes can be used to evaluate the integrity of the spine including transverse and axial planes. In sagittal planes the ossification centres of the vertebral body and posterior arches form two parallel lines that converge in the sacrum.

The best application of 3D ultrasound for brain examination lies in the multiplanar mode. This is particularly useful for the diagnosis of midline anomalies of the fetal brain can always be made accurately using 3D median views. Although the corpus callosum is not usually visualised directly, agenesis is consistently associated with an absent or small cavum septi pellucidi, which is easily identified in the 3D median view.

The use of 3D examination of the fetal spine gives the possibility of visualising the entire length of the bony elements of the spine of the mid-trimester fetus in one single image.

In a low risk pregnancy around midgestation, if the transventricular plane and the transcerebellar plane are satisfactorily obtained, the head measurements (head circumference in particular) are within normal limits for gestational age, the atrial width is less than 10.0 mm and the cisterna magna width is between 2–10 mm, many cerebral malformations are excluded, the risk of a CNS anomaly is exceedingly low and further examinations are not indicated.

405 Imaging of implants used for anti-incontinence and prolapse surgery

Hans Peter Dietz, University of Sydney, Australia

Over the last 10 years, the popularity of synthetic implants in female urology and urogynaecology has increased tremendously. More and more women present with complications or recurrence after such implant surgery, often without being aware of the nature of the procedure. Synthetic slings such as the TVT, Sparc, ICS, Monarc, TVT-O etc. are now first-line procedures. Ultrasound can confirm the presence of such a sling, distinguish between transobturator and transretzius slings, and even allow an educated guess regarding the nature of the sling. The degree of tensioning of the sling can also be evaluated. A tight c shape at rest and a gap of less than 1 cm between tape and symphysis pubis makes functional obstruction very likely and suggests tape division if there are worsened symptoms of bladder irritability or clinically significant voiding dysfunction.

Since about 2004, many prolapse surgeons have started using mesh implants for the repair of large and/or recurrent cystocele, or for posterior compartment prolapse. These implants are generally highly echogenic, and surgical audit in such patients has already yielded surprising insights into the mode of action of mesh implants, as well as suggesting causes of failure.

406 How useful is ultrasound in the management of secondary PPH?

David Ellwood, The Australian National University Medical School, Australia

Secondary postpartum haemorrhage (PPH) is a relatively common condition affecting 1–2% of postpartum women. It is difficult to define accurately as there is a wide range of normal variation in postpartum blood loss, both in terms of frequency and duration. In general, the diagnosis is made when there is a significant increase in the amount of fresh bleeding, at a time when the loss has begun to settle to a blood-stained discharge (lochia). The common causes are endometritis, retained products of conception such as placenta, or both. Typically, it occurs at 10–15 days postpartum, although the definition includes any bleeding after the first 24 hours.

One of the mainstays of diagnosis has always been ultrasound, looking for evidence of retained products and the usual treatment, if found, has been postpartum curettage. However, there are significant risks involved in such surgical management including uterine trauma, perforation and the long-term consequences of amenorrhoea and infertility due to intrauterine adhesions (Ashermann's syndrome)

There is now a body of evidence to suggest that the normal postpartum uterus contains quite large amounts of echogenic

material which is often referred to after ultrasound as 'retained products'. Once this ultrasound diagnosis is made and reported, the clinician is put in the difficult position of doing a curettage which may not be warranted and can cause harm.

This presentation will look at what is known about the appearances of the post-partum uterus, and examine the evidence for and against the use of ultrasound in this condition. Alternative ways of reporting the ultrasound findings will be discussed to more accurately guide clinicians in the correct management.

407 Prediction of emergency operative delivery and pelvic floor trauma

Hans Peter Dietz, University of Sydney, Australia

A large number of women in the developed world expect a normal vaginal delivery without obstetric intervention only to experience a highly medicalised birth, resulting in a sense of personal failure or suboptimal care. In addition, some of those women are left with long-term morbidity due to trauma to the anal sphincter, levator muscle and pelvic organ support. Unplanned emergency delivery may have major psychological and somatic sequelae and significantly affect the future life of woman and child, even if somatic trauma does not occur. Identification of antenatal risk factors for intervention would hold promise in terms of reducing somatic and psychological trauma as well as the cost of service delivery.

In a recently conducted prospective observational study, we tested potential clinical predictors and ultrasound parameters of potential predictive value. A multivariate model derived from these parameters was moderately predictive of delivery mode, reaching a corrected Nagelkerke R2 of 26.8% in a group of 125 nulliparae with uncomplicated singleton pregnancies assessed between 36 and 40 weeks' gestation. When multivariate regression models were constructed considering the (sometimes considerable) interdependence of variables, the best model had a discriminatory ability c = 0.852 (equivalent to area under ROC curve), indicating excellent discrimination between NVD and non-NVD.

Current work at our unit focuses on optimising this predictive model, using it in intervention trials aimed at high-risk women. Furthermore, we are working to develop a similar model for the prediction of major pelvic floor trauma.

408 Saline hysterosonography – a useful adjunct to the gynaecological scan

David Ellwood, The Australian National University Medical School, Australia

Saline infusion sonohysterography (SIS) was first described in 1986, in a landmark paper by Randolph, *et al*. A submission to the Health Insurance Commission (HIC) in 1998 resulted in a comprehensive report by the Medical Services Advisory Committee in 1999, which ultimately resulted in the granting of an item number (55736) for this procedure. Surprisingly, the uptake into clinical practice has been relatively low and in the financial year 2005–06 only 4177 of these procedures were recorded and rebated by Medicare. The utilisation by state and territory shows enormous variation in practice. In the evidence given to the HIC it was argued that there should be a clear saving from the reduction of hysteroscopy and curettage procedures. Clearly this has not been the case across the whole country.

The technique is relatively simple and can be learned very easily. There is little doubt that it aids diagnosis and allows, in many cases, for a diagnosis to be made at the first ultrasound as opposed to waiting for a surgical procedure. The technique also has very high patient acceptability as it leads to greater certainty of diagnosis in many cases.

This presentation will explore the usefulness of this technique using a number of case presentations and examine the reasons why the uptake in Australia and New Zealand has been limited.

409 Percutaneous gastrostomy guided by ultrasound and fluoroscopy

Torben Lorentzen, Herlev Hospital, Denmark

Objective

To review the indications and various techniques of percutaneous gastrostomy with focus on a radiologic technique guided by ultrasound and fluoroscopy.

Abstract

Feeding via a gastrostomy tube is an established way of maintaining enteral nutrition in patients who have disorders that makes oral intake inadequate. In the early 1980s, two alternative methods to surgical gastrostomy were introduced: percutaneous endoscopic gastrostomy (PEG) and percutaneous radiologic gastrostomy (PRG). The use of gastropexy devices in PRG, so-called T-fasteners, was first reported in 1986.

PEG and RPG have both shown to be safe and efficient alternatives to surgical gastrostomy, since both techniques have significantly lower rates of complications.

In children and newborns, PEG is often the preferred method. However, the choice of technique is generally governed by local availability and expertise. The conventional PRG technique is guided solely by fluoroscopy after having distended the stomach with air.

At Copenhagen University Hospital at Herlev, an alternative guiding technique has been preferred the last 15 years: This PRG technique deviates from the conventional technique in two ways:

1) The fluid filled stomach is punctured, guided by ultrasound and not by fluoroscopy; and
2) Only a single T-fastener is utilised temporarily during the PRG procedure. This T-fastener is used along the puncture tract to facilitate tract dilatation and tube insertion. This technique is presented including the results of 154 cases.

Reference

1 Lorentzen T, Nolsøe CP, Admensen S. Percutaneous radiologic gastrostomy with a simplified gastropexy technique under ultrasonographic and fluoroscopic guidance: experience in 154 patients. *Acta Radiol* 2007; 48: 13–9.

ASUM travel scholarship to Vietnam

Henry Murray travels to Vietnam with the ASUM Vietnam Asia Link Scholarship Fund

On arrival in Vietnam I met with Harley Roberts. Harley has spent endless hours working with personnel from Tu Du Hospital, especially Dr Nguyen Ha, to foster the practise of scanning in obstetrics and gynaecology. The major issues presented to me on arrival were to teach the use of Doppler flow in obstetrics, provide logical follow up guidelines for fetal anomalies given the limited facilities for neonatal surgery and tertiary neonatal care in Vietnam, improve the quality of CVS sampling and to teach the relevance of advanced scanning to the general obstetricians working in southern Vietnam. This latter task was to be undertaken at the Vietnamese Congress in Obstetrics and Gynaecology, which was held during my stay in Ho Chi Minh City.

The job of helping produce guidelines for the management of fetal anomalies was something I was able to undertake since I work in high risk obstetrics as a feto-maternal medicine subspecialist looking after high-risk pregnancies, including fetal anomalies. The initial days were spent assessing what facilities were available for neonatal care and then working to accommodate those limitations within any guidelines.

Part of the process of familiarising myself with the hospital facilities was to meet and discuss issues with the obstetric staff of Tu Du Hospital. This facility performs over 45 000 deliveries per year, of which 55% approximately are primiparous. Despite these large numbers, it was obvious and surprising that the hospital was more than adequately staffed to deal with the clinical load. There were a minimum of one midwife and two student midwives assigned to each individual patient, and up to 12 medical staff on the labour floor at any one time. It was enough to make a doctor working in obstetrics in Australia jealous.

A considerable amount of my time in the Tu Du Hospital was spent discussing issues of patient management, especially the high-risk pregnancy. Change in Vietnam comes from the top down and I was lucky to give presentations on high-risk pregnancy management to all levels of the hospital hierarchy during my visit. Changes of protocols based on evidence are underway and refinements and suggestions will be made by email contact over the coming months.

I sincerely thank ASUM, especially Dr Caroline Hong, Dr Harley Roberts, and Dr Nguyen Ha (Tu Du Hospital) for facilitating my trip to Vietnam. I believe that such visits can be of great value to all involved.

For those interested in visiting Vietnam, I can assure you that you are guaranteed a warm welcome from a people that make smiling an art form. The food and atmosphere are amazing, prices are cheap and pollution is low. The government inputs to health care and education are to be commended and although people may be poor by western standards, I did not see poverty like that in other developing countries. Vietnam is a great and safe place to visit and I would commend it to anyone.

Henry Murray
Nepean Hospital

Editor's Note

Dr Henry Murray was the recipient of the 2007 ASUM Vietnam Asia Link Scholarship Fund award for travel to Vietnam in order to teach high-risk obstetrics. He spent two weeks at Tu Du Hospital in Ho Chi Minh City from 12th–26th May, 2007.

Winners ASUM Awards and Fellowships

Chris Kohlenberg Teaching Fellowship Martin Necas (Regional NSW). Sponsored by GE Healthcare

Beresford Buttery Teaching Fellowship George Condous (NSW and Vic). Sponsored by GE Healthcare

Gulia Franco Teaching Fellowship Elvie Haluszkiewicz (NT and Regional Nth Qld) Sponsored by Toshiba

Anthony Tynan Award for Best Clinical Presentation Kerry Thoirs. Sponsored by Siemens Value $1000

Best Research Presentation Award Peter Coombs. Sponsored by Siemens Value $1500

Best Sonographer Research Presentation Award David Fauchon. Sponsored by Philips Value $2000

Best Poster Award sponsored by ASUM Jackie Cartmill. Value about $1500, made up of free registration to ASUM meeting 2008 Auckland and $500 spending money

UI UL Plenary Award Recipient Assoc Prof Jon Hyett
Hon. Fellows Rosina Davies and Mary Young

ASUM honours 2007

Mary Young DMU AMS Honorary Fellow, ASUM

Mary Young's commenced her sonography carrier in 1976 at the Mercy Hospital for Women, Victoria in 1976, under the direction of Dr Christine Action. She is one of the founding members of the sonography profession and an exemplary member of ASUM.

With a keen interest in education, Mary assisted in running meetings of the Melbourne Clinical Ultrasound Group which formed the nucleus of ASUM's Victorian Branch. She became Victoria's liaison officer of the DMU examinations organising sonographer education meetings; venue organisation and invigilation and practical examiner.

Through the late 80s and early 90s, Mary held executive positions in the Victorian Branch of treasurer, secretary and finally, chairman and as such, was on the organising committees of ASUM's many Victorian meetings. Susie Woodward, ASUM Councillor's nomination saw Mary become ASUM's assistant honorary secretary leading her to become honorary secretary, a position she held for six years.

During those years, Council worked on the foundations of those who had gone before, to develop the international links of the Society, to try to grow the Society from Australasian to international, and to nurture the fledgling ultrasound communities within our global region.

Other notable achievements of this time include winning the bid to host WFUMB '09; establishing the Research Foundation; laying the foundations of the ASAR; development of the Multidisciplinary workshops and continuing support for the Bulletin.

Mary continues to work in private practice in Melbourne with Dr Max Hardy. The Society salutes Mary Young as an Honorary Fellow.

Rosina Davies DMU Honorary Fellow, ASUM

Rosina Davies' introduction to ultrasound was in 1975 at Sydney Hospital, when it purchased one of the first commercial ultrasound machines in Australia. She was chief radiographer of the Radiotherapy Department, incorporating nuclear medicine and ultrasound. In 1978 she transferred to full-time sonography at Park House Ultrasound, Macquarie Street, Sydney, in obstetrics, gynaecology and general studies.

During this time Rosina became an ASUM member gained training at the Ultrasonics Institute, particularly with the tuition of David Robinson, and gained the DMU.

In 1983, Rosina commenced work as an ultrasound application specialist with Toshiba (Australia) expanding her knowledge of ultrasound, commerce and the ultrasound community and was promoted to Business Unit Manager for Ultrasound by the years end.

She was appointed General Manager Toshiba (Australia) Pty Ltd in 1993 a position she retained until she retired in August 2007.

At WFUMB 1985, in Sydney, Toshiba introduced colour Doppler systems to Australia with Rosina being at the forefront.

Her career path encompassed development of new technologies; clinical applications and techniques and teaching as she visited so many sites. As General Manager of Toshiba, Rosina has supported, in cooperation with the subsequent business unit managers, the Society's interests at local, branch and national meetings in Australasia and in the World Federation.

Through a request from Rosina to ASUM, Toshiba has sponsored the annual Guilia Franco Teaching Fellowship, which increases the educational opportunities of members who live outside the main centres.

Always gentle, ever vigilant and generous, deservedly, Rosina Davies has been made an Honorary Fellow of ASUM at its Annual General Meeting.

DMU Asia Recipients

The following candidates have fulfilled the DMU (Asia) requirements and have been awarded the Diploma (Asia) by the ASUM Council.

I congratulate them on their success and wish them well in their development as sonographers.

Peng Hwei Fun
Foo Siew Keay (Phoebe)
Lai Xiao Hui
Lee Pei Yee
Leong Chai Kim (Stacia)
Marian Ab. Malik
Nur Marni bt. Ahmad
Yeo Siang Joo

Andrew Ngu
Chairman DMU (Asia)
Board of Examiners

DMU key dates for 2008

Part I and Part II Application Open
1st December 2007
Part I and Part II Application Close
31st January 2008)
Part I and Part II Late Application Close
31st March 2008
Application for Exemption Close
31st March 2008)

DMU Preparation Course
Sydney 26th–30th March
DMU Part I Written Examination
26th July 2008
DMU Part II Written Examination
26th July 2008
DMU Part II Oral Examination Period
September 2008
DMU Part II Practical Examination Period
August 2008
DMU Part I Supplementary Written Exam
1st November 2008

DMU fees and charges 2008

2008 DMU Examination Fees

DMU Enrolment (once only fee)
$A326.00 + GST = $A358.60
DMU Part I APP
$A326.00 + GST = $A358.60
DMU Part I PHY
$A326.00 + GST = $A358.60
DMU Part II Written
$A540.00 + GST = $A594.00
DMU Part II Oral
$A540.00 + GST = $A594.00
DMU Part II Practical
$A800.00 + GST = $A880.00

Supplementary Examinations

DMU Part I Supplementary APP
$A326.00 + GST = $A358.60
DMU Part I Supplementary PHY
$A326.00 + GST = $A358.60

Convenor's Report – 3rd New Zealand branches of ASUM and RANZCR combined scientific meeting

Dr Matthew Andrews and New Zealand Scientific Meeting Co-convenor Dr Hong Soo Wong

The 3rd New Zealand ASUM branches and RANZCR Combined Scientific Meeting was held in Wellington from 20th–22nd July 2007. The delegates and the speakers were welcomed with tears from the sky.

We were all saddened by the loss of Prof Fung Yee Chan, who was scheduled to be a keynote speaker. A time was devoted at the beginning of the ASUM meeting in memory of Prof Chan, who will forever live in the minds and hearts of so many of her patients, friends, colleagues and, obviously, family.

Our sincere thanks go to our international speakers, Prof Lil Valentin and Assoc Prof Jon Hyett. Prof Valentin travelled a long way from Sweden to give her lectures on gynaecology ultrasound, which provided very clear, comprehensive and educational coverage of acute and chronic gynaecology conditions. Prof Valentin had also provided us with an expert insight into the past, present and future role of ultrasound in gynaecology. We were also very grateful to Assoc Prof Jon Hyett who agreed to sit in for Prof Fung Yee Chan at very short notice. He had already given excellent coverage on nuchal translucency screening in the pre-conference course and agreed to stay on so as to provide a good run down on fetal surveillance in the conference.

We were also graced with some most distinguished local and Australasian speakers, including Prof Kevin Pringle, Dr Billy Ying Kei Cheung, Dr Ramesh Tripathi, Mr Ian Ross and Dr John Matthews, Mr Stephen Bird, Mr Martin Necas, Dr David Rogers and Dr Roger Davies. They are well known experts in the field of vascular, obstetrics, interventional and musculo-skeletal imaging and telemedicine. Together, they provided an expansive coverage of the application of ultrasound, from the latest advances to some unusual yet interesting conditions that might not be covered in other meetings. Special thanks go to Dr Cheung who also provided some good ideas for the program.

The proffered paper and ASUM best sonographer/registrar/student sonographer sessions were thoroughly enjoyed, as well as the poster display. There was a very good collection of papers and all the participants agreed that the standard was very high. It was a challenge to allocate the paper to the sessions, and even more so for the judges to decide on the winners of the awards. We look forward to reading these papers in the *Ultrasound Bulletin*.

The conference dinner was held among the National Museum displays at Te Papa. We had a wonderful time together. Thanks to Ms Christine Birchall, NZ ASUM Committee Member, who not only took her time to support the organisation of the meeting but also found the band that created the atmosphere for the conference dinner and provided us with such entertaining music.

I would like to thank the ASUM Council and the ASUM New Zealand Branch for their generous, continued support, especially Dr Caroline Hong, Mr Keith Henderson, Dr Matthew Andrews, Dr David Rogers, Mr Rex de Ryke (who also helped in the organisation of the pre-conference course) and Ms Nancy Leung and Mrs Iris Hui from the ASUM Secretariat for their hard work. I would also like to thank the past convenor, Ms Yvonne Taylor, for sharing her precious experience. It was challenging to organise a combined meeting but, through recognising and understanding our common grounds as well as the differences, the Committee members walked together, in providing the best for our members, who are our prime concern.

On behalf of ASUM New Zealand Branch, I would like to thank our Platinum Sponsor, GE Healthcare, our Silver Sponsors, Siemens, Philips and Carestream Health (Kodak) and our Bronze Sponsor, Comrad Medical Systems, as well as the exhibitors for their support. The last but not the least, credit also goes to MIANZ for their management of the conference.

Since there were nearly 300 delegates, with a good mixture of Australians and New Zealanders, there was ample time for communication and networking over the tea breaks, lunchtime, happy hour and the conference dinner. It was an excellent opportunity to meet with old friends and to make new ones. Three days went quickly. The sun finally made its appearance to farewell our delegates and speakers. We look forward to meeting you all again at the next ASUM meeting in New Zealand.

Dr Hong Soo Wong
Co-convenor
ASUM New Zealand Branch

Cairns 2007: Delegates enjoy super 37th ASM

Delegates at the extensive trade exhibition

The 37th ASUM Annual Scientific Meeting was held on 13th–16th September at the Cairns Convention Centre, which is a leisurely stroll from the city centre and the main hotels.

The meeting commenced with the Skills Day on Thursday. The workshops covered a wide range of topics and were of a very high standard. The day ran very smoothly thanks to the organisation of Sue Davies, Lynette Hassle and Barbara Vanini.

The main program ran over Friday, Saturday and Sunday. The meeting opened with an interesting talk by Prof Julie Campbell on her research into growing vascular conduits in the peritoneal cavity.

The musculoskeletal program was organised by Craig Cairns and featured quality overseas speakers Carlo Martinoli and Eugene McNally, both endured a gruelling program and gave talks of the highest standard. The program was complimented by the expertise of Dr Neil Simmons and Shane Brun. I think everyone felt they learned something new in this field from every presentation.

Brendan Cramp was convenor for the vascular component, which included overseas speakers Joe Polak and David Evans, supported by local experts Deb Coghlan, Yvonne Butcher, Roxanne Wu and Christina Steffen. The program was diverse and covered topics such as 'Carotid intima-media thickness' by Joe Polak and 'Cerebral circulation' covered by David Evans. It was a pleasure to have a local representation in Roxanne Wu, who told us about the 'Great expectations' of the vascular surgeon and Christina Steffen, who spoke on the high-risk diabetic foot in Cairns.

We were also lucky to have an excellent O & G program, with outstanding presentations from all of the speakers including David Nyberg, Jon Hyett, Rob Cincotta, Peter Dietz. David Ellwood, Robert Miller, and Yves Ville. The subject matter ranged from Peter Dietz's dynamic talks on the pelvic floor to a comprehensive look at first trimester through to third trimester ultrasound. The presentations tended to deal with the tertiary level of obstetrics rather than the basics, so we hope everyone learned something from this program.

The small parts and general program consisted of Tom Stavros, Toreben Lorentzen, Richard Allan, Michelle Pedretti, Susane Fraser, Matthew Andrews and Stephen Bird. Tom Stavros, as in previous years, gave a number of quality talks on a diverse range of topics including breast, thyroid and groin.

Susane Fraser gave an extremely interesting workshop on breast intervention, its technique and how to recognize a good sample, this was complimented by a talk on rural and remote breast diagnosis.

Richard Allan and Torben Lorentzen, both liver ultrasound experts, gave presentations on liver Doppler and intervention. I liked the title of Michelle Pedretti's talk, 'Peyronie's disease, the long and the short of it'. Say no more!

The meeting ran without a hitch, which was due to the wonderful facilities at the Cairns Convention Centre and the ever-helpful staff, and also to the tireless efforts of Sarah Hall, Sarah Markey-Hamm and Kate Weston from conference organisers ICMS to whom the Committee is extremely grateful.

We all relaxed on Saturday night at the gala dinner held at the Convention Centre. The evening commenced with our guest speaker, the captivating Samantha Riley, who gave an enlightening speech entitled 'The power of rain'. We then partied to the excellent band – although the conga line became a little dangerous. There were even fireworks outside as part of the Cairns Festival, which added to the party atmosphere.

The Committee would like to recognise the importance of our sponsors GE Healthcare, Philips, Toshiba, and Siemens. We would especially like to thank GE Healthcare for their generous sponsorship of Tom Stavros and Sam Riley and Toshiba for their generous sponsorship of Eugene McNally. The sponsors held symposia on Friday, which were well attended and well received by the delegates.

We would also like to thank ASUM, especially Caroline Hong, Keith Henderson and Matthew Andrews for their support throughout the organising process and also Council members Stephen Bird and Ros Savage, they always offer and give help where necessary.

We are also grateful to Deb Coghlan, Yvonne Butcher, and Alison Lee-Tannock. They not only gave presentations of their usual high standard, but also helped by chairing sessions and were happy to help wherever they could.

To close, the Committee would like to thank all those who attended the ASM and who made it such a success. We hope all of the delegates enjoyed it as much as we did and we hope you will continue to support ASUM in the future.

Deb Moir
Elizabeth Carter
Convenors


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email stephanie.mason@ge.com
General Manager Kevin Potter
www.gemedicalsystems.com

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email ian.stewart@
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email
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www.qldxray.com.au

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Sonosite Australasia Pty Ltd
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email
matt.tucker@sonosite.com
www.sonosite.com

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Mark Mooney
tel 02 9005 7702
email mark.mooney@
symbionhealth.com
www.symbionhealth.com

Toshiba (Aust) Pty Ltd Medical Division
Louise Archer
tel 02 9887 8041
email larcher@toshiba-tap.com
General Manager Nick Swaan
www.toshiba.com.au

ASUM invites suppliers of medical equipment, services and consumables to join the Society. Call Dr Caroline Hong tel +61 2 9438 2078 for information

New ASUM members

NEW MEMBERS – JULY 2007

FULL (30)
Andrew Bickell Vic
Charmaine Burdett SA
Anthony Day Qld
Katherine Eagles NSW
Timothy Eller Qld
Wouter Gerryts WA
Joanne Glover WA
Tina Guy SA
Penny Koh Vic
Waiyee Lai NSW
Tanya Maunder Qld
Linda McKendrick SA
Vivian Morrow NSW
Vu Nguyen Vic
Michael Petrucco Vic
Wayne Pitcher Qld
Marilyn See NSW
Peter Spyropoulos SA
Karen Thomson Vic
Sue Belgrave NZ
Rhonda Buchanan NZ
Melanie Cosford NZ
Patrice Crawford NZ
David Hamments NZ
Alexandra Ivancevic NZ
Gareth Robb NZ
Deborah Stanley NZ
Peter Staub NZ
Brigid Van Der Kroon WA
Hong Soo Wong NZ

ASSOCIATE (8)
Victoria Alderdice Qld
John Garland NSW
Amanda Kellaway SA
Belinda Larsen Qld
Jenna Tessari SA
Andrew Graham NZ
Lucy Hellberg NZ
Xuesen Liu NZ

AFFILIATE (6)
Marcia Bonazzi Vic
Mark Gillett NSW
Swati Mahajan Fiji
Siva Navaneethan NSW
Woo Tan ACT
Sampsa Kiuru NZ

NEW MEMBERS – AUGUST 2007
FULL (131)
Sanjeeva Abeywickrema NSW
Bruce Allen NZ
Roger Allison Qld
John Andersen Qld
Troy Anderson NSW
Ramesh Arunach NZ
Malcolm Baigent NZ
Michael Baker NZ
Kylie Baker Qld
Rachel Belsham NZ
Stuart Berry Vic
Ian Best NZ
Gill Beveridge NZ
Damon Blair NZ
Philip Bobby NSW
Simon Bodicoat NZ
Lusiana Bolalailai NZ
Philip Borrie NZ
Susan Brooks NZ
Fraser Brown Vic
Roy Buchanan NZ
Stephen Busby NZ
Lisa CaOpelle NZ
Ben Castle NZ
Donald Chan NZ
Sarat Chander NZ
Billy Cheung NZ
Bruce Chisholm NZ
Barnaby Clark NZ
Andrew Clarke NZ
Richard Coates NZ
Rodger Colbert NZ
Terence Cousins NZ
David Cranefield NZ
Daan De La Rey NZ
Francois DeBruin NZ
John Denton NZ
Megan Di Quinzio Vic
Peter Dixon NZ
Paul Dukes NZ
Thomas Ecker NSW
Geoffrey Edwards Vic
Christine Elder NZ
Albert Eshun NZ
Charitha Fernando NZ
Raj Fernando NZ
Trevor Fitzjohn NZ
Amy Fong NZ
George Foote NZ
Martin Forbes NSW
John Goulden NZ
Rhys Harding NZ
Chris Harrington NZ
Rebecca Harris NZ
Cristian Hartopeanu NZ
Barbara Hochstein NZ
Jocelyn Homer NZ
Tony House NZ
Greg Hunt NZ
Helen Joyce NZ
Harry Kaplan Vic
Nicholas Kenning NZ
Liz Kenny NZ
Michael Kerr NZ
Len Killman Vic
Andrew Kingzett-Taylor NZ
Andrew Klava NZ
Martin Kluckow NSW
Louis Lao NZ
Mark Leadbitter NZ
Chris Leaper NZ
Remy Lim NZ
Henry Liu NZ
Brett Lyons NZ
Ian Macdonald NSW
Matthew Mackay NZ
John Mathews NZ
Kim McAnulty NZ
Fran McCaul NZ
Rachael McEwing NZ
Ben McGuinness NZ
Chris McKee NZ
Jann Medlicott NZ
Grant Meikle NZ
Anna Moon Vic
Vicki Morganti NZ
Gillian Morris NZ
Sabaratnam
Muthukumaraswamy NZ
Nikolay Nedev NZ
Johan Nel NZ
Rosanne Newman NZ
Richard Ng NZ
Sharon Ngu NZ
Mike Nowitz NZ
Patrick O'Dell NSW
Fleur O'Leary NZ
Medhat Osman NZ
Umesh Pandey NZ
Maria Pearse NZ
Jane Peart NZ
Clinton Pinto NZ
Zahurul Quddus NZ
Ian Revfem NSW
Ricky Rutledge NZ
Diane Sommerville NZ
Graham Stevens NZ
Lisa Sweetman NZ
Tevita Taka NZ
Su Yin Tang NZ
Glyn Thomas NZ
Glen Thomson NZ
Deborah Trembath NZ
Caroline Tsai NZ
Leanne Tyrie NZ
Gianluca Valsenti NZ
Jennifer Walker NZ
Iain Ward NZ
George Waterworth NZ
Gavin Watson NZ
Scott Wells NZ
Margret Weston NZ
Edward Williams NZ
Jacqueline Williamson Vic
Ben Wilson NZ
Sonia Wong NZ
David Wong Qld
Katherine Wood NZ
Rebecca Woodward NZ
Jarrad Wrightson NZ
Rodney Wu NZ
Rauf Yousaf NZ
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Bronwen Allen NZ
Rowena Amin NSW
Fay Anstis NZ
Annemieke Arron NZ
Christine Birchall NZ
Justin Bowra NSW
Pauline Brown NZ
Mary Burman Vic
Joan Burns NSW
James Bushell SA
Tracey Cadogan NZ
Penelope Cain NZ
Shawnee Carter NZ
Lucy Cheetham NSW
Eunice Chong NZ
Olwen Clarke NZ
Sally Colbeck NZ
Nicola Corbitt Tas
Cathryn Dixon NSW
Gaye Douglas NZ
Mukesh Edward NSW
Jennifer Evanson NZ
Shadley Fataar NSW
Tim Fitzpatrick Vic
Petar Fizulic SA
Jennifer Flower NZ
Kathryn-Therese
Fraser Vic
Karyn Gregan NZ
Jane Grimm NZ
Steven Hatzikostas Vic
Sandra Hellewell NZ
Michael Jacob NSW
Shiree Keane NSW
Mulvey Kelly NZ
Suzana Kotevska Vic
Tony Lawson NZ
Gail Le Claire NZ
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Lisa Messenger NZ
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Bronwyn Nicholson NSW
Felicity Park NSW
Gemma Penn NZ
Pregs Pillay Vic
Annie Poulton NZ
Michael Sedgley Vic
Peter Soaki NSW
Russell Thompson NT
Yusuke Ueno-Dewhirst Qld
Sheryl Watkin NZ
Nicholas Yule Vic

CORRESPONDING (3)
Debra Ikeda USA
Philip Tirman USA
Lil Valentin Sweden

TRAINEE (2)
Peter Preisz NSW
Talat Uppal NSW

NEW MEMBERS – SEPTEMBER 2007

FULL (83)
Mike Alchin NZ
Timothy Alchin NSW
Sue Andretzke SA
Hazel Bell NZ
Nalini Bhola NSW
Renee Bolton ACT
Grant Bradly NSW

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Shane Brun Qld
Nicholas Bryant Qld
Yvonne Butcher Qld
William Campbell Vic
Julie Campbell Qld
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Emma Larkin Vic
Dekang Mao Vic
Jacqueline O'Connor NZ
Sam Orde WA
Ranjan Perera NSW
Mark Salib WA
Catherine Taylor Qld
Bei Toh NSW
Jinlin Zhao SA

Calendar of ultrasound events

13th Nov 2007
ASUM & ASA Interesting Case Night 2007
Charles LaTrobe Lecture Theatre, Royal Melbourne Hospital
Contact Monica Pahuja
Email asum_vic_branch@hotmail.com

Saturday 1st Dec 2007
ASUM SA Branch Education Event 2007
Venue Flinders Medical Centre, SA Australia
Contact Cheryl Buckingham gabck03@optusnet.com.au

2008

26th–27th Mar 2008
DDU Technical Seminar (Physics)
Venue Sydney, Australia
Contact ASUM PO Box 943, Crows Nest NSW 1585 Sydney Australia
Ph +61 2 9438 2078 Fax +61 2 9438 3686

26th–30th Mar 2008
DMU Preparation Course 2008
Venue Sydney, Australia
Contact ASUM PO Box 943, Crows Nest NSW 1585 Sydney Australia
Ph +61 2 9438 2078 Fax +61 2 9438 3686

27th Mar 2008
Nuchal Translucency Course
Venue Sydney, Australia
Contact ASUM PO Box 943, Crows Nest NSW 1585 Sydney Australia
Ph +61 2 9438 2078 Fax +61 2 9438 3686

28th–29th Mar 2008
O&G Symposium
Venue Sydney, Australia
Contact ASUM PO Box 943, Crows Nest NSW 1585 Sydney Australia
Ph +61 2 9438 2078 Fax +61 2 9438 3686

28th–29th Mar 2008
ASUM Multidiciplinary Workshop 2008
Venue Sydney, Australia
Contact ASUM PO Box 943, Crows Nest NSW 1585 Sydney Australia
Ph +61 2 9438 2078 Fax +61 2 9438 3686

23rd – 25th May 2008
81st Annual Scientific Meeting of the Japan Society of Ultrasonics in Medicine (JSUM)
Venue Kobe Convention Center
Chairperson Prof. Shintaro Beppu (Osaka University School of Allied Health Sciences)

26th July 2008
ASUM DMU Part I & Part II Written Examination – Provisional
Venue As allocated. Candidates receive individual notification.
Contact DMU Coordinator
Ph +61 2 9438 2078 Fax +61 2 9438 3686
dmu@asum.com.au

18th – 21st Sept 2008
ASUM Annual Scientific Meeting 2008
Venue SkyCity Auckland Convention Centre, New Zealand
Contact ASUM PO Box 943, Crows Nest NSW 1585 Sydney Australia
Ph +61 2 9438 2078 Fax +61 2 9438 3686
www.asum.com.au

2009

Sunday 30th Aug 2009 – Thursday 3rd Sept 2009
ASUM hosts WFUMB 2009 World Congress in Sydney Australia
Venue Sydney Convention and Exhibition Centre
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ASUM Head Office
PO Box 943, Crows Nest NSW 1585, Sydney Australia
www.asum.com.au and www.wfumb2009.com

Guidelines for authors

Authors are invited to submit papers for publication in the categories described below. Final responsibility for accepting material lies with the Editor, and the right is reserved to introduce changes necessary to ensure conformity with the editorial standards of the *Ultrasound Bulletin.*

Original research

Manuscripts will be subject to expert referee prior to acceptance for publication. Manuscripts will be accepted on the understanding that they are contributed solely to the *Ultrasound Bulletin.*

Quiz cases

A case study presented as a quiz, involving no more than three or four images and a paragraph briefly summarising the clinical history as it was known at the time. It will pose two or three questions, and a short explanation.

Case reports

Case reports are more substantial presentations resembling short scientific papers which illustrate new information, or a new or important aspect of established knowledge.

Review articles

Review articles are original papers, or articles reviewing significant areas in ultrasound and will normally be illustrated with relevant images and line drawings. Unless specifically commissioned by the Editor, articles will be subject to expert referee prior to acceptance for publication.

Forum articles

Members are invited to contribute short articles expressing their observations, opinions and ideas. Forum articles should not normally exceed 1000 words. They will not be refereed but will be subject to editorial approval.

Calendar items

Organisers of meetings and educational events relevant to medical ultrasound are invited to submit details for publication. Each listing must contain: activity title, dates, venue, organising body and contact details including name, address, telephone and facsimile numbers (where available) and email address (where available). Notices will not usually be accepted for courses run by commercial organisations.

Corporate news

Corporate members are invited to publish news about the company, including structural changes, staff movements and product developments. Each corporate member may submit one article of about 200 words annually. Logos, illustrations and tables cannot be published in this section.

Format

Manuscripts should be submitted in triplicate in print and on PC formatted diskette as MS Word documents.
Images must be supplied separately and not embedded. PowerPoint presentations are not accepted.

- Font size: maximum 12 pt, minimum 10 pt
- Double spacing for all pages
- Each manuscript should have the following:

Title page, abstract, text, references, tables, legends for illustrations.

- Title page should include the:

Title of manuscript, the full names of the authors listed in order of their contribution to the work, the department or practice from which the work originated, and their position.

Corresponding author's name, contact address, contact telephone number and facsimile number (where available) for correspondence.

- Abbreviations may be used after being first written in full with abbreviation in parentheses.
- References should be cited using the Vancouver style, numbered according to the sequence of citation in the text, and listed in numerical order in the bibliography. Examples of Vancouver style:

1 In-text citation Superscript. If at the end of a sentence the number(s) should be placed before the full stop or comma.

2 Journal article Britten J, Golding RH, Cooperberg PL. Sludge balls to gall stones. *J Ultrasound Med* 1984; 3: 81–84.

3 Book: Strunk W Jr, White EB. The elements of style (3rd ed.). New York: Macmillan, 1979.

4. Book section Kriegshauser JS, Carroll BA. The urinary tract. In: Rumack CM, Wilson SR, Charboneau JW, eds. *Diagnostic Ultrasound*. St Louis, 1991: 209–260.

Abstract

Manuscripts for feature articles and original research must include an abstract not exceeding 200 words, which describes the scope, major findings and principal conclusions. The abstract should be meaningful without reference to the main text.

