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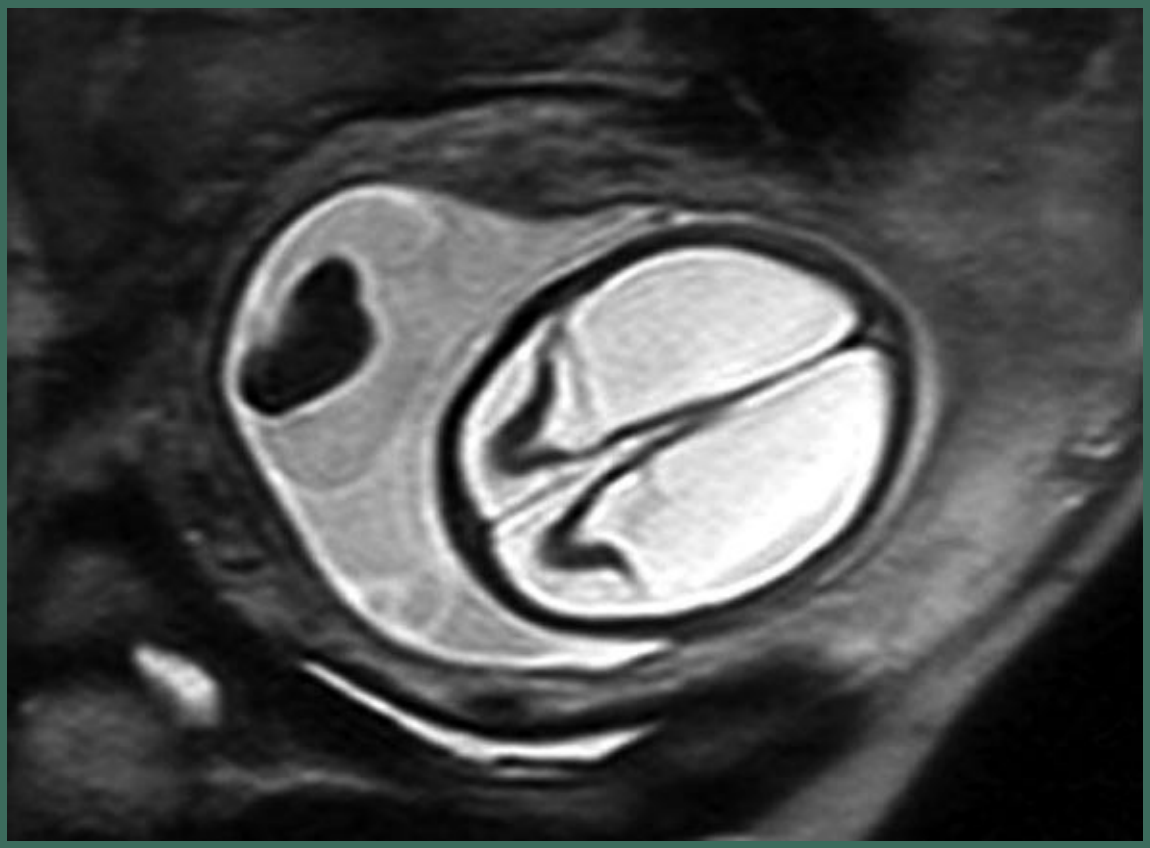
Ultrasound Bulletin