Images

Images may be submitted as hard copy (in triplicate) or in digital format. Images sent must have all personal and hospital or practice identifiers removed. Do not embed images in text. Separate images are required for publication purposes.

A figure legend must be provided for each image. Hard copy images should be presented as glossy print or original film. Any labelling should be entered on the front of the glossy print using removable labels. Send one copy of illustrations without labelling as this can be added electronically prior to publication. On the back of the print include the author's name, figure number and a directional arrow indicating the top of the print.

Digitised graphics should be supplied as JPG or TIFF files on PC formatted 3.5" diskette or CD, which must be clearly labelled with the author's name and the names of the image files.

Copyright

Authors are required to provide assurance that they own all property rights to submitted manuscripts, and to transfer to ASUM the right to freely reproduce and distribute the manuscript.

2007 / 2008 ULTRASOUND BULLETIN PUBLICATION DATES

	Feb 08	May 08	Aug 08	Nov 08
Submission Deadline	10 Dec	31 Mar	30 June	29 Sep
Post Date	15 Feb	16 May	8 Aug	14 Nov

Australasian Society for Ultrasound in Medicine

Ultrasound Bulletin

ASUM Ultrasound Bulletin November 2007 10 (4)

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Original research, case reports, quiz cases, short articles, meeting reports and calendar information are invited and should be addressed to The Editor at the address below

Membership and general enquiries
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EDUCATION

REPORTS

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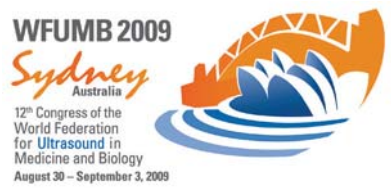

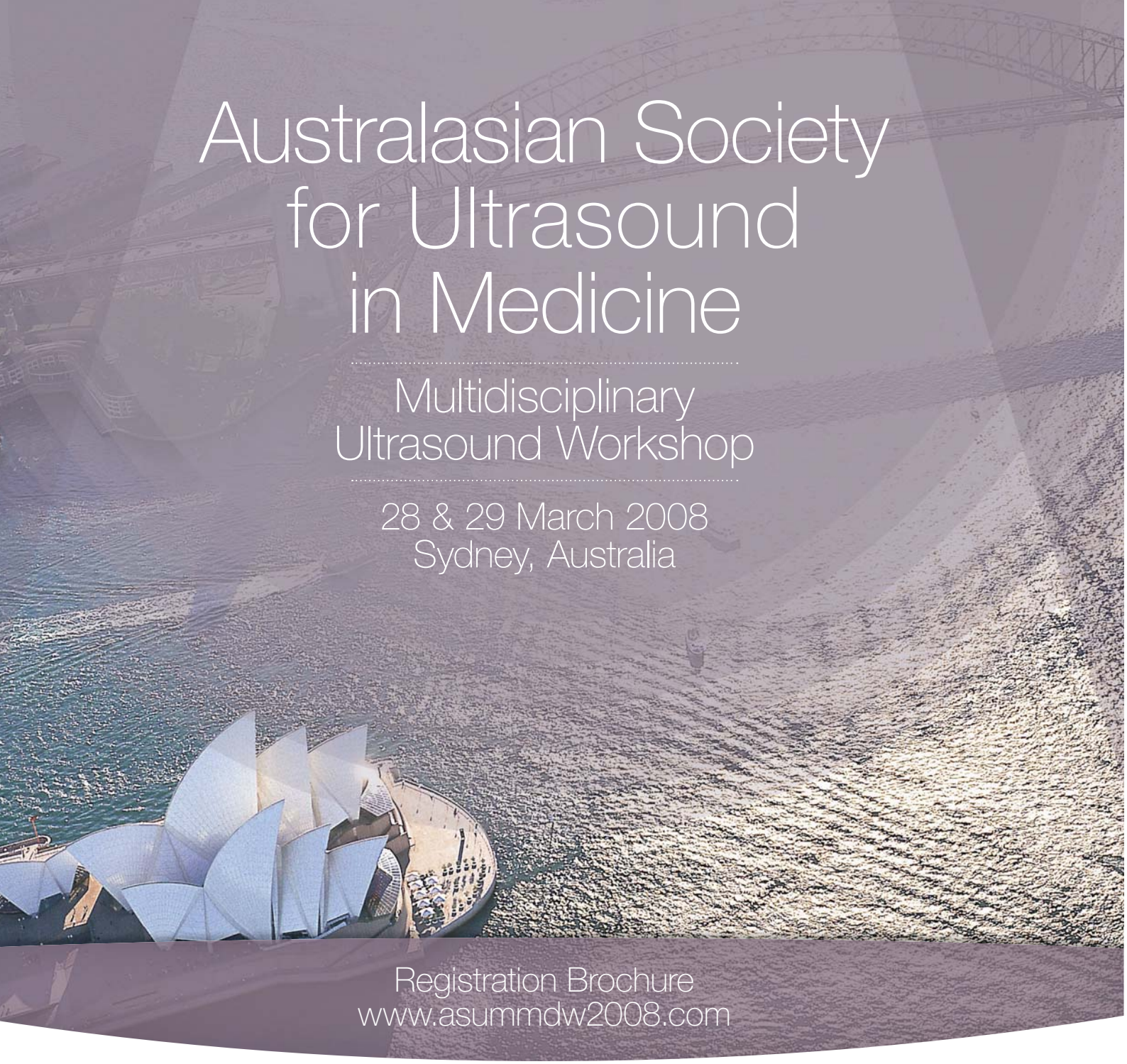

Australasian Society for Ultrasound in Medicine

Multidisciplinary Ultrasound Workshop

28 & 29 March 2008
Sydney, Australia

Registration Brochure
www.asummdw2008.com

Convenors

Dr Glenn McNally
Obstetrics & Gynaecology

Dr Susan Campbell Westerway
General

Mrs Jenifer Kidd
Vascular

Dr Andrew McLennan
Nuchal Translucency

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26 – 27 March 2008

DMU Preparation Courses
26 – 30 March 2008

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27 March 2008

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Provisional Program

Please visit www.asummdw2008.com for further information.
The program is subject to change at any time without notice.

** Please indicate on your registration form which concurrent session you will be attending.*

Wednesday 26 March 2008

DMU Preparation Courses and DDU Technical Seminar

- Physics

Faculty : Mark Bryant, Roger Gent & Rob Gill

Thursday 27 March 2008

DMU Preparation Courses and DDU Technical Seminar

- Physics

Faculty : Mark Bryant, Roger Gent & Rob Gill

Nuchal Translucency

Course organised by Ann Robertson (RANZCOG)

Course convenor: Andrew McLennan

Faculty : Jon Hyett, Andrew McLennan, Vanessa Pincham, Ann Robertson

Friday 28 March 2008

DMU Preparation Courses

Vascular

Cardiac

General & Obstetrics

Obstetrics & Gynaecological Ultrasound Symposium

- Neonatal Spine
- Ultrasound Guided Paediatric Interventions
- Obstetric Ultrasound: When? Why? How?
- First Trimester Anomaly Detection
- Thoracoabdominal abnormalities
- Fetal Ocular Pathology
- Multiple Pregnancy and Fetal Therapy
- Early Pregnancy Complications

Faculty : Ron Benzie, Alan Cameron, Danny Challis, Terry Chang, George Condous, Hans Peter Dietz, David Elwood, Jon Hyett, Greg Kesby Simon Meagher, Ashley Robinson, John Smolinec

Format : Lecture Sessions

General Ultrasound

- Paediatric Hip/Spine, Renal and Abdomen
- Upper limb neuro
- Fetal Heart
- Calf/thigh muscles
- Renal
- Interventional Ultrasound
- Salivary Glands
- Thyroid
- Forefoot pain
- Hip/groin
- Testes

Faculty : Matthew Andrews, Stephen Bird, Roger Gent, Jo Lennox, David McCauley, Neil Simmons

Format : Live Scanning Workshops, Lecture Sessions

Vascular Ultrasound

- Cerebrovascular Disease Clinical Perspectives
- Is there a High Risk Plaque for Stroke and what's the current Status of Carotid Stenosis Grading?
- Carotid Endarterectomy vs Carotid Stenting
- Duplex follow-up after Carotid Stenting
- Peripheral Arterial Disease Clinical Perspectives
- Ankle Brachial Indices – are they relevant?
- Current Status of SFA angioplasty/ stenting
- Importance of a Surveillance Program following Infrainguinal Bypass Grafting
- Pre & Post operative Imaging for Haemodialysis Access
- Carotid Duplex
- Lower Extremity Vein Graft Imaging
- Upper Limb Arteries & Veins
- Aorto-iliac & Lower Extremity Arteries

Faculty : Bernard Bourke, Alan Bray, Alison Burnett, Deb Coghlan, Jenifer Kidd, Virginia Makeham, Elizabeth Pluis, Philip Walker

Format : Live Scanning Workshops, Lecture Sessions

Saturday 29 March 2008

DMU Preparation Courses

Vascular

Cardiac

General & Obstetrics

Obstetrics & Gynaecological Ultrasound Symposium

- Fetal Brain Development: Systerna Magna and Cerebellar Vermis Development and Anomalies
- Ultrasound in the Delivery Suite
- Fetal Therapy Update
- Pediatric Surgical Overview of Thoracoabdominal abnormalities
- Uterine Anomalies: Role of 3D/4D
- Evaluation of Endometriosis
- 3D/4D and Surgical Practic
- Updating Clinicla and Molecular Genetics
- Ultrasound and Infertility

Faculty : Ron Benzie, Alan Cameron, Guy Henry, Glenn McNally, Simon Meagher, David Mowett, Andrew Ngu, Ashley Robinson

Format : Lecture Sessions

General Ultrasound

- Hip/groin
- Paediatric head
- Common Pitt falls
- Shoulder
- Fetal Heart
- Abdominal vasculature
- Neck/Salivary
- Wrist/hand/elbow
- Scrotum
- Forefoot Pain
- Hernias
- Abdomen – Biliary Tree
- Ankle

Faculty : Stephen Bird, Roger Gent, Rob McGregor, Delwyn Nicholls, Ann Quinton, Neil Simmons, Robin Tantau

Format : Live Scanning Workshops, Lecture Sessions

Vascular Ultrasound

- Aneurysmal Disease Clinical Perspectives
- Evolution and Current Status of Aortic Grafts for Repair of AAA
- Duplex Ultrasound for Endoleak Detection and Aortic Endograft Assessment
- Renal and Mesenteric Disease
- Renal and Mesenteric Imaging – Optimisation is everything
- Venous Disease Clinical Perspectives
- What's new in DVT management and follow up
- Varicose veins and perforator disease – What the surgeon needs to know
- Upper Extremity Venous Thrombosis – U/S Diagnosis and follow up
- Aortic Stent Graft Imaging
- Renal & Mesenteric Artery Imaging
- DVT Imaging
- Venous Incompetence Imaging

Faculty : Alan Burnett, Kathryn Busch, Deb Coghlan, Debbie Hamilton, John Harris, Jenifer Kidd, Andrew Lennox, Philip Walker

Format : Live Scanning Workshops, Lecture Sessions

Sunday 30 March 2008

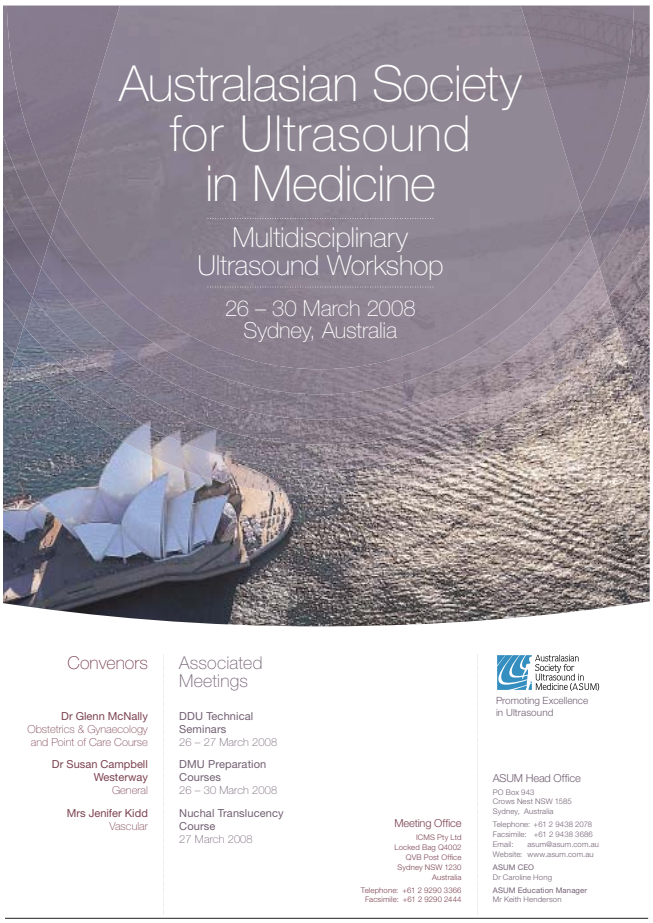
DMU Preparation Courses

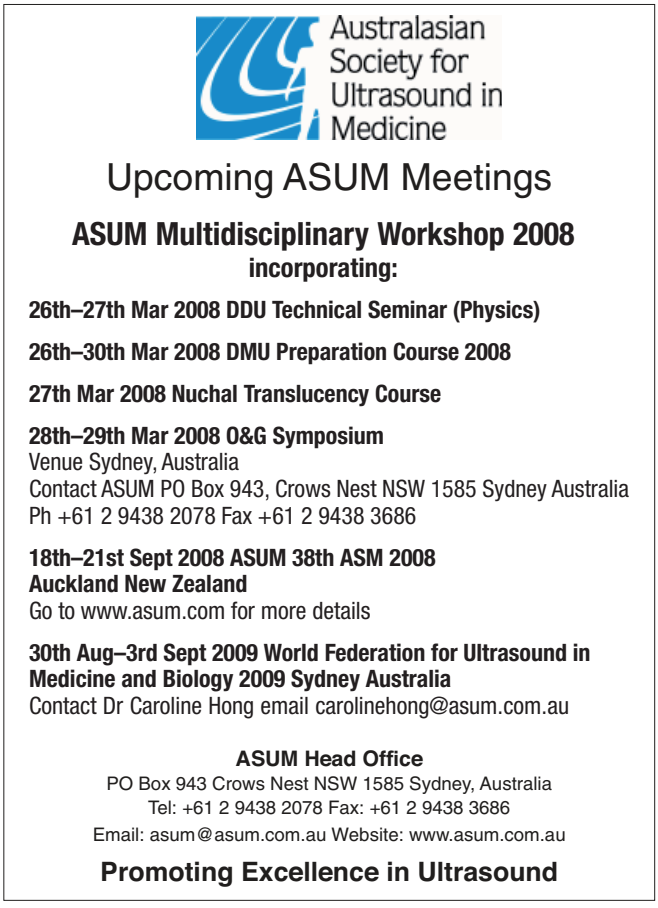
Vascular

Cardiac

General & Obstetrics

ASUM extends a warm welcome to you at upcoming ASUM meetings





www.asum.com.au

Forever curiously testing new opinions


Prof Ron Benzie

The complete quote by W Pater (1839–1894), where the heading is from, is 'What we have to do is to be for ever curiously testing new opinions and courting new impressions, never acquiescing in a facile orthodoxy of Comte, of Hegel or of our own'.

In this issue, you will find two articles containing opinions which may arouse your curiosity. Dr Lachlan de Crespigny presents the case for a complete fetal anatomy scan at the nuchal translucency screen at 12 weeks gestation. In an ideal world we could be doing this, but in areas of the country where it is difficult to find a sonographer let alone a sonologist, it will be more problematic. We would like to hear your opinion on the feasibility of the fetal morphology scan being done in the first trimester. How much more training would it involve? How would we inform our patients? What about the prenatal diagnosis of neural tube defects? Would we continue doing the 18–20 week morphology scan?

Elsewhere, Prof Jack Wall, a leading thyroidologist, makes no bones about being less than impressed by the thyroid scan reports from radiologic colleagues. Is he right? Let us know your thoughts please. Ultrasonographic sub-specialisation seems to be extending its reach well beyond the cardiac, the vascular and musculoskeletal areas. Is this inevitable? As in so many fields of medicine is the generalist becoming an endangered species?

From opinions to facts. Dr Jackie Cartmill highlights the 'elephant trunk' sign in the prenatal diagnosis of a fetus with a rare anomaly. Even if you never see the abnormality in question, you are bound to remember the pachyderm's proboscis sign! And the cover picture will, we hope, reinforce that. Jackie won the best poster award at ASUM's 37th Annual Scientific Meeting with another case, which we hope to bring you in a subsequent issue.

We also welcome the article by Prof David Evans of the Chair of Medical Physics, University of Leicester, UK on the detection of cerebral embolus using Doppler ultrasound. He gave a lecture on this topic at the recent annual ASUM conference in Cairns and we acknowledge the timely receipt of his manuscript prior to the meeting.

Finally, we wish to extend thanks and a welcome to our new local editorial board members whose expertise will add to the quality of the Bulletin's content. They are Dr S Barnett, scientist and a past President of ASUM, Dr G Larcos, Head of Nuclear Medicine at Westmead Hospital, Sydney and Dr S Cooper, Paediatric Cardiologist, The Children's Hospital, Westmead, Sydney. We appreciate the time these volunteers will give to the Bulletin. As you know, ASUM relies on the services of the willing. With only 22 months till WFUMB 2009, hosted by ASUM, volunteers will be of the essence.

Prof Ron Benzie

Simplicity is cutting edge technologies for your demanding practice – iU22 Vision 2008

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Future direction of ultrasound

Matthew Andrews

As all ASUM members are well aware, ultrasound is being utilised in an ever-increasing range of medical applications. Technological advances are providing machines that are less expensive, more compact, portable and provide better images, spearheading innovative uses by multiple medical craft groups.

The challenge that we, who are involved in the provision of ultrasound services, face is to ensure that ultrasound studies are appropriate and are adequately performed. Improved patient outcomes should always be the aim of any medical service and ultrasound is no different. Just because ultrasound can be performed, doesn't necessarily mean it should be. No test should be performed unless its result impacts positively on patient management. A test should always be optimised to ensure its maximum potential is attained.

Ultrasound applications range from increasing numbers of clinicians using it as an extension of their clinical examination and procedures to referred ultrasound performed by ultrasound specialists. The latter category is further divided into ultrasound performed by specialists specific to their specialty, such as obstetricians and vascular surgeons, and medical imaging specialists such as radiologists, who use ultrasound as one of their range of imaging modalities. The imaging specialist groups may or may not provide their services in conjunction with sonographers. Thus, an ultrasound practitioner can range from the clinician who uses an ultrasound machine for one specific purpose to a diagnostic imaging specialist who performs a wide range of examinations covering all body systems.

It is clearly in the interest of the patient that, when ultrasound is performed, the practitioner is competent in its use and is capable of extracting maximum advantage from the test. Any medical practitioner using ultrasound should be appropriately trained and qualified for the manner in which he or she uses ultrasound.

ASUM's charter obliges the Society to provide education and qualifications to medical practitioners and sonographers. The range of ultrasound practice provides a logistical challenge to ensure targeted and specific training and certification is provided for each type of practice.

The Diploma of Diagnostic Ultrasound (DDU) has traditionally been ASUM's non-specific ultrasound qualification for ultrasound specialists. There has been nothing for non-specialist practitioners and also for specialist clinicians who use ultrasound as part of their clinical practice. ASUM has recognized this new direction of ultrasound and has responded by developing the Certificate of Clinician Performed Ultrasound (CCPU), which will be awarded in a number of categories of medical practice.

As I have mentioned in previous Presidential messages, the CCPU has been driven largely by the considerable efforts of Dr Glenn McNally and the ASUM Secretariat that has gone into developing the structure of the CCPU and organising the courses that support it. There has also been considerable support and contribution from ASUM members. Even at this infant stage the CCPU is attracting a large number of enrolees. It will soon pose significant organisational challenges, which ASUM is keen and ready to meet. The CCPU is attracting clinician members to ASUM, thus it is adding to the diversity and knowledge base of the Society.

I would like to acknowledge and thank the considerable number of dedicated personnel, including specialist sonologists, sonographers, corporate members, the ASUM secretariat, and clinicians utilising ultrasound, who have contributed to ASUM's ability to embrace, support and advance this new direction in medical ultrasound.

These efforts are ensuring that the Society remains at the forefront of contemporary ultrasound practice and is the peak ultrasound body in Australasia.

Matthew Andrews
President

ASUM 2007 ASM Photographic Competition. First prize: Simon Southern – Granite Beach

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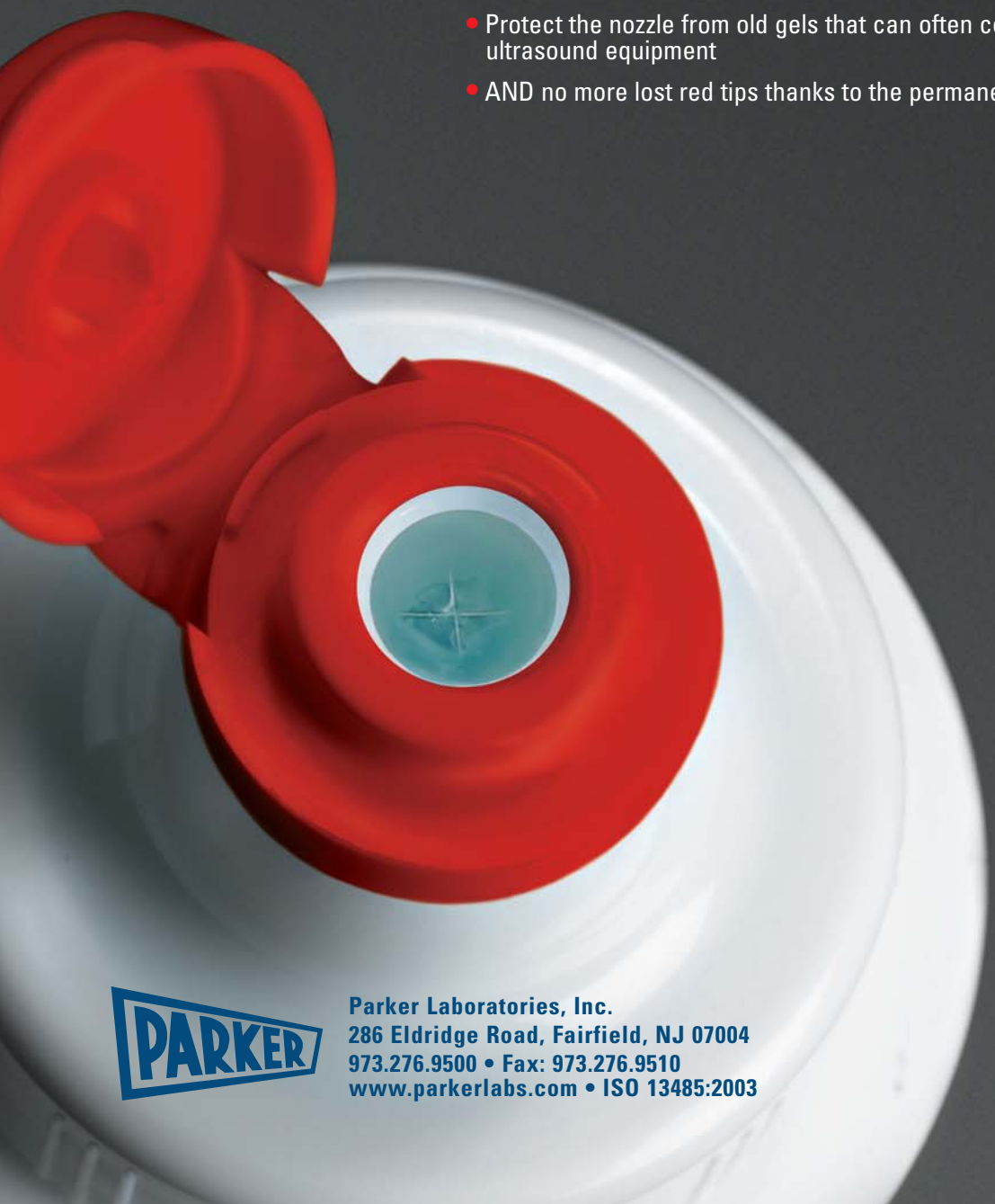

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CEO's message

Dr Caroline Hong

Success at the ASUM 2007 Cairns ASM

What a meeting! More than 350 people gathered in Cairns at the Cairns Convention Centre from 13th to 16th September for this wonderful, high quality ASM.

ASUM showcased the best in the Skills Day workshops on Thursday, the Scientific Program on Friday, Saturday and Sunday and at the magnificent exhibition.

The success of the meeting would not have been possible without the high quality presentations and workshops delivered by the invited international and local speakers.

We are grateful to the international speakers, Dr Joseph Polak (USA), Dr Eugene McNally (UK), Dr David Evans (UK), Prof Torben Lorentzen (Denmark), Dr Carlo Martinoli (Italy), Dr Yves Ville (France), Dr Tom Stavros (USA) and Dr David Nyberg (USA), all of whom travelled long distances to deliver a high quality program. The Australian and New Zealand speakers were also all of international reputation and, overall, the meeting received rave reviews.

The meeting would not have been such a success without the strong support and presence of the Gold sponsors, Toshiba, GE Healthcare, Siemens and Philips. We are indebted to the co-convenors, Deborah Moir and Liz Carter, Skills Day coordinator, Sue Davies, and the team of volunteers who worked tirelessly behind the scenes.

ASM prizewinners

ASUM extends congratulations to the prize winners recognised at the ASUM 2007 Cairns meeting. They are:

Chris Kohlenberg Teaching Fellowship Martin Necas (Regional NSW) sponsored by GE.

Beresford Buttery Teaching Fellowship George Condous (NSW and Vic) sponsored by GE.

Gulia Franco Teaching Fellowship Elvie Haluszkiewicz (NT and Regional Nth Qld) sponsored by Toshiba.

Anthony Tynan Award for Best Clinical Presentation Award Kerry Thoirs. Sponsored by Siemens, value $1000.

Best Research Presentation Award Peter Coombs. Sponsored by Siemens, value $1500.

Best Sonographer Research Presentation Award David Fauchon. Sponsored by Philips,value $2000.

Best Poster Award Jackie Cartmill. Sponsored by ASUM. Valued at $1500, made up of free registration to ASUM meeting 2008 Auckland and $500 spending money.

UI/UL Plenary Award recipient Assoc Prof Jon Hyett.

Honorary Fellows Rosina Davies and Mary Young.

Toshiba – first Major Sponsor for WFUMB 2009

We are pleased to announce the support of Toshiba's commitment as the first Major Sponsor for the biggest project to be undertaken by ASUM, hosting the WFUMB 2009 Sydney World Congress at the Sydney Convention and Exhibition Centre from 30th August to 3rd September 2009.

Toshiba's main contact for ultrasound is:
Louise Archer
National Sales and Marketing Manager
Ultrasound Toshiba (Australia) Pty Limited – Medical Division
Tel +61 (2) 9887 8041
Mob +61 (0) 417 251 479
Email larcher@toshiba-tap.com

We are indebted to Louise Archer for working with ASUM to achieve this commitment from the Global Toshiba Head Office in Japan. Toshiba has been a long-standing loyal and strong supporter at many ASUM meetings and workshops throughout Australia and New Zealand. Toshiba has supported ASUM as a Gold Sponsor at the Annual Scientific Meetings for many years. Toshiba also sponsors the Guilia Franco Traveling Fellowships each year.

Thank you to Dr David Rogers and Dr David Davies-Payne

The ASUM Council thanked Dr David Rogers and Dr David Davies-Payne, both of whom retired from Council at the outgoing Council Meeting on 15th September in Cairns. I have had the pleasure of working with Dr David Rogers in his capacity as Councillor for many years and again when he was President from 2004–2006. Both Davids have contributed enormously to ASUM over the years and have given their time generously, in particular, when they were Chairmen of the Education Committee, in succession. They will be sorely missed on Council.

New councillors and officers

The ASUM Council welcomes two new members to Council, Dr Simon Meagher and Dr Monica Pahuja, both of whom were elected for a three-year term from 2007 to 2010. All Councillors generally hold responsibility for a portfolio or committee. Dr Meagher was appointed as Chair of the Standards of Practice Committee and Dr Monica Pahuja was appointed as Chair of the Education Committee.

Prof Ron Benzie was unanimously elected as President Elect. He will become President of ASUM for a two-year term commencing September 2008.

Honorary Fellows

ASUM Council unanimously approved the appointment of two Honorary Fellows in 2007. You will read about Rosina Davies and Mary Young elsewhere in this issue. Both have given a lot to the ultrasound profession and community and deserve public recognition by the Society.

Mary Young started her career in 1962. She was among the early users of the Octoson ultrasound machine in the 1970s and was an active contributor to the founding of the Victorian Branch of the ultrasound education group.

Rosina Davies also started her ultrasound career in the 1970s and over the years, moved up the ranks of Toshiba to become General Manager. Throughout her career, she has been a supporter and contributor to ASUM and the ultrasound profession.

CADUCEUS meets at the ASM. Prof Torben Lorentzen, Dr Caroline Hong and Dr Matthew Andrews

CADUCEUS

The Collaborative Australasian Danish Undertaking for Continued Excellence in UltraSound Memorandum of Agreement between ASUM and the Danish Society for Diagnostic Ultrasound (DSDU) was signed in 2005. The primary purpose of the agreement is to promote a high standard of professional practice in medical ultrasound and also to promote a mutual exchange of information on or relating to education and training in medical ultrasound. The signatories to this memorandum were Dr David Rogers, then ASUM President, Dr Caroline Hong, ASUM CEO and Company Secretary, Dr Christian Nolsøe, DSDU President and Dr Michael Bachmann Nielsen, Chairman of the DSDU Education Commitee.

Dr Nolsøe was the exchange speaker at the ASUM meetings in 2005 in Adelaide and in 2006 in Melbourne. Prof Torben Lorentzen was the DSDU exchange speaker at our ASUM meeting in Cairns in September this year.

Dr David Rogers and Dr Roger Davies were the exchange speakers at the DSDU interventional radiology meeting in Copenhagen in 2006. Prof Ron Benzie will be the exchange speaker, representing Dr Matthew Andrews in 2008 in Copenhagen.

Training placement exchange programs from DSDU have included Christian Brushoj in 2004 in Melbourne, Morten Boesen in 2006 in Melbourne and we are now progressing with the placement of Akram Dakhil in Adelaide with Dr Neil Simmons.

The other training placement exchange programs from ASUM in Copenhagen have been Mary Langdale in 2006 and Robert Zeigenbein in 2007.

The CADUCEUS program is thriving and we expect to see a large delegation from Denmark at future ASUM meetings and WFUMB 09. The friendship is already strong, so we will welcome our Danish colleagues in a special way when they visit or attend our meetings and the congress.

ASUM members are encouraged to write to the CEO with your expressions of interest and a copy of your CV, to be considered for the CADUCEUS scholarship sponsored by ASUM for one–two weeks stay in Denmark for ultrasound training and experience. Enquiries can be directed by email to carolinehong@asum.com.au. Applications for 2008 close on 30th March 2008.

UI/UL Plenary Award

The UI/UL Plenary Lecture was established in 2002 to commemorate the contribution made by the Ultrasonics

Institute (Dept of Health) and the Ultrasonics Laboratory (CSIRO). This year, the honour was bestowed on Assoc Prof Jon Hyett. Past recipients of this award have been Prof David Ellwood, Prof Rob Gibson, Dr Rita Teele, Prof John Newman and Assoc Prof Albert Lam.

BMUS ASUM 2007 relationship – Harrogate UK

The BMUS-ASUM exchange program is thriving. Our President Dr Matthew Andrews will be attending the BMUS annual scientific meeting in Harrogate in December 2007. Past exchanges from ASUM have included Dr Stan Barnett in 2002, Dr Glenn McNally in 2004, Dr David Rogers in 2005. We look forward to welcoming Dr Kevin Martin from BMUS to the ASUM 2008 Auckland meeting in September next year. Past exchanges from BMUS have included Dr David Pilling and Dr Grant Baxter. The exchange program now operates on alternate years for each society.

ISUOG 2007

ASUM sent Dr Glenn McNally as the Council's representative to Florence on 7th October to attend the meeting of the safety committees of WFUMB and ISUOG with invited stakeholders from ultrasound societies, regulatory bodies and industry.

ASUM's Position Statement on the Appropriate Use of Diagnostic Ultrasound Equipment was included in this meeting. Drs S Barnett and J Abramowicz chaired an open forum for WFUMB and ISUOG on 8th October. Topics discussed included bioeffects and safety risk, epidemiology, ethical issues, medico-Legal implications and others.

Congratulations

ASUM congratulates Dr Kurosh Parsi, President, and the Council of the Australasian College of Phlebology on its inauguration ceremony at the University of Sydney. The ceremony celebrated the achievements and contributions of individuals to the science and practice of Phebology in Australasia. The ASUM President and CEO sent congratulatory messages on behalf of the Society.

ASUM also congratulates Dr Ron Shnier, President of the Australian Diagnostic Imaging Association (ADIA) on the launch of the Informed Financial Consent website and 1800 Hotline by the Hon Tony Abbott, Minister for Health and Ageing, on 30th October at the St George Private Hospital. Senator Concetta Fierravanti-Wells represented the Minister. Many prominent representatives of the medical professions attended the event, ASUM was represented by the CEO.

The Cairns Convention Centre

The website was developed with the support of the AMA and is a major initiative of ADIA. It will provide patients with greater certainty of their out of pocket expenses. More than 200 hospitals are listed on the website and for those who cannot access the web, there is the 1800 hotline number service.

Visit the website at www.adiaifc.com.au. The Hotline number is 1800 244 442.

Department of Health and Ageing issues

The Commonwealth Department of Health and Ageing conducted a national forum for stakeholders on 5th September, regarding the mandatory accreditation of diagnostic imaging services under Medicare.

Dr Fergus Scott and Dr Glenn McNally represented ASUM. They put a strong case for ASUM's policies and standards in ultrasound within the framework of diagnostic imaging services and Medicare. More than 20 colleges, societies and associations participated in the forum.

RANZCR – QUDI

ASUM has been consulted by the RANZCR for input into the document *Ultrasound Scan – Consumer Information*. ASUM, being the peak body representing medical specialists, sonographers and corporate members, is obviously the ideal body to provide input in the document as part of the QUDI program. Information about QUDI is available at www.ranzcr.com.au.

WFUMB 2009 Sydney Congress planning is on track

The Congress is progressing in accordance to its planning schedules. ICMS Pty Ltd has been appointed as the conference agent to provide support and logistics.

ASUM has been working with ICMS since the ASUM 2002 Annual Scientific Meeting, which was held on the Gold Coast. This was the first meeting for which ASUM used a professional accredited conference agent. It was also the first time that the financial and policy decisions of the meetings became the responsibility of the Finance Committee and the ASUM CEO, working with the conference agents in monitoring the expenses and budgets. The pleasant part of organising the scientific program and sourcing and inviting speakers became the task of the Organising Committee and Convenor.

Running the WFUMB 09 Congress has been cited by many members of ASUM to be like organising another ASUM meeting, except that it will be on a much larger scale, with a broader perspective and will target a wider international audience.

Plans are underway to run a workshop jointly with the WINFOCUS World Congress. This is scheduled on the last day of the WFUMB Congress and prior to the WINFOCUS Congress.

ASUM is pleased to announce that discussions are underway with several more potential major sponsors of the WFUMB 09 Congress. We are confident that this Congress will be the best ever ASUM meeting and will be a showcase for the Australian ultrasound profession.

Some of the topics in the program will cover point of care, cutting edge ultrasound practice and technology, safety and quality assurance, medico-legal issues, 3D and 4D ultrasound, echocardiography, ultrasound contrast, therapeutic applications, hands-on workshops and live-demonstration sessions, pediatrics, obstetrics and gynecology, musculoskeletal, vascular, emergency room and veterinary and other non-medical applications of ultrasound.

There will also be a huge exhibition to enable delegates to meet with exhibitors. Suppliers of diagnostic, interventional and therapeutic equipment, supplies and services will be displaying their newest and most innovative products.

Dr Stan Barnett, Convenor of WFUMB 2009 Sydney, will be writing a series of articles about WFUMB in the lead up to 2009.

DDU, DMU, DMU (Asia),CCPU

ASUM continues to rely on the work of a dedicated team of volunteer members who lead and make it possible for ASUM to maintain high standards in ultrasound practice.

ASUM takes great pride in the quality and high standard of the professional qualification that it awards candidates who have successfully completed the requirements for the Diploma or Certificate.

Dr Chris Wreidt continues as Chair of the DDU Board of Examiners. Mrs Margaret Condon has been appointed as Chair of the DMU Board of Examiners. Dr Andrew Ngu is the Chair of the DMU (Asia) Board of Examiners, and Dr Glenn McNally is Chair of the CCPU Certification Board.

ASUM welcomes new members

Once again, I urge all ASUM members to encourage and invite your collegues to join ASUM and to attend our future workshops and meetings. People keep coming back each time as we work hard to improve the quality of our workshops and annual scientific meetings, taking into account the needs of our delegates as well as our corporate sponsors and exhibitors. You can view all of our updates on the website at www.asum.com.au.

Dr Caroline Hong
Chief Executive Officer
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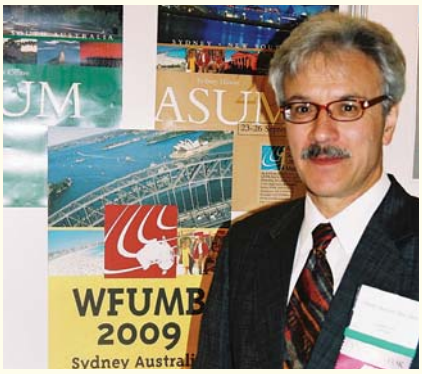
Invitation to a global ultrasound event, Sydney WFUMB 2009!