Journal of the Australasian Society for Ultrasound in Medicine



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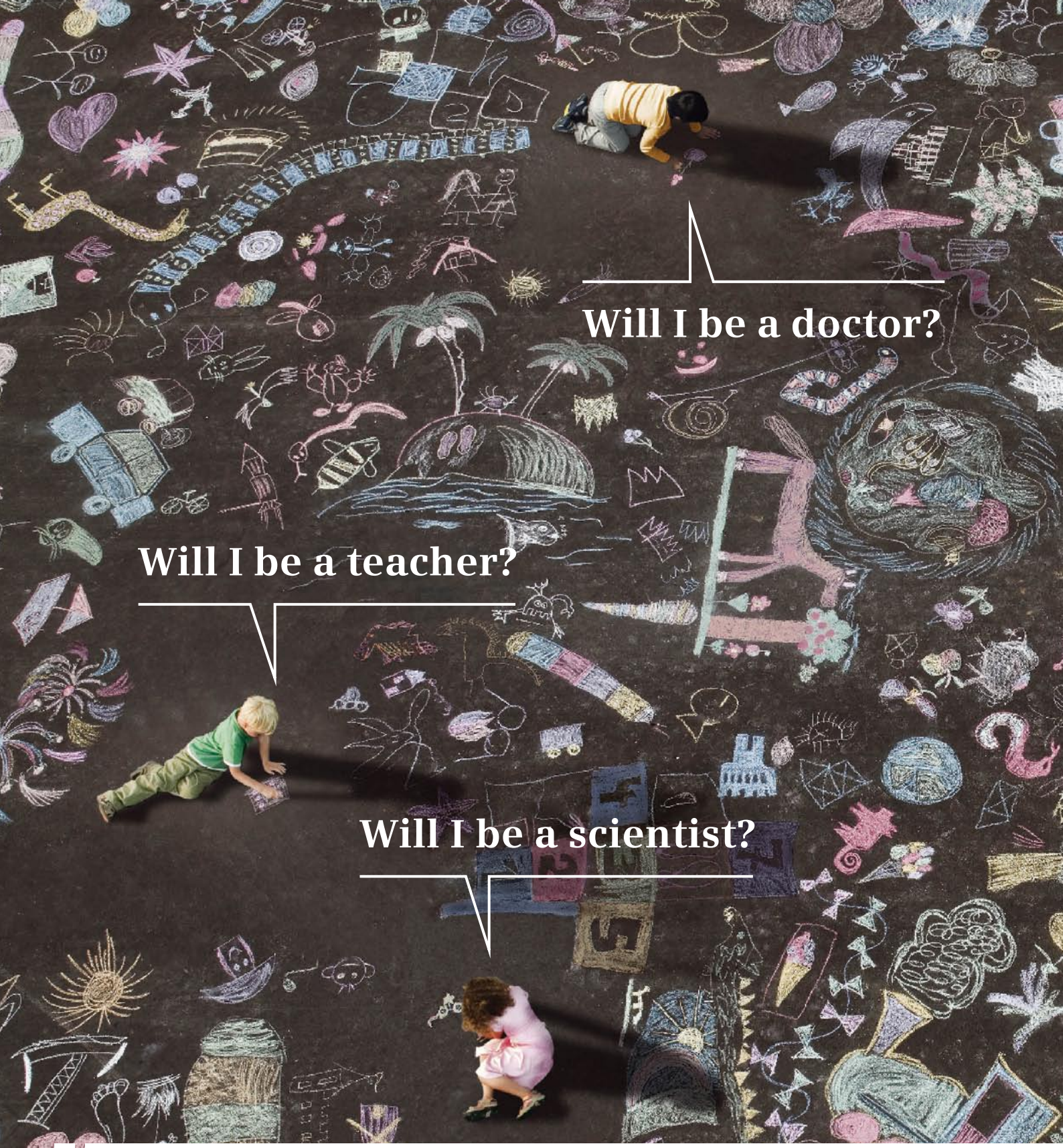

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Editorial contributions
Original research, case reports, quiz cases, short articles, meeting reports and calendar information are invited and should be addressed to The Editor at the address below

Membership and general enquiries
to ASUM at the address below

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Ultrasound Bulletin

ASUM Ultrasound Bulletin February 2008 11 (1)

THE EXECUTIVE

DIAGNOSTIC ULTRASOUND

CASE REPORT

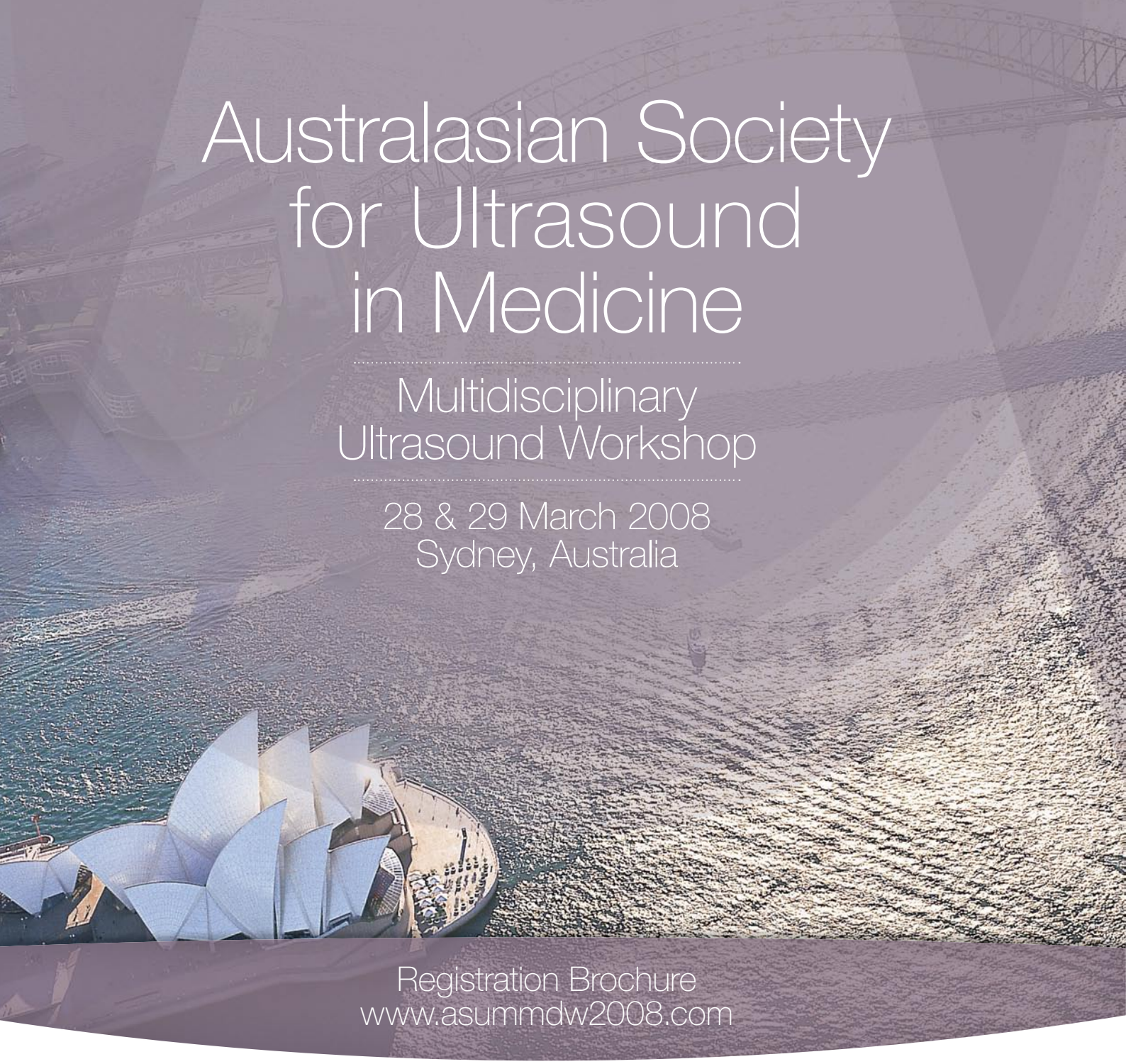
REVIEWS AND ABSTRACTS

EDUCATION

REPORTS

NOTICES

Cover image: Prenatal axial MRI of fetal brain demonstrating hydranencephaly. P 31.