Whether you are a primary user of ultrasound, or a medical specialist with an interest in learning more on the subject, please make sure that you mark your professional calendar for WFUMB 20089 the most important event in the sonography world's calendar. The dates to record are 30th August to 3rd September 2009. The venue is the Darling Harbour Conference and Convention Centre in the heart of Sydney. This is the major scientific congress that combines ultrasound imaging in all of its aspects with new developments in therapeutic applications.

The program emphasises such areas as interventional radiology and sonology, ultrasound contrast agents, point-of-care applications in emergency medicine, fetal echo-cardiology, early first trimester Doppler imaging of fetal ductus venosus, and volume imaging in 3D and 4D. The congress



Dr Stan Barnett

program will also include opportunities for colleagues in developing economies through support for the established WFUMB Centres of Excellence.

With less than two years until the congress, it is time to start planning both your scientific contribution and your associated cultural and travel program. Please take advantage of this rare opportunity to visit one of the most sought-after tourist destinations in the world while also gaining knowledge and improving skills in the use of ultrasound in medicine. This will be only the second occasion in 24 years for the WFUMB World Congress to be held in Australia, so take care not to miss out. The scientific program has many opportunities for both ultrasound end-users and the corporate members, our industry partners. There is a high level of interest and support from the global ultrasound industry.

Please refer to the website www.wfumb2009.com for further information and spread the word to your colleagues in related disciplines about this great opportunity to visit down-under.

On behalf of the WFUMB and the local host society, the Australasian Society for Ultrasound in Medicine, I would like to welcome you to share our event in Sydney in 2009.

Dr Stan Barnett
Convenor
12th World Congress WFUMB 2009
www.wfumb2009.com

Should a nuchal translucency scan include a detailed fetal anatomy assessment?

Lachlan de Crespigny

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Introduction

A nuchal translucency (NT) scan should include as full an assessment of fetal anatomy as can be reasonably achieved. A thorough fetal anatomical evaluation should receive the same emphasis as risk evaluation for Down syndrome. When a fetal anomaly is detected at the midtrimester scan that was not seen at the NT scan we should ask ourselves: 'Why was the anomaly not seen?'

Beautiful fetal anatomical images can be obtained at a scan at 12–13 weeks. Data collected about a decade ago and published in 1999 reported that: 'The majority of fetal structural and chromosomal abnormalities can be detected by sonographic screening at 11–14 weeks'[1].

In 2006 there were 77 093 Medicare claims for NT scans – item number 55707[2] – this is nearly one-third of the 255 000 live births in Australia per year. This does not include NT scans performed in the public system. Women are stampeding to take the opportunity for early diagnosis of chromosome abnormality, yet even now in 2007, sonographers and sonologists commonly place little emphasis on the early diagnosis of structural abnormalities.

Although the majority of anomalies diagnosed at a 19 to 24 weeks scan can be detected at a NT scan, more will be diagnosed at a midtrimester scan. Reasons include:

1 Views at a NT scan may be poor despite a careful transabdominal plus transvaginal scan e.g. when an anteverted uterus is sitting high above the pelvis (limiting transvaginal views) in a woman who is overweight (limiting transabdominal views).
2 Fetal position is a potentially limiting factor, as always with ultrasound. Best views are achieved using a transvaginal scan with the fetus facing the transducer, enhancing heart, face and limb views.
3 Some abnormalities can evolve between 12 and 19 weeks. These include defects involving growth such as microcephaly and some types of dwarfism; excessive enlargement of organs, particularly fluid filled organs, as in hydronephrosis and ventriculomegaly.
4 There may be intervening failure of development (such as agenesis of the corpus callosum).

Guidelines

The Medicare Benefit Schedule designates the fee for item number 55707 is for an ultrasound scan where 'nuchal translucency measurement is performed to assess the risk of fetal abnormality'[2]. There is no requirement to assess fetal anatomy.

The *ASUM Guidelines for the Performance of First Trimester Ultrasound* (Revised July 2005) presents potentially conflicting messages. It reads that: 'A vaginal transducer should always be available and a transvaginal scan should be offered to the patient when it is anticipated that this would result in a more diagnostic study'. This could be interpreted as indicating that a vaginal scan should be offered if this would improve anatomical assessment. On the other hand, it could be argued that anatomical assessment is not part of a 'diagnostic study' in the first trimester.

It is stated later in the policy that: 'The following list of gestational ages at which various fetal structures may be visualised is not intended to provide a complete list of what should be examined. However, using high resolution equipment (often only with a vaginal transducer) the following structures can commonly be seen: 11 weeks: stomach, spine, ossified cranium, four-chamber heart; 12 weeks: mid gut herniation no longer present, kidneys, bladder'. The policy could be interpreted as meaning that this superficial check is of interest only; it certainly does not clearly advocate a full fetal anatomical assessment.

What can be seen?

Some authors have argued against a careful first trimester anatomical assessment. Rustico, *et al*. deemed routine early cardiac assessment ill advisable, because of high costs in terms of time, equipment and involvement of operators, combined with a low sensitivity in detecting congenital heart disease[3]. The contrary view is taken by Bronshtein and Zimmer[4] who believe that '… depiction of the heart anatomy is easier in early pregnancy compared with advanced gestation… The technique of transvaginal scanning is not difficult to learn and sonographers can adopt it in a short time period of a few months. It is therefore our belief that in the future an

early detailed fetal cardiac examination should be performed in all pregnant women'.

It is well recognised that fetal anatomy can be assessed in detail at the NT scan. For most women, this assessment is more thorough with a transvaginal ultrasound examination. Modern equipment, however, frequently allows a very detailed assessment even with transabdominal ultrasound.

Lombardi, *et al.* have reported that at 12–13 weeks in at increased risk women, a cardiac scan was performed successfully in 456 (75%) using a 15 MHz linear transducer transabdominal ultrasound alone, and the additional use of a 6 MHz transducer allowed diagnostic images to be obtained in a further 152[5]. Normal cardiac anatomy was assessed confidently within 10 min in 517/608 (85%) pregnancies.

This figure would be expected to be higher, and the scan quicker, if transvaginal ultrasound was included. Yet transvaginal ultrasound is uncommonly considered to be part of the assessment at the time of the nuchal translucency scan. Since the nuchal translucency is usually best assessed transabdominally, all sonographers and sonologists do not routinely offer transvaginal ultrasound. In other words, common practice is that this scan is primarily for aneuploidy screening and that careful assessment of fetal anatomy is not essential.

It is worth looking at the depth of anatomy that Lombardi, *et al.* examined in their study. It shows what is possible at a NT scan. It was more detailed than often done in a midtrimester scan. In summary, the operator looked for the following fetal cardiac anatomy[5]:

1 Abdominal situs with the aorta to the left of the spine and the inferior vena cava anterior and to the right of the spine; the heart lying on the left side angled at 45° from the midline, occupying one quarter of the chest;
2 The four chambers of the heart with the left atrium in front of the spine and the right ventricle just below the sternum; atrial appendages; atrioventricular valve offsetting;
3 The aorta arising centrally in the heart from the left ventricle and the pulmonary trunk arising from the anteriorly placed right ventricle and crossing to the fetal left side over the ascending aorta;
4 Interventricular septum: aortic continuity in the left outflow view; and
5 The anteriorly positioned ductal arch and the transverse aortic arch on the left side, converging towards the fetal spine and being equal in size.

Studies on detection of fetal structural abnormalities at the time of the NT scan have tended to focus on cardiac abnormalities[3–7]. This may be because these are both common but also usually the most testing anomalies to detect. Data on detection of other abnormalities however shows that high detection rates for other anomalies are very achievable[1,8,9].

Why diagnose fetal abnormality early?

Women's preference

The NT scan is considered primarily to be for Down syndrome screening, gestational age assessment and the diagnosis of multiple pregnancies. The midtrimester ultrasound is for assessment of fetal anatomy. It might be suggested that assessing fetal anatomy at the first trimester is unnecessary since it will be done more effectively at the midtrimester scan and that such an assessment merely adds a second fetal anatomy examination when one would be just as effective.

There are several reasons why such an approach should be rejected. First, it ignores the well documented demand of women for early diagnosis. The importance of early diagnosis was seen in the introductory phase of chorionic villus sampling (CVS) when the risk of the test was many times that of amniocentesis. Yet from the outset, large numbers of women chose CVS to avoid late diagnosis following amniocentesis.

The same pattern was seen more recently for trisomy 21 screening. Midtrimester serum screening has been available for decades, but in Australia the take up was very poor except in South Australia. Yet when NT screening, and particularly when the first trimester combined test, became available early Down syndrome screening became standard practice. In Victoria, for example, about 80% of pregnant women now have screening (Genetic Health Services Victoria figures).

Women go to great lengths to have screening early – we should support them. Increasingly, they are expecting fetal anomalies to be detected in the first trimester. When an abnormality is found in the second trimester, they commonly ask: 'Could this abnormality have been detected at the earlier scan'. The answer is often yes. Doctors should not have to explain that no diligent attempt was made to make the diagnosis.

Scanning issues

Optimal midtrimester fetal visualisation is more likely to be obtained if the ultrasound examination is delayed to 19–20 weeks, and sometimes beyond. Delaying the scan to improve fetal assessment can be done with more confidence if fetal anatomy has been carefully assessed at the NT scan. Indeed for some women, such as very obese women, the best assessment of fetal anatomy can be a vaginal scan at 12–13 weeks, fetal views may be compromised at 20 weeks and beyond on transabdominal assessment.

Medical factors

Medical reasons to prefer earlier versus later abortion include the fact that early abortion is safer. In addition, surveys show that obstetricians are prepared to offer termination for more abnormalities early in pregnancy

than they are later in pregnancy[10]. Pregnant women, their doctors and Australians in general, more often oppose later abortion. It is therefore in women's interest to strive for early diagnosis to enhance their management options – women are more likely to be denied abortion later in pregnancy.

A recent survey of Melbourne obstetricians showed that they have become more reluctant to offer abortion after the diagnosis of fetal abnormality, even prior to 20 weeks, because of concerns about unclear laws and recent adverse press[11]. Early abortion is perceived to reduce these risks, hence early diagnosis enhances women's choices.

Legal factors

Abortion law, and the way doctors interpret it, limits access to later termination of pregnancy in many Australian jurisdictions, particularly from 20 weeks[12]. In Western Australia, for example, abortion is available from 20 weeks only on the approval of an anonymous committee. Careful early assessment of fetal anatomy reduces the risk that women will have an abnormality diagnosed in the midtrimester of pregnancy for which they will seek pregnancy termination.

We have legal and ethical responsibilities to carry out a state-of-the-art fetal anatomical assessment at 18–20 weeks. Such responsibilities should also apply at 13 weeks – a thorough fetal assessment can be offered to most women at this time with the expectation that a high detection rate of fetal abnormalities will be achieved in the first trimester.

Objections to fetal abnormality screening at the NT scan

What arguments might be raised by those that believe that a detailed fetal anatomical assessment at 12 weeks should not be a major focus?

Cost

Problem: The rebate figure for first trimester nuchal translucency scanning is so low that it is difficult to see how this figure could be charged if state-of-the art equipment was used to do an appropriate nuchal translucency assessment, let alone include a fetal anatomical assessment as well.
Response: Doctors have no role in unilaterally limiting valuable medical services that are wanted by patients. It is, however, unreasonable to expect ultrasound practices to carry the financial cost of a more prolonged first trimester assessment. Sadly, the government has eroded the ultrasound Medicare fee, particularly in the first trimester, to the detriment of pregnant women from all socio-economic groups. In most capital cities, ultrasound practices already charge a fee well above the Medicare schedule for pregnancy scans. Detailed fetal anatomical assessment may necessitate some providers raising fees.

Time and resources

Problem: Already obstetric ultrasound practices are stretched; this applies particularly in the public sector where few institutions offer NT assessment. Prolonging the NT scan to carefully assess fetal anatomy will magnify service provision problems.
Response: Our responsibility is to offer a state of the art service to patients whom we examine. It is not our role to unilaterally deny a complete examination to women because of practice time and resource issues. It is no more acceptable to use this argument to limit fetal assessment in the first trimester than it would be in the second trimester.

Limits of diagnosis

Problem: First trimester fetal anatomical assessment may be limited by fetal position, maternal body habitus, etc.
Response: This is true. It is also true at any other time of pregnancy – including the midtrimester. This is not an argument to limit the examination, but it is a reality of ultrasound examinations.
Problem: First trimester anatomical assessment may raise concerns about an abnormality where no problems exist: for example, a possible exomphalos, or hydrocephaly.
Response: This is also true at other times in pregnancy, although the uncertainties may be more common in the first trimester. This is no justification for providing a limited ultrasound examination in the first trimester, just as it is no justification at other times in pregnancy. It is an argument for cautious interpretation of possible abnormalities, for sensitive explanation to women and for timely review of the findings.
Problem: If an abnormality is diagnosed and abortion requested, fetal autopsy is limited or impossible.
Response: This also is true. It puts additional onus on sonologists to be cautious in offering a certain diagnosis of abnormality in the first trimester. A second opinion may be necessary, or alternatively, early rescan at 14 or 15 weeks rather than 18–20 weeks. In addition, specialist pathological expertise is available to obtain maximal information from early autopsy.

Vaginal ultrasound

Problem: A vaginal scan is often necessary to obtain optimal first trimester views. This is usually not needed for the NT measurement, which is the prime focus of the examination. Women prefer to avoid vaginal ultrasound.
Response: A vaginal ultrasound examination should be a woman's choice in the first trimester, just as it is at any other time. It should not be considered routine. In the first trimester, women should understand that the

vaginal scan is usually not required for NT assessment, but it will usually enhance anatomical assessment. Most, but not all, informed women choose to accept the offer of vaginal ultrasound to improve the chance of early anomaly detection.

Equipment

Problem: Good equipment is needed for anatomical assessment.
Response: Yes it is. It is also needed for NT assessment.

Training

Problem: First trimester scanning skills requires sonographers to have new and more extensive training.
Response: It does require training to look at the detailed anatomy of first trimester fetuses. The training is not dissimilar to that required for second trimester screening. Those doing second trimester assessment can readily adapt. This includes learning transvaginal scanning skills which are essential for all trained obstetric scanners.

Conclusion

There is no reason to deny women state-of-the-art effective prenatal diagnostic services in the first trimester or at any other time of pregnancy. A careful fetal anatomical assessment, including giving women the option of a transvaginal scan if that would enhance imaging, should be a standard part of a 12–13 week scan. Long gone is the time that doctors can unilaterally limit effective prenatal tests without disclosing this to women before the scan.

If a limited scan is planned, doctors should disclose this to allow women the option of going elsewhere to have a more complete examination.

A 12–13 weeks scan should allow the detection of most structural abnormalities diagnosable in the second trimester, including most structural heart abnormalities. This is not to advocate all women should be offered a first trimester scan for fetal anatomy assessment only, but if a scan is performed for another reason, such as NT, fetal anatomy should be considered an integral part of the assessment. Anatomical assessment at 12–13 weeks does not replace a mid-trimester scan.

Proposal

We are abdicating our responsibilities to patients if a NT scan does not include a careful fetal anatomical assessment. Offering a transvaginal scan should be routine at a 12–13 week scan when that might enhance fetal anatomical views. NT scans are best performed at 12–13 weeks because fetal structural detail is better than at 11 weeks.

References

1 Whitlow BJ, Chatzipapas IK, Lazanakis ML, Kadir RA, Economides DL. The value of sonography in early pregnancy for the detection of fetal abnormalities in an unselected population. *BJOG* 1999; 106: 929–36.

2 NT Medicare item. Medicare Australia. Available online at: www.medicareaustralia.gov.au [verified September 07].

3 Rustico MA, Benettoni A, D'Ottavio G, Fischer-Tamaro L, Conoscenti GC, Meir Y, *et al*. Early screening for fetal cardiac anomalies in an unselected population: the role of operator experience. *Ultrasound Obstet Gynecol* 2000; 16: 614–19.

4 Bronshtein M, Zimmer EZ. The sonographic approach to the detection of fetal cardiac anomalies in early pregnancy. *Ultrasound Obstet Gynecol* 2002; 19: 360–65.

5 Lombardi C, Bellotti M, Fesslova V, Cappellini A. Fetal echocardiography at the time of the nuchal translucency scan. *Ultrasound Obstet Gynecol* 2007; 29: 249–57

6 Becker R, Wegner RD. Detailed screening for fetal anomalies and cardiac defects at the 11–13-week scan. *Ultrasound Obstet Gynecol* 2006; 27: 613–18.

7 Rasiah SV, Publicover M, Ewer AK, Khan KS, Kilby MD, Zamora J. A systematic review of the accuracy of first-trimester ultrasound examination for detecting major congenital heart disease. *Ultrasound Obstet Gynecol* 2006; 28: 110–16.

8 Kang A, Struben H, Holzgreve W, Lapaire O, Doht S, Tercanli S. Detection of fetal anomalies in the first and second trimesters. *Ultrasound Obstet Gynecol* 2006; 28: 365.

9 Johnson SP, Sebire NJ, Snijders RJ, Tunkel S, Nicolaides KH. Ultrasound screening for anencephaly at 10–14 weeks of gestation. *Ultrasound Obstet Gynecol* 1997; 9: 14–16.

10 Savulescu J. Is current practice around late termination of pregnancy eugenic and discriminatory? Maternal interests and abortion *J Med Ethics* 2001; *27*: 165–71.

11 de Crespigny L, Savulescu J. Women wanting to be pregnant: the forgotten people in the abortion debate (submitted for publication).

12 de Crespigny L, Savulescu J. Abortion: time to clarify Australia's confusing laws. *MJA* 2004; 181: 201–3.

What do clinical users of ultrasound know about safe use in pregnancy?

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Professional medical ultrasound societies share a common goal to ensure the safe and effective use of diagnostic ultrasound to an accepted standard of clinical practice. ASUM has published guidelines for safety and standards of practice and has issued policy statements that are in accordance with other international organisations. In practical terms, the safe and appropriate use of ultrasound is the responsibility of the sonologist/sonographer. In recent decades, the regulation of ultrasound acoustic output (as applied by the Food and Drug Administration (FDA) Centre for Devices and Radiological Health) has been relaxed for most applications in comparison with the original intensity limits imposed on each application[1,2]. The rationale for this relaxation of applied intensity limits was that the ultrasound user should be able to assess the risk of causing ultrasound-related biological effects or potential adverse effects, based on information provided by the manufacturer in the form of equipment output displays.

The concept of using an output display to moderate the application and output conditions during an ultrasound examination allows the clinician to dictate the level of exposure received by the patient, rather than having arbitrary acoustic output limits imposed by regulatory authorities. In essence, this would appear to be an ideal situation, with the clinician being responsible for making decisions of any potential risk in a given exam application. In fact, the concept has been used by some industry groups in the USA to apply pressure to the FDA to reduce further, or eliminate entirely, all restrictions on output. However, for this situation to work effectively, it assumes that a number of basic conditions apply. In order for the clinician/user to make such an assessment, essential elements are assumed, including the following:

1 Awareness of potential, or actual bioeffects that might result from a particular ultrasound application (the level of risk differs for different applications, early pregnancy presenting the greatest risk);
2 Understanding the basic concepts of the Output Display Standard; and
3 Ability to interpret information provided in the equipment output display.

The recent publication by Sheiner, *et al.*[3] clearly shows that the above assumptions are incorrect. This paper describes findings in a study that was part of a PhD thesis. The study set out to determine the clinical end-users' knowledge of safety aspects of diagnostic ultrasound during pregnancy. End-users' attitudes towards the use of ultrasound in low risk pregnancies were assessed in a questionnaire of 130 physicians and obstetricians attending review courses.

Remarkably, approximately 80% of these physicians were unaware that an output display of acoustic indices appeared on the sonographic monitor during the examination, or had no idea where to find such vital information. Interestingly, almost 70% of respondents disapproved of keepsake, or entertainment, scanning. This may be due to the recent increased publicity within the news media. While approximately 20% of these physicians were familiar with the term 'mechanical index', only 4% described it properly. The authors concluded that ultrasound end-users are poorly informed regarding safety issues during pregnancy. They also, quite correctly, state in the discussion section that 'Obviously, if professional end-users show such poor knowledge of safety issues, one cannot expect end users in shopping malls, performing souvenir ultrasound exams, to have a better understanding of safety topics.'

Clearly, these are major issues to do with standards of practice and ethical and appropriate use of a medical specialty. Some professional ultrasound organisations have published opinion and official policy on the subject of souvenir ultrasonography. The World Federation for Ultrasound in Medicine and Biology (WFUMB) has embarked on an international project, in collaboration with the International Society of Ultrasound in Obstetrics and Gynecology (ISUOG) to assess the scientific background and stake-holder opinion with the purpose of creating a set of international guidelines. Professional ultrasound societies, including the ASUM, have been invited to send representatives to participate in the workshop, to be held in Florence in October 2007.

The paper by Sheiner, *et al.* has reiterated concerns held by the scientific community that has been dealing with ultrasound standards for some years. This publication offers clear evidence that the substantial efforts over decades to educate end-users of diagnostic ultrasound about the output display standard[4] has been somewhat less than successful or effective than anticipated. It would be a very interesting exercise to submit a similar test as part of ASUM's education practice.

References

1 Barnett SB. Key issues in the analysis of safety of diagnostic ultrasound. *ASUM Ultrasound Bull* 2003; 6 (3): 41–3.

2 Barnett SB, ter Haar G. Guidelines and recommendations for the safe use of diagnostic ultrasound: the users' responsibilities. In: ter Haar, G and Duck, F editors. The Safe Use of Ultrasound in Medical Diagnosis. London: BMUS/BIR Publications; 2000. pp. 102–12.

3 Sheiner E, Shoham-Vardi I, Abramowicz JS. What do clinical users know regarding safety of ultrasound during pregnancy? *J Ultras Med* 2007; 26: 319–25.

4 Abbott, JG. Rationale and derivation of MI and TI – A review. *Ultras Med Biol* 1999; 25: 431–41.

Cerebral embolus detection using Doppler ultrasound

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Abstract

Cerebral embolism is a common occurrence during many operative procedures including carotid endarterectomy, cardiac by-pass surgery and bone fracture repair. It may also occur during the course of everyday life and embolism from the carotid artery or heart is known to be a major cause of stroke. Transcranial Doppler ultrasound can be used to detect cerebral emboli as they propagate through the major cerebral vessels. The detectability of an embolus is determined by many factors including its size and composition, the ultrasound frequency, the size of the Doppler sample volume, the embolus trajectory and its interaction with the ultrasound beam. In general, even relatively small gas bubbles will be detected, but some larger solid emboli may be missed. With regard to size and composition, several techniques have been suggested as being useful for characterising composition and while, in general, considerable progress has been made in this direction, there are still many challenges in distinguishing between large particulate emboli and small gaseous emboli.

Introduction

A significant proportion of strokes are caused by emboli from distal sites blocking vessels in the brain. The discovery that emboli of various types can be detected using Doppler ultrasound as they are carried through the major cerebral arteries[1,2] has led to a new field of study, which has considerable potential. The basic principle of detection is extremely simple: if an embolus backscatters more power than the surrounding blood in which it is moving, then the transient increase in Doppler power can be detected and measured. Questions that arise from this principle surround the circumstances under which such power increases can be detected, and whether the size and composition of the embolus can be inferred from such measurements.

The standard transcranial Doppler ultrasound (TCD) methodology for embolus detection consists of fixing a single element pulsed Doppler probe, with a frequency of around 2 MHz, over the temporal bone and adjusting its position, orientation and sample volume depth to obtain a good signal from the blood flow in the ipsilateral middle cerebral artery (MCA). Most frequently, micro-embolic signals (MES) are 'detected' subjectively, although there have been several attempts to automate the process[3,4,5]. Doppler audio signals from emboli are described as sounding like a 'snap', a 'chirp', or a 'moan'[6] and appearing on the Doppler sonogram as a short-duration unidirectional high-intensity signal within the Doppler flow spectrum, occurring at random within the cardiac cycle[7,8]. More objectively, they may be described as short-duration (usually between 8 and 80 ms) amplitude modulated sine waves that exceed the level of the background blood flow signal by between 3 dB and 60 dB[9]. Some signals also exhibit significant frequency modulation[9,10]. An example of an MES that is approximately 9 dB higher than the background blood signal is shown in Fig. 1.

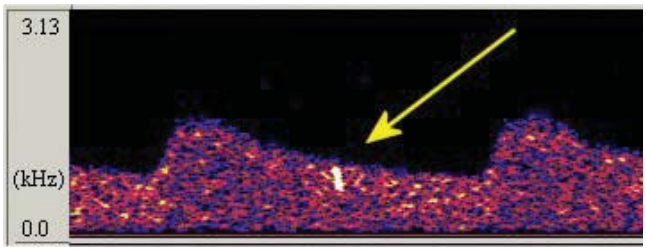

Fig. 1: Example of a sonogram of a Doppler signal recorded from the MCA of a patient in the recovery room following carotid endarterectomy. The MES appears as a region of increased Doppler power as indicated by the arrow.

Basic principles

The scattering of ultrasound by microemboli was first explored in detail by Lubbers and van den Berg (1976)[11], who calculated the scattering from gaseous microemboli, red blood cell aggregates (RCAs), and fat emboli flowing in blood. Their equations show that the backscatter cross-section (BSC) is a function of embolus size, ultrasound frequency, and the composition of both the embolus and its surrounding medium. It is not possible to measure the absolute power scattered by an embolus from within the body as the attenuation of the ultrasound by the tissue between the embolus and the transducer is unknown, and therefore it is necessary to compare the signal from the embolus with a known scatterer such as blood, if calibrated measurements are to be made. With this in mind, Moehring and Klepper (1994)[12] introduced the concept of 'embolus-to-blood ratio' (EBR), which they defined as:

(Equation 1)

$$EBR = \frac{\sigma_B + \sigma_E}{\sigma_B} = 1 + \frac{\sigma_E}{V\alpha}$$

where σ_E and σ_B are the BSCs of the embolus and flowing blood within the sample volume respectively; V is the volume of flowing blood within the sample volume; and α is the volume backscatter coefficient of blood. Equation (1)

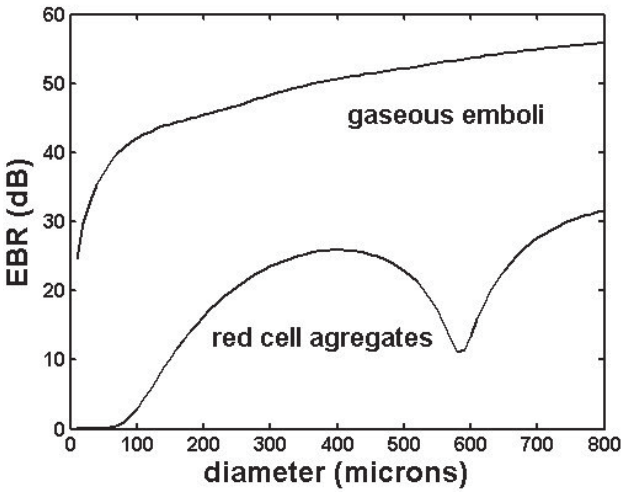

Fig. 2a: EBR power ratios for air and red cell aggregate emboli plotted as a function of embolic diameter (it has been assumed that the blood vessel diameter is 3 mm, the sample volume 10 mm in length, the transmission frequency 2 MHz, and the haematocrit 45%).

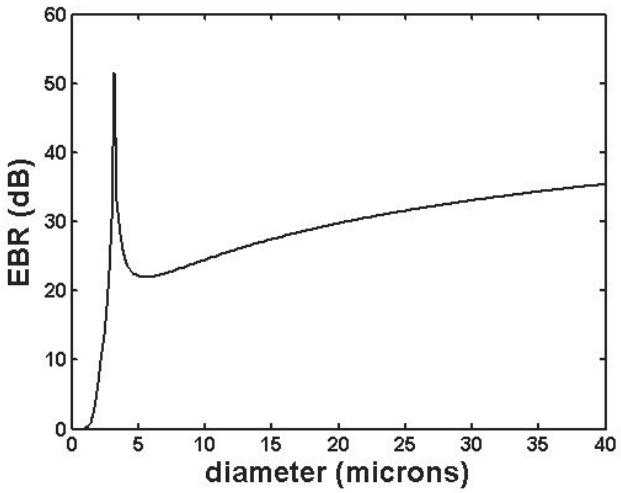

Fig. 2b: Detail of EBR power ratios for small gaseous emboli.

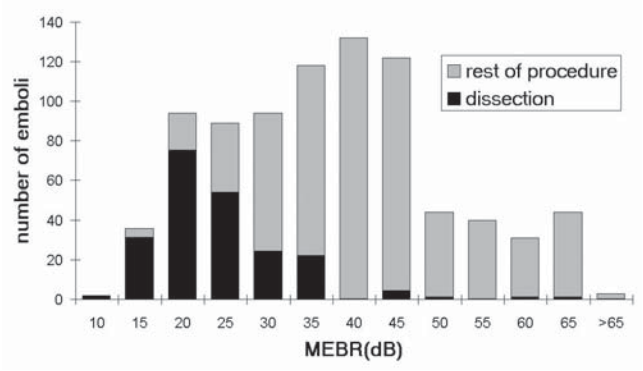

Fig. 3a: Distribution of the MEBR values of 849 embolic signals recorded during 17 carotid endarterectomies. Dark shading indicates emboli detected during dissection, which can only be particulate in nature. Light shading indicates emboli detected during other phases of the operation where the emboli may be either solid or gaseous.

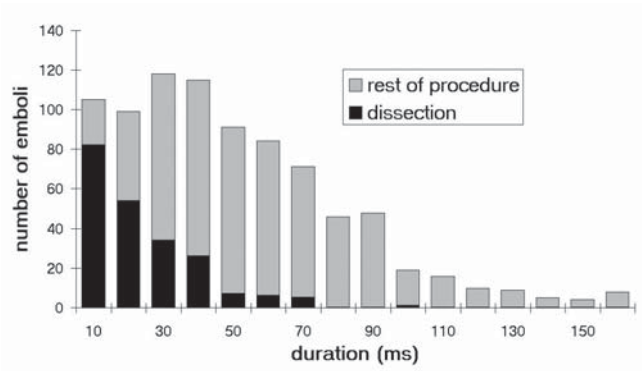

Fig. 3b: Distribution of the durations of the signals from the same 849 emboli.

has been evaluated as a function of embolic diameter for emboli consisting of RCAs and of air, for a typical geometry found in TCD studies[13] and the results plotted in Figs. 2a and 2b to illustrate a number of points relevant to detection of emboli. First, gaseous emboli always backscatter more power than similarly sized solid emboli, but very small gaseous emboli may backscatter similar amounts of power to large solid emboli. Second, it is possible to detect gaseous emboli with diameters as small as about 2 microns, but solid emboli do not backscatter significantly greater power than the surrounding blood unless they have diameters of the order of 80 to 120 microns. Third, backscattered power does not rise monotonically with size.

Practical considerations

Ideally, Doppler ultrasound studies would provide the clinician with information about embolus prevalence, composition and size, but there are difficulties both in making accurate measurements on MES and also in the interpretation of such measurements. In this section we discuss some of the practical difficulties of making measurements.

The first thing to note about Doppler embolic signals is that they are unlike typical Doppler signals from blood flow – in particular they exhibit very high dynamic ranges (a small solid embolus may exceed the background blood signal by only 6 dB, but a moment later a gaseous embolus may produce a signal 50 dB higher), and that they have very short durations (often of the order of 10 to 20 ms). Fig. 3 shows typical values of the measured EBR (MEBR) and durations from 849 embolic signals recorded during the course of 17 carotid endarterectomies[14]. More recently we have published a more detailed study of the characteristics of embolic signals observed during the recovery phase of carotid endartectomy[15].

MES dynamic range

In general the instruments used for TCD work are relatively simple and cannot adequately cope with the large dynamic ranges involved, especially where gaseous emboli are present. Emboli with large BSCs cause overloading, particularly in the audio frequency stages of Doppler instrumentation and leads to several problems, which include the impossibility of estimating EBR, and the difficulty of distinguishing MES from artifact signals. Clearly, steps must be taken to avoid this problem if accurate measurements are to be made[16].

MES duration

The short duration of embolic signals also poses some

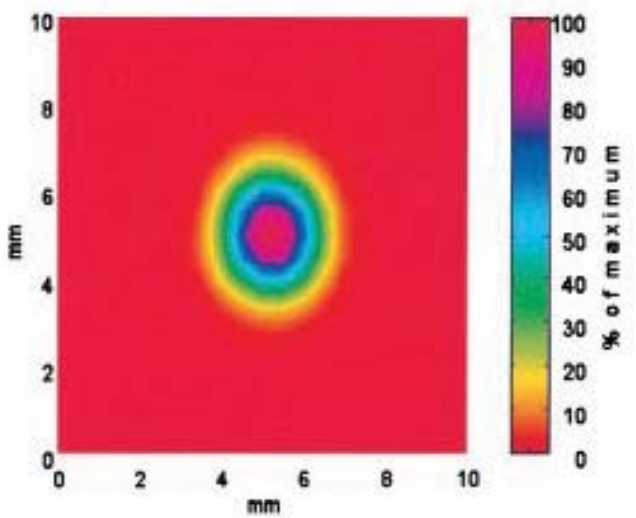

Fig. 4a: Received field beam sensitivity of a Scimed TCD transducer plotted at an axial distance of 5.0 cm from the transducer face for a beam path through water.

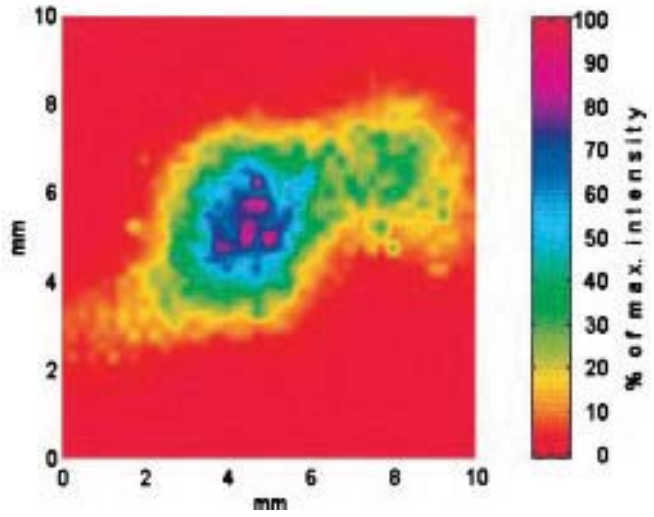

Fig. 4b: Received field beam sensitivity of a Scimed TCD transducer plotted at an axial distance of 5.0 cm from the transducer face for a beam path through human temporal bone.

difficulties for measurements made using conventional FFT spectral analysis systems. Since some embolic events last less than 10 ms it is desirable to be able to make temporal measurements with a resolution of 2.5 ms or better, which implies a frequency resolution of only 400 Hz. Since the Doppler frequencies involved are of the order of only 2 kHz, this is clearly inadequate. To overcome this limitation we and other groups have used time-frequency analysis to achieve high temporal resolution measurements without sacrificing frequency resolution[16].

Measurement limitations

The concept of EBR is extremely valuable, but is defined in terms of the BSCs of blood and emboli, which cannot be measured directly. In practice, what is measured is the relative powers of the signals from the Doppler sample volume in the presence and absence of embolic events, which is therefore perhaps better called 'measured EBR' or MEBR to distinguish it from the more theoretical quantity. MEBR is influenced by many factors, but perhaps the most important are the size of the MCA, the shape of the ultrasonic beam, the embolic trajectory through the artery and the interaction of these parameters. Even if the free-field ultrasonic beam is sufficiently uniform to provide uniform insonation over a large sample volume, the shape of the skull, with its convoluted inner surface, leads to very non-uniform ultrasound fields within the brain[17,18]. Figs. 4a and 4b show the effect of one sample of human temporal bone on the field shape of a commercial transducer. Because of the non-uniformity of the ultrasound beam, the amount of power backscattered by an embolus will be dependent on the particular trajectory it follows through the MCA. The power backscattered by the blood will depend on the ultrasonic beam shape and the diameter of the blood vessel, neither of which will be known, and the angle of insonation, which also may not be known. In a study from our laboratory, in which simulations were performed using ultrasound beam shapes measured through temporal bone and likely geometrical configurations; the effects of embolus trajectory, likely insonation angles, and plausible vessel misalignments introduced uncertainties in MEBR values of up to 12dB[19].

Information from micro-embolic signals

Ideally, embolus-monitoring systems would detect all micro-embolic events and would be able to determine the size and composition of the causative embolus. Although much progress has been made in this direction, many challenges remain.

Detection of emboli

It will be clear from the previous section that there is a considerable degree of uncertainty in measurements on MES and this must influence the sensitivity of event detection. Furthermore, most embolus detection systems rely on subjective decisions made by an operator and therefore, in addition to variability due to physical factors, some intra-observer and inter-observer variability must be expected. Although there is a high probability that emboli with large BSCs (relative to BSC of the blood in the sample volume) will be detected, there is also a high probability that a significant percentage of emboli with small BSCs will be missed. Fortunately, clinical experience suggests that quite large numbers of solid emboli which produce signals close to the detection threshold are necessary to cause any measurable damage to the brain. Thus, while individual events may well be missed, the presence of significant numbers of emboli will not.

Artifact rejection

One of the difficulties of embolic event detection is that of distinguishing between signals due to true events, and those due to non-embolic events. There are many mechanisms that produce transient high intensity signals, many of which have similar characteristics to true MES. Any movement of the Doppler probe, either intentional or accidental, or of the underlying tissue such as that caused by head movement, speech, snoring or talking, can produce signals not dissimilar to MES.