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

Associated Meetings

DDU Technical Seminar
26 – 27 March 2008

DMU Preparation Courses
26 – 30 March 2008

Nuchal Translucency Course
27 March 2008

Faculty

Prof Alan Cameron
Scotland

Dr Ashley Robinson
Canada

plus a strong faculty of 40 from Australia and New Zealand

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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 : Roger Gent & Rob Gill

Thursday 27 March 2008

DMU Preparation Courses and DDU Technical Seminar

- Physics

Faculty : 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 : Alison 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

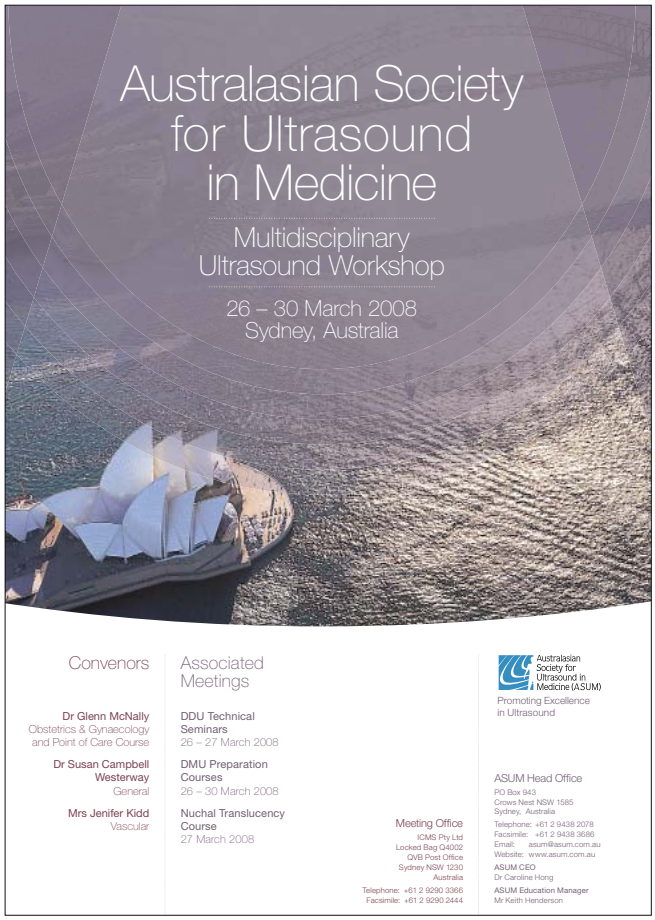
DMU Preparation Courses

Vascular

Cardiac

General & Obstetrics

ASUM extends a warm welcome to you at upcoming ASUM meetings



Australasian Society for Ultrasound in Medicine

Upcoming ASUM Meetings

ASUM Multidisciplinary Workshop 2008
Sydney, Australia 5 - 9 March 2008
Go to www.asum.com.au for more details

ASUM 38th Annual Scientific Meeting 2008
Auckland, New Zealand 18 - 21 September 2008
Go to www.asum.com.au for more details

World Federation for Ultrasound in Medicine and Biology 2009
Sydney, Australia 30 August- 3 September 2009
Go to www.asum.com.au for more details

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Promoting Excellence in Ultrasound

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Authors in Ireland, Denmark, Holland and Australia add an international flavour to our journal


Prof Ron Benzie

Our first issue of the New Year has an international flavour, with research and reviews from Ireland, Denmark, Holland and Australia. There is also an interesting letter to the editor with excellent advice for sonographers and sonologists.

Jacqueline Cartmill, now in Belfast, and her colleagues at the University of Sydney present three fetal intracranial anomalies where MRI was used in addition to ultrasound for prenatal diagnosis. As we all know, working out what the actual lesion in the fetal head is can be a challenge. If we have access to MRI in a tertiary centre, we should consider its use. In the cases presented, it certainly helped parental decision-making.

Lisa Hui has written a thorough review of Australian charts for assessing fetal growth. This is a complex area and more studies are needed. The author concludes her excellent summation of current knowledge with recommendations, which we would do well to consider implementing in our practices.

Those of you who did not manage to attend the 37th Annual Scientific Meeting at Cairns last year will find Part 2 of the abstracts of interest (Part 1 was published in the December 2007 issue).

Our CADUCEUS (Collaborative Australasian Danish Undertaking for Continued Excellence in Ultrasound) connection has again borne fruit. Torben Lorentzen and Christian Nolsøe, both recent ASUM visiting speakers, provide a review of interventional ultrasound in gastroenterology. This is a rapidly expanding area and undoubtedly we will see more clinical applications for its use.

And from Holland, Eveline Bauman and Lisanne Hollander and colleagues here and in the University of Nijmegan found that there are several factors which affect parental desire to find out their baby's gender before birth. We might think that the answer to the question 'Why do you want to know baby's sex' is a simple one, however, it has uncovered factors we might not have thought about.

The two lead authors were final year medical students when they conducted their research and it was their first such project. Doubtless, they learned a lot about formulating and testing a hypothesis, as well as doing rigorous literature searches and writing up the final article. We hope the experience will have encouraged them to continue a research interest.

WFUMB 2009 Congress

At the time of writing it is only 18 months until the WFUMB 2009 Congress. I would urge you to go to the website www.wfumb2009.com and see for yourself the innovative program being created by the Committee from ASUM, which is hosting this major event – the Sydney 'Olympics of the Ultrasound World'! If you would like to participate in any way please contact us.

Prof Ron Benzie

Letter to the editor – Bush sonography, flying solo

For a sonographer working alone in a small rural hospital, life can be both confronting and rewarding.

You are responsible for diagnostic scans when there are no other imaging modalities available. The nearest major centre with a CT may be hundreds of kilometers away. This can mean seriously disrupting families plus the added cost of transport. If a diagnosis can be made in a small hospital environment a lot of precious time and money can be saved.

I started ultrasound in country western Victoria and south-east South Australia and spent 12 years on a very steep learning curve. Although I undertook the RMIT and ASUM DMU courses, my main focus was hands-on scanning. The medical staff had the notion that if you could hold a transducer you were automatically a competent sonographer. This was a serious expectation that had to be overcome.

In the ensuing years, I encountered ruptured spleens and kidneys from sporting mishaps, torsion of an ovarian cyst in a 10-year-old when the clinical diagnosis was appendicitis and numerous other medical emergencies.

There were many memorable times as well. I was once called during the early hours of the morning to the labour ward to scan for fetal presentation only to stay for a happy uneventful birth.

Sadly, sometimes the outcomes were not so good and it was always difficult to be caught up in the highs and lows of people's lives in a small rural community.

At present I am employed at a busy suburban medical clinic equipped with state-of-the-art CT and ultrasound machines including all the bells and whistles. Life is certainly easier but I will never stop appreciating where I started to learn my trade.

The top survival tips in a small country hospital are as follows:

- Do not try and pretend to know what you really do not. That is, know your limitations.
- If you are struggling to obtain a good diagnostic scan for various reasons, say so.
- Always spend time to expand your knowledge base by reading and undertaking courses and attending conferences whenever possible.
- Use experts in major hospitals or ultrasound clinic. They are always more than happy to give you some direction and advice and are simply a phone call away.

In summary, work closely with the physicians, it's all about teamwork.

Chairmaine Burdett

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Pace picks up for WFUMB 2009 planning

Matthew Andrews

On behalf of the ASUM Council and Staff, I would like to wish all ASUM members a very happy 2008. This year will be crucial for the Society. In addition to its usual wide range of activities and services, the organisation of the World Federation of Ultrasound in Medicine (WFUMB) 2009 World Congress, being hosted by ASUM in Sydney, will be consolidated.

British Medical Ultrasound Society

I was recently fortunate to take part in the ASUM/BMUS Presidential Exchange Program, in which I was invited to represent ASUM at the BMUS Annual Scientific Meeting. This program was established several years ago to promote cooperation and the exchange of scientific and organisational knowledge between the two societies.

BMUS has a similar membership profile to ASUM, with the bulk of members being sonographers and radiologists. Membership numbers are also similar to ASUM.

Physicists appear to play a greater role in BMUS currently than they do in ASUM. Dr Kevin Martin, the current BMUS President, is a physicist and the President-elect, Ms Julie Walton is a sonographer.

The BMUS meeting is rotated around Britain and in 2007 was held in Harrogate, approximately three hours train journey north of London. Similar to the ASUM ASM, the BMUS meeting is held over three days, but within the working week, with no weekend component. The meetings have similar numbers of registrants and similar sized trade components.

Features of the scientific program included several veterinary ultrasound sessions, with dogs being scanned, an interactive quiz session and an extremely interesting History of Ultrasound talk by Dr Paul Allen, Past President of BMUS, which featured some ASUM members.