The most common method of rejecting artifacts is still subjective assessment of a candidate signal by comparing it with a set of standard criteria. One commonly used set is that published as a result of a consensus meeting[6]. Another approach to artifact rejection is to use more than

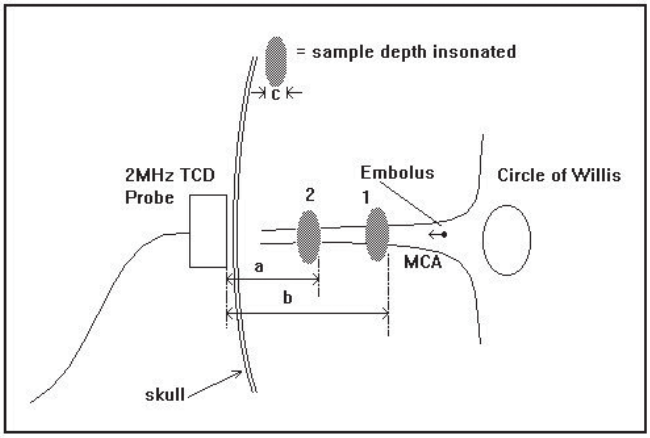

Fig. 5a: Schematic diagram of dual-gated TCD configuration insonating a middle cerebral artery (MCA). Sample depths 1 and 2 are positioned along the artery as shown (although in practice the sample volumes will overlap).

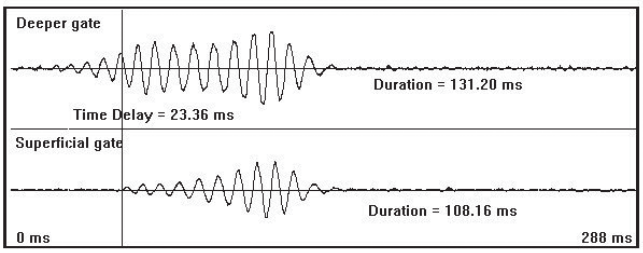

Fig. 5b: Time-domain display of the Doppler signals from an embolus passing through the two gates. The signal appears in the deeper gate approximately 23 ms before it appears in the superficial gate. In the case of an artifact the two signals would appear at the same time.

one Doppler sample volume in an attempt to track the movement of an embolus through the circulation[20,21,22]. The method consists of placing two or more sample volumes at different positions along the arterial tree, and monitoring the signal from each gate for transient increases in power (Fig. 5a). If such transients are due to an embolus, then since it is flowing with the blood, it will enter the distal sample volume (SV1) before it enters the proximal sample volume (SV2), and therefore the resulting increase in power from SV1 will occur before that from SV2 (Fig. 5b). The time difference will be given by the velocity of embolus propagation divided by the distance between the leading edges of the two sample volumes[23] (very approximately – see Smith, *et al.* 1997). If, on the other hand, the transient increase in power is not due to an embolus, it is likely that either the increase in power will occur only in one sample volume or in both simultaneously. This technique has been shown to be quite reliable for MES with relatively high MEBR, but is unfortunately less useful for MES with low MEBR which is when it is most difficult to distinguish MES from artifacts using standard criteria.

Embolic composition

It is important to know the nature of any embolus for several reasons, but most importantly because solid emboli are believed to be more hazardous than small gaseous emboli. Even if emboli of different types produced similarly sized MES this would be important, but it is particularly so since small gaseous emboli produce similar signals to large solid emboli.

Power based methods

The most obvious characteristic of MES that can be used to discriminate between solid and gaseous emboli is the EBR. Reference to Figs. 2a and 2b shows that if EBR exceeds about 30 dB then the embolus is likely to be gas, while if EBR is less than 20 dB the embolus is likely to be solid. For values in between there is a region of uncertainty, but in itself this is probably not of too great a concern, it is more a question of how to estimate EBR directly or indirectly with sufficient accuracy to use this property for classifying emboli. Some of the difficulties of making accurate measurements of EBR and associated quantities have been described earlier; where it has been seen there are considerable uncertainties. If it were not for these uncertainties it is likely that methods based on power estimation would be adequate for distinguishing between solid and gaseous emboli in most circumstances.

Partial gas pressure manipulation

There has long been a controversy over whether the very high numbers of microemboli detected in patients with prosthetic heart valves are solid or gaseous. One school of thought has it that they cannot be solid, otherwise the patient would show significant clinical effects, while the opposite school maintains that even if gas bubbles were generated in the heart, they would dissolve before reaching the brain. To some extent this controversy has been resolved by studying the effect of oxygen ventilation and of hyperbaria on these patients[24,25]. The result of oxygen ventilation is to dramatically decrease the number of MES, while the effect of hyperbaria is to increase the counts, implying that at least a significant proportion of the emboli are gaseous. While techniques like these cannot help to classify individual emboli, where there is a chronic source of emboli it can provide useful information.

Sub-harmonic and ultra-harmonic emissions

Gas bubbles behave in a non-linear manner when at, or near resonance, while solid particle scatter in a linear manner irrespective of frequency. It is possible that this property could be used to classify emboli. Palanchon, *et al.*[26] have explored this property *in-vitro* using low ultrasound frequencies (130 kHz and 250 kHz) and showed that scattering takes place at the second and third harmonic frequencies when bubbles sizes are approaching resonance, and at even higher harmonic frequencies when their sizes are very close to resonance. They subsequently showed that by using properties of sub-harmonics, ultra-harmonics, and harmonics, bubbles around the resonance size, and around twice the resonance size can be detected from the surrounding medium[27]. While this technique has obvious attractions, it remains to be seen if it can be made to work *in-vivo*.

Frequency modulation

For reasons as yet unknown, it appears that gaseous emboli are much more likely to generate frequency modulation in the Doppler signal than solid emboli. Indeed, while as many as 43% of gaseous emboli appear to generate rapid frequency modulation, few if any solid emboli exhibit this behavior[10]. It is not known if this provides additional information when compared to power based methods.

Embolic size

An ultimate goal of embolus detection work would be to estimate the size of each embolus. To date there has been little progress towards this goal. The most obvious quantity to measure with sizing in mind would be MEBR, but there are two difficulties with this. The first is that, for solid emboli (for example RCAs), EBR does not increase monotonically with power and therefore any one value of MEBR could correspond to two or three embolus sizes. The second is that the variation in EBR with size is not large compared with the errors in estimating MEBR. One technique that has shown some promise *in-vitro* is to make use of more that one transmitted frequency. The principle behind this is that since the pattern of variation of EBR with diameter is frequency dependent, it should be possible to combine independent information from measurements made at different frequencies[28,29]. Even *in-vitro* however, beam refraction causes considerable difficulties, and at present the *in-vivo* problem is far from being solved.

Summary and conclusions

It is relatively easy to detect both solid and gaseous microemboli traveling in the major cerebral arteries, but great care is needed in the interpretation of the resulting MES. Most emboli can be classified as 'gaseous' or 'probably solid' solely on the grounds of the amount of Doppler power they backscatter, but there is an overlap between the size of the signals from small gaseous and large solid emboli. Solid emboli are likely to be more dangerous than gaseous emboli, but unfortunately they are the most difficult to detect. Power measurements on emboli have a high degree of variability associated with them due to unknown factors such as the shape of the ultrasound field inside the brain, the size of the artery, and the vessel/ultrasound beam configuration. Work is continuing on new techniques for characterising and sizing emboli, and on automating their detection.

References

1 Padayachee TS, Gosling RG, Bishop CC, Burnand K, Browse NL. Monitoring middle cerebral artery blood velocity during carotid endarterectomy. *Br J Surg* 1986; 73: 98–100.

2 Spencer MP, Thomas GI, Nicholls SC, Sauvage LR. Detection of middle cerebral artery emboli during carotid endarterectomy using transcranial Doppler ultrasonography. *Stroke* 1990; 21: 415–23.

3 Cullinane M, Reid G, Dittrich R, Kaposzta Z, Ackerstaff R, Babikian V, *et al.* Evaluation of new online automated embolic signal detection algorithm, including comparison with panel of international experts. *Stroke* 2000; 31: 1335–41.

4 Fan L, Evans DH, Naylor AR. Automated embolus identification using a rule–based expert system. *Ultrasound Med Biol* 2001; 27: 1065–77.

5 Fan L, Boni E, Tortoli P, Evans DH. Multigate transcranial Doppler ultrasound system with real–time embolic signal identification and archival. *IEEE Trans Ultrason Ferroelec Freq Contr* 2006; 53: 1853–61.

6 Ackerstaff RGA, Babikian VL, Georgiadis D, Russell D, Siebler M, Spencer MP, Stump D. Basic identification criteria of Doppler microemboli signals: Consensus committee of the 9th International Cerebral Hemodynamics Symposium. *Stroke* 1995; 26: 1123.

7 Georgiadis D, Grosset DG, Kelman A, Faichney A, Lees KR. Prevalence and characteristics of intracranial microemboli signals in patients with different types of prosthetic cardiac valves. *Stroke* 1994; 25: 587–92.

8 Spencer MP. Detection of cerebral arterial emboli. In: Newell DW, Aaslid R, editors Transcranial Doppler. New York: Raven Press; 1992. pp 215–30.

9 Evans DH, Smith JL, Naylor AR. Characteristics of Doppler ultrasound signals recorded from cerebral emboli. *Ultrasound Med Biol* 1997; 23: S140.

10 Smith JL, Evans DH, Naylor AR. Analysis of the frequency modulation present in Doppler ultrasound signals may allow differentiation between particulate and gaseous cerebral emboli. *Ultrasound Med Biol* 1997; 23: 727–34.

11 Lubbers J, van den Berg JW. An ultrasonic detector for microgas emboli in a bloodflow line. *Ultrasound Med Biol* 1976; 2: 301–10.

12 Moehring MA, Klepper JR. Pulse Doppler ultrasound detection, characterization and size estimation of emboli in flowing blood. *IEEE Trans Biomed Eng* 1994; 41: 35–44.

13 Evans DH. Ultrasonic detection of cerebral emboli. In: Yuhas DE, Schneider SC, editors. Proc. 2003 Ultrasonics Symposium. Piscataway: IEEE; 2003. 316–26.

14 Evans DH. Detection of microemboli. In: Babikian VL, Wechsler LR, editors. Transcranial Doppler Ultrasonography 2nd edn. Boston: Butterworth Heinemann; 1999. pp 141–155.

15 Chung EML, Fan L, Naylor AR, Evans DH. Characteristics of Doppler embolic signals observed following carotid endarterectomy. *Ultrasound Med Biol* 2006; 32: 1011–23.

16 Smith JL, Evans DH, Fan L, Thrush AJ, Naylor AR. Processing Doppler ultrasound signals from blood borne emboli. *Ultrasound Med Biol* 1994; 20: 455–62.

17 White DN, Curry GR, Stevenson RJ. The acoustic characteristics of the skull. Ultrasound Med Biol 1978; 4: 225–52.

18 Deverson S, Evans DH, Bouch DC. The effects of temporal bone on transcranial Doppler ultrasound beam shapes. *Ultrasound Med Biol* 2000; 26: 239–44.

19 Angell EL, Evans DH. Limits of uncertainty in measured values of embolus–to–blood ratio due to Doppler sample volume shape and location. *Ultrasound Med Biol* 2003; 29: 1037–44.

20 Georgiadis D, Goeke J, Hill M, König M, Nabavi DG, Stögbauer F, *et al.* A novel technique for identification of Doppler microembolic signals based on the coincidence method. In vitro and in vivo evaluation. *Stroke* 1996; 27: 683–86.

21 Smith JL, Evans DH, Fan L, Bell PRF, Naylor AR. Differentiation between emboli and artefacts using dual–gated transcranial Doppler ultrasound. *Ultrasound Med Biol* 1996; 22: 1031–36.

22 Evans DH. Multigate emboli detection. In: Hennerici MG, Meairs SP, eds Cerebrovascular Ultrasound: Theory, practice and future developments. Cambridge: Cambridge University Press; 2001. pp 360–73.

23 Smith JL, Evans DH, Naylor AR. Signals from dual gated TCD systems: Curious observations and possible explanations. *Ultrasound Med Biol* 1997; 23: 15–24.

24 Georgiadis D, Wenzel A, Lehmann D, Lindner A, Zerkowski HR, Zierz S, Spencer MP. Influence of oxygen ventilation on Doppler microemboli signals in patients with artificial heart valves. *Stroke* 1997; 28: 2189–94.

25 Baumgartner RW, Frick A, Kremer C, Oechslin E, Russi E, Turina J, Georgiadis D. Microembolic signal counts increase during hyperbaric exposure in patients with prosthetic heart valves. *J Thorac Cardiovasc Surg* 2001; 122: 1142–46.

26 Palanchon P, Bouakaz A, Van Blankenstein JH, Klein J, Bom N, De Jong N. New technique for emboli detection and discrimination based on nonlinear characteristics of gas bubbles. *Ultrasound Med Biol* 2001; 27: 801–8.

27 Palanchon P, Bouakaz A, Klein J, De Jong N. Subharmonic and ultraharmonic emissions for emboli detection and characterization. *Ultrasound Med Biol* 2003; 29: 417–25.

28 Moehring MA, Ritcey JA. Sizing emboli in blood using pulse Doppler ultrasound I: Verification of the EBR model. *IEEE Trans Biomed Eng* 1996; 43: 572–80.

29 Moehring MA, Ritcey JA, Ishimaru A. Sizing emboli in blood using pulse Doppler ultrasound II: Effects of beam refraction. *IEEE Trans Biomed Eng* 1996; 43: 581–88.

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Use of real-time thyroid ultrasonography by endocrinologists – a work in progress

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Key words: cysts, differentiated thyroid cancer, fine-needle aspiration biopsy, Graves' disease, nodules, thyroid ultrasonography, thyroiditis.

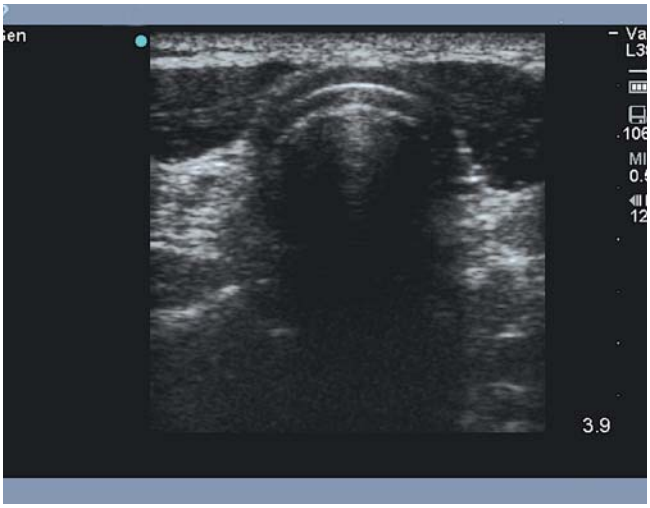

Fig. 1: Thyroid agenesis. Black spaces where the thyroid lobes and isthmus should be, in a 15-year-old hypothyroid boy born without a thyroid gland.

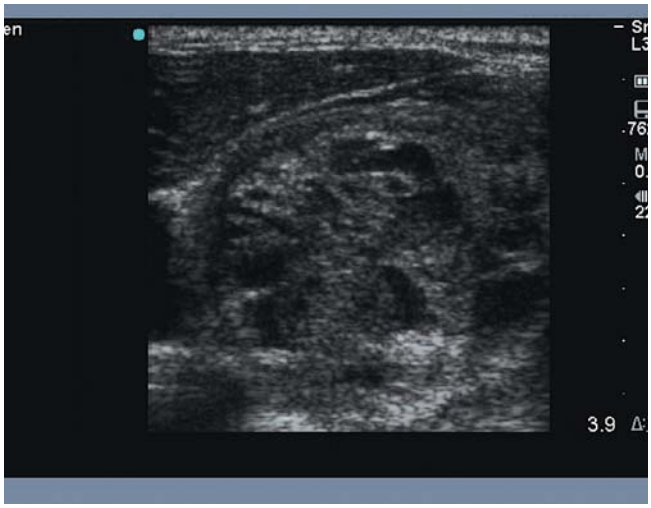

Fig. 2: Large hypo echoic thyroid nodule with speckled intra nodular calcification and an irregular edge suspicious for differentiated thyroid cancer.

Introduction

There is growing recognition among endocrinologists that it is not possible to be a 'thyroid specialist' without having one's own ultrasound machine, i.e. to use real-time ultrasonography as a diagnostic and management aid. For most of us hospital-based thyroid specialists, this means a portable machine. In private practice, groups of thyroidologists might consider the purchase of a larger machine with greater capabilities in the context of their business plan. The author's practice comprises approximately 80% patients with thyroid disease on whom he performs about 1000 high-resolution conventional thyroid ultrasounds per year. His machine is a Titan Sonosite portable, incorporating a small parts transducer probe with colour flow to assess vascularity, but not Doppler. He is a thyroid specialist who, for 25 years in North America, restricted his practice to patients with thyroid problems. The author is one of very few endocrinologists in Australia who routinely performs real-time ultrasonography and ultrasound guided fine needle aspiration (FNA) biopsy in a largely thyroid-based practice. He is mainly self-taught and is still learning to assess lumps and swellings outside the thyroid gland such as enlarged lymph nodes and parathyroid adenomas. While the use of real-time thyroid ultrasonography is limited in this country, it is state-of-the-art in Europe and in the USA. Real-time thyroid ultrasonography is not used by endocrinologists in Canada because there is no scheduled fee for an endocrinologist to perform ultrasound in either the hospital or private office setting. You can do it, but you won't get paid for it. In Canada, FNA biopsy of thyroid nodules is carried out by palpation, i.e. without ultrasound guidance, for which there is a fee, or by 'ultrasonographers' (radiologists, nuclear medicine physicians etc.) and pathologists under ultrasound guidance. In Australia, there is no Pharmaceutical Benefit Scheme (PBS) reimbursement for performing FNA, even by palpation. Thus, endocrinologists who do not have an ultrasound machine must refer their patients to imaging departments for ultrasound and then to pathologists to carry out biopsy by palpation or under guidance, for which they are paid a fee. However, 'imagers' who perform thyroid ultrasonography without knowledge of the patient's medical history and laboratory results often misinterpret what they see on ultrasound, or at least this is the impression that many thyroid specialists have.

Although there are many uses for thyroid ultrasonography, its main use is to assess thyroid nodules, and therein lies the problem; thyroid nodules and cysts are very common, being found by palpation in about 5–8% of adults[1] and by ultrasonography in up to 60% of adults[2,3]. Even though the prevalence of thyroid cancer in adults appears to be increasing, especially in white adult males[4], only about 8–10% of nodules are malignant[5,6]. Indeed, the author used to say to his patients in Canada, 'I have never ordered a thyroid ultrasound' (because if you do, you are then obliged to deal with all the nodules and cysts that are found). However, once the decision to have an ultrasound is made there is no turning back. Every

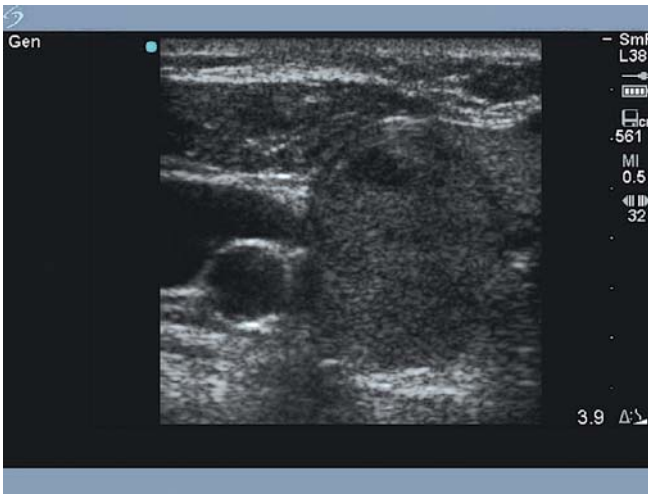

Fig. 3: Large hypo echoic nodule with an irregular edge in a patient with established papillary thyroid cancer.

Fig. 4: Large benign thyroid cyst with a small amount of solid material around the periphery.

Fig. 5: Benign looking, oval shaped, thyroid isthmal nodule with halo.

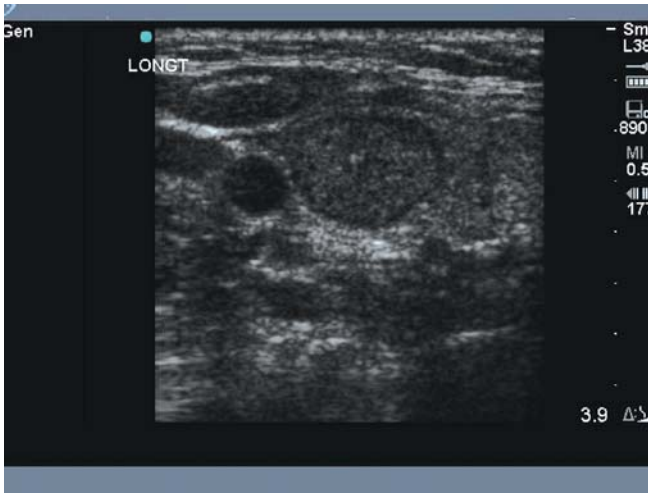

Fig. 6: Small hyper echoic thyroid nodule with a smooth sharp surface, likely a colloid nodule.

nodule, cyst, lump and lesion must be assessed in respect to its characteristics, size and change in size, shape or nature over a period of time, and decisions made about what to biopsy and when and when to refer the patient to a thyroid surgeon for 'open biopsy'. This does put a big load on practicing thyroidologists who find themselves responsible for the management of large numbers of patients.

In this country, there is an increasing interest in the use of thyroid ultrasound by general endocrinologists, particularly those with a focus on thyroid disease. Courses have been arranged, mainly through the American Thyroid Association, and more endocrinologists are purchasing ultrasound machines for use in their office or in the hospital setting. This review will focus on the current use of thyroid ultrasonography by the thyroid specialist in assessing and managing patients with various thyroid disorders, particularly nodules, multinodular goitre, differentiated thyroid cancer and thyroiditis.

The normal thyroid

With experience, normal thyroid size, texture (echoicity) and overall appearance is well understood and the abnormal more easily recognised. Thyroid size varies with age and in old age the gland atrophies somewhat and nodules and cysts are more often found. The thyroid gland descends with age to a partly or largely retrosternal position. Thyroid ultrasonography can be used to localise the thyroid in patients with suspected retrosternal goitre or ectopic thyroid and to confirm its absence in thyroid agenesis. In the latter case, the empty tissue spaces (where the thyroid lobes and isthmus should be) can be clearly seen as an interesting way to confirm hypothyroidism (Fig. 1).

Thyroid nodules and cysts

The main challenge that confronts the thyroid specialist is that, of all the nodules noted on thyroid ultrasonography, he or she must identify the approximately 10% that are cancerous. The overall risk for differentiated thyroid cancer (DTC) does not increase proportionally to the number of nodules but certain characteristics of individual nodules make the overall chance of thyroid cancer greater[6–11]. In the evaluation of thyroid nodules the following characteristics are looked for; regularity of margins, halo sign, intra nodular calcification, so-called pseudo-calcification with 'comet tail' or vascularity and evidence for invasion of the thyroid capsule and surrounding tissues. As well, nodule size and degree of echoicity (hyper-, hypo-, iso-echoic) are determined. Features which are suspicious for DTC include; hypoechoicity (Fig. 2), speckled intra nodular calcification (Fig. 2), intra nodular vascularity, an irregular margin with

Fig. 7: Single, benign looking, iso echoic thyroid nodule with a halo and regular surface that was shown to be autonomous ('hot') on technetium scan.

Fig. 8: Calcified nodule in a patient with end stage Hashimoto's thyroiditis. Peripheral ('egg shell') calcification, reflecting chronic inflammation and scarring, is seen.

absence of a halo (Fig. 3), taller than wide, size, and increase in size by >20% over a 6–12 month period. Nodules can be classified as low, medium, or high risk for malignancy on the basis of nodule characteristics found on ultrasonography[12]. An individual nodule has a greater chance of being malignant in patients who received head and neck irradiation as a child[13,14]. Thyroid cysts, even large ones (Fig. 4), are almost always benign, but the solid part of a complex solid/cystic nodule, which can be measured at regular intervals to monitor its growth, may be cancerous. The typical benign nodule is <1–2 cm in all three measurements, isoechoic, has a clear sharp halo and is round (Fig. 5). Others have the same features but are hyper echoic (Fig. 6).

Ultimately, however, the thyroidologist must make management decisions based on all of the ultrasound findings and salient clinical features such as the hardness of a gland, whether or not the nodule is functioning on technetium or 123I scan – 'warm' or 'hot' nodules (Fig. 7) are rarely malignant – and whether there is associated neck pain or hoarseness. Benign nodules are treated conservatively, i.e. by follow-up with repeated ultrasounds in the long term, thyroid function testing and FNA biopsy if necessary, although some patients eventually seek definitive treatment by total thyroidectomy simply because of the inconvenience of repeated visits and tests[15].

Thyroid calcification

Calcification of various types is commonly seen in the thyroid. While speckled micro calcification within a nodule is a suspicious sign of thyroid cancer (Fig. 2), more solid, linear or capsular ('egg shell') calcifications often accompanied by 'comet tails' are commonly seen features of chronic thyroid inflammation, especially Hashimoto's thyroiditis (Fig. 8).

Use of FNA biopsies of thyroid nodules

The use of FNA biopsy of thyroid nodules complements ultrasonography and, used together, greatly enhances the sensitivity and specificity of detection of DTC[8,9,16–18]. FNA biopsy by palpation and/or under ultrasound guidance is performed on all suspicious nodules regardless of size, dominant nodules in a multinodular goitre[5] and, where possible, under ultrasonography guidance, the solid component of a mixed solid/cystic lesion, if it has any suspicious signs. Typically, in a multinodular goitre, the biggest three or four nodules would be biopsied.

Information derived from FNA is critical to the assessment of nodules and the basis on which surgical and other therapy is planned. Unfortunately, there is some variability in reporting FNA biopsy results by the pathologists, who are not necessarily expert thyroid cytopathologists. Also, the terminology used by different pathologists varies. Generally, results are given as; 'benign' (usually a colloid nodule), haemorrhage into a cyst or nodule, papillary cancer (the most common form of differentiated thyroid cancer), follicular 'neoplasm' (since it is not possible to characterise a follicular lesion as malignant unless features of invasion are seen), 'suspicious' for papillary thyroid cancer, 'atypical' (usually on the basis of a hypercellular specimen), 'indeterminate' or 'non-diagnostic' (i.e. not enough follicular cells seen to make a definitive diagnosis). Other less common cytological diagnoses are; Hurthle cell tumours, which can be benign or malignant, medullary thyroid carcinoma and anaplastic carcinoma. Recently, attempts have been made to standardise the way in which FNA biopsies are reported[19] and that promises to make management of thyroid nodules more rational.

Multinodular goitre

Difficulties arise in the assessment of large or overlapping nodules, which is quite common in multinodular goitre. Since it is difficult to measure individual nodules, any change in size with time cannot be easily determined. Moreover, it is also difficult under these circumstances to identify hypoechoicity, intra-nodular calcification and intra-nodular vascularity. Indeed, many patients with multinodular goitres are eventually referred for thyroidectomy, simply because it is too difficult to assess their nodules.

Other patients are referred for thyroidectomy because of development of hyperthyroidism, obstructive symptoms, or, more often, patients' concerns about needing repeated ultrasound testing and FNA biopsies, usually after about 12 months. Otherwise, the management of benign nodular disease is conservative and thyroidologists can prevent many patients from having unnecessary thyroid surgery.

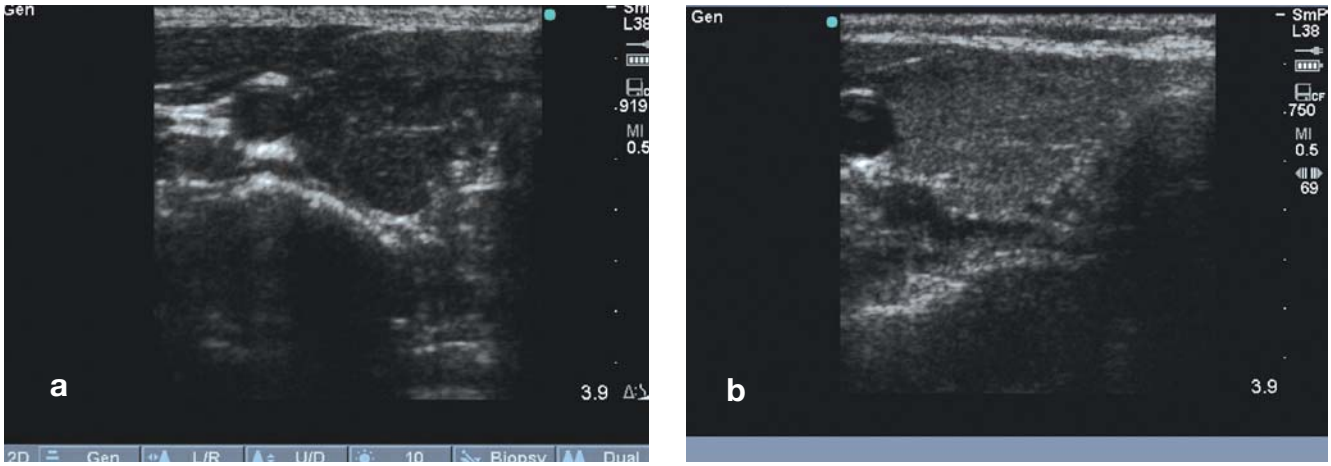

Fig. 9: Sub acute thyroiditis during the early hyperthryoid phase a), showing enlarged inflamed-looking patchy thyroid and on recovery b), showing filled in spaces and overall normal, iso echoic, appearance throughout.

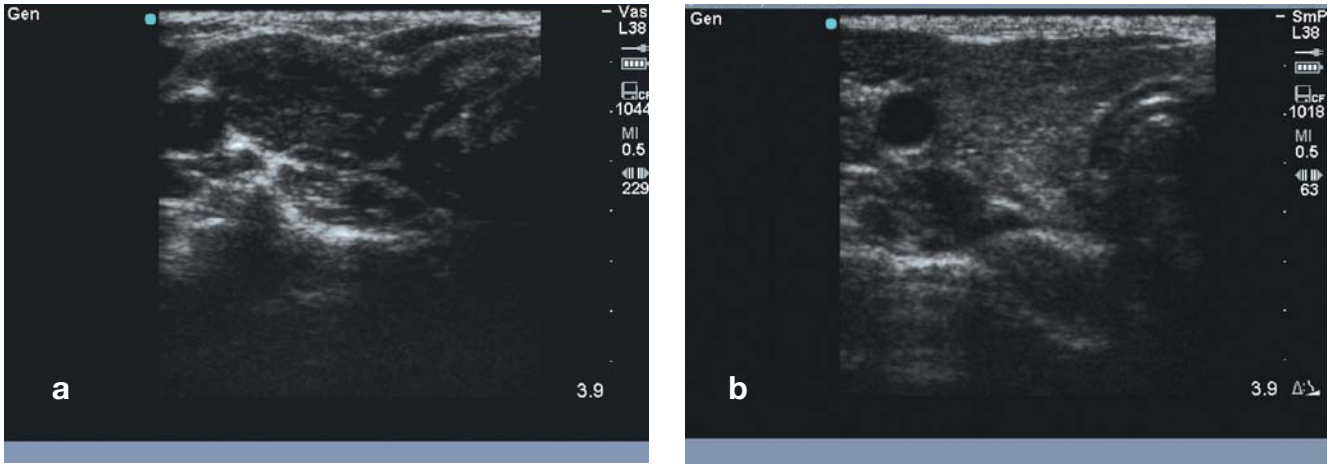

Fig. 10: Inflamed thyroid gland in a 11-year-old euthyroid female with Hashimoto's thyroiditis at the first visit when serum fT4 and TSH were normal (a) and, 13 months later when end stage (b). The thyroid now appears empty and 'moth eaten'.

Thyroiditis

The use of real-time thyroid ultrasonography allows the thyroid specialist to follow the stages of transient – sub-acute, silent and postpartum – and progressive (Hashimoto's) thyroiditis. During the early hyperthyroid stage of post viral sub acute thyroiditis the gland is 'inflamed' and vascular with scattered patches that reflect diffuse inflammatory infiltration (Fig. 9a) while later, when the thyroid cells are damaged, it appears 'empty' before recovering to normal after a few weeks (Fig. 9b). In the case of Hashimoto's thyroiditis, inflammation is progressive; following an early inflammatory stage characterised by a tender enlarged thyroid gland, lymphocytic infiltration and increased vascularity (Fig. 10a) the thyroid tissue is slowly eliminated, being replaced by scar tissue and patches of linear or encasing (egg shell) calcification to a final end-stage when the whole gland takes on a 'moth eaten' appearance (Fig. 10b). Patients can be followed with fT4 and TSH levels and ultrasonography and told precisely when they are 'end stage' and need life long thyroxine replacement therapy.

Graves' disease

In Graves' disease, the thyroid gland is hyperplastic due to the stimulatory action of TSH-receptor antibodies, diffusely enlarged (Fig. 11) and the blood supply is markedly increased. These features are easily recognised at baseline thyroid ultrasonography. With antithyroid treatment, the thyroid gland

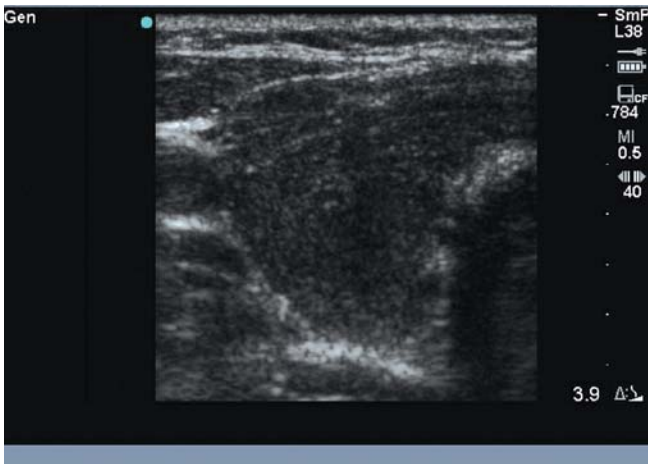

Fig. 11: Diffusely enlarged thyroid gland in a patient with untreated Graves' hyperthyroidism. The thyroid has a patchy, inflamed, appearance.

decreases in size and one characteristic of increased chance of long-term remission is a small goitre at the end of a 12 month treatment period. One can also follow changes in size, echoicity and vascularity of the the nodules that are commonly seen in older people with so-called 'nodular Graves'' disease.

Thyroid cancer

The main use of real-time thyroid ultrasonography is to assess thyroid nodules for features of DTC and, in those who

turn out to have thyroid cancer, to quantify the disease burden at the time of diagnosis based on the size of the cancer, any extension into adjacent neck tissues and the number and size of any involved lymph nodes. The baseline assessment helps the surgeon to plan therapy which is typically total thyroidectomy, removal of the central lymph nodes and any other lymph nodes which are seen to be enlarged, and treatment with 100–150 mCi of radioiodine 3–4 weeks later when the patient is hypothyroid. The use of thyroid ultrasonography to assess the initial cancer burden is of importance because it is now recognised that the first intervention is the best opportunity to cure DTC. On follow-up after thyroidectomy, ultrasound is used to identify any new thyroid tissue and enlarged neck lymph nodes. These findings are correlated with serum levels of thyroglobulin which in the absence of functional thyroid cells, is undetectable.

Because there is an increased prevalence of differentiated thyroid cancer in patients with Hashimoto's thyroiditis[20], nodules are of a particular importance in this common group of patients. The prevalence of thyroid cancer is not increased in patients with Graves' disease or transient thyroiditis.

Hyperparathyroidism

Endocrinologists, who are largely self-taught, find it more difficult to assess lymph nodes and parathyroid glands. We are good inside the thyroid gland, but still learning outside. Patients with suspected hyperparathyroidism display increased serum and urine calcium, increased serum parathyroid hormone and normal serum vitamin D. The diagnosis is confirmed by correlating ultrasound findings with nuclear imaging. The ability to localise the presumed parathyroid adenoma allows the surgeon to plan limited neck surgery, which is attractive to the patients[21]. Parathyroid adenomas are usually single, located in one of the four parathyroid glands, are about the same size as lymph nodes, are round and hypoechoic and situated behind one or other pole of the thyroid. Experience is needed to identify parathyroid adenomas, especially when they are not in their expected position behind the thyroid. It is not clear whether normal parathyroid glands can be visualised by neck ultrasonography, so its use in the diagnosis of primary and secondary (post thyroidectomy or radioiodine ablation) hypoparathyroidism is speculative.

Research applications of thyroid ultrasonography

The author's primary research interest is in thyroid-associated ophthalmopathy, or 'poppy eyes'[22–24]. Large thyroid size, as a measure of the severity of the 'thyroiditis', may be a risk factor for the development of eye changes. We are presently measuring isthmus diameter, as a surrogate for overall thyroid volume, in patients with newly-diagnosed hyperthyroidism and eye signs at baseline or on follow-up. There will be other research applications for the thyroidologist with research interests as well.

Some tricks of the trade

It is often said by thyroidologists who use real-time ultrasonography that reports from imaging departments are often inaccurate or unhelpful. With experience, the thyroid specialist becomes the 'expert'. Some things that he/she finds that might be missed, or not recognised as providing helpful clinical information by those with less experience, include; lateral or oblique views of thyroidal blood vessels which are misreported as 'cysts', the various stages of sub-acute thyroiditis (as described above), return to normal size of Graves' thyroid after anti-thyroid drug treatment, areas of lymphoid infiltration or lymphoid nodules in Graves' or Hashimoto's thyroid that are misinterpreted as 'cysts' or 'nodules' and the end stage of long standing Hashimoto's thyroiditis which is often reported as showing nodules that might even be considered 'suspicious' if associated with micro calcification.

Summary

Because the use of thyroid real-time ultrasonography as a routine diagnostic tool for patients with various thyroid and parathyroid disorders is new, its role is still being assessed. It is likely that additional subtle abnormalities will be recognised in cancerous thyroid nodules, thereby helping to differentiate the 10% of nodules that are malignant from the 90% that are not in an adult population in whom as many as 60% will have one or more nodules or cysts on ultrasonography. Subtle thyroid abnormalities will also be noted in patients with transient or progressive thyroiditis that may help plan early intervention and long term management. There will also be new ways to assess whether treatment with antithyroid medication would be indicated in patients with Graves' hyperthyroidism, or whether initial treatment with radioactive iodine or by thyroidectomy might be more logical. Finally, as a thyroidologist interested in 'Graves' ophthalmopathy', use of ultrasonography to differentiate eye muscle enlargement from orbital connective tissue inflammation, is, with experience, possible and may offer a new clinical aid for the early diagnosis and even prevention of the eye disorder. There will also be many research applications of thyroid and neck ultrasonography.

References

1 Vander JB, Gaston EA, Dawber TR. The significance of non toxic thyroid nodules. Final report of a 15-year study of the incidence of thyroid malignancy. *Ann Intern Med* 1968; 69: 537–40.

2 Ezzat S, Sarti DA, Cain DR, Braunstein GD. Thyroid incidentalomas. Prevalence by palpation and ultrasonography. *Arch Intern Med* 1994; 154: 1838–40.

3 Brander A, Viikinkoski P, Nickels J, Kivisaari L. Thyroid gland: US screening in a random adult population. *Radiology* 1991; 181: 683–87.

4 Larson SD, Jackson LN, Riall TS, Uchida T, Thomas RP, Qiu S, Evers BM Increased incidence of well-differentiated thyroid cancer associated with Hashimoto thyroiditis and the role of the PI3k/Akt pathway. *J Am Coll Surg*. 2007; 204: 764–73.

5 Frates MC, Benson CB, Doubilet PM, Kunreuther E, Contreras M, Cibas ES, *et al.* Prevalence and distribution of carcinoma in patients with solitary and multiple thyroid nodules on sonography. *J Clin Endocrinol Metab* 2006; 91: 3411–17.

6 Tae HJ, Lim DJ, Baek KH, *et al.* Diagnostic value of ultrasonography to distinguish between benign and malignant lesions in the management of thyroid nodules. *Thyroid* 2007; 17: 461–66.

7 American Association of Clinical endocrinologists and Associazione Medici Endocrinologi medical guidelines for clinical practice for the diagnosis and management of thyroid nodules. *Endocr Pract* 2006; 12: 63–102.

8 Cooper DS, Doherty GM, Haugen BR *et al.* Management guidelines for patients with thyroid nodules and differentiated thyroid cancer. *Thyroid* 2006; 16: 109–42.

9 Kim EK, Park CS, Chung WY, *et al*. New sonographic criteria for recommending fine needle aspiration biopsy of non palpable solid nodules of the thyroid. *AJR Am J Roentgenol* 2002; 178: 687–91.

10 Waters DA, Ahuja AT, Evans RM, *et al.* Role of ultrasound in the management of thyroid nodules. *Am J Surg* 164: 654–57.

11 Nam-Goong IS, Kim HY, Gong G, Lee HK, Hong SJ, Kim WB, Shong YK. Ultrasonography-guided fine-needle aspiration of thyroid incidentaloma: correlation with pathological findings. *Clin Endocrinol (Oxf)* 2004; 60: 21–8.

12 Kioke E, Noguchi S, Yamashita H, *et al.* Ultrasonographic characteristics of thyroid nodules: prediction of malignancy. *Arch Surg* 2001; 136: 334–37.

13 Zheng R, Dahlstrom KR, Wei Q, Sturgis EM Gamma radiation-induced apoptosis, G2 delay, and the risk of salivary and thyroid carcinomas – a preliminary report. *Head Neck* 2004; 26: 612–18.

14 Nikiforov YE Radiation-induced thyroid cancer: what we have learned from Chernobyl. *Endocr Pathol* 2006; 17: 307–17.

15 Hermus RA, Huysmans DA, Treatment of benign nodular thyroid disease. *New Engl J Med* 1998; 338: 1438–47.

16 Carmeci C, Jeffrey RB, McDougall IR, Nowels KW, Weigel RJ. Ultrasound-guided fine-needle aspiration biopsy of thyroid masses. *Thyroid* 1998; 8: 283–9.

17 Frasoldati A, Pesenti M, Gallo M, Caroggio A, Salvo D, Valcavi R Diagnosis of neck recurrences in patients with differentiated thyroid carcinoma. *Cancer* 2003; 97: 90–6.

18 Livolski V. Thyroid nodule FNA and frozen section: partners or adversaries. Proceedings of the *AAES Annual Meeting,* 2007 Tuscon AZ, Apr 29–May 1, (abstract).

19 Ogilvie JB, Piatigorsky EJ, Clark OH. Current status of fine needle aspiration for thyroid nodules. *Adv Surg* 2006; 40: 223–38.

20 Laurberg P. Remission of Graves' disease during anti-thyroid drug therapy. Time to reconsider the mechanism? *Eur J Endocrinol* 2006; 155: 783–86. Review.

21 Pisanu A, Piu S, Cois A, Uccheddu A. Coexisting Hashimoto's thyroiditis with differentiated thyroid cancer and benign thyroid diseases: indications for thyroidectomy. *Chir Ital* 2003; 55: 365–72.

22 Simonella G, Massaccesi E, De Marzi C, Staffolani P, Falco A, Morosini P. Minimally invasive surgery versus bilateral neck exploration for primary hyperparathyroidism: controlled prospective study. Role of intraoperative rapid parathyroid hormone assay and radiological preoperative detection of adenomas. *Recenti Prog Med* 2005; 96: 483–87

23 Tani J, Wall JR. Analysis – Can the development of thyroid-associated ophthalmopathy be explained by autoimmunity against eye muscle antigens? *Can Med Assoc J* 2006; 17: 239–41.

24 Gopinath B, Musselman R, Adams C, Tani J, Beard N, Wall JR. Study of serum antibodies against three eye muscle antigens and the connective tissue antigen collagen XIII in patients with Graves' disease with and without ophthalmopathy – correlation with clinical features. *Thyroid* 2006; 16: 967–74.

25 Tani J, Gopinath B, Nuygen B, Wall JR. Immunological mechanisms for the eye muscle and orbital connective tissue reactions of thyroid-associated ophthalmopathy. *Expert Reviews in Clin Immunol* 2007; 3: 299–311.

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The 'elephant trunk' sign and prenatal diagnosis of cloacal exstrophy

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Fig. 1: Transverse view of omphalocoele at 13 weeks four days gestation.

Fig. 2: Sagittal view of omphalocoele at 13 weeks four days gestation.

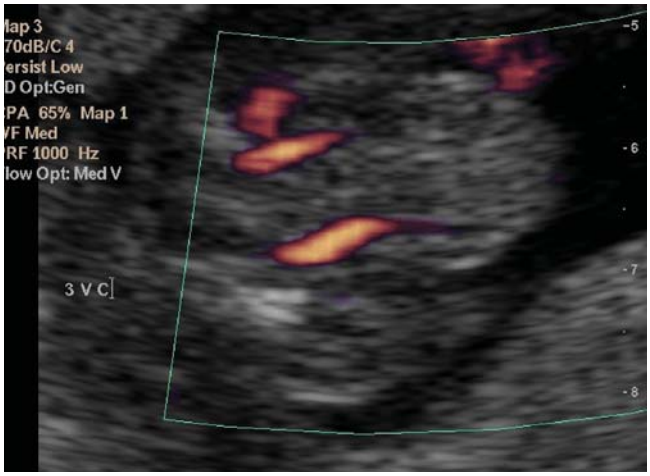

Fig. 3: Omphalocoele and absent bladder at 16 weeks three days gestation.

Introduction

The ultrasound diagnosis of fetal anterior abdominal wall defects is generally straightforward, however, unusual appearances may signify a more complex underlying anomaly. Multiple examinations of the fetus may be required to monitor development and to visualise normal physiological functions such as bladder filling. This case report describes how an abdominal wall defect detected in the first trimester necessitated a series of scans extending into the second trimester, in order to make a definitive prenatal diagnosis of cloacal exstrophy.

Case report

A 31-year-old woman in her second pregnancy was referred to our centre for further assessment following detection of a fetal omphalocoele at a nuchal translucency (NT) scan performed at 11 weeks four days gestation. The NT measured 1.3 mm and when combined with biochemistry gave an adjusted Down syndrome risk of 1:491 and adjusted trisomy 13 or 18 risk of 1:16 755. The patient was reviewed at 13 weeks four days gestation and a transvaginal scan was performed. There was evidence of an echogenic anterior wall mass in association with the cord origin, measuring 12 x 11 x 8 mm. It extended towards, but stopped short of the perineum. The contents appeared to be entirely bowel and the liver appeared to be intra-abdominal. The mass was well circumscribed and appeared encapsulated, consistent with an omphalocoele (Figs. 1 and 2) Transabdominal chorionic villus sampling (CVS) was performed and demonstrated a normal male (46 XY) karyotype.

The patient was seen in our department for a detailed morphology scan at 16 weeks three days, which demonstrated an omphalocoele with a superior cord insertion, containing bowel. The liver, gallbladder and stomach appeared to be normally sited. It was difficult to visualise the region between the omphalocoele and the perineum and normal bladder and genitalia could not be adequately identified (Fig. 3). We also noted a structure of similar echotexture to fetal bowel, that appeared to be protruding from the omphalocoele and was of uncertain significance (Fig. 4).

A further ultrasound performed at 17 weeks five days

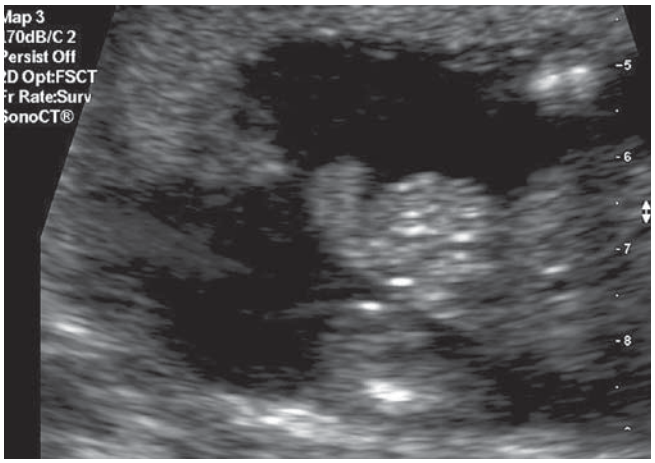

Fig. 4: Omphalocoele with unusual appearance at 16 weeks three days gestation.

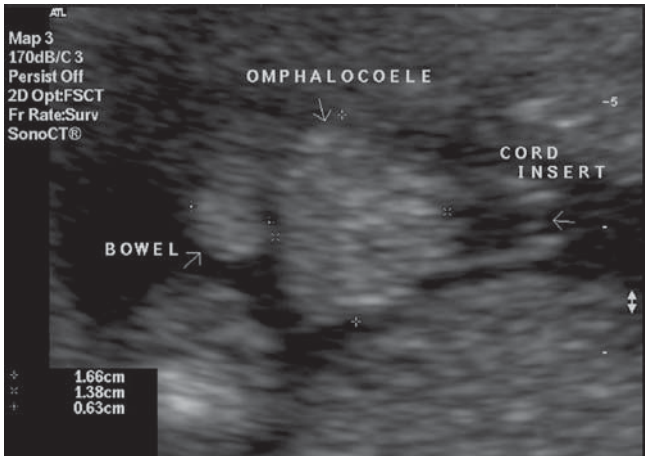

Fig. 5: Coronal view of superior cord insertion at 17 weeks five days gestation.

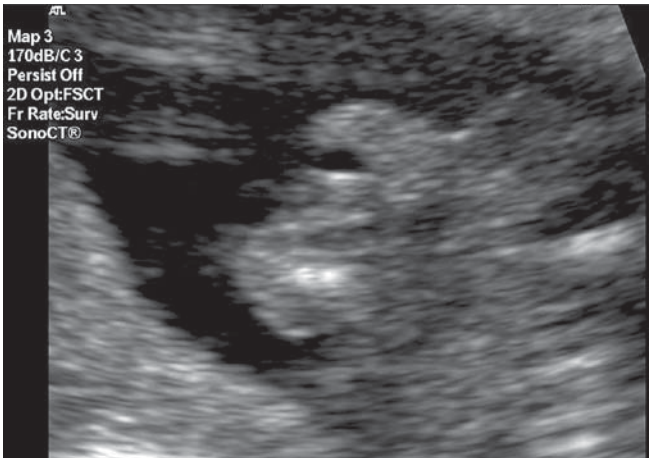

Fig. 6: Elephant trunk sign.

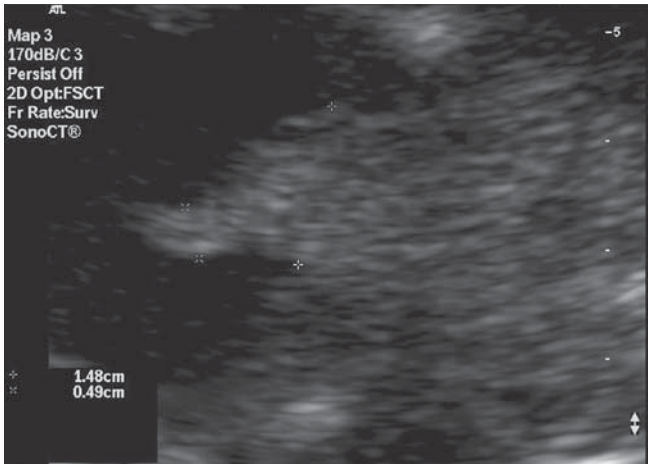

Fig. 7: Elephant trunk sign.

gestation demonstrated features highly suggestive of cloacal exstrophy. The bladder could not be visualised and there was a large infraumbilical exomphalos. The elongated protrusion seen previously was felt to correspond to the 'elephant trunk' sign. This sonographic appearance represents the prolapsed terminal ileum and was first reported by Hamada, *et al.* in 1999[1,2] (Figs. 5–7). The remainder of the scan, particularly the spine and lower limbs, appeared normal. The patient was counselled regarding the findings, likely diagnosis and outcome. She requested termination of pregnancy, which was performed with Cervagem vaginal pessaries.

The patient gave consent for post-mortem examination of the fetus, which confirmed cloacal exstrophy with omphalocoele and imperforate anus, most likely representing omphalocoele-exstrophy-imperforate anus-spinal defects (OEIS) complex[3].

Discussion

Cloacal exstrophy is a rare, complex anomaly, occurring in approximately 1/200 000 births with a reported female sex preponderance[4]. It is caused by a defect in the formation of the urogenital septum, which results in the persistence of a common cloaca receiving ureters, ileum and a rudimentary hindgut, in association with a wide range of urogenital tract anomalies, spinal dysraphism and imperforate anus. Over 85% also have an omphalocoele[5] and most patients have a single umbilical artery.

This case demonstrates how an omphalocoele with unusual sonographic features may represent a more serious underlying defect with a less favourable prognosis. Prenatal diagnostic criteria for cloacal exstrophy have been devised, and categorised as major and minor, based on frequency of occurrence rather than severity[6] (Table 1). In addition to these criteria, another ultrasonographic feature has previously been reported. A segment of soft tissue protruding from the infraumbilical anterior abdominal wall resembling the trunk of an elephant has been shown to represent the

Table 1: (Modified from Austin, *et al.* 1986) Prenatal ultrasound diagnostic criteria in cloacal exstrophy.

Major criteria
Absence of bladder
Large midline anterior wall defect with cord insertion superiorly or cystic anterior structure (persistent cloacal membrane)
Omphalocoele
Myelomeningocoele
Minor criteria
Abnormality of lower extremities
Renal tract anomalies
Ascites
Widened pubic arches
Narrow thorax
Hydrocephalus
Single umbilical artery

prolapsed terminal ileum[1,2]. Indeed, it was this elephant trunk feature, in conjunction with non-visualisation of the bladder and the finding of a large infraumbilical anterior abdominal wall defect, which assisted us in making the diagnosis of cloacal exstrophy.

Survival rates with cloacal exstrophy have been reported to be as high as 90%[7], due mainly to improvements in neonatalogy, anaesthesia, nutrition, antibiotics and surgical reconstructive techniques. However, there are still concerns regarding quality of life and psychosocial issues[6], particularly in regard to gender reassignment in patients who are genetically male but who lack phallic tissue from which to build a satisfactory penis[8].

In conclusion, this case highlights the importance of paying attention to detail when scanning fetal abdominal wall defects, such as the position of the cord insertion in relation to the defect and the presence or absence of a bladder. Accurate prenatal diagnosis of cloacal exstrophy ensures that patients receive appropriate information and counselling, and also provides an opportunity for multidisciplinary management strategies to be implemented.

References

1 Hamada H, Takano K, Shiina H, Sakai T, Sohda S, Kubo T. New ultrasonography criterion for the prenatal diagnosis of cloacal exstrophy: elephant trunk-like image. *J Urol* 1999; 162: 2123–24.

2 Monica MD, Nazzaro A, Lonardo F, Ferrara G, Di Blasi A, Scarano G. Prenatal ultrasound diagnosis of cloacal exstrophy associated with myelocystocele complex by the 'elephant trunk-like' image and review of the literature. *Prenat Diagn* 2005; 25: 394–97.

3 Carey JC, Greenbaum B, Hall BD. The OEIS complex (omphalocele, exstrophy, imperforate anus, spinal defects). *Birth Defects* Orig Artic Ser XIV 1978; 6B: 253–63.

4 Martinez-Frias ML, Bermejo E, Rodriguez-Pinilla E, Frias JL. Exstrophy of the cloaca and exstrophy of the bladder: two different expressions of a primary developmental field defect. *Am J Genet* 2001; 99: 261–69.

5 Gearhart JP, Jeffs RD. Exstrophy-epispadias complex and bladder anomalies. In campbell's Urology (7th ed) 1998, Walsh PC, Retnik AB, Vaughan ED, Wein AJ (editors). Philadelphia; WB Saunders. pp 1939–90.

6 Austin PF, Homsy YL, Gearhart JP, Porter K, Guidi C, Madesen K, Maizels M. The prenatal diagnosis of cloacal exstrophy. *J Urol* 1998; 160: 1179–81.

7 Hurwitz RS, Manzoni GM, Ransley PG, Stephens FD. Cloacal exstrophy: A report of 34 cases. *J Urol* 1987; 138: 1060–64.

8 Lund DP, Hendren WH. Cloacal exstrophy: A 25-year experience with 50 cases. *J Pediatr Surg* 2001; 36: 68–75.

B2 Guidelines for Disinfection of Intracavitary Transducers

May 1996, Reaffirmed September 1999, Revised July 2005, September 2007

Every patient must be regarded as a potential source of infection and appropriate precautions should be taken to prevent cross-infection between patient and operator. These are known as 'Universal Precautions' and are promoted throughout all health care institutions. Particularly important is the washing of hands both before and after direct patient contact[1]. Other precautions will include use of personal protective equipment (PPE) where appropriate and correct handling and disposal of waste and maintenance of a clean working environment.

Potential sources of infection associated with vaginal ultrasound scanning include those organisms transmitted by blood and genital secretions such as HIV, HBV, HCV, Cytomegalovirus, *Neisseria gonorrhoea*, *Chlamydia trachomatis*, *Trichomonas vaginalis*[1] and Human Papilloma Virus. It should be remembered that some organisms, including some viruses, can remain infectious for days outside the body, particularly if kept moist in blood or serum.

All sterilisation/disinfection represents a statistical reduction in the number of microbes present on a surface. Meticulous cleaning of the instrument is the essential key to an initial reduction of the microbial/organic load by at least 99%[2].

The following protocol is recommended for the cleaning and preparing of intracavitary transducers between patients. These will include transvaginal, transrectal, transoesophageal and endoscopic transducers. The principles are the same for any transducers that may come into contact with body secretions.

1 Cleaning

After removing the cover from the transducer, all gel and any extraneous material should be removed from the transducer, preferably under running water. The transducer should then be cleaned with soap and water (dishwashing liquid may be used), rinsed thoroughly and dried with a paper towel.

2 Disinfection

The cleaning of the transducer is the main disinfection process. However, high-level disinfection with a chemical agent is necessary for further statistical reduction in the number of infective agents on the transducer, particularly because of possible rupture of the transducer cover. A high-level instrument grade disinfectant should be used for this purpose. It is recommended that the manufacturer of your ultrasound equipment be consulted before using a specific chemical agent on a transducer.

Currently the only available high-level instrument grade disinfectant is glutaraldehyde, which requires special facilities for safe handling. Where the use of glutaraldehyde is precluded, and other high-level instrument grade disinfectants are not available, hypochlorite solution or ortho-phthalaldehyde solution might be used.

Recommendations for the use of disinfectants:

a) Glutaraldehyde 2% Soak the transducer in the glutaraldehyde for 20 minutes followed by rinsing under running tap water then drying.

Note: Buffered glutaraldehyde as a cold disinfectant has a broad spectrum of activity with rapid microbiocidal action. It is non-corrosive to most materials, including metals and rubber. 'Aidal Plus' is a satisfactory glutaraldehyde preparation and is available from Whiteley Industries Pty Ltd, PO Box 785, Rosebery, NSW 2018 (tel: 61 2 9700 9799). Because of potential irritant effects of glutaraldehyde extreme care must be taken with its use, and manufacturers' instructions on usage should be followed strictly. Spent glutaraldehyde solutions disposed of to the sewer should be flushed with copious amounts of water[3].

b) *Sodium hypochlorite diluted to 500 ppm.* Soak the transducer in the sodium hypochlorite for two minutes followed by rinsing under running tap water and drying.

Note: Hypochlorite solution requires changing daily as it deteriorates rapidly. It can be made up with 50 ml of 'Milton' solution (1% sodium hypochlorite) in one litre of tap water. Hypochlorites have bactericidal, fungicidal and virucidal activity. Their decomposition is accelerated by the presence of metals, sunlight and heat. Some water supplies, particularly in remote areas, may contain oxidisable (e.g. organic) materials that could reduce the amount of free chlorine available. If the quality of the water supply is uncertain the free chlorine should be measured with a high range test kit such as those manufactured by Hach, Lovibond or Palm, or deionised water should be used.

c) *Ortho-phthalaldehyde 0.55%.* Soak the transducer in the solution for a minimum of 10 minutes at 20 degrees Celsius (20°C), or higher, followed by rinsing under running tap water then drying. Ortho-phthalaldehyde has a broad spectrum of activity with rapid microbiocidal effects, with the exception of some bacterial endospores; it is non-corrosive to most materials including metals and rubber. Cidex OPA is a satisfactory preparation available from Johnson and Johnson Medical Pty Limited, 1–5 Khartoum Road, North Ryde NSW 2113, Australia. Usual precautions must be taken with its use with regard to protection from irritant effects. Regular testing needs to be performed to ensure a minimal effective concentration with the use of test strips. Spent solutions disposed of to the sewer should be flushed with copious amounts of water.

Other products may be used to disinfect intracavity transducers provided that they have TGA approval.

3 Transducer covers

The transducer should be covered before intracavitary insertion with an appropriate barrier where thickness is at least 38 microns. This may include plastic surgical drapes, other purpose specific probe covers or surgical gloves. Prior to the use of a transducer cover, specific enquiry should be directed towards latex sensitivity. Covering the transducer without prior cleaning and disinfecting is inadequate because there is an incidence of perforation of any transducer cover.

4 Appropriate technique

The operator must wear a disposable (non-sterile) glove on the hand used during passage of the transducer. Care must be taken to ensure that contaminated gloves do not contact the ultrasound machine's control panel or exposed transducer cable. The transducer cover should be removed and disposed of carefully to prevent contamination of surroundings by bodily fluids/secretions. At the completion of the procedure, gloves should be removed and hands washed thoroughly with soap and water.

Important notes

i) Compliance with the National Guidelines on Disinfecting and Sterilising Pre-useable Medical and Surgical Instruments – Australian Standard (AS) 4187 – is recommended. The ASUM guidelines should be read in conjunction with that Standard, which is available from Standards Australia.

ii) Infection control guidelines will only be useful if they are followed and form part of an overall approach to Universal Precautions in minimising infection risk. The ASUM guidelines are provided as a mechanism to assist you in the development of appropriate risk management compliance processes.

iii) The use of sodium hypochlorite is not recognised by the NHMRC.

iv) Gel used can be a potential source of infection. For some procedures the use of sterile gel should be considered.

References

1 Garland SM and de Crespigny L. Prevention of infection in obstetric and gynaecological ultrasound practice. *Ultrasound Obstet. Gynaecol* 1996; 7: 1–4.

2 American Institute of Ultrasound in Medicine. Report for Cleaning and Preparing Endocavity Ultrasound Transducers Between Patients *AIUM Reporter* 1995; 11: 7.

3 National Industrial Chemicals Notification and Assessment Scheme (1994). Priority Existing Chemical No.3. glutaraldehyde. Full Public Report. ISBN 0 644 34875 1. Australian Government Publishing Service, Canberra.

Book reviews

Echocardiography – The Normal Examination and Echocardiographic Measurements
Author Bonita Anderson
Publisher Blackwell Publishing
ISBN 0646391399

Bonita Anderson is a well-known figure in echocardiography and is highly regarded for her expertise as an exponent and teacher. This impressive second edition of her book improves on the tradition set by the first edition of 2000 by providing a concise yet comprehensive text on the theory and practice of echocardiography today.

This book uniquely fulfils a great need within the echocardiographic community for resource material which focuses on the basic, although not simple, theoretical and practical aspects of the contemporary echocardiographic examination.

This carefully and thoroughly crafted work is obviously a lot more than a handbook. In 15 chapters and 337 pages, Bonita Anderson has developed on the first text by updating many areas. Notably, she has added excellent sections on 2D and Doppler artefacts, Doppler tissue imaging and strain and strain rate imaging.

This edition has a new, vastly improved look, featuring an attractive hard cover. Many quality colour figures and illustrations are placed liberally throughout the text.

A strong appeal is the generous use of tables and figures as well as the provision of an exhaustive set of normal values for the many measurements that can be made. The appendices at the end of the book are invaluable in this regard. Potentially confusing equations are methodically outlined and carefully explained. A detailed reference list after each chapter points to more information if required.

For a book of this type, there is no equal. In this excellent publication, Bonita Anderson displays her supreme expertise as an educator and her capacity for thorough and careful work. Sonographers and physicians who work in this discipline should familiarise themselves with the many concepts expounded in this book, even if they will not be expected to employ them all in each routine examination.

I strongly recommend this book to all who practice echocardiography, the novice and the experienced practitioner alike, as a highly effective instructional reference text. For those who want to purchase just one book on echocardiography, there is no doubt that his book should be it.

Dr Christopher Choong
Senior Staff Cardiologist
Royal North Shore Hospital

The Fetus in Three Dimensions
Authors Asim Kurjak, Guillermo Azumendi
Publisher Informer UK Ltd
ISBN-10: 0415375231

In the past 50 years, gray scale imaging, real-time and Doppler ultrasound were the important technological breakthroughs in ultrasound. Today 3D and 4D ultrasound is the new frontier. The literature is now dominated by results of innovative clinical investigations and a new collection of normal values and tables is available. It is truly an international endeavour to define the world of 3D and 4D sonography in obstetrics and gynaecology. The authors of this book and its contributors have been leaders in this field.

The content is very comprehensive as the book consists of 27 chapters. It starts of with a good chapter on how to use the 3D technology to the neophite.

Chapters 2–9 deal with the basic embryology and anatomy, normal and abnormal developments in the first trimester of pregnancy. The additional information possibly obtainable using 3D sonography in the detection of fetal abnormality is illustrated from chapters 10–18.

Chapter by chapter the book deals with the 3D findings in major anatomical systems. Chapter 19 is devoted to assessment of fetal well being in an IUGR fetus.

The area of fetal behaviour is very eloquently presented in chapters 21–26. It concludes with the final chapter on the safety of 3D and 4D sonography.

It is a well-written text book, easy to read with appropriate illustrations. It contains adequate basic anatomy, physiology, and appropriate up to date data to direct the readers to the current and relevant clinical use of three dimensional and four dimensional sonography in obstetrics.

This is a very useful, comprehensive text book on the clinical relevance of three dimensional and four dimensional sonography in obstetrics. It is of great value to all sonologists who care for obstetric patients.

Dr Andrew Ngu
Obstetrician
East Melbourne Ultrasound

Scanning the journals

Cognitive function in young adults following intrauterine growth restriction with abnormal aortic blood flow

Tideman E, *et al. Ultrasound Obstet Gynaecol* 2007; 29; 614–18.

The group working at Lund University in Sweden are well known for their work on fetal vascular flows in IUGR. This however is their first follow up on intellectual function 18 years after an *in-utero* diagnosis of IUGR and abnormal aortic flows. They compared 19 IUGR patients' cognition with a control group of 23 patients of the same age who had had normal blood flow and weights. Using standard psychological tests they clearly demonstrated significantly lower cognition at 18 years in the IUGR group, which is yet another reason for us to be on the look out for growth restriction *in-utero*.

Population-based study of antenatal detection of congenital heart disease by ultrasound examination

Chew C, *et al. Ultrasound Obstet Gynaecol* 2007; 29: 619–24.

This Victorian study between 1993–2002 of 4897 cases of congenital heart disease (CHD) collected from the Victorian Perinatal Data Collection Unit and Birth Defects Registry is of enormous interest.

They found that the overall antenatal detection rate of CHD was 52.8%. As we might expect, hypoplastic left heart was the most diagnosed antenatally with only15% not being diagnosed. The lowest pick up antenatally was for simple transposition of the great arteries where 83% were missed.

At a time when a body of opinion is to make a cardiac anomaly diagnosis at the NT scan, it is a concern that even at 16–22 weeks, we only pick up just over half of all cardiac anomalies. It could be argued that we need to improve cardiac diagnosis in the second trimester before pursuing the holy grail of first trimester diagnosis. ASUM has a major role in such skills development.

Diameter of the normal fetal thymus on ultrasound

Cho JY, *et al. Ultrasound Obstet Gynaecol* 2007; 29: 634–38.

This will be a good article to refer to for normal data on the transverse diameter of the fetal thymus from 19–38 weeks. Thymic hypoplasia can occur with 22q11.2 deletion as well as Ellis-van Creveld syndrome, chondrodysplasia punctata, alcohol exposure and severe immunodeficiency, so the prediction of impaired immunologic function postnatally might be possible. They were able to measure the ***transverse*** diameter in 94% of their 376 fetuses. The diameter of the thymus in mm is equal to the AC in cm in the second trimester. We don't measure the thymus routinely of course but this article assures us if we ever have to, the transverse diameter is easy to measure. The next article suggests another reason for checking it too.

Fetal thymus size as a predictor of chorioamnionitis in women with preterm premature rupture of membranes

Yinon Y, *et al. Ultrasound Obstet Gynaecol* 2007; 29: 639–43.

This study of only 13 patients suggests that finding a small fetal thymus may (measuring the perimeter) be useful in the early diagnosis of PPROM and chorioamnionitis. Using the previous papers and normative data a nice study could be done on a larger sample size to investigate the potential of thymic measurements.

Sonographic findings of groin mass

Yang DM, *et al. J Ultrasound Med* 2007; 26: 605–14.

Radiologists and sonographers need to be aware of the variety of groin lesions that are detectable by ultrasound. This well illustrated review article from Korea will serve as a reminder. Even though biopsy may be needed for tissue diagnosis, sonography can be useful although CT is more specific for lipomas, haematomas and abscesses.

Color Doppler imaging and 3-dimensional sonographic findings of urinary bladder leiomyoma

Sherer DM, *et al. J Ultrasound Med* 2007; 26: 667–70.

Leiomyomas of the bladder are more common in women than men. This is the first description of the 3D sonographic findings of a urinary bladder leiomyoma. The prevalence of bladder tumours in postmenopausal patients is said to be 1.07%. Sooner or later we may expect to see one and this case of a non-gynaecologic pelvic abnormality, although rare, shows that 3D ultrasound can be helpful.

What do clinical users know regarding safety of ultrasound during pregnancy?

Sleiner E, *et al. J Ultrasound Med* 2007; 26: 319–25.

The results of this American study of 130 ultrasound users are a worry. The authors conclude that ultrasound end users are poorly informed regarding safety issues during pregnancy. The terms 'thermal index' and 'mechanical index' were unknown to the majority of responders! It would be interesting to see this study repeated in Australia. There is always a need to keep in mind the possible bioeffects of ultrasound and to pay attention to the on-screen information on acoustic output indices.

Sonographic femur length to trunk cross-area ration: prediction of fetal outcome in 30 cases in which micromelia was suspected

Arahori H, ***et al***. *J Obstet Gynaecol Res* 2007; 33(Mo.3): 248–53.

This retrospective Japanese study found in 30 cases with a presumptive diagnosis of micromelia, that the ratio of femur length / trunk cross area (FL/FTA) was a useful parameter to help differentiate fetuses with non-lethal skeletal dysplasias from normal fetuses with either constitutionally short limbs or IUGR. The FL/FTA ratio is significantly lower in non-lethal skeletal dysplasia than in the others. But ascites and hepatomegaly for example would cause the ratio to be lower so as a screening test it is not useful.

The Gleaner

Abstracts 37th Annual Scientific Meeting Cairns, 2007

201 Tissue engineered vascular and urogenital grafts

Julie H Campbell, University of Queensland, Australia

Objectives

To tissue engineer autologous grafts for smooth muscle-walled organs using the peritoneal cavity as a bioreactor.

Insertion of tubing of various lengths and diameters into the peritoneal cavity of dogs, rabbits, rats or mice induces the formation of a tissue capsule over 2–3 weeks. The capsule consists of myofibroblasts and the collagen matrix they produce covered by a single layer of mesothelial cells. The myofibroblasts are of bone marrow (monocyte/macrophage) origin as demonstrated by *in situ* hybridisation studies in irradiated chimeric mice and FACS analysis of capsules produced in c-fims EGFP mice.

Tubes of tissue harvested from the dog are 1.5 mm thick with bursting strength in excess of 2500 mmHg and suture holding strength of 11.5 Newtons. The tissue has been successfully grafted by end-to-end anastomoses into the femoral artery of the same animal in whose peritoneal cavity it was grown, replacing segments of natural artery. The grafts are patent for at least 6 months, and the tissue doubles in thickness due to development of an adventitia containing vasa vasora. Elastic fibres form within the media and the myofibroblasts differentiate further into smooth muscle-like cells. These cells respond to vasoconstrictor agents and undergo endothelium-dependent relaxation in response to acetylcholine.

Other smooth muscle organ grafts such as bladder, vas deferens and uterus have been similarly grown in the peritoneal cavity of rats and rabbits using appropriately shaped moulds. Patency and function after autologous grafting to replace an excised segment of the appropriate organ is at least 14 months.

202 Liver abscesses: imaging and treatment guided by ultrasound

Torben Lorentzen, Herlev Hospital, Denmark

Objective

To review clinical and imaging aspects of liver abscesses (LA) with focus on ultrasound imaging and ultrasound guided intervention for diagnosing and treatment.

Abstract

The major forms of LA, classified by etiology, are as follows: Pyogenic abscess, which is most often polymicrobial, accounts for 80% of hepatic abscesses cases in the United States. Amoebic abscess due to Entamoeba histolytica accounts for 10% of cases. Fungal abscess, most often due to Candida species, accounts for less than 10% of cases. Furthermore, Hydatid disease and Schistsomiasis can cause LA.

Biliary tract disease is the most common source of pyogenic LA. Obstruction of bile flow allows for bacterial proliferation. Biliary stone disease, obstructive malignancy affecting the biliary tree, stricture, and congenital diseases are common inciting conditions. With a biliary source, abscesses usually are multiple, unless they are associated with surgical interventions or indwelling biliary stents. In these instances, solitary lesions can be seen. Other entryways to the liver are via the portal vein (pyophlebitis) in patients with appendicitis or diverticulitis. Finally, an arterial entryway is seen in patients with osteomyelitis or endocarditis.

CT evaluation with contrast and ultrasonography remain the radiologic modalities of choice in diagnosing liver abscesses. However, the final diagnosis is established with a ultrasound (or CT) guided puncture confirming pus.

Treatment with a combination of iv antibiotics and percutaneous drainage (needle drainage or catheter drainage) carries a high success rate.

Typically diagnostic and interventional images (ultrasound and CT), case stories, and differential diagnoses will be presented.

203 Upper limb intervention

Eugene G McNally, Nuffield Orthopaedic Centre, United Kingdom

Ultrasound is an ideal method for guiding interventional musculoskeletal procedures. This presentation will discuss the indications, rationalisation and technique of the common interventional musculoskeletal procedures in the upper limb. Technical points will include target identification, puncture point location and tips for aspiration and injection. Procedures at the shoulder will include subacromial subdeltoid bursal injection, management of calcific tendonopathy by barbotage, guided joint injection including acromioclavicular and glenohumeral joint. In the elbow joint injection including ultrasound arthrography, and management of epicondylar enthesopathy using corticosteroid injection, dry needling and autologous blood injection. Procedures at the wrist include identification and injection of the numerous small joints around the wrist including the distal radioulnar joint, radiocarpal joint, mid carpal joint, pisiform triquetral joints and basal joint of the thumb. A safe approach to guided tendon injection is important to avoid complications of tendon rupture.