There were lunchtime trade seminars, where vendors displayed their latest technologies. The scientific presentations, both oral and poster, were wide-ranging and of a very high standard.

Volume acquisition ultrasound talks were impressive, where a whole volume is scanned and images then processed and obtained on workstation in any plane required. This would appear to have the potential to revolutionise the way ultrasound is practised.

My presentation was part of a seminar discussing the future of ultrasound practice, including the roles of sonographers, sonologists and clinicians performing ultrasound, where I gave the Australasian perspective.

The forum allowed me the opportunity to showcase ASUM's Certificate of Clinician Performed Ultrasound (CCPU), which was very well received by both BMUS and clinicians in attendance. BMUS expressed interest in exploring the CCPU concept further and will liaise with ASUM.

I would like to acknowledge the very kind hospitality provided to me by BMUS including the BMUS staff, who were extremely helpful.

I am confident my visit will be of benefit to ASUM and I look forward to welcoming Dr Martin when he reciprocates by attending this year's ASUM meeting in Auckland. I would also like to acknowledge the foresight of my predecessors in establishing this exchange program.

Dr Matthew Andrews

Help us promote WFUMB 2009 Sydney

ASUM welcomes members' assistance in promoting the Congress. To help spread the message, members who are attending and presenting at meetings overseas are encouraged to include promotional slides for WFUMB 2009 in their presentation

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CEO's message

Dr Caroline Hong

New Year's resolutions

The New Year started for me with a number of key resolutions: to include a more work-life-family balance; more exercise; eating healthily; and remembering to make time for celebrations, big and small.

I hope you are happy with the way the year 2008 has begun for you.

Last year was a good year for ASUM as we all worked hard to use our time and resources effectively to provide member services and to advance the Society. I am pleased to report that the ASUM membership as at 31st December 2007 has increased by 14% compared to 31st December 2006.

WFUMB 2009 major sponsors

We are filled with gratitude for the confidence and support that the major global ultrasound companies have shown to ASUM, in our recent dealings with them.

Over the years and in the last few months, I have been involved, together with various members of the ASUM Executive and the WFUMB Organising Committee, in discussions with the trade about sponsorship opportunities for ASUM meetings. At the same time, we have also been talking to them about sponsorship opportunities for the WFUMB 2009 World Congress.

We are pleased to report that, as of 21st January 2008, Toshiba, GE Healthcare, Medison and Philips have been confirmed as our four major sponsors.

We also value the strong support of Siemens, a gold supporter of ASUM meetings for some time. The global office has indicated support at WFUMB 2009, with the level of support to be determined soon.

On behalf of the Society, staff, members and Council, we gratefully thank the major sponsors for their early commitment of support, almost two years ahead of the Congress. This is a demonstration of the successful partnership we have with our corporate supporters, to ensure a strong working relationship for the most ambitious project ever taken on by ASUM.

WFUMB 2009 sponsorship opportunities

There are many sponsorship opportunities that can be specifically tailored to individual company needs. If any member is interested or knows of anyone who might be interested in being a sponsor or exhibitor, or wishes to suggest and refer potential sponsors/supporters, please email carolinehong@asum.com.au or alternatively to sponsorship@icms.com.au.

ASUM also welcomes members' assistance in promoting the Congress. To help spread the message, members who are attending and presenting at meetings overseas are encouraged to include promotional slides for WFUMB 2009 in their presentation. We thank the members who already have responded and assisted in this promotion.

If anyone wishes to help in this manner, please email carolinehong@asum.com.au to obtain a set of the promotional slides or for more information. We are regularly updating the WFUMB 2009 Congress website as our planning and organising progress. The address is www.wfumb2009.com.

ASUM MDW 2008 Sydney

By popular demand, the ASUM Multidisciplinary Workshops (MDW)

will be on again soon, from 26th–30th March 2008. The MDW incorporates the DMU and DDU preparation courses. The MDW will be held at the Hilton Sydney Hotel immediately after the Easter holidays.