204 Brachial plexus ultrasound

Carlo Martinoli, Enrico Capaccio, Alberto Tagliafico, Nunzia Pignataro, Universita di Genova, Italy
Nicola Stagnaro, Italy, Stefano Bianchi, Fondation des Grangettes, Switzerland

Objectives

- Describe the standardised technique of US examination of the brachial plexus.
- Teach and familiarise sonologists with the anatomic landmarks and the US aspects of the roots, trunks, divisions and cords of the plexus.
- Recognise the utility of this technique in the traumatic setting.
- Emphasise the role of US in the management of brachial plexus lesions to further delineate the nature and extent of the process.

Abstract

US is a promising alternative to MR imaging for direct imaging of the brachial plexus. In adults, US has proved capable

to follow in a spatially continuous manner the out of plane course of the nerves in this anatomically complex area as well as to detect lesions of traumatic, compressive, neoplastic and inflammatory nature affecting the plexus nerves. US provides useful information regarding the lesion site, extent and anatomic relationships and can be helpful in surgical planning. The advantages of US are mainly related to its ability to directly visualize the nerves, providing fine details such as nerve disruption, demarcation of changes in nerve size and fascicular echotexture. In brachial plexus injuries, US examination performed in an acute setting may help the clinician to better orient the treatment strategy (conservative vs. surgical) as well as to help the surgeon to evaluate the length of the abnormal segments for nerve graft planning. With respect to MR imaging, US involves less discomfort to the patient and is more cost effective. On the other hand, US has limitation in evaluating the costoclavicular space.

205 Sports medicine

Shane Brun, James Cook University, Australia

This presentation will be a two-part fairly relaxed discussion on the role of interventional sports and musculoskeletal medicine. The latest evidence will be provided regarding common sports injuries and musculoskeletal conditions including appropriate investigations and management techniques.

206 Peripheral vascular disease- lower extremity imaging including stents and grafts

Deb A Coghlan, Queensland Vascular Diagnostics, Australia

Objective

The aim of this presentation is to discuss how ultrasound of the native lower extremity arteries, bypass grafts and stent surveillance, plays a crucial role in vascular surgery practices. Techniques, criteria and pitfalls of scanning native arteries, grafts and stents will be presented.

Abstract

Non-invasive vascular studies have traditionally been utilised to confirm the presence of clinically suspected lower extremity peripheral vascular disease. The improved resolution of duplex imaging has made ultrasound a suitable alternative to contrast angiography in an increasing number of patients. A significant advantage of ultrasound is its ability to detect anatomic and blood flow information, providing an assessment of the haemodynamic effect of arterial occlusive lesions.

Duplex arterial mapping for operative planning before infrainguinal bypass is also performed routinely, and ultrasound can accurately identify suitable runoff vessels for bypass grafting.

Duplex surveillance of arterial bypass grafts has become increasingly important and has an important role in prevention of graft failure. Identification and correction of vein defects prior to the occurrence of graft thrombosis are critical since most vein grafts do not maintain long-term patency after mechanical thrombectomy or graft thrombolysis.

Techniques of minimally invasive endovascular surgery for the treatment of lower extremity chronic ischemia have expanded rapidly in recent years. Percutaneous transluminal angioplasty, stenting and subintimal angioplasty, are now common place in most surgical practice and duplex examinations have become increasing important for the surveillance of these procedures.

Clinicians have come to rely on duplex scanning for post procedural evaluation of surgical and interventional procedures.

207 Doppler Ultrasound in the functional assessment of the cerebral circulation

David H Evans, University of Leicester, United Kingdom

Objectives

To describe the use of transcranial Doppler ultrasound as a tool for studying cerebral haemodynamics. To discuss its strengths, weaknesses and applications.

Abstract

Doppler ultrasound is becoming an increasingly important tool for studying cerebral haemodynamics in conditions as diverse as prematurity, birth asphyxia, orthostatic hypotension, stroke, dementia, and head injury. As with most Doppler ultrasound techniques it has the advantages of being totally non-invasive and of having excellent temporal resolution. There are also a number of limitations of the method. In order to penetrate the skull it is necessary to use a relatively low transmitted frequency, which leads to poor spatial resolution and relatively weak scattering by the blood, and the transmission through the skull leads to distortion of the ultrasound beam shape. Also Doppler measurements are often made without concomitant imaging so that insonation angles are unknown. Finally there is evidence that under some circumstances the diameters of major cerebral vessels can change over relatively short time periods. Despite these difficulties the method has much to offer and has many applications. During this talk we will discuss the use of Doppler ultrasound to measure cerebral blood velocity, cerebral blood flow, cerebrovascular resistance, pressure autoregulation and cerebrovascular reactivity.

208 Duplex and the surgeon: great expectations

Roxanne Wu, Cairns Private Hospital, Cairns, Australia

This lecture will address the needs of the vascular surgeon from complex vascular ultrasound with particular reference to complex varicose veins and dialysis fistulas. Discussion will centre around the main aspects of what the surgeon is looking for and will be illustrated with clinical cases.

209 Sonographic assessment of extent and aggressiveness of malignant breast nodules

Thomas Stavros, Radiology Imaging Associates, United States

Appropriate staging of breast cancer is essential to minimising 'positive margins' and the number of surgeries necessary and also in minimising 'local recurrences' which are really not 'recurrences', but unrecognised unresected malignant disease persisting from the time of initial treatment.

MRI is the gold standard for staging, not sonography. However, the quality and availability of breast MRI varies greatly. When adequate breast MRI is not available, ultraound may be our best staging tool.

Sonographic staging can be performed in any patient who has a suspicious or malignant solid nodule. The normally targeted exam can be extended to the whole breast bilaterally and to the ipsilateral axilla – to best detect multifocal and multicentric and contralateral disease, and to detect metastatic lymph nodes.

For the index lesion, two different concepts of maximum diameter exist – prognostic diameter, the maximum diameter of the invasvie part of the lesion (hard suspicious findings) and total diameter of the lesion, including the invasive and DCIS components (hard and soft suspicious findings. The prognostic maximum diameter is related to

survival, while total diameter is related to the ability to locally resect the lesion with adequate cosmesis.

Morphologically abnormal lymph nodes (LN) can be biopsied with core or FNA techniqes. A positive biopsy obviates sentinel LN procedure, enabling the surgeon to proceed directly to axillary dissection. A negative ultrasound or negative biopsy of an abnormal lymph node does not prevent sentinel node procedure, so a positive LN biopsy is more valuable than a negative biopsy.

211 Scrotum ultrasound

Stephen Bird, Benson Radiology, Australia

Sonography remains the most effective imaging modality for assessment of scrotal pathology. This paper will explore the applications of ultrasound in a variety of clinical settings. Acute pain, chronic pain, palpable lumps, scrotal swelling, trauma, cryptorchidism and infertility assessment will be explored. A variety of potential pitfalls as well as some interesting normal variants and benign intra-testicular masses are considered. A protocol for extending sonographic assessment of varicoceles beyond the scrotum, particularly in the setting of infertility is presented. Many recent clinical cases are used to demonstrate the sonographic appearances of a comprehensive range of scrotal conditions.

212 What thyroid nodules need FNA according to the SRU Consensus Panel?

Thomas Stavros, Radiology Imaging Associates, United States

In 2004, a multidisciplinary panel of radiologists, cytopathologists, endocrinologists and surgeons met to offer guidelines about which nodules should be biopsied.

FNA is the method of choice for biopsying thryoid nodules, not core biopsy.

Size correlates poorly with the risk of thyroid cancer.

In a gland with multiple discrete nodules each nodule carries a lower risk than does a solitary nodule, but the cumulative risk for all of the nodules is similar (10–13%) to that of a solitary nodule. In a multinodular gland that contains a malignant nodule, the largest nodule will be malignant only two-thirds of the time.

Nodules found incidentally at imaging carry the same risk as do nodules that are palpable.

An almost completely solid texture has the highest sensitivity and microcalcifications have the highest positive predictive value for cancer. Findings such as hypoechogenicity and hypervascularity were not chosen for the FNA criteria. A >75% cystic component and colloid crystals were the only findings carrying enough negative predictive value to avoid biopsy.

Recommendations for FNA in solitary nodules

1) Solid nodules of 1 cm or more that have microcacifications
2) Solid nodules with coarse calcifications or without calcifications of 1.5 cm or more
3) Complex cystic nodules with mural nodules of 2 cm or more
4) Growing nodules

Recommedations for no FNA

1) Almost entirely cystic lesions
2) Presence of colloid crytals (minority opinion that I share)

Recommendations for gland with multiple nodules – subject each nodule to above criteria

For insufficient FNA – repeat FNA

213 Salivary gland ultrasound

Stephen Bird, Benson Radiology, Australia

CT and MRI remain the most effective modalities for assessment of head and neck malignancy. In particular, CT and MRI have the advantage of providing panoramic images allowing appreciation of the full extent of the disease process and accurate staging information. Despite the strengths of CT and MRI for tumour staging, sonography has an important role to play in the assessment of salivary gland pathology. The advantage of ultrasound remains its dynamic nature and ability to tailor each examination to the particular clinical presentation. As an initial imaging test ultrasound can provide the required information in the majority of cases.

This presentation will discuss the sonographic technique, key landmarks, anatomical appearances and pathological processes involving the parotid, submandibular and sublingual salivary glands.

215 Lower limb interventional procedures

Eugene G McNally, Nuffield Orthopaedic Centre, United Kingdom

Musculoskeletal interventional techniques in the lower limb cover a myriad of procedures useful in clinical practice. The anatomy, rationale and techniques of the most important of these will be discussed. Pelvic procedures include sacroiliac and symphyseal joint injections as well as guided nerve blockade. Procedures at the hip include bursal injection, with differentiation of the trochanteric from the subgluteus medius and subgluteus minimus bursa. Joint injection and aspiration, especially in children, and management of the snapping hip. Procedures around the knee joint include diagnostic joint injection including the proximal tibio-fibular joint, identification of the bursal spaces around the knee and dry-needling techniques for patellar tendonopathy. At the ankle & foot, management of Achilles tendonopathy, plantar fasciitis and Morton's Neuroma will be emphasised.

216 Ultrasound of ankle tendons

Carlo Martinoli, Alberto Tagliafico, Enrico Capaccio, Nunzia Pignataro, Universita di Genova, Italy, Nicola Stagnaro, Italy, Stefano Bianchi, Fondation des Grangettes, Switzerland

Objectives

Teach and familiarize sonologists with the normal and US anatomy of ankle tendons. Learn to differentiate between the most common pathologic conditions affecting these structures.

Abstract

In the ankle and foot, US has become increasingly important in the assessment of tendon abnormalities. In the anterior ankle, US is able to identify either the rupture or the distal tendinopathy of the tibialis anterior tendon. In the lateral ankle, injuries to the peroneal tendons are commonly encountered in clinical practice and include tenosynovitis, tendinosis, rupture and instability.

The US diagnosis of peroneal tendon instability is based on detection of the tendons lateral to the distal lateral malleolus, instead of posterior to it. Dynamic examination with both dorsiflexion and eversion of the foot can help to detect cases of intermittent subluxation.

When the peroneus brevis is split longitudinally, it can assume a horseshoe shape at US examination with the

peroneus brevis that partially envelops the longus. In the medial ankle, the tibialis posterior is the most commonly injured. The instability of the tibialis posterior tendon relative to the medial malleolus is rare. Stenosing tenosynovitis of the flexor hallucis longus occurs as either the result of focal areas of synovitis or fibrosis within the tendon sheath or in association with the os trigonum syndrome. There being many tendons to be examined in the ankle joint, the US examination should be focused on the basis of clinical findings in an attempt to save time and increase the efficacy of the study.

217 US in small joint arthritis

Eugene G McNally, Nuffield Orthopaedic Centre, United Kingdom

With the increasing trend for early treatment with powerful disease modifying antirheumatic drugs, radiographic detection of bony erosions is increasingly considered as being a stage too late in the diagnosis of arthritis. It is also recognised that many patients with apparent monoarthritis have clinically occult synovitis elsewhere which potentally reclassifies them as oligo or polyarthritis. MRI has played a leading role in the earlier detection of occult synovitis and erosions. As a practical clinical based tool, ultrasound also has much to offer. This presentation will focus on a systematic approach to the diagnosis of small joint arthritis, focusing primarily on small joint arthritis of the hand and wrist. Learnng points will include imaging technique, definitions and classification of synovitis and erosion, methods for assessing and classification of synovial activity and limitations of ultrasound compared with other imaging techniques.

218 Carotid intima-media thickness (cIMT)

Joseph F Polak, Tufts University School of Medicine, United States

Objectives

This session will review how carotid intima-media thickness (cIMT) is a measurement useful in cohort studies of atherosclerosis intervention. Data will be presented on why the adoption of cIMT as a diagnostic test will require a paradigm shift: the clinical indications for the ulrasound test will be different and the type of ultrasound imaging will change.

Abstract

Carotid intima-media thickness cIMT is used as a surrogate measurement of atherosclerosis in epidemiological studies and drug interventions. cIMT is a measurement of the carotid artery wall that is specific to ultrasound imaging. cIMT includes the layer of the carotid artery wall between the lumen-intima interface (the boundary of the artery wall) and the media-adventitia interface (the external elastic membrane).

Epidemiological studies have shown that individuals with large cIMT values are more likely to have cardiac and cerebrovascular disease. Large values predict the risk of subsequent stroke or myocardial infarction. Drug interventions that lower cholesterol levels decrease cIMT. Drug interventions that alter the risk of heart attack are associated with changes in cIMT. The protocols for cIMT measurements vary but most use the common carotid artery and the internal carotid artery. cIMT measurements require specialized software with training and certification of both cIMT sonographers and cIMT readers taking up to three months. Continued quality assurance is needed in order to maintain consistency in cIMT measurements.

Clinical application of cIMT will likely target individuals less than 65 years of age who are at intermediate risk for heart disease.

219 Upper extremity vascular disorders/imaging

Deb Coghlan, Queensland Vascular Diagnostics, Australia

Objectives

The aim of this presentation is to discuss pathophysiology and clinical presentation of vascular disorders that affect the upper extremity, and how ultrasound plays an important role in diagnosis.

Abstract

Atherosclerosis and complications of diabetes mellitus are the most common causes of lower extremity ischemia. However, the etiology of upper extremity ischemia includes not only atherosclerosis, but arteritis, blood dyscrasias, drug-induced occlusions, occupational trauma, thoracic outlet syndrome, trauma, aneurysms, and complications of renal dialysis fistula. In order to accurately diagnose the disorder, it is important to identify both the location of the obstruction and its nature, and to document whether the process is proximal or distal to the brachial artery.

Ultrasound examination should begin with the measurement of segmental arterial pressures. Duplex scanning is then performed and provides anatomic information, locates stenotic or occlusive lesions and evaluates their extent and severity. Ultrasound identifies collateral pathways, and defines the patency of arteries distal to an occlusion.

With the improvement in ultrasound equipment, and the skill levels of the sonographer, duplex scanning is rapidly replacing many of the more traditional imaging methods, especially when the information required is largely anatomic. All major arteries of the arm, forearm, wrist, and hand are readily identified, and even those of the digits can be imaged. Absence of colour in an artery clearly visualised by B-mode imaging is diagnostic of total occlusion, and an increase in velocity identifies stenotic sites.

Ultrasound is an important tool for diagnosis and management of upper extremity vascular disorders.

220 Ultrasonic detection of cerebral emboli

David H Evans, University of Leicester, United Kingdom

Objectives

To provide an overview of the current state of the art of detection of cerebral emboli with transcranial Doppler, including methods for distinguishing embolic signals from artefacts, of distinguishing between particulate and gaseous emboli, and of sizing emboli.

Abstract

Many strokes are caused by emboli from distal sites blocking vessels in the brain. The discovery that emboli of various types can be detected using Doppler ultrasound as they are carried through the major cerebral arteries has led to a new field of study, which has considerable potential. The basic principle of detection is extremely simple: if an embolus backscatters more power than the surrounding blood in which it is moving, then the transient increase in power can be detected and measured. Questions that arise from this principle surround the circumstances under which such power increases can be detected, and whether the size and composition of the embolus can be inferred from such measurements.

The detectability of an embolus is determined by many factors including its size and composition, the ultrasound frequency, the size of the Doppler sample volume, the embolus trajectory and its interaction with the ultrasound beam. In general even relatively small gas bubbles will be detected, but some larger solid emboli may be missed. With regard to size and composition, several techniques have been suggested as being useful for characterizing composition, and whilst in general considerable progress has been made in this direction there are still many challenges in distinguishing between large particulate emboli and small gaseous emboli.

221 Cerebral embolism research in Leicester

David H Evans, University of Leicester, United Kingdom

Objectives

To describe the use of Doppler ultrasound as a method for detecting cerebral emboli, and provide an overview of some of the clinical and technical research on this technique carried out in Leicester.

Abstract

The Medical Physics and Surgery Departments in Leicester have had a major research interest in cerebral embolism over the past 15 years, and the main investigational tool has been Doppler ultrasound. Initially research focused on embolic events occurring during carotid artery surgery, but has expanded to include interest in emboli occurring post carotid surgery, during cardiac surgery, during aortic and carotid stenting, and in a variety of other clinical situations. A major strength of this research has been the very close collaboration between physicists, engineers and clinicians. This talk will concentrate on technical aspects of the research, on the Doppler techniques used, the way in which the Doppler signals are interpreted, and some new approaches to embolus detection, but will also describe the very significant reduction in the incidence of peri-operative strokes that have occurred, in large part due to embolus monitoring.

222 Diabetic foot in Tropical North Queensland: The Cairns High Risk Foot Service – 10 years on

Christina Steffen, Cairns Base Hospital, Australia

Ethnic, climatic, economic and cultural factors have resulted in an epidemic of diabetic foot disease in tropical north east Australia. Cairns, population 135,000, situated on the east coast at 17 S is the referral centre for surrounding rural districts plus the sparsely populated Cape and Torres districts further north. Cairns Base Hospital averages 2–5 acute surgical admissions per week for diabetic foot problems. Many are from remote indigenous communities.

In 1996, a High Risk Foot Service was established at Cairns Base Hospital. The service enlisted existing resources of general/vascular surgeons, public health physician, podiatrist, diabetes educators and nursing staff.

Combining chronic and acute management strategies including assessment, basic podiatry, surveillance, education, outreach services and rapid intervention for acute problems the High Risk Foot Service has been important in delivering effective outpatient surveillance and treatment, reducing frequency and length of hospital stay and the extent of surgical intervention. The policy of preservation of foot elements, wherever feasible, has also resulted in improved attendances at clinics and earlier presentations with acute problems.

Major amputation represents the end-point in diabetic foot disease, indications being inoperable vascular disease, failed vascular intervention and uncontrollable sepsis. Despite large population increases and an exponential rise in the prevalence of diabetes in all groups between 1995 and 2005 in this region of Australia a comparable increase in major amputations has not eventuated. We attribute this to the systematic chronic disease management and prompt response to acute surgical problems that the multidisciplinary High Risk Foot Service has been able to provide.

223 Recent developments in Doppler ultrasound

David H Evans, University of Leicester, United Kingdom

Objectives

To survey some of the more recent developments in Doppler ultrasound.

Doppler ultrasound is an extremely valuable technique for detecting and measuring blood flow and other movements within the body, however it still suffers from a number of limitations. Three of these limitations, together with possible solutions will be discussed.

1) The vector problem. All Doppler ultrasound instruments measure the component of velocity towards or away from the transducer. In many situations this is not an issue, but where complex flow patterns are present may give misleading information. Solutions to this limitation include vector Doppler systems, transverse Doppler systems, speckle tracking systems, and where volumetric flow only is important, C-mode Doppler techniques.
2) The frame rate problem. In general Doppler frame rates are much lower than imaging frame rates because in order to get a reliable estimate of velocity it is necessary to sample each region of interest several (often between 8 and 16) times, whereas to generate a pulse-echo image it is only necessary to sample once. One potential solution to this is to use synthetic aperture techniques which greatly speed up image acquisition.
3) Axial resolution. The axial resolution of some Doppler systems is limited by the transmitted pulse length. A solution which has previously been applied to pulse echo systems is to use coded excitation. It now appears that a similar solution can be used for Doppler signals without introducing the serious artifacts that might be anticipated.

224 Abdominal aortic aneurysm (AAA) screening

Joseph F Polak, Tufts University School of Medicine, United States

Objectives

To present data on why ultrasound imaging is a robust and reliable approach for the detection of abdominal aneurysms, monitoring their growth and following the patient after intervention. To review the technical aspects of abdominal aorta imaging

Abstract

Abdominal aortic aneurysms reach a prevalence of close to 10% in men aged more than 65 years. The rupture of an aneurysm is a catastrophic event almost always leading to death. The United States health care system has implemented abdominal aneurysm screening for all individuals reaching 65 years of age.

The diagnostic imaging test is an elective test. The

imaging protocol needs to include documentation of the upper, middle and distal parts of the abdominal aorta as well as the iliac arteries. Measurements are made in the transverse plane, outer wall to outer wall. Longitudinal images are used to characterize the aneurysm. Aneurysm surveillance is modified as a function of the size of the aneurysm. Expansion rates are typically less than 2 mm/year.

Continued surveillance is done until the aneurysm reaches 5.5 cm in size. At that point, aneurysm repair, either open or with stent graft, is performed. After aneurysm repair, ultrasound imaging can be used to confirm the success of the intervention. Following open surgery and graft placement, integrity of the anastomotic sites can be confirmed. Following stent-graft placement, stabilization of aneurysm size and even shrinking can be confirmed. Endoleaks can also be detected.

225 US of the shoulder

Eugene G McNally, Nuffield Orthopaedic Centre, United Kingdom

This presentation will outline a systematic approach to the ultrasound examination of the rotator cuff. Emphasis is placed on identifying the key anatomical relationships, particularly around the anterior interval where many abnormalities of the rotator cuff begin, and a stepwise approach to the diagnosis of cuff tears. Learning points will include how to acquire and interpret static images, how movement plays a key role in facilitating the diagnosis of cuff and bursal disease and imaging algorhythmns for biceps and subscapular injury.

226 Ultrasound of entrapment neuropathies of the upper extremity

Carlo Martinoli, Alberto Tagliafico, Enrico Capaccio, Nunzia Pignataro, Universita di Genova, Italy, Nicola Stagnaro, Italy, Stefano Bianchi, Fondation des Grangettes, Switzerland

Objectives

Provide an overview of the US aspects of the most common entrapment neuropathies of the upper extremity. Describe the US anatomy of the median, ulnar and radial nerves. Emphasize the role of US in the management of these lesions to further delineate the nature and extent of the process.

Abstract

The refinement of transducers has enhanced the potential of US to evaluate entrapment neuropathies in the upper extremity, including the spiral groove area for the radial nerve, the supinator tunnel for the posterior interosseous nerve and the radial styloid area for the superficial sensory branch of the radial nerve, the cubital and Guyon tunnel for the ulnar nerve, the proximal forearm for the anterior interosseous nerve and the carpal tunnel for the median nerve.

As regards the impact of US as a complement of clinical examination and nerve conduction studies, it may, as a result, be informative in patients with absent motor or sensory responses when it is difficult to localize the site of compression. US can assess the status of the involved nerve and surrounding tissues that could help in determining the causes and modalities of nerve compression. We believe that the main advantages of US over MR imaging include higher spatial resolution, availability, lower cost and the ability to explore long nerve segments in a single study. US allows continuous imaging of nerves across the joints during joint movements. This evaluation takes the advantage, as opposed to MR imaging, to better recognise intermittent impingement and snapping syndromes.

227 Ultrasound of the ankle

Eugene G McNally, Nuffield Orthopaedic Centre, United Kingdom

The ankle and foot is the most common area examined using ultrasound in our centre. It is particularly valuable when focal rather than diffuse symptoms are present. This presentation will use a clinical approach to discuss conditions other than the tendon disorders. Techniques, normal anatomy and pathology of the lateral, deltoid and spring ligaments, fascial injuries and impingement syndromes will be included. A compartment approach to mass lesions of the foot can be a useful aid to diagnosis. Although generally, ultrsound is limited in the assesment of bone disease, some lesions such as stress fractures and coalition can be suggested. Advantages and limitations of ultrasound comparedwith MRI will be discussed.

228 Pelvic floor ultrasound – the basics

Hans Peter Dietz, University of Sydney, Australia

Diagnostic imaging is rapidly gaining in importance in urogynaecology, largely due to increasing availability of ultrasound and magnetic resonance imaging equipment. As a result of cost and access problems, MRI has been of limited clinical use in the evaluation of pelvic floor disorders, and slow acquisition speeds have until very recently precluded dynamic imaging. Ultrasound, on the other hand, is almost universally available and provides for real- time observation of manoeuvres. The last 10 years have seen rapid advances in the capabilities of diagnostic ultrasound, and several are of major relevance to pelvic floor imaging. 3D/ 4D ultrasound may be of limited use to general Obstetric and gynaecological applications, but in urogynaecology it has markedly enhanced our capabilities.

As of 2007, pelvic floor ultrasound has reached the spatial resolution of MRI in any arbitrarily defined plane, and is far superior to MRI in temporal resolution.

This talk will cover indications for pelvic floor ultrasound, basic technique as well as the most common findings on 2D pelvic floor imaging.

230 Pelvic floor trauma

Hans Peter Dietz, University of Sydney, Australia

Recent advances in pelvic floor assessment have led to the rediscovery of a form of maternal birth trauma, which was first described in 1907 but currently is absent from modern textbooks. Avulsion of the pubovisceral muscle from the pelvic sidewall seems to occur in 15–30% of vaginally parous women. Its prevalence is probably on the rise as the likelihood of trauma increases with higher maternal age at first delivery. Levator avulsion appears to be a significant part of the missing link between vaginal childbirth and prolapse and is likely to be the root cause of many cases of recurrence after prolapse surgery. As of now, no techniques exist for the surgical repair of resulting defects.

This talk will discuss the diagnosis of levator trauma on clinical examination as well as US and MR imaging. It will also cover prediction of trauma and potential approaches for primary and secondary prevention.

231 The Day 1 renal transplant Doppler assessment

Alan M Williams, Auckland City Hospital, New Zealand

Evaluation of a renal allograft should include a detailed B-mode and Doppler investigation. Transplant dysfunction and complications can be classified as parenchymal, i.e. acute

tubular necrosis (ATN), acute rejection or both; vascular occlusions; obstruction; haemorrhage; urinary leak; collections; infection and; drug toxicity related to the antirejection therapy itself.

From a historical perspective, qualitative grey-scale assessment of renal morphology and peritransplant collections has an invaluable role to play. On the other hand, colour and power imaging provides an instantaneous global impression of allograft perfusion while spectral Doppler and Resistive Index measurements serve as a useful quantitative parameter for demonstrating changing arterial waveforms that may occur with renal disease.

Numerous articles published in the last decade have investigated the potential and reliability of Doppler resistive index measurements as a useful indicator of renal dysfunction. Unfortunately, however, Doppler sonography has not been able to reliably differentiate intrinsic parenchymal disease and it is clear from the results of research to date, further investigation on the topic is to be encouraged.

This presentation will highlight, with demonstrative images, the role of grey-scale and Doppler ultrasound in its assessment of early post renal transplant. The trends of Day 1 transplant RI values obtained from patients at Auckland City Hospital, with reference to recent literature will be discussed.

232 High frequency ultrasound for the measurement of oedema in chronic venous disease

Antonina I Volikova, Sue E Hoskin, Lorraine Linacre, Gail Brunt, Fremantle Hospital, Perth, Hilary J Wallace, Jan Edwards, Michael C Stacey, University of Western Australia, Australia

Objectives

To assess dermal thickness in patients with venous leg ulcers using high-frequency ultrasound, to compare this with age-matched controls and to determine if compression therapy has a significant impact on dermal thickness.

Abstract

Oedema is an early sign of venous insufficiency and is commonly present in advanced venous disease. Currently oedema is assessed by clinical appearance and leg volume. Oedema increases dermal water content and leads to an increase in dermal thickness.

Seventeen patients with venous leg ulcers but not receiving compression therapy, and 17 age-matched healthy controls, were entered into the study. Dermal thickness was measured 7.5cm above the medial malleolus with a 17 MHz linear probe and a B-Mode ultrasound scanner (Philips).

In patients with venous ulcers, leg volume was also measured. Dermal thickness and leg volume were reassessed in the ulcer patients after 1 week of compression.

Prior to compression therapy, dermal thickness in patients with venous leg ulcers (median 0.228 cm) was significantly greater than the dermal thickness of the control subjects (median 0.134 cm, $P < 0.0005$). After 1 week of compression the dermal thickness in patients with venous ulcers reduced significantly (median 0.185 cm, $P < 0.0005$). Leg volume also reduced significantly after 1 week of compression ($P < 0.001$).

Dermal thickness using high-frequency ultrasound provides an objective measure of skin oedema in patients with venous leg ulcers. This may be a useful non-invasive technique to evaluate the treatment of chronic venous disease with compression therapy and to assist in the early detection of venous disease (e.g. post-thrombotic syndrome).

233 Reference values for sonographic measurements of the ulnar nerve at the elbow

Kerry Thoirs, Marie Williams, Maureen Phillips, University of South Australia, Australia

Objectives

Sonographic measurements of the ulnar nerve at the elbow have been reported to differentiate individuals with and without ulnar nerve entrapment at the elbow (UNEE). The aim of this study was to investigate the value of using sonographic measurements of the ulnar nerve in an Australian population using a reliable and valid measurement protocol, and to compare the results against international studies which have used similar measurements.

Methods

A parallel group design compared two Australian sample populations (asymptomatic sample; $n = 108$ limbs, symptomatic UNEE sample; $n = 22$ limbs) using identical measurement protocols. Rank ANCOVA tests were performed to determine if significant differences existed for sonographic measurements between the symptomatic and asymptomatic limbs. A comparative analysis compared data between this study and previous studies.

Results

Two measurements of the nerve differed significantly between people with and without UNEE; maximum diameter (UNEE 0.44 ± 0.1 cm vs. No UNEE mean 0.38 ± 0.09 cm) and cross-sectional area (No UNEE 0.08 ± 0.03 cm vs. UNEE 0.12 ± 0.05 cm). Gender, weight, body mass index, age, measurement site, and elbow position were found to significantly confound measures of the ulnar nerve at the elbow. Significant differences existed between the mean values of similar measurements between this and previous studies.

Conclusions

Sonographic measurements of ulnar nerve size can be used to discriminate between nerves affected and unaffected by UNEE. Reference data derived from specific sample populations is unlikely to accurately reflect alternate populations.

234 Turning astronauts into sonographers: assessing the clinical utility of ultrasound on board the International Space Station (ISS)

Marilyn Zelesco, Royal Perth Hospital, Robin Hart, AION-diagnostics, Paul Lombardo, Monash University, Australia

Human spaceflight (HSF) is a major component of the National Aeronautics and Space Administration (NASA) mission. The health, safety and required human performance levels of the crew must be maintained for mission success. Humans are the most fragile components of the entire system, and medical emergencies require quick diagnosis and treatment. The only form of medical imaging on board the ISS is ultrasound. However, ultrasound is highly operator dependent and presently there are no sonographers in the astronaut corps.

Objectives

This talk summarises a study undertaken to assess the feasibility of the use of ultrasound by astronauts to diagnose nine medical conditions identified by NASA as high risk, high impact and high likelihood. Ultrasound protocols were developed for each condition, and their usefulness for medical support in a terrestrial analogue of a spaceflight situation was assessed.

Five non-medical, inexpert ultrasound operators undertook an ultrasound quiz to assess their ability to identify normal and abnormal images in conjunction with images demonstrating technical artefacts. The same operators trialled two protocols and the resultant images were assessed for diagnostic value using visual analogue scales (VAS) by five sonographers. These two protocols were revised following operator feedback, and then re-trialled. Subsequent experiment analysis indicated a significant improvement in both the operators' confidence levels and the diagnostic quality of images.

Conclusion

Sixty nine percent of images were classed as diagnostically useful, indicating the feasibility of non-medical, inexpert ultrasound operators to acquire clinically effective ultrasound images in environments where expertise is unavailable.

235 The outcome of pregnancies of unknown location according to the mother's age and gestational age

Ben Van Calster, Dirk Timmerman, Sabine Van Huffel, Katholieke Universiteit Leuven, Belgium, George Condous, University of Sydney, Australia, Emma Kirk, Tom Bourne, University of London, United Kingdom

Objectives

We aimed at investigating the way in which the mother's age and maternal age influence the outcome of a pregnancy of unknown location (PUL).

Abstract

856 PULs were investigated at St Georges Hospital, London. There were 460 failing PULs, 330 intra-uterine pregnancies (IUP), and 66 ectopic pregnancies. Using multicategory kernel logistic regression, the mother's age was used to predict the PUL outcome. Kernel logistic regression is a flexible nonlinear method.

In a second step, both age and gestational age were used to predict the outcome. The analysis of the mother's age indicated that the probability of a failing PUL increased with age while the probability of an intra-uterine pregnancy decreased with age. This increase, respectively decrease was stronger after the age of 35. Before the age of 23, the chance of an IUP is between 45% and 60%, while that of a failing PUL is between 40 and 45%.

After the age of 23, failing PUL is more likely than an intra-uterine pregnancy. Ectopic pregnancy appears most likely at the age of 29 years (11%). The analysis of both the age and gestational age suggested that mothers of around 22 years with a gestational age around 4 weeks have the highest chance of an intra-uterine pregnancy (89%). Mothers of around 43 years with a gestational age around 8-9 weeks have the highest chance of a failing PUL (>95%).

236 What measurements are needed to predict pregnancy outcome in pregnancies of unknown location: does measuring hCG suffice?

Ben Van Calster, Dirk Timmerman, Sabine Van Huffel, Katholieke Universiteit Leuven, Belgium, George Condous, University of Sydney, Australia, Emma Kirk, Tom Bourne, University of London, United Kingdom

Objectives

We aimed at investigating what information is sufficient for making a good prediction of the outcome of pregnancies of unknown location (PUL).

Abstract

856 PULs were investigated at St Georges Hospital, London. There were 460 failing PULs, 330 intra-uterine pregnancies (IUP), and 66 ectopic pregnancies. Mathematical diagnostic models were constructed (a) using only hCG information, (b) using hCG and progesterone information, and (c) using an optimal set of measurements based on variable selection.

The method used was multicategory logistic regression. Models were trained on a training set and evaluated on a test set using the area under the receiver operating characteristic curve (AUC). This was repeated 100 times in each of which the data were split randomly into training and test sets. The 100 resulting test set AUCs were summarised by their median.

Three AUCs were computed each time: one for each outcome. Model (c) used hCG and progesterone information, the level of vaginal bleeding, and age. The median test set AUCs to predict failing PUL were 0.982 (a), 0.987 (b), and 0.987 (c). To predict IUP, we obtained 0.979 (a), 0.983 (b), and 0.984 (c).

To predict ectopic pregnancy, we obtained 0.884 (a), 0.916 (b), and 0.931 (c). Thus, detection of failing PUL and IUP was easy using hCG information. Predicting ectopic pregnancy was more difficult. Mainly progesterone information but also age and the level of vaginal bleeding improved the prediction. The use of more advanced methods (support vector machines, kernel logistic regression) yielded similar conclusions.

301 Novel first trimester markers for Down syndrome

Jon Hyett, Royal Brisbane and Women's Hospital, Australia

First trimester screening for Down syndrome with a combination of nuchal translucency assessment and biochemical screening (fBhCG and PaPP-A) has been shown to be highly sensitivity in several prospective studies. New markers, both from a biochemical and ultrasound perspective continue to be described and may be useful in terms of further improvements in the sensitivity of screening and also in reducing the false positive rate associated with screening. These markers will be reviewed, together with an assessment of how they may best be incorporated in routine practice.

302 Labour ward ultrasound – what, when and why?

David Ellwood, The Australian National University Medical School, Australia

Labour ward ultrasound is a specialised sub-section of obstetric ultrasound that requires special skills and training. It is now commonplace for moderate and larger-sized maternity units to have an ultrasound machine either permanently located within the labour ward, or at least for a machine to be readily available to use at any time. It is also now a requirement of training in obstetrics and gynaecology in Australia and New Zealand that trainees have exposure to at least 200 hours of ultrasound training, including transvaginal work.

This should mean that O&G specialists of the future will be more competent and confident in using ultrasound to guide their practice in all settings including dealing with acute labour ward problems. Despite this and the expanding uses of labour ward ultrasound, there is little evidence available in the scientific literature to look at the effectiveness of the various

uses, and the improvement, if any, in perinatal outcome.

This presentation will look at all the possible uses of labour ward ultrasound including the diagnosis of abnormal presentation and placentation, malpositions of the fetal head, assistance with delivery of the second twin and the management of post-partum haemorrhage and retained placentae. Specific examples will be given of where ultrasound can facilitate management and potentially improve outcome. Directions for future research will be discussed.

303 Increased nuchal translucency with normal karyotype

Yves Ville, Université Paris, France

Background and objective

Screening for fetal aneuploidy is routinely offered to pregnant women and nuchal translucency (NT) thickness measurement is widely used as part of this screening. Around 1% of all fetuses should show increased nuchal translucency above the 99th centile for gestational age in an unselected population. Data on prospective follow-up assessment are needed to counsel couples following prenatal diagnosis. The objectives of this study were to describe the prevalence of developmental abnormalities as well as the relationship between nuchal translucency thickness and neonatal and pediatric outcome following first trimester measurement of NT >99th centile with normal karyotype .

Population and methods

We conducted a cohort study in a large unselected pregnant population undergoing first trimester ultrasound screening for fetal aneuploidy in a single health authority. All patients gave oral consent to undergo follow-up. The local ethics committee approved the study. Fetuses with NT measurement >99th centile adjusted for gestational age were included in this long-term follow-up study.

A detailed ultrasound examination was performed in all chromosomally normal fetuses at between 16 and 18 weeks of gestation to follow-up changes in nuchal translucency thickness and to rule out major fetal anatomical defects including fetal echocardiography. This was repeated at between 22 and 24 weeks of gestation. In cases with persistent increased nuchal fold, parents were counselled that the risk of worsening in utero or delivering a baby with a severe abnormality was higher than in the general population.

Pediatric clinical examination aimed at assessing postnatal growth, psychomotor skills and speech as well as interaction with the child. This was completed by serial questionnaire to be answered by the parents. Moreover, our study population was compared to an external control group. This control group was made of the 370 full-term control children from a French national population-based cohort study designed in 1997 to investigate the consequences of very preterm birth.

Results

Routine first-trimester ultrasound screening was performed in 21 149 unselected pregnant women between 1st January 2001 and 31st December 2003, including nuchal translucency measurement at 11–14 weeks.

248 fetuses (1.2%) had NT >99th centile for CRL. Neonatal outcome was completed in 162 live-born children. Two children (1.2%) were lost for follow-up at between 12 and 24 months.

The prevalence of an adverse prenatal outcome in chromosomally normal fetuses increased 2.4-fold with each mm of NT thickness (OR = 2.4/mm 95% CI [1.68–3.44]).

Among 160 children born alive, 29 (18.1%; 95% CI [15.4–30.5%]) had an ASQ (Ages and Stages Questionnaire) 2 SD below the mean score in at least one domain. Although close to statistical significance threshold, there was no significant association between the prevalence of an abnormality and NT thickness (OR = 1.35/mm 95% CI [0.88–2.06]) or between deviant ASQ scores at two years of age and NT thickness (OR = 1.37/mm 95% CI [0.93–2.01]). The prevalence of children with at least one abnormal element at paediatric clinical examination was not associated with increased NT thickness (OR = 1.39/mm 95% CI [0.64 –2.99]). Furthermore development at the age of two years was similar to that of the controls.

Clinical implications

After a first trimester measurement of nuchal translucency >99th percentile with normal karyotype, parents should be informed that when the fetus is shown to be normal by ultrasound at 22–24 weeks of gestation the risk of adverse neonatal outcome or developmental delay in early childhood is not increased.

305 The outcomes of pregnancies referred with preterm prelabour rupture of membranes (PPRoM)

Jon Hyett, Royal Brisbane and Women's Hospital, Australia

Preterm prelabour rupture of membranes is defined as the rupture of amniotic membranes for >1 hour before labour occurs in a pregnancy <37 weeks gestation and occurs in approximately one-third of all preterm births. In addition to the risks of prematurity, PPRoM is associated with other significant risks of morbidity and mortality such as the risk of maternal and neonatal infection as well as the risk of umbilical cord prolapse/compression and of placental abruption. Rupture of membranes prior to 24 weeks gestation has typically been associated with poor fetal prognosis as the loss of amniotic fluid at this stage can affect lung development and result in pulmonary hypoplasia.

This presentation will review the role of ultrasound in the diagnosis of preterm prelabour rupture of membranes and its potential contribution to further management. The use of ultrasound and amniocentesis in the prediction of chorioamnionitis and the likelihood of imminent delivery will also be examined.

307 The prenatal diagnosis of genetic syndromes

Jon Hyett, Royal Brisbane and Women's Hospital, Australia

The introduction of a routine 18–20 week anomaly scan over the last 20 years has led to the diagnosis of a substantial proportion of fetuses that have major structural abnormalities. Despite this, many conditions that have an underlying genetic basis are difficult to detect using ultrasound unless the sonographer has a high level of suspicion.

The implications and plans for follow-up, of sonographic anomalies such as increased nuchal translucency, the short femur and hyperechogenic bowel will be discussed.

In addition, the application of molecular genetics to the prenatal diagnosis of genetic disorders – a rapidly expanding and changing field, will be discussed.

308 Sonography of the sacrotuberous ligament

Neil Simmons, Australia

Objectives

To demonstrate the anatomy of the sacrotuberous ligament,

scanning technique and relevent clinical conditions.

Abstract
The sacrotuberous ligament has a broad attachment to the sacrum, sacroiliac joint and posterior iliac bone. It narrows as it passes to the ischium, spiralling slightly. Its superficial fibres are in continuity with the biceps femoris and thus link with the hamstrings. Gluteus maximus attaches to its posterior surface as may piriformis, superior and inferior gemellus and obturator internus. A variable membranous reflection of the distal ligament (the falciform ligament) runs along the ischial ramus towards the obturator fascia with which it may fuse.

The ligament runs parallel and medial to the sciatic nerve, with which it may be confused. It is echogenic, as is the nerve and is of similar size. If confused, trace the structure back to the ischial tuberosity. The sciatic nerve passes lateral to the tuberosity and the ligament attaches to its superficial aspect.

The pudendal nerve lies immediately anterior to the ligament. Entrapment of the nerve can cause a large number of clinical complaints. Ultrasound guided injection of cortisone and local anaesthetic through the mid to distal ligament may relieve symptoms and is thus also a useful clinical test.

Irritation of the ligament at the junction with the hamstrings can cause localised pain. Swelling, reduced echogenicity and focal tenderness are noted. Ultrasound guided injection can easily be performed.

Avulsion of the ischial tuberosity epiphysis in mid to late teen sportsmen and women can have severe consequences. The role of the ligament will be examined.

309 Sonography of retinacula and other fascial structures

Neil Simmons, Australia

Objective
To highlight the importance of fascia and retinacula in the function of the musculoskeletal system. Sonographic features of common pathological conditions will be demonstrated.

Abstract
Fascia, from the Latin for band or tether, refers to sheets of fibrous tissue which help hold the body together. It surrounds and supports muscles, bones and joints. It provides attachments to muscles and acts as a pathway for nerves and vessels.

Retinacula are essentially focal thickenings of fascia with more complex histology. The histology varies slightly depending on the function of the retinaculum. Retinacula act as pulleys, guiding tendons and restraining them in position.

Pathological conditions affecting fascia include degeneration, proliferation tears and infection. Nerves may be entrapped as they pass through or beneath fascia.

Retinacula are subject to high loads during tendon movement. They can become thickened and/or inflamed. Tendons passing beneath them may become entrapped. Constant strain can cause retinacular stretching, resulting in tendon subluxation. Trauma can tear retinacula within their substance or at their bony attachments.

310 Diagnostic test algorithms in carotid disease

Joseph F Polak, Tufts University School of Medicine, United States

Objectives
This session will review how carotid artery disease can be evaluated by many different diagnostic tests. To show why carotid ultrasound remains the most cost-effective approach in the majority of patients.

Diagnostic evaluation of the extracranial carotid artery can be made with very different imaging modalities. These include carotid ultrasound, carotid arteriography (CA), magnetic resonance angiography (MRA) and computed tomographic angiography(CTA).

Doppler carotid ultrasound is a flow sensitive technique that measures the physiological effect of the alteration in blood flow velocity caused by a stenosis. Time-of-flight MRA does the same.

Both techniques have been combined as a replacement for diagnostic arteriography in most patients with significant stenoses of the internal carotid artery. Measurement of luminal narrowing by arteriography is the gold standard but the riskiest of the techniques used. It measures the residual lumen of the artery. Gadolinium enhanced MRA does the same, with the added technical limitation of artifacts due to bolus timing and patient motion. CTA can give an image of the carotid artery lumen as well as some anatomic information on the character of the artery wall. Correlative studies and quality assurance issues require side-by-side review of the selected imaging test used in the evaluation of a given patient.

Knowledge of the strengths and limitations of the imaging modalities affects the selection of a given technique in a patient. Technical limitations affecting the quality of the carotid ultrasound examination is the most common indication for obtaining another diagnostic test.

311 Ultrasound-guided RF-ablation of liver tumours

Torben Lorentzen, Herlev Hospital, Denmark

Objectives
Introduction to RF technique with special focus on ultrasound (US) as diagnostic, procedure guiding and follow-up modality.

Abstract
Radiofrequency (RF) ablation is receiving increasing attention as treatment for primary and metastatic liver cancer. RF ablation can be performed percutaneously, during open surgery, and laparoscopically. An electrode is introduced into the liver tumor and RF energy is applied. Tissue surrounding the electrode heats up and is killed above approximately 60°C, where tissue coagulation occurs. Current devices can create coagulation zones up to 5 cm diameter. For large tumors multiple sequential applications are often required. Current limitations include inadequate imaging modalities, uncontrolled shapes and size of coagulation zones, and inability to reach adequate temperatures close to large vessels.

The role of US is essential in RF ablation. Preprocedure and postprocedure, US combined with a contrast agent can distinguish metastatic lesions from benign lesions and coagulated areas from areas with viable tumor tissue, respectively.

Because of the real time nature, US is ideal for guiding placement of the RF electrode. During the procedure, the RF heating creates microbubbles in the tumor area that temporary obscure the visibility of the tumor. Follow up is performed at standardised intervals with (PET) CT, US and blood tests including carcinoembryonic antigen and alpha fetoprotein. In case of a recurrence, the patient is offered another RF treatment. RF treatment is often combined with chemotherapy.

Disclosure
Torben Lorentzen has a royalty agreement with TYCO

Healthcare on his patent US No 5,951,546 covering the Cool Tip RF Electrode.

312 Simplifying the ultrasound of post-endovascular intervention for aneurysmal disease

Brendan Cramp, Peninsula Vascular Diagnostics, Australia

Objectives

The objectives of this presentation are to demonstrate the potential accuracy and usefulness of ultrasound in the routine follow-up of endovascular intervention for aneurysmal disease; and provide useful techniques and considerations which can be applied to the ultrasound of any region of the body post EVAR, which will aide the general sonographer in obtaining information critical to the vascular surgeon.

Background

The UK Small Aneurysm Trial has shown that infrarenal abdominal aortic aneurysms with diameters of greater than 5.5 cm, demonstrate a significantly increased risk of rupture. Findings from recent multicentre randomised trials (EVAR-1 and -2) and voluntary registries (EUROSTAR) investigating the outcomes of using endovascular aneurysm repair (EVAR) or conventional open repair (OR) to treat abdominal aortic aneurysms (AAA) of greater than 5.5cm indicate the following practices:

1) EVAR is most appropriate for high operative risk patient with anatomical feasibility.
2) OR is most appropriate for younger patients with low operative risk and long life expectancy.
3) Medical treatment alone is most appropriate for those with marginal anatomic suitability and high operative risk.

Further analysis of these registries indicates EVAR treatment of small AAA (<5.5 cm) demonstrate a lower all cause mortality and aneurysm related death rate than EVAR treatment of large aneurysm (>5.5 cm) at 3 years.

There have been inadequate long-term studies to determine suitability of EVAR to treat aneurysmal disease of visceral, upper and lower limb aneurysms. Early results, however, indicate that cumulative secondary patency rates of EVAR achieve patency rates similar to OR. Patient selection for EVAR repair still represents a fundamental consideration.

Due to the minimally invasive nature of EVAR, improved hospitalisation stays and patency rates approaching OR, EVAR will continue to play a significant role in the management of patients with aneurysmal disease. At present, computerized tomography (CT) and ultrasound are used as the diagnostic test of choice for follow up studies. Ultrasound has been criticised because of its inter-observer variability and poor reproducibility.

The general sonographer who only images the EVAR graft infrequently may feel overwhelmed and daunted. However, the increasing prevalence of EVAR procedures necessitates the need for increased general sonographer training in this area. A summary of significant post EVAR ultrasound findings applicable to any aneurysm repair anywhere throughout the arterial tree includes:

Residual aneurysmal sac changes document size

- Shrinking of sac indicates success.
- Enlargement be very suspicious of the presence of endoleak.
- Asymmetry of residual sac may also indicate the presence of endoleak.
- Flow outside the graft in the aneurysmal sac indicates endoleak.

Endoleak document type and location

- Type 1 and 3 require intervention as does Type 2 if it is associated with sac enlargement.
- Type 2 with no sac enlargement requires monitoring
- Low flow (<100cm/sec) Type 2 endoleaks or Type 2 endoleaks with a to-and-fro waveform may have a higher incidence of spontaneous sealing.

Integrity of stent graft

- Stent deformation, bowing and compression may indicate the presence of increased sac pressure and endoleak.
- Migration and dislocation of graft associated with endoleak.
- Incorporation of stent.
- Kinking of stent.
- Stenosis and occlusion of stent requires intervention.

The high operator dependency of post EVAR ultrasound surveillance can be minimized with sonographer training and a standardised protocol. At Peninsula Vascular Diagnostic, the use of ultrasound to assess patients with endoluminal grafts has given excellent information comparable to other modalities.

313 Carotid IMT (cIMT): protocols and approaches

Joseph F Polak, Tufts University School of Medicine, United States

Objectives

To review the protocols used to measure carotid intima media thickness (cIMT) in epidemiological studies and drug trials. To present data on the technical requirements of cIMT image acquisition and analysis.

Abstract

cIMT is a measurement of two layers of the carotid artery wall that is specific to ultrasound imaging. cIMT protocols for image acquisition are completely dependent on gray scale images. Standard image acquisition sites are used in the distal common carotid artery (CCA), the common carotid artery bulb (Bulb; effectively the internal carotid artery sinus) and the proximal internal carotid artery (ICA; beyond the flow divider).

Variations on this theme are as follows: common carotid artery only; CCA, Bulb and ICA as three separate sites; and CCA with a combined bulb/ICA measurement. cIMT measurements are normally made of the far wall only but near wall measurements are often included. Images are acquired at end-diastole as identified either by the R-wave of an EKG or mechanical end-diastole. cIMT values increase with age; there is therefore more inherent variability with larger cIMT values.

Technical factors that can affect image acquisition are sonographer skill, imaging device, imaging probe frequency and spatial resolution. Factors that cannot be controlled are patient body habitus, age, gender and race.

cIMT measurements require specialised software. In epidemiological studies and drug trials cIMT sonographers and cIMT readers can take up to three months to be certified. Continued quality assurance is needed in order to maintain consistency in cIMT measurements.

314 Sonography of lower limb nerve entrapments

Neil Simmons, Australia

Objectives

Demonstrate the sonographic features of common nerve entrap-

ments in the lower limb and some of their clinical presentations. Relevent less common pathologies will be demonstrated.

Abstract
The sciatic nerve and its branches supplies power and sensation to most of the lower limb.The femoral nerve supplies the anterior thigh and lesser nerves also contribute to the groin and proximal thigh.

Common entrapment sites for the sciatic nerve itself are in the buttock and adjacent to the hamstrings origin. Tears of the hamstring muscles and some of their consequences (scarring and calcification) can also cause sciatic nerve entrapment in the thigh.

The two divisions of the sciatic nerve are the common pereoneal and tibial nerve.

The common pereoneal can be entrapped as it winds around the proximal fibula and the proximal tibio-fibular joint. One of its terminal branches, the medial branch of the deep peroneal,can be entrapped in the dorsal foot. This is known as the anterior tarsal tunnel syndrome. This is more common than the literature would suggest and representative cases will be shown.

Most tibial nerve entrapment occurs in the tarsal tunnel, postero-medial to the medial malleolus. Branches of the tibial nerve, the interdigital nerves of the toes, can be entrapped by degenerative tissue between the metatarsal heads. These so-called Morton's neuromata are difficult to demonstrate without a dedicated technique. Examples will be shown.

Superficial sensory nerves can be entrapped as they pierce fascia or run in exposed positions. Some examples will be demonstrated.

315 Shoulder ultrasound beyond the rotator cuff

Carlo Martinoli, Enrico Capaccio, Alberto Tagliafico, Nunzia Pignataro, Universitia di Genova, Nicola Stagnaro, Italy Stefano Bianchi, Fondation des Grangettes, Switzerland

Objectives
Describe typical US findings of the most common non rotator cuff disorders of the shoulder. Teach and familiarize sonologists with abnormalities of the shoulder other than rotator cuff pathology. Learn to differentiate between these pathologic conditions. Recognise the utility of this technique not only for rotator cuff disease.

Abstract
There are a number of shoulder abnormalities other than rotator cuff pathology that are amenable to US examination. They can mimic rotator cuff tears clinically and may involve a variety of structures around the shoulder, including the deltoid and pectoralis muscle, the glenohumeral joint and its recesses, the bone and cartilage, the subacromial subdeltoid bursa, the labrum and some nerves (suprascapular and axillary).

Acromioclavicular joint lesions (i.e. osteoarthritis, instability, posttraumatic osteolysis of the clavicle) can mimic rotator cuff disease because of the proximity of this joint to the cuff. In acute phases, fractures of the humerus (greater tuberosity, lesser tuberosity, Hill-Sachs type, McLaughlin type) may be radiographically occult and these patients may be referred to US to look for a rotator cuff tear. Although US is not used either when the clinical suspicion of fracture is high or for the evaluation of patients with shoulder instability, fractures can be detected with this technique.

Compression of the suprascapular nerve can present as nonspecific shoulder pain. At US, a paralabral cyst may be seen centered at the level of the supraspinous and spinoglenoid notch. The axillary neuropathy is usually secondary to fibrous bands or stretching injuries at the quadrilateral space.

316 Sonography of bursae

Neil Simmons, Australia

Objectives
To highlight the number and position of the numerous bursae of the musculoskeletal system,their function and the sonographic signs of malfunction. To demonstrate the usefulness of ultrasound guided injections.

Bursae are sacs that are positioned in the body in places of friction, to reduce the friction. A thin film of lubricating fluid within each bursa allows gliding of the bursal walls upon each other.

Bursae are situated in many different positions – between skin and bony prominences (e.g. prepatellar, olecranon and superficial Achilles' bursae); at tendon insertions (e.g. Achilles', deep infrapatellar and gluteus medius); as tendons cross bones or joints (e.g. iliopsoas at the hip joint and gluteus maximus as it crosses the lateral aspect of the greater trochanter); tendon/ligament interfaces (biceps femoris and lateral ligament of knee) and tendon/muscle (subdeltoid between rotator cuff and deltoid muscle).

Some bursae communicate with nearby joints and some with each other. Some develop secondary to repetitive trauma (adventitial bursae).

Pathological conditions are usually due to either acute or chronic inflammation. Less common causes include autoimmune disorders, synovial hypertrophic conditions, haemorrhage and infection.

Sonography of common [and some less common] bursal conditions will be demonstrated. The role of ultrasound-guided injections will be emphasised.

318 Intrauterine CMV infection, prognosis and perspectives for treatment

Yves Ville, Université Paris, France

Objectives
To retrospectively evaluate:
1) The prognostic value of ultrasound abnormalities, fetal thrombocytopenia and elevated plasma levels of liver enzymes in fetal blood of fetuses infected by CMV.
2) The possibility of intrauterine treatment with oral valaciclovir.

Methods
We analysed retrospectively data collected prospectively in 73 fetuses infected by CMV with a positive CMV PCR in amniotic fluid. Fetal blood sampling was performed for evaluation of platelet count, aminotransferases level and gammaglutamyltransferase plasma levels, presence of viremia and presence of specific IgM.

Targeted ultrasound examination was performed every fortnight. Ultrasound findings were categorised into three groups: normal examination, ultrasound abnormality of the fetal brain, and other ultrasound abnormalities. Primary outcome measure combined histological findings after termination of pregnancy and evidence of cytomegalic inclusion

disease at birth when pregnancies were continued. Clinical symptoms at birth or histological lesions attributable to CMV were considered as poor outcome.

Pregnancies with confirmed fetal cytomegalovirus infection were treated with oral VACV (8g/day). Fetal viral load and drug concentration were monitored in amniotic fluid and in fetal blood.

Results

In univariate analysis, only thrombocytopenia and the presence of any ultrasound abnormality were associated with a poor outcome (p <10-4 for both abnormalities). In the multivariate analysis, both thrombocytopenia and presence ultrasound abnormalities remained significant independent predictors of a poor outcome. Based on univariate logistic regression, odds ratio for a poor outcome was 1.24, 7.2, 22.5 and 25.5 for a 10000/mm^3 decrease in platelet count, a non-cerebral ultrasound abnormality, any ultrasound abnormality and a cerebral ultrasound abnormality respectively.

Twenty pregnancies including 21 fetuses were treated at 27.4 ± 3.2 weeks (range: 22 to 34) for 6.3 ± 3.5 weeks (range: 1 to 12). Ten infants are developing normally at between 1 and 5 years of age. Two infants (both 2 years) have severe unilateral deafness. One neonate presented with microcephaly and severe deafness but was also diagnosed with incontinentia pigmenti. Six out of seven cases that eventually requested termination of pregnancy had evidence of in-utero progression of the disease with worsening cerebral lesions. One fetus died in utero. Therapeutic VACV concentrations were achieved in maternal and fetal blood. The viral load in the fetal blood decreased significantly after 1 to 12 weeks of treatment (U Mann Whitney $P = 0.006$).

The outcome of 14/24 (58.3%) untreated symptomatic infected fetuses was poor, with either TOP, IUFD or severe congenital infection disease of the neonate.

Conclusions

The prognosis of CMV infected fetuses relies on both targeted ultrasound examination and fetal platelet count. The prognostic value of platelet count was therefore justifying fetal blood sampling in infected fetuses even in the absence of ultrasound features of brain involvement. Intrauterine treatment of fetal CMV infection may be possible with maternal oral administration of valacyclovir. Our results suggest that in cases where termination of pregnancy is declined, a randomised controlled study to further study this treatment option may be warranted.

321 Ultrasound and the pelvic floor surgeon

Hans Peter Dietz, University of Sydney, Australia

Clinical examination is generally regarded as sufficient for the assessment of pelvic organ support in urogynaecology and female urology. Most colleagues do not see any need to employ modern imaging methods in the investigation of women with urinary incontinence, pelvic organ prolapse and recurrent urinary tract infections. We use the Baden-Walker grading or, at best, the POP-Q Pelvic Organ Prolapse grading system, to describe surface anatomy. There have been attempts in the past to introduce imaging methods into the clinical practice of pelvic floor surgeons. Recently, ultrasound has found widespread acceptance, whether transvaginal or introital/ transperineal/ translabial.

Ultrasound can be of great help to the pelvic reconstructive surgeon. This talk will focus on two examples – the differential diagnosis of posterior compartment prolapse and the issue of levator trauma. In both instances, information derived from pelvic floor imaging is very likely to influence surgical management and has the potential to improve outcomes.

322 Ultrasound in nephrology

Torben Lorentzen, Copenhagen University Hospital af Herlev, Denmark

Objective

To review the use of ultrasound in the nephrologic patient with the focus on normal anatomy and variations, renovascular hypertension, the uraemic patient, the transplanted kidney, and peritoneal dialysis.

The normal kidney is about 11 x 5 x 2.5 cm, however the right kidney is smaller than the left. Renal length correlates with body height and renal size decreases with advancing age. Anatomic variations are parenchymal junction defects, hypertrophy of the column of Bertin, lobulation of the left kidney, and dilatation of the left renal vein.

A patient with acute or chronic renal failure should undergo ultrasound to exclude urinary obstruction due to prostatic disease, bladder stones, pelvic mass, or solitary kidney. Furthermore, congenital anomalies as agenesia, hypoplasia, ectopia (pelvic kidney or thoracic kidney), horseshoe kidney, or renal duplex / ureterocele / UPJ obstruction should be excluded. Diminished kidneys are seen in diabetic nephropathy, chronic pyelonephritis (often reflux), hypertensive nephropathy, and renal artery stenosis. Other parenchymal diseases are polycystic kidney disease, nephrocalcinosis, and glomerulonephritis. In the latter case, the kidney on US can be swollen and diffusely echogenic due to oedema, however, often the kidney looks normal and the diagnosis rest upon a US-guided biopsy.

Using B-mode and Doppler the renal artery can be investigated for a stenosis. On the direct technique, the renal artery close to the aorta is examined for high velocity flow. On the indirect technique, the intrarenal arteries (segmental) are examined for a parvus-tardus flow pattern causing decrease in acceleration time and decrease in resistance index.

323 Diagnosis of fetal CNS anomalies using a combination of ultrasonic and magnetic resonance

Guowei Tao, Shaoping Liu, Tao Gu, Xinfeng Zhan, Lin Chen, Chuanfu Li, QiLu Hospital of Shandong University, China

Objective

To diagnose fetal central nervous system (CNS) anomalies combining ultrasonography (US) with magnetic resonance (MR).

Methods

From 2005 to 2007, 56 pregnant women underwent MR for fetal CNS evaluation within 24 hours after an abnormal CNS was found by ultrasonography. MR was performed on 3.0T MR units, using T2WI SSFSE sequences and T1WI SPGR sequences. US was performed with HDI 4000 equipment. Gestational age ranged from 26–40 weeks with a mean of 33 weeks. Prenatal US and MR imaging findings were compared with postnatal diagnoses.

Results

The gyrus, sulcus, corpus callosum, thalamus, cerebellum

and brainstem of the fetus were shown more clearly on MR images than ultrasound. MR demonstrated the region of sonographic abnormality in all cases, correctly provided additional information to the US-determined diagnosis in 11 cases and correctly changed the US diagnosis in 6 cases.

In the ventriculomegaly cases, we found MR is more valuable for the diagnosis of the ventriculomegaly cases and posterior fossa abnormity in the third trimester than US.

Conclusion

Ultrasound continues to be the screening modality of choice in the evaluation of fetal anomalies. MR imaging as an adjunct to prenatal US may provide valuable information that could add to the prenatal evaluation of fetal anomalies, particularly those involving the central nervous system.

324 Ultrasound assessment of the effects of smoking in pregnancy on endothelial function

Ann E Quinton, Colleen M Cook, Michael J Peek, University of Sydney at Nepean Hospital, NSW, Australia

Introduction

Pregnant women who smoke have increased perinatal morbidity but a decreased incidence of preeclampsia. An association has been demonstrated between endothelial dysfunction and preeclampsia. Further, smoking has been shown to cause endothelial dysfunction in non-pregnant studies.

Aim

To compare the effects of smoking on endothelial function in pregnant women who smoke with non-smoking pregnant women.

Method

Pregnant women (28–32 weeks gestation) who daily smoked 10 cigarettes were recruited and compared with pregnant non-smokers. The smokers were asked to refrain from cigarettes from midnight. Endothelial function was assessed by the ultrasound technique of flow-mediated dilatation (FMD). FMD is the percentage increase in brachial artery diameter as measured by ultrasound, caused by reactive hyperaemia after blood-pressure cuff deflation. After the first test, all the women had a 10–15 minute break during which time the smokers had a cigarette. The FMD test was then repeated in the same manner on all volunteers.

Results

Forty-one women were enrolled (21 smokers; 20 non-smokers). The first test FMD was significantly different (P <0.001) at 4.0 ± 2.3 (smokers) vs 9.7 ± 4.0, (non-smokers). This difference was unchanged at the re-test (smokers 4.4 ± 2.5 vs non-smokers 9.6 ± 3.8, P <0.001) (mean ± SD) despite smokers having a cigarette.

Conclusion

First, the FMD for non-smokers was the same as the women in our previously reported normal study whereas the FMD of the women who smoked was markedly lower, indicating endothelial dysfunction. Second, using this test-retest method, this endothelial dysfunction was shown to be constant.

325 Prenatal sonographic diagnosis of aberrant fetal sulcation

Peter R Coombs, Monash Medical Centre, Australia

The essential formation of cerebral cortex occurs early in fetal life. Four developmental stages provide the distinctive sulci/gyri evident in the human brain. Arrested or aberrant formation in these stages can cause marked alteration to cerebral development. Prenatal diagnosis is important as abnormal sulcation with a very poor prognosis. Detailed fetal cranial ultrasound evaluation provides the opportunity to make this diagnosis in selected high-risk pregnancies.

Objectives

This paper describes cerebral sulcation in detail and uses this to identify the major sulci and gyri seen on prenatal ultrasound. These are the:

- Parieto-occipital fissure
- Calcarine fissure
- Cingulate sulcus
- Central, postcentral, superior temporal sulci
- Sylvian fissure/insula[1]

Anatomical animation, ultrasound and correlative fetal MR will be used to demonstrate the anatomical and sonographic changes of the sulci/gyri through the prenatal period. The standard planes in which the sulci/gyri are imaged will be described. Patient selection, potential pitfalls and the considerable value of 3D/4D will be also considered.

The major example in this paper is failed sulcation demonstrated by lissencephaly ('smooth brain'). This is derived in the genetic syndromes, Miller-Dieker and Walker-Warburg or may be a complication of early cerebral hypoxia and infection. The paper will briefly consider other possible more subtle diagnoses in this area.

Sonographic diagnosis of altered cerebral development is a new horizon, which presents opportunities for a better understanding of fetal prognosis and more informed counselling for parents.

Reference

1 Ghai S, *et al*. Prenatal US and MR findings of lissencephaly. *Radiographics* 2006; 26: 389–405.

326 Does postnatal cerebellar growth predict developmental outcome at two years of age in very preterm infants?

Sheryle R Rogerson, J Cheong, Royal Womens Hospital Melbourne, Australia, Kelly Howard, Peter Anderson, Murdoch Institute of Medical Research Melbourne, Australia, Rod Hunt, Lex Doyle, Royal Womens Hopsital, Australia

Background

MRI measured cerebellar volume at term-equivalent is not associated with adverse outcome. Data relating postnatal cerebellar growth to neurodevelopmental outcome are limited.

Aims

Does serial transcerebellar diameter (TCD measurments relate to two-year developmental outcome?

Subjects and Setting

Infants born at the Royal Women's Hospital, Melbourne, in 2001 <30 weeks gestation or <1250 g birthweight who were followed to two years of age were eligible. TCD was measured on all infants with a GE Logic 500 with an 8 MHz curvilinear probe on days 1, 3,7, 28 and 60. Measurements were plotted on a fetal centile chart for TCD. Suboptimal cerebellar growth (SCG) was defined as a TCD that fell through centile channels and remained lower than the original birth centile channel. The remainder were considered to have optimal cerebellar growth (OCG). Infants were assessed with the Bayley Scales of Infant Development - 2nd

Editions at two years of age, corrected for prematurity, by psychologists blinded to knowledge of the TCD.

Results

Forty-four patients were enrolled; 16 had SCG and 28 had OCG. There were no substantial differences between the groups on the Mental Developmental Index (MDI) or the Psychomotor Developmental Index (PDI) (Table 1).

Table 1. MDI and PDI related to cerebellar growth

	SCG $n = 16$	OCG $n = 28$	Mean difference	P value
MDI	83.0 (19.3)	82.0 (19.4)	-1.05 needs 95% CI	0.86
PDI	88.9 (19.5)	85.0 (15.7)	-3.8 needs 95% CI	0.48

Conclusions

SCG does not correlate with long-term developmental outcome. This is consistent with results from MRI volumetric studies at term.

327 Fetal anatomy assessed by three-dimensional ultrasound at 11–13 + 6 weeks gestation, correlated with the 18–20 week scan and postnatal outcomes

David EV Fauchon, University of Sydney, Australia, Ron J Benzie, University of Sydney, Australia, Deborah A Wye, Nepean Hospital, Australia

Objectives

To correlate the fetal anatomy observations at 11–13 +6 weeks gestation obtained by a single 3D sweep with fetal anatomy at 18–20 weeks gestation and postnatal outcomes.

Methods

A retrospective review to obtain the information at the fetal anatomy scan and the postnatal outcomes of all 273 fetuses scanned at 11–13 + 6 weeks gestation with three-dimensional ultrasound.

Results

In the first 209 patients followed, 4 had a fetal anomaly. There was 1 chromosomal abnormality (47XXX), a hyperplastic left heart, an abnormal left hand and a duplex renal collecting system. There were 4 stillbirths all with normal phenotypes. The chromosomal abnormality had a normal nuchal translucency measurement but the patient's age and serum biochemistry resulted in a high risk for aneuploidy. The diagnosis was confirmed by amniocentesis. The cases with the hyperplastic left heart, the abnormal left hand and the duplex renal collecting system were diagnosed at the 18-20 week ultrasound.

Conclusions

This review confirms two findings from other studies. The first is that a single transabdominal three-dimensional sweep between 11–13 + 6 weeks gestation provides appropriate views of the fetus for evaluation of both anatomy and nuchal translucency in the vast majority of cases. Second, the recommendation still stands that a fetal anatomy scan be performed in the second or third trimester as the first trimester 3D sweep must not be expected to diagnose all anomalies.

330 Early pregnancy failure – the role of assessment units

David Ellwood, The Australian National University Medical School, Australia

Complications of early pregnancy such as vaginal bleeding, early pregnancy failure and ectopic pregnancies are relatively commonplace. Indeed, as the average age at first pregnancy increases, it may be that as many as 1-in-3 or -4 pregnancies will either miscarry, or present in the first trimester as non-viable. Apart from extra-uterine pregnancies, these complications of early pregnancy are neither clinically urgent, nor do they usually pose a significant risk to maternal health. However, they are of great emotional significance to the woman and their management requires both expediency and compassion.

Over the last two decades, there have been many different models developed of early pregnancy assessment units. These have been driven by several factors. First, the availability of rapid and accurate quantitative HCG assay, and access to high-resolution transvaginal ultrasound has enabled earlier and more accurate diagnosis of both site and viability of early pregnancies. Second, there has been the realisation that Emergency Departments are not the best place to manage women who are emotionally vulnerable yet with a relatively non-urgent clinical problem. The third factor has been the emergence of data showing that many early pregnancy complications can be managed non-surgically, requiring an efficient follow-up mechanism.

This presentation will look at the needs of the woman who is experiencing an early pregnancy complication, and the way that early pregnancy assessment units can best serve them.

402 Managing monochorionic twin pregnancies

Jon Hyett, Royal Brisbane and Women's Hospital, Australia

The prevalence of multiple pregnancies has increased over the last 20 years. This is in part related to the trend of advancing maternal age for pregnancy, but is also related to the increased use of assisted reproductive technologies. Twin pregnancies are associated with a 5-fold increase risk of neonatal mortality and an 8-fold increase in risk of adverse neurodevelopment outcome. Vascular accidents related to monochorionicity and preterm delivery are the major factors causing this morbidity.

Chorionicity is best determined in the first trimester of pregnancy. At the routine 12-week (NT) scan, the membrane inserts into the placenta in a 'T' shape whereas in the dichorionic situation, where a peak of placental tissue rises between the membranes, this is an 'l' shape. A statement of chorionicity should be made in all routine first trimester scans and should lead to differential management of monochorionic and dichorionic pairs.

The longitudinal follow up of a cohort of monochorionic twin pregnancies has shown that the periods of high risk for mortality occur between 16–24 and after 32 weeks. The main cause of mortality appears to be twin-twin transfusion in both of these situations. In the second trimester, this is best monitored by serial ultrasound with scans every 2 weeks from 16 weeks of gestation, continuing to 24 weeks. In the third trimester early delivery (at 34–36 weeks) by caesarean section may reduce risk – although there is little prospective data to support this.

Recent studies have looked at improving the prediction of poor outcome (twin-twin transfusion syndrome or intrauterine fetal death) using first trimester markers. To date, a 20%

discrepancy in NT and absent/reversed flow in the ductus venosus have both been shown to be associated with poor outcome: with positive and negative LRs of 2.0/0.67 and 2.5/0.67 respectively. The findings of NT discordance and an abnormal DV increase the risk of poor outcome by 3.0 whilst normal ultrasound findings decrease the risk by a factor of 2.

404 Fetal brain examination

Yves Ville, Université Paris, France

Evaluation of the fetal CNS can optimally be obtained in the second and third trimesters of pregnancy. In late gestation, visualisation of the intracranial structures is frequently hampered by the ossification of the calvarium. Most basic examinations can be performed with 3-5 MHz transabdominal transducers. Fetal neurosonography frequently requires transvaginal examinations usually performed with transducers between 5 and 10 MHz. The targets of the routine CNS examination are: head shape, lateral ventricles, cavum septi pellucidi, thalami, cerebellum, cisterna magna and spine. Three-dimensional ultrasound may facilitate the examination of the fetal brain and spine.

The appropriate axial planes are:

1) The transventricular plane demonstrating the anterior and posterior portion of the lateral ventricles.
2) The transcerebellar plane demonstrates the cerebellum and posterior fossa.
3) A third scanning plane, obtained at an intermediate level is also frequently used in the sonographic assessment of the fetal head, and is commonly referred to as the transthalamic plane or biparietal diameter plane. The anatomical landmarks include, from anterior to posterior, the frontal horns of the lateral ventricles, the cavum septi pellucidi, the thalami and the hippocampal gyruses. The most frequent of the severe spinal abnormalities, open spina bifida, is usually associated with abnormal intracranial anatomy. However, a longitudinal section of the fetal spine should always be obtained because it may reveal, at least in some cases, other spinal malformations including vertebral abnormalities and sacral agenesis.

Coronal planes include:

1) The transfrontal plane obtained through the anterior fontanelle and depicts the midline interhemispheric fissure and the anterior horns of the lateral ventricles on each side.
2) The transcaudate; and
3) The transthalamic planes.

Three sagittal planes are also usually studied: the midsagittal and the parasagittal of each side of the brain.

Three types of scanning planes can be used to evaluate the integrity of the spine including transverse and axial planes. In sagittal planes the ossification centres of the vertebral body and posterior arches form two parallel lines that converge in the sacrum.

The best application of 3D ultrasound for brain examination lies in the multiplanar mode. This is particularly useful for the diagnosis of midline anomalies of the fetal brain can always be made accurately using 3D median views. Although the corpus callosum is not usually visualised directly, agenesis is consistently associated with an absent or small cavum septi pellucidi, which is easily identified in the 3D median view.

The use of 3D examination of the fetal spine gives the possibility of visualising the entire length of the bony elements of the spine of the mid-trimester fetus in one single image.