We are indebted to Dr Glenn McNally, Sue Campbell Westerway, Jeni Kidd, Dr Rob Gill and Dr Andrew McLennan, all of whom have worked tirelessly with the ASUM Secretariat and in particular, Keith Henderson, to present to our members a quality program of workshops. These workshops are very popular and fill up quickly.

This year, we have invited two very special overseas presenters, Prof Alan Cameron and Dr Ashley Robinson.

Prof Cameron is a Consultant Obstetrician and Head of Fetal Medicine at the Queen Mother's Hospital, Glasgow. His specialist areas are prenatal diagnosis and fetal therapy. He trained in Glasgow, Newcastle and Canada and has published widely on the subject of high-risk pregnancy.

Prof Cameron is the Scottish members' representative on the Council of the Royal College of Obstetricians and Gynaecologists. He is also a member of Council of the Royal College of Midwives, a founder member of the British Maternal and Fetal Society and a member of the International Fetal Medicine and Surgery Society.

He is a reviewer for the *British and American Journals of Obstetrics and Gynaecology* and for the *Journal of Ultrasound in Obstetrics and Gynaecology*. He is an editor of the first international CD text of fetal ultrasound.

His current research interest is the development of *in utero* keyhole surgical techniques in an attempt to improve the outcome for babies with congenital malformations.

Dr Robinson did his radiology training in Manchester, UK, followed by three fellowships in general paediatric radiology, paediatric interventional radiology, both at the Hospital for Sick Children in Toronto, Canada, then ultrasound at the University of California, San Francisco. He is currently a radiologist at the Children's and Women's Hospital of British Columbia, Canada, specialising in fetal imaging and pediatric intervention.

His awards include the Derek Harwood-Nash Award from the American Society of Pediatric Neuroradiology, the Ella Preiskel Prize in Pediatric Radiology from the Royal College of Radiologists (UK) and the John Kirkpatrick Award from the Society of Pediatric Radiology.

Once again we are indebted to Toshiba, Philips, GE Healthcare and Siemens for their ongoing support and agreeing to be gold sponsors at this workshop.

Accommodation at the Hilton Sydney Hotel, as the preferred conference hotel, has been block booked for this workshop. There is a limited room block so please make sure you click 'Book online' via the 'Accommodation' section on the website at www.asummdw2008.com to get the specially negotiated ASUM rates for 2008.

Registration brochures and online registration for all the various disciplines are now available at www.asummdw2008.com:

- 2008 ASUM Multidisciplinary Workshop 28th–29th March 2008
- ASUM Annual O & G Ultrasound Symposium 28th–29th March 2008
- 2008 DMU Preparation Course 26th–30th March 2008
- Nuchal Translucency Course 27th March 2008

Log in NOW for complete registration details on www.asummdw2008.com.

For all enquiries about your registration, please email asummdw2008@asum.com.au.

For general ASUM enquiries, email asum@asum.com.au.

The multidisciplinary workshops fill up on a first come first serve basis. Please register early to avoid disappointment.

ASUM 2008 ASM Auckland

ASUM thanks GE Healthcare, Siemens, Philips and Toshiba for their ongoing support and agreeing to be gold sponsors of the ASUM 2008 ASM. This meeting will be held from 18th–21st September 2008 at the Skycity Auckland Convention Centre, Auckland, New Zealand. A special thanks also goes to GE Healthcare for sponsorship of a keynote speaker, Prof Bernard Benoit.

For enquiries about sponsorship and the trade exhibition, email admin@mianz.co.nz or contact the ASUM CEO at carolinehong@asum.com.au directly for specially tailored packages.

A great program – 'Into the Next Dimension' – has been created by Dr David Rogers and the Organising Committee. Look out for regular updates at www.asum2008.com.au.

The format of the meeting will include a skills day on Thursday 18th September, followed by a three-day event from Friday 19th September to Sunday 21st September for the main part of the meeting. Members are encouraged to submit their proffered papers and poster abstracts no later than Friday 16th May 2008.

The registration brochure is ready and is being distributed with this issue of the *Ultrasound Bulletin*.