In a low risk pregnancy around midgestation, if the transventricular plane and the transcerebellar plane are satisfactorily obtained, the head measurements (head circumference in particular) are within normal limits for gestational age, the atrial width is less than 10.0 mm and the cisterna magna width is between 2–10 mm, many cerebral malformations are excluded, the risk of a CNS anomaly is exceedingly low and further examinations are not indicated.

405 Imaging of implants used for anti-incontinence and prolapse surgery

Hans Peter Dietz, University of Sydney, Australia

Over the last 10 years, the popularity of synthetic implants in female urology and urogynaecology has increased tremendously. More and more women present with complications or recurrence after such implant surgery, often without being aware of the nature of the procedure. Synthetic slings such as the TVT, Sparc, ICS, Monarc, TVT-O etc. are now first-line procedures. Ultrasound can confirm the presence of such a sling, distinguish between transobturator and transretzius slings, and even allow an educated guess regarding the nature of the sling. The degree of tensioning of the sling can also be evaluated. A tight c shape at rest and a gap of less than 1 cm between tape and symphysis pubis makes functional obstruction very likely and suggests tape division if there are worsened symptoms of bladder irritability or clinically significant voiding dysfunction.

Since about 2004, many prolapse surgeons have started using mesh implants for the repair of large and/or recurrent cystocele, or for posterior compartment prolapse. These implants are generally highly echogenic, and surgical audit in such patients has already yielded surprising insights into the mode of action of mesh implants, as well as suggesting causes of failure.

406 How useful is ultrasound in the management of secondary PPH?

David Ellwood, The Australian National University Medical School, Australia

Secondary postpartum haemorrhage (PPH) is a relatively common condition affecting 1–2% of postpartum women. It is difficult to define accurately as there is a wide range of normal variation in postpartum blood loss, both in terms of frequency and duration. In general, the diagnosis is made when there is a significant increase in the amount of fresh bleeding, at a time when the loss has begun to settle to a blood-stained discharge (lochia). The common causes are endometritis, retained products of conception such as placenta, or both. Typically, it occurs at 10–15 days postpartum, although the definition includes any bleeding after the first 24 hours.

One of the mainstays of diagnosis has always been ultrasound, looking for evidence of retained products and the usual treatment, if found, has been postpartum curettage. However, there are significant risks involved in such surgical management including uterine trauma, perforation and the long-term consequences of amenorrhoea and infertility due to intrauterine adhesions (Ashermann's syndrome)

There is now a body of evidence to suggest that the normal postpartum uterus contains quite large amounts of echogenic

material which is often referred to after ultrasound as 'retained products'. Once this ultrasound diagnosis is made and reported, the clinician is put in the difficult position of doing a curettage which may not be warranted and can cause harm.

This presentation will look at what is known about the appearances of the post-partum uterus, and examine the evidence for and against the use of ultrasound in this condition. Alternative ways of reporting the ultrasound findings will be discussed to more accurately guide clinicians in the correct management.

407 Prediction of emergency operative delivery and pelvic floor trauma

Hans Peter Dietz, University of Sydney, Australia

A large number of women in the developed world expect a normal vaginal delivery without obstetric intervention only to experience a highly medicalised birth, resulting in a sense of personal failure or suboptimal care. In addition, some of those women are left with long-term morbidity due to trauma to the anal sphincter, levator muscle and pelvic organ support. Unplanned emergency delivery may have major psychological and somatic sequelae and significantly affect the future life of woman and child, even if somatic trauma does not occur. Identification of antenatal risk factors for intervention would hold promise in terms of reducing somatic and psychological trauma as well as the cost of service delivery.

In a recently conducted prospective observational study, we tested potential clinical predictors and ultrasound parameters of potential predictive value. A multivariate model derived from these parameters was moderately predictive of delivery mode, reaching a corrected Nagelkerke R2 of 26.8% in a group of 125 nulliparae with uncomplicated singleton pregnancies assessed between 36 and 40 weeks' gestation. When multivariate regression models were constructed considering the (sometimes considerable) interdependence of variables, the best model had a discriminatory ability c = 0.852 (equivalent to area under ROC curve), indicating excellent discrimination between NVD and non-NVD.

Current work at our unit focuses on optimising this predictive model, using it in intervention trials aimed at high-risk women. Furthermore, we are working to develop a similar model for the prediction of major pelvic floor trauma.

408 Saline hysterosonography – a useful adjunct to the gynaecological scan

David Ellwood, The Australian National University Medical School, Australia

Saline infusion sonohysterography (SIS) was first described in 1986, in a landmark paper by Randolph, *et al*. A submission to the Health Insurance Commission (HIC) in 1998 resulted in a comprehensive report by the Medical Services Advisory Committee in 1999, which ultimately resulted in the granting of an item number (55736) for this procedure. Surprisingly, the uptake into clinical practice has been relatively low and in the financial year 2005–06 only 4177 of these procedures were recorded and rebated by Medicare. The utilisation by state and territory shows enormous variation in practice. In the evidence given to the HIC it was argued that there should be a clear saving from the reduction of hysteroscopy and curettage procedures. Clearly this has not been the case across the whole country.

The technique is relatively simple and can be learned very easily. There is little doubt that it aids diagnosis and allows, in many cases, for a diagnosis to be made at the first ultrasound as opposed to waiting for a surgical procedure. The technique also has very high patient acceptability as it leads to greater certainty of diagnosis in many cases.

This presentation will explore the usefulness of this technique using a number of case presentations and examine the reasons why the uptake in Australia and New Zealand has been limited.

409 Percutaneous gastrostomy guided by ultrasound and fluoroscopy

Torben Lorentzen, Herlev Hospital, Denmark

Objective

To review the indications and various techniques of percutaneous gastrostomy with focus on a radiologic technique guided by ultrasound and fluoroscopy.

Abstract

Feeding via a gastrostomy tube is an established way of maintaining enteral nutrition in patients who have disorders that makes oral intake inadequate. In the early 1980s, two alternative methods to surgical gastrostomy were introduced: percutaneous endoscopic gastrostomy (PEG) and percutaneous radiologic gastrostomy (PRG). The use of gastropexy devices in PRG, so-called T-fasteners, was first reported in 1986.

PEG and RPG have both shown to be safe and efficient alternatives to surgical gastrostomy, since both techniques have significantly lower rates of complications.

In children and newborns, PEG is often the preferred method. However, the choice of technique is generally governed by local availability and expertise. The conventional PRG technique is guided solely by fluoroscopy after having distended the stomach with air.

At Copenhagen University Hospital at Herlev, an alternative guiding technique has been preferred the last 15 years: This PRG technique deviates from the conventional technique in two ways:

1) The fluid filled stomach is punctured, guided by ultrasound and not by fluoroscopy; and
2) Only a single T-fastener is utilised temporarily during the PRG procedure. This T-fastener is used along the puncture tract to facilitate tract dilatation and tube insertion. This technique is presented including the results of 154 cases.

Reference

1 Lorentzen T, Nolsøe CP, Admensen S. Percutaneous radiologic gastrostomy with a simplified gastropexy technique under ultrasonographic and fluoroscopic guidance: experience in 154 patients. *Acta Radiol* 2007; 48: 13–9.

ASUM travel scholarship to Vietnam

Henry Murray travels to Vietnam with the ASUM Vietnam Asia Link Scholarship Fund

On arrival in Vietnam I met with Harley Roberts. Harley has spent endless hours working with personnel from Tu Du Hospital, especially Dr Nguyen Ha, to foster the practise of scanning in obstetrics and gynaecology. The major issues presented to me on arrival were to teach the use of Doppler flow in obstetrics, provide logical follow up guidelines for fetal anomalies given the limited facilities for neonatal surgery and tertiary neonatal care in Vietnam, improve the quality of CVS sampling and to teach the relevance of advanced scanning to the general obstetricians working in southern Vietnam. This latter task was to be undertaken at the Vietnamese Congress in Obstetrics and Gynaecology, which was held during my stay in Ho Chi Minh City.

The job of helping produce guidelines for the management of fetal anomalies was something I was able to undertake since I work in high risk obstetrics as a feto-maternal medicine subspecialist looking after high-risk pregnancies, including fetal anomalies. The initial days were spent assessing what facilities were available for neonatal care and then working to accommodate those limitations within any guidelines.

Part of the process of familiarising myself with the hospital facilities was to meet and discuss issues with the obstetric staff of Tu Du Hospital. This facility performs over 45 000 deliveries per year, of which 55% approximately are primiparous. Despite these large numbers, it was obvious and surprising that the hospital was more than adequately staffed to deal with the clinical load. There were a minimum of one midwife and two student midwives assigned to each individual patient, and up to 12 medical staff on the labour floor at any one time. It was enough to make a doctor working in obstetrics in Australia jealous.

A considerable amount of my time in the Tu Du Hospital was spent discussing issues of patient management, especially the high-risk pregnancy. Change in Vietnam comes from the top down and I was lucky to give presentations on high-risk pregnancy management to all levels of the hospital hierarchy during my visit. Changes of protocols based on evidence are underway and refinements and suggestions will be made by email contact over the coming months.

I sincerely thank ASUM, especially Dr Caroline Hong, Dr Harley Roberts, and Dr Nguyen Ha (Tu Du Hospital) for facilitating my trip to Vietnam. I believe that such visits can be of great value to all involved.

For those interested in visiting Vietnam, I can assure you that you are guaranteed a warm welcome from a people that make smiling an art form. The food and atmosphere are amazing, prices are cheap and pollution is low. The government inputs to health care and education are to be commended and although people may be poor by western standards, I did not see poverty like that in other developing countries. Vietnam is a great and safe place to visit and I would commend it to anyone.

Henry Murray
Nepean Hospital

Editor's Note

Dr Henry Murray was the recipient of the 2007 ASUM Vietnam Asia Link Scholarship Fund award for travel to Vietnam in order to teach high-risk obstetrics. He spent two weeks at Tu Du Hospital in Ho Chi Minh City from 12th–26th May, 2007.

Winners ASUM Awards and Fellowships

Chris Kohlenberg Teaching Fellowship Martin Necas (Regional NSW). Sponsored by GE Healthcare

Beresford Buttery Teaching Fellowship George Condous (NSW and Vic). Sponsored by GE Healthcare

Gulia Franco Teaching Fellowship Elvie Haluszkiewicz (NT and Regional Nth Qld) Sponsored by Toshiba

Anthony Tynan Award for Best Clinical Presentation Kerry Thoirs. Sponsored by Siemens Value $1000

Best Research Presentation Award Peter Coombs. Sponsored by Siemens Value $1500

Best Sonographer Research Presentation Award David Fauchon. Sponsored by Philips Value $2000

Best Poster Award sponsored by ASUM Jackie Cartmill. Value about $1500, made up of free registration to ASUM meeting 2008 Auckland and $500 spending money

UI UL Plenary Award Recipient Assoc Prof Jon Hyett
Hon. Fellows Rosina Davies and Mary Young

ASUM honours 2007

Mary Young DMU AMS Honorary Fellow, ASUM

Mary Young's commenced her sonography carrier in 1976 at the Mercy Hospital for Women, Victoria in 1976, under the direction of Dr Christine Action. She is one of the founding members of the sonography profession and an exemplary member of ASUM.

With a keen interest in education, Mary assisted in running meetings of the Melbourne Clinical Ultrasound Group which formed the nucleus of ASUM's Victorian Branch. She became Victoria's liaison officer of the DMU examinations organising sonographer education meetings; venue organisation and invigilation and practical examiner.

Through the late 80s and early 90s, Mary held executive positions in the Victorian Branch of treasurer, secretary and finally, chairman and as such, was on the organising committees of ASUM's many Victorian meetings. Susie Woodward, ASUM Councillor's nomination saw Mary become ASUM's assistant honorary secretary leading her to become honorary secretary, a position she held for six years.

During those years, Council worked on the foundations of those who had gone before, to develop the international links of the Society, to try to grow the Society from Australasian to international, and to nurture the fledgling ultrasound communities within our global region.

Other notable achievements of this time include winning the bid to host WFUMB '09; establishing the Research Foundation; laying the foundations of the ASAR; development of the Multidisciplinary workshops and continuing support for the Bulletin.

Mary continues to work in private practice in Melbourne with Dr Max Hardy. The Society salutes Mary Young as an Honorary Fellow.

Rosina Davies DMU Honorary Fellow, ASUM

Rosina Davies' introduction to ultrasound was in 1975 at Sydney Hospital, when it purchased one of the first commercial ultrasound machines in Australia. She was chief radiographer of the Radiotherapy Department, incorporating nuclear medicine and ultrasound. In 1978 she transferred to full-time sonography at Park House Ultrasound, Macquarie Street, Sydney, in obstetrics, gynaecology and general studies.

During this time Rosina became an ASUM member gained training at the Ultrasonics Institute, particularly with the tuition of David Robinson, and gained the DMU.

In 1983, Rosina commenced work as an ultrasound application specialist with Toshiba (Australia) expanding her knowledge of ultrasound, commerce and the ultrasound community and was promoted to Business Unit Manager for Ultrasound by the years end.

She was appointed General Manager Toshiba (Australia) Pty Ltd in 1993 a position she retained until she retired in August 2007.

At WFUMB 1985, in Sydney, Toshiba introduced colour Doppler systems to Australia with Rosina being at the forefront.

Her career path encompassed development of new technologies; clinical applications and techniques and teaching as she visited so many sites. As General Manager of Toshiba, Rosina has supported, in cooperation with the subsequent business unit managers, the Society's interests at local, branch and national meetings in Australasia and in the World Federation.

Through a request from Rosina to ASUM, Toshiba has sponsored the annual Guilia Franco Teaching Fellowship, which increases the educational opportunities of members who live outside the main centres.

Always gentle, ever vigilant and generous, deservedly, Rosina Davies has been made an Honorary Fellow of ASUM at its Annual General Meeting.

DMU Asia Recipients

The following candidates have fulfilled the DMU (Asia) requirements and have been awarded the Diploma (Asia) by the ASUM Council.

I congratulate them on their success and wish them well in their development as sonographers.

Peng Hwei Fun
Foo Siew Keay (Phoebe)
Lai Xiao Hui
Lee Pei Yee
Leong Chai Kim (Stacia)
Marian Ab. Malik
Nur Marni bt. Ahmad
Yeo Siang Joo

Andrew Ngu
Chairman DMU (Asia)
Board of Examiners

DMU key dates for 2008

Part I and Part II Application Open
1st December 2007
Part I and Part II Application Close
31st January 2008)
Part I and Part II Late Application Close
31st March 2008
Application for Exemption Close
31st March 2008)

DMU Preparation Course
Sydney 26th–30th March
DMU Part I Written Examination
26th July 2008
DMU Part II Written Examination
26th July 2008
DMU Part II Oral Examination Period
September 2008
DMU Part II Practical Examination Period
August 2008
DMU Part I Supplementary Written Exam
1st November 2008

DMU fees and charges 2008

2008 DMU Examination Fees

DMU Enrolment (once only fee)
$A326.00 + GST = $A358.60
DMU Part I APP
$A326.00 + GST = $A358.60
DMU Part I PHY
$A326.00 + GST = $A358.60
DMU Part II Written
$A540.00 + GST = $A594.00
DMU Part II Oral
$A540.00 + GST = $A594.00
DMU Part II Practical
$A800.00 + GST = $A880.00

Supplementary Examinations

DMU Part I Supplementary APP
$A326.00 + GST = $A358.60
DMU Part I Supplementary PHY
$A326.00 + GST = $A358.60

Convenor's Report – 3rd New Zealand branches of ASUM and RANZCR combined scientific meeting

Dr Matthew Andrews and New Zealand Scientific Meeting Co-convenor Dr Hong Soo Wong

The 3rd New Zealand ASUM branches and RANZCR Combined Scientific Meeting was held in Wellington from 20th–22nd July 2007. The delegates and the speakers were welcomed with tears from the sky.

We were all saddened by the loss of Prof Fung Yee Chan, who was scheduled to be a keynote speaker. A time was devoted at the beginning of the ASUM meeting in memory of Prof Chan, who will forever live in the minds and hearts of so many of her patients, friends, colleagues and, obviously, family.

Our sincere thanks go to our international speakers, Prof Lil Valentin and Assoc Prof Jon Hyett. Prof Valentin travelled a long way from Sweden to give her lectures on gynaecology ultrasound, which provided very clear, comprehensive and educational coverage of acute and chronic gynaecology conditions. Prof Valentin had also provided us with an expert insight into the past, present and future role of ultrasound in gynaecology. We were also very grateful to Assoc Prof Jon Hyett who agreed to sit in for Prof Fung Yee Chan at very short notice. He had already given excellent coverage on nuchal translucency screening in the pre-conference course and agreed to stay on so as to provide a good run down on fetal surveillance in the conference.

We were also graced with some most distinguished local and Australasian speakers, including Prof Kevin Pringle, Dr Billy Ying Kei Cheung, Dr Ramesh Tripathi, Mr Ian Ross and Dr John Matthews, Mr Stephen Bird, Mr Martin Necas, Dr David Rogers and Dr Roger Davies. They are well known experts in the field of vascular, obstetrics, interventional and musculo-skeletal imaging and telemedicine. Together, they provided an expansive coverage of the application of ultrasound, from the latest advances to some unusual yet interesting conditions that might not be covered in other meetings. Special thanks go to Dr Cheung who also provided some good ideas for the program.

The proffered paper and ASUM best sonographer/registrar/student sonographer sessions were thoroughly enjoyed, as well as the poster display. There was a very good collection of papers and all the participants agreed that the standard was very high. It was a challenge to allocate the paper to the sessions, and even more so for the judges to decide on the winners of the awards. We look forward to reading these papers in the *Ultrasound Bulletin*.

The conference dinner was held among the National Museum displays at Te Papa. We had a wonderful time together. Thanks to Ms Christine Birchall, NZ ASUM Committee Member, who not only took her time to support the organisation of the meeting but also found the band that created the atmosphere for the conference dinner and provided us with such entertaining music.

I would like to thank the ASUM Council and the ASUM New Zealand Branch for their generous, continued support, especially Dr Caroline Hong, Mr Keith Henderson, Dr Matthew Andrews, Dr David Rogers, Mr Rex de Ryke (who also helped in the organisation of the pre-conference course) and Ms Nancy Leung and Mrs Iris Hui from the ASUM Secretariat for their hard work. I would also like to thank the past convenor, Ms Yvonne Taylor, for sharing her precious experience. It was challenging to organise a combined meeting but, through recognising and understanding our common grounds as well as the differences, the Committee members walked together, in providing the best for our members, who are our prime concern.

On behalf of ASUM New Zealand Branch, I would like to thank our Platinum Sponsor, GE Healthcare, our Silver Sponsors, Siemens, Philips and Carestream Health (Kodak) and our Bronze Sponsor, Comrad Medical Systems, as well as the exhibitors for their support. The last but not the least, credit also goes to MIANZ for their management of the conference.

Since there were nearly 300 delegates, with a good mixture of Australians and New Zealanders, there was ample time for communication and networking over the tea breaks, lunchtime, happy hour and the conference dinner. It was an excellent opportunity to meet with old friends and to make new ones. Three days went quickly. The sun finally made its appearance to farewell our delegates and speakers. We look forward to meeting you all again at the next ASUM meeting in New Zealand.

Dr Hong Soo Wong
Co-convenor
ASUM New Zealand Branch

Cairns 2007: Delegates enjoy super 37th ASM

Delegates at the extensive trade exhibition

The 37th ASUM Annual Scientific Meeting was held on 13th–16th September at the Cairns Convention Centre, which is a leisurely stroll from the city centre and the main hotels.

The meeting commenced with the Skills Day on Thursday. The workshops covered a wide range of topics and were of a very high standard. The day ran very smoothly thanks to the organisation of Sue Davies, Lynette Hassle and Barbara Vanini.

The main program ran over Friday, Saturday and Sunday. The meeting opened with an interesting talk by Prof Julie Campbell on her research into growing vascular conduits in the peritoneal cavity.

The musculoskeletal program was organised by Craig Cairns and featured quality overseas speakers Carlo Martinoli and Eugene McNally, both endured a gruelling program and gave talks of the highest standard. The program was complimented by the expertise of Dr Neil Simmons and Shane Brun. I think everyone felt they learned something new in this field from every presentation.

Brendan Cramp was convenor for the vascular component, which included overseas speakers Joe Polak and David Evans, supported by local experts Deb Coghlan, Yvonne Butcher, Roxanne Wu and Christina Steffen. The program was diverse and covered topics such as 'Carotid intima-media thickness' by Joe Polak and 'Cerebral circulation' covered by David Evans. It was a pleasure to have a local representation in Roxanne Wu, who told us about the 'Great expectations' of the vascular surgeon and Christina Steffen, who spoke on the high-risk diabetic foot in Cairns.

We were also lucky to have an excellent O & G program, with outstanding presentations from all of the speakers including David Nyberg, Jon Hyett, Rob Cincotta, Peter Dietz. David Ellwood, Robert Miller, and Yves Ville. The subject matter ranged from Peter Dietz's dynamic talks on the pelvic floor to a comprehensive look at first trimester through to third trimester ultrasound. The presentations tended to deal with the tertiary level of obstetrics rather than the basics, so we hope everyone learned something from this program.

The small parts and general program consisted of Tom Stavros, Toreben Lorentzen, Richard Allan, Michelle Pedretti, Susane Fraser, Matthew Andrews and Stephen Bird. Tom Stavros, as in previous years, gave a number of quality talks on a diverse range of topics including breast, thyroid and groin.

Susane Fraser gave an extremely interesting workshop on breast intervention, its technique and how to recognize a good sample, this was complimented by a talk on rural and remote breast diagnosis.

Richard Allan and Torben Lorentzen, both liver ultrasound experts, gave presentations on liver Doppler and intervention. I liked the title of Michelle Pedretti's talk, 'Peyronie's disease, the long and the short of it'. Say no more!

The meeting ran without a hitch, which was due to the wonderful facilities at the Cairns Convention Centre and the ever-helpful staff, and also to the tireless efforts of Sarah Hall, Sarah Markey-Hamm and Kate Weston from conference organisers ICMS to whom the Committee is extremely grateful.

We all relaxed on Saturday night at the gala dinner held at the Convention Centre. The evening commenced with our guest speaker, the captivating Samantha Riley, who gave an enlightening speech entitled 'The power of rain'. We then partied to the excellent band – although the conga line became a little dangerous. There were even fireworks outside as part of the Cairns Festival, which added to the party atmosphere.

The Committee would like to recognise the importance of our sponsors GE Healthcare, Philips, Toshiba, and Siemens. We would especially like to thank GE Healthcare for their generous sponsorship of Tom Stavros and Sam Riley and Toshiba for their generous sponsorship of Eugene McNally. The sponsors held symposia on Friday, which were well attended and well received by the delegates.

We would also like to thank ASUM, especially Caroline Hong, Keith Henderson and Matthew Andrews for their support throughout the organising process and also Council members Stephen Bird and Ros Savage, they always offer and give help where necessary.

We are also grateful to Deb Coghlan, Yvonne Butcher, and Alison Lee-Tannock. They not only gave presentations of their usual high standard, but also helped by chairing sessions and were happy to help wherever they could.

To close, the Committee would like to thank all those who attended the ASM and who made it such a success. We hope all of the delegates enjoyed it as much as we did and we hope you will continue to support ASUM in the future.

Deb Moir
Elizabeth Carter
Convenors


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email stephanie.mason@ge.com
General Manager Kevin Potter
www.gemedicalsystems.com

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email ian.stewart@
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email
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www.qldxray.com.au

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Sonosite Australasia Pty Ltd
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email
matt.tucker@sonosite.com
www.sonosite.com

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Mark Mooney
tel 02 9005 7702
email mark.mooney@
symbionhealth.com
www.symbionhealth.com

Toshiba (Aust) Pty Ltd Medical Division
Louise Archer
tel 02 9887 8041
email larcher@toshiba-tap.com
General Manager Nick Swaan
www.toshiba.com.au

ASUM invites suppliers of medical equipment, services and consumables to join the Society. Call Dr Caroline Hong tel +61 2 9438 2078 for information

New ASUM members

NEW MEMBERS – JULY 2007

FULL (30)
Andrew Bickell Vic
Charmaine Burdett SA
Anthony Day Qld
Katherine Eagles NSW
Timothy Eller Qld
Wouter Gerryts WA
Joanne Glover WA
Tina Guy SA
Penny Koh Vic
Waiyee Lai NSW
Tanya Maunder Qld
Linda McKendrick SA
Vivian Morrow NSW
Vu Nguyen Vic
Michael Petrucco Vic
Wayne Pitcher Qld
Marilyn See NSW
Peter Spyropoulos SA
Karen Thomson Vic
Sue Belgrave NZ
Rhonda Buchanan NZ
Melanie Cosford NZ
Patrice Crawford NZ
David Hamments NZ
Alexandra Ivancevic NZ
Gareth Robb NZ
Deborah Stanley NZ
Peter Staub NZ
Brigid Van Der Kroon WA
Hong Soo Wong NZ

ASSOCIATE (8)
Victoria Alderdice Qld
John Garland NSW
Amanda Kellaway SA
Belinda Larsen Qld
Jenna Tessari SA
Andrew Graham NZ
Lucy Hellberg NZ
Xuesen Liu NZ

AFFILIATE (6)
Marcia Bonazzi Vic
Mark Gillett NSW
Swati Mahajan Fiji
Siva Navaneethan NSW
Woo Tan ACT
Sampsa Kiuru NZ

NEW MEMBERS – AUGUST 2007
FULL (131)
Sanjeeva Abeywickrema NSW
Bruce Allen NZ
Roger Allison Qld
John Andersen Qld
Troy Anderson NSW
Ramesh Arunach NZ
Malcolm Baigent NZ
Michael Baker NZ
Kylie Baker Qld
Rachel Belsham NZ
Stuart Berry Vic
Ian Best NZ
Gill Beveridge NZ
Damon Blair NZ
Philip Bobby NSW
Simon Bodicoat NZ
Lusiana Bolalailai NZ
Philip Borrie NZ
Susan Brooks NZ
Fraser Brown Vic
Roy Buchanan NZ
Stephen Busby NZ
Lisa CaOpelle NZ
Ben Castle NZ
Donald Chan NZ
Sarat Chander NZ
Billy Cheung NZ
Bruce Chisholm NZ
Barnaby Clark NZ
Andrew Clarke NZ
Richard Coates NZ
Rodger Colbert NZ
Terence Cousins NZ
David Cranefield NZ
Daan De La Rey NZ
Francois DeBruin NZ
John Denton NZ
Megan Di Quinzio Vic
Peter Dixon NZ
Paul Dukes NZ
Thomas Ecker NSW
Geoffrey Edwards Vic
Christine Elder NZ
Albert Eshun NZ
Charitha Fernando NZ
Raj Fernando NZ
Trevor Fitzjohn NZ
Amy Fong NZ
George Foote NZ
Martin Forbes NSW
John Goulden NZ
Rhys Harding NZ
Chris Harrington NZ
Rebecca Harris NZ
Cristian Hartopeanu NZ
Barbara Hochstein NZ
Jocelyn Homer NZ
Tony House NZ
Greg Hunt NZ
Helen Joyce NZ
Harry Kaplan Vic
Nicholas Kenning NZ
Liz Kenny NZ
Michael Kerr NZ
Len Killman Vic
Andrew Kingzett-Taylor NZ
Andrew Klava NZ
Martin Kluckow NSW
Louis Lao NZ
Mark Leadbitter NZ
Chris Leaper NZ
Remy Lim NZ
Henry Liu NZ
Brett Lyons NZ
Ian Macdonald NSW
Matthew Mackay NZ
John Mathews NZ
Kim McAnulty NZ
Fran McCaul NZ
Rachael McEwing NZ
Ben McGuinness NZ
Chris McKee NZ
Jann Medlicott NZ
Grant Meikle NZ
Anna Moon Vic
Vicki Morganti NZ
Gillian Morris NZ
Sabaratnam
Muthukumaraswamy NZ
Nikolay Nedev NZ
Johan Nel NZ
Rosanne Newman NZ
Richard Ng NZ
Sharon Ngu NZ
Mike Nowitz NZ
Patrick O'Dell NSW
Fleur O'Leary NZ
Medhat Osman NZ
Umesh Pandey NZ
Maria Pearse NZ
Jane Peart NZ
Clinton Pinto NZ
Zahurul Quddus NZ
Ian Revfem NSW
Ricky Rutledge NZ
Diane Sommerville NZ
Graham Stevens NZ
Lisa Sweetman NZ
Tevita Taka NZ
Su Yin Tang NZ
Glyn Thomas NZ
Glen Thomson NZ
Deborah Trembath NZ
Caroline Tsai NZ
Leanne Tyrie NZ
Gianluca Valsenti NZ
Jennifer Walker NZ
Iain Ward NZ
George Waterworth NZ
Gavin Watson NZ
Scott Wells NZ
Margret Weston NZ
Edward Williams NZ
Jacqueline Williamson Vic
Ben Wilson NZ
Sonia Wong NZ
David Wong Qld
Katherine Wood NZ
Rebecca Woodward NZ
Jarrad Wrightson NZ
Rodney Wu NZ
Rauf Yousaf NZ
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Bronwen Allen NZ
Rowena Amin NSW
Fay Anstis NZ
Annemieke Arron NZ
Christine Birchall NZ
Justin Bowra NSW
Pauline Brown NZ
Mary Burman Vic
Joan Burns NSW
James Bushell SA
Tracey Cadogan NZ
Penelope Cain NZ
Shawnee Carter NZ
Lucy Cheetham NSW
Eunice Chong NZ
Olwen Clarke NZ
Sally Colbeck NZ
Nicola Corbitt Tas
Cathryn Dixon NSW
Gaye Douglas NZ
Mukesh Edward NSW
Jennifer Evanson NZ
Shadley Fataar NSW
Tim Fitzpatrick Vic
Petar Fizulic SA
Jennifer Flower NZ
Kathryn-Therese
Fraser Vic
Karyn Gregan NZ
Jane Grimm NZ
Steven Hatzikostas Vic
Sandra Hellewell NZ
Michael Jacob NSW
Shiree Keane NSW
Mulvey Kelly NZ
Suzana Kotevska Vic
Tony Lawson NZ
Gail Le Claire NZ
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Lisa Messenger NZ
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Bronwyn Nicholson NSW
Felicity Park NSW
Gemma Penn NZ
Pregs Pillay Vic
Annie Poulton NZ
Michael Sedgley Vic
Peter Soaki NSW
Russell Thompson NT
Yusuke Ueno-Dewhirst Qld
Sheryl Watkin NZ
Nicholas Yule Vic

CORRESPONDING (3)
Debra Ikeda USA
Philip Tirman USA
Lil Valentin Sweden

TRAINEE (2)
Peter Preisz NSW
Talat Uppal NSW

NEW MEMBERS – SEPTEMBER 2007

FULL (83)
Mike Alchin NZ
Timothy Alchin NSW
Sue Andretzke SA
Hazel Bell NZ
Nalini Bhola NSW
Renee Bolton ACT
Grant Bradly NSW

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Shane Brun Qld
Nicholas Bryant Qld
Yvonne Butcher Qld
William Campbell Vic
Julie Campbell Qld
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Emma Larkin Vic
Dekang Mao Vic
Jacqueline O'Connor NZ
Sam Orde WA
Ranjan Perera NSW
Mark Salib WA
Catherine Taylor Qld
Bei Toh NSW
Jinlin Zhao SA

Calendar of ultrasound events

13th Nov 2007
ASUM & ASA Interesting Case Night 2007
Charles LaTrobe Lecture Theatre, Royal Melbourne Hospital
Contact Monica Pahuja
Email asum_vic_branch@hotmail.com

Saturday 1st Dec 2007
ASUM SA Branch Education Event 2007
Venue Flinders Medical Centre, SA Australia
Contact Cheryl Buckingham gabck03@optusnet.com.au

2008

26th–27th Mar 2008
DDU Technical Seminar (Physics)
Venue Sydney, Australia
Contact ASUM PO Box 943, Crows Nest NSW 1585 Sydney Australia
Ph +61 2 9438 2078 Fax +61 2 9438 3686

26th–30th Mar 2008
DMU Preparation Course 2008
Venue Sydney, Australia
Contact ASUM PO Box 943, Crows Nest NSW 1585 Sydney Australia
Ph +61 2 9438 2078 Fax +61 2 9438 3686

27th Mar 2008
Nuchal Translucency Course
Venue Sydney, Australia
Contact ASUM PO Box 943, Crows Nest NSW 1585 Sydney Australia
Ph +61 2 9438 2078 Fax +61 2 9438 3686

28th–29th Mar 2008
O&G Symposium
Venue Sydney, Australia
Contact ASUM PO Box 943, Crows Nest NSW 1585 Sydney Australia
Ph +61 2 9438 2078 Fax +61 2 9438 3686

28th–29th Mar 2008
ASUM Multidiciplinary Workshop 2008
Venue Sydney, Australia
Contact ASUM PO Box 943, Crows Nest NSW 1585 Sydney Australia
Ph +61 2 9438 2078 Fax +61 2 9438 3686

23rd – 25th May 2008
81st Annual Scientific Meeting of the Japan Society of Ultrasonics in Medicine (JSUM)
Venue Kobe Convention Center
Chairperson Prof. Shintaro Beppu (Osaka University School of Allied Health Sciences)

26th July 2008
ASUM DMU Part I & Part II Written Examination – Provisional
Venue As allocated. Candidates receive individual notification.
Contact DMU Coordinator
Ph +61 2 9438 2078 Fax +61 2 9438 3686
dmu@asum.com.au

18th – 21st Sept 2008
ASUM Annual Scientific Meeting 2008
Venue SkyCity Auckland Convention Centre, New Zealand
Contact ASUM PO Box 943, Crows Nest NSW 1585 Sydney Australia
Ph +61 2 9438 2078 Fax +61 2 9438 3686
www.asum.com.au

2009

Sunday 30th Aug 2009 – Thursday 3rd Sept 2009
ASUM hosts WFUMB 2009 World Congress in Sydney Australia
Venue Sydney Convention and Exhibition Centre
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Guidelines for authors

Authors are invited to submit papers for publication in the categories described below. Final responsibility for accepting material lies with the Editor, and the right is reserved to introduce changes necessary to ensure conformity with the editorial standards of the *Ultrasound Bulletin.*

Original research

Manuscripts will be subject to expert referee prior to acceptance for publication. Manuscripts will be accepted on the understanding that they are contributed solely to the *Ultrasound Bulletin.*

Quiz cases

A case study presented as a quiz, involving no more than three or four images and a paragraph briefly summarising the clinical history as it was known at the time. It will pose two or three questions, and a short explanation.

Case reports

Case reports are more substantial presentations resembling short scientific papers which illustrate new information, or a new or important aspect of established knowledge.

Review articles

Review articles are original papers, or articles reviewing significant areas in ultrasound and will normally be illustrated with relevant images and line drawings. Unless specifically commissioned by the Editor, articles will be subject to expert referee prior to acceptance for publication.

Forum articles

Members are invited to contribute short articles expressing their observations, opinions and ideas. Forum articles should not normally exceed 1000 words. They will not be refereed but will be subject to editorial approval.

Calendar items

Organisers of meetings and educational events relevant to medical ultrasound are invited to submit details for publication. Each listing must contain: activity title, dates, venue, organising body and contact details including name, address, telephone and facsimile numbers (where available) and email address (where available). Notices will not usually be accepted for courses run by commercial organisations.

Corporate news

Corporate members are invited to publish news about the company, including structural changes, staff movements and product developments. Each corporate member may submit one article of about 200 words annually. Logos, illustrations and tables cannot be published in this section.

Format

Manuscripts should be submitted in triplicate in print and on PC formatted diskette as MS Word documents.
Images must be supplied separately and not embedded. PowerPoint presentations are not accepted.

- Font size: maximum 12 pt, minimum 10 pt
- Double spacing for all pages
- Each manuscript should have the following:

Title page, abstract, text, references, tables, legends for illustrations.

- Title page should include the:

Title of manuscript, the full names of the authors listed in order of their contribution to the work, the department or practice from which the work originated, and their position.

Corresponding author's name, contact address, contact telephone number and facsimile number (where available) for correspondence.

- Abbreviations may be used after being first written in full with abbreviation in parentheses.
- References should be cited using the Vancouver style, numbered according to the sequence of citation in the text, and listed in numerical order in the bibliography. Examples of Vancouver style:

1 In-text citation Superscript. If at the end of a sentence the number(s) should be placed before the full stop or comma.

2 Journal article Britten J, Golding RH, Cooperberg PL. Sludge balls to gall stones. *J Ultrasound Med* 1984; 3: 81–84.

3 Book: Strunk W Jr, White EB. The elements of style (3rd ed.). New York: Macmillan, 1979.

4. Book section Kriegshauser JS, Carroll BA. The urinary tract. In: Rumack CM, Wilson SR, Charboneau JW, eds. *Diagnostic Ultrasound*. St Louis, 1991: 209–260.

Abstract

Manuscripts for feature articles and original research must include an abstract not exceeding 200 words, which describes the scope, major findings and principal conclusions. The abstract should be meaningful without reference to the main text.

Images

Images may be submitted as hard copy (in triplicate) or in digital format. Images sent must have all personal and hospital or practice identifiers removed. Do not embed images in text. Separate images are required for publication purposes.

A figure legend must be provided for each image. Hard copy images should be presented as glossy print or original film. Any labelling should be entered on the front of the glossy print using removable labels. Send one copy of illustrations without labelling as this can be added electronically prior to publication. On the back of the print include the author's name, figure number and a directional arrow indicating the top of the print.

Digitised graphics should be supplied as JPG or TIFF files on PC formatted 3.5" diskette or CD, which must be clearly labelled with the author's name and the names of the image files.

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	Feb 08	May 08	Aug 08	Nov 08
Submission Deadline	10 Dec	31 Mar	30 June	29 Sep
Post Date	15 Feb	16 May	8 Aug	14 Nov