Early registration rates close on Sunday 20th July 2008, so book early to benefit from the reduced rate and also to secure your accommodation requirements. Special rates can be negotiated for company, hospital, institution and private group bookings paid in full and in group blocks. Overseas members of affiliated societies of WFUMB are also welcome to register at member rates. These requests should be directed to carolinehong@asum.com.au.

Auckland, popularly known as the City of Sails, is the biggest city in New Zealand. It is an attractive city with many things to do and see. The ASM is a wonderful opportunity to combine attendance, participation or exhibition at the meeting with a New Zealand holiday. You may wish to start planning your stay in Auckland as a visitor and conference delegate by viewing www.aucklandnz.com. More information about the ASUM 2008 meeting venue at Skycity Auckland Convention Centre can be seen at www.skycity.co.nz.

ISUM seeks speakers for Jakarta meeting

An email broadcast was sent out to members in December 2007, with a request from the Indonesian Society for Ultrasound in Medicine (ISUM) for speakers to present at the Society's meeting in Jakarta on 21st–22nd November.

The ASUM Executive had approved support for ISUM by sending one or two speakers to present at the meeting.

The 6th Asian Breast Diseases Association (ABDA) Teaching Course will be held in conjunction with the 17th Annual Meeting of the Indonesian Society of Ultrasound in Medicine and

2nd Annual Meeting of the Indonesian Society of Oncology Imaging.

This meeting will be held at the Novotel Hotel, Jarkarta. Any member interested in presenting at the meeting should contact Dr Caroline Hong, ASUM CEO, at asum@asum.com.au for more details. Conditions apply.

DMU registration closes on 31st March

As of 31st December 2007, 1534 sonographers and doctors had been awarded the Diploma of Medical Ultrasonography (DMU), since the Diploma was introduced in 1979.

The 2008 examination registration date closes on 31st March. Candidates should contact ASUM at dmu@asum.com.au if they have any enquiries.

To assist in preparing for the examinations, candidates are encouraged to enrol for the DMU preparation courses, which will run from 26th–30th March 2008 at the Hilton Sydney. Register online at www.asummdw2008.com.

ASUM is proud to have established the DMU in 1979. The Diploma was the first certification established by ASUM for sonographers. It is a self-directed program of study leading to the postgraduate DMU examination. The main prerequisite to be eligible for the DMU is to have a Bachelor degree in any discipline.

There are two parts to the examination. The Part I Examination consists of two written multiple-choice papers, each of two hours duration. Part I examinations are usually held on the last Saturday in July and on the first Saturday in November each year.

It is important to understand that a DMU candidate does not have to be employed in sonography to sit for the Part I Examination, but will be required to have at least two years of ultrasound scanning experience to be eligible to sit for the Part II Examination. Information about the 2008 DMU Handbook, regulations, syllabus, application form and enrolment criteria are available in the DMU section of the ASUM website at www.asum.com.au.

DMU (Asia)

As of 31st December 2007, 22 sonographers, who completed their training at Vision College in Kuala Lumpur since the College was established in 2005, have been awarded the Diploma of Medical Ultrasonography (Asia).

The level of interest is increasing each year, with a recent decision from the Malaysian Government to allow Vision College to accept enrolment of students from outside Malaysia.

The DMU (Asia) was established by ASUM in 2005 through an agreement between ASUM and Vision College, a private educational body. The DMU (Asia) standards satisfy the diploma accreditation requirements in Malaysia for sonographer qualification for practice in Asia. Vision College provides the training for students who are enrolled in the DMU (Asia) and the Diploma is awarded by ASUM to the candidates who have successfully completed and passed the examinations conducted by ASUM approved examiners.

DDU

As of 31st December 2007, the DDU has been awarded to 535 medical specialists, since it was established in 1976.

Registrations for the 2008 examinations will close on 17th March 2008. Candidates should contact ASUM at ddu@asum.com.au if they have any enquiries.

The DDU was established in 1976 by ASUM. It was the first and remains the only diploma certification for doctors in diagnostic ultrasound.

ASUM is recognised by the government and industry bodies as the peak body for ultrasound and the ASUM DDU remains a highly sought after qualification.

Information about the 2008 Handbook, regulations, syllabus, application form and enrolment criteria are in the DDU section on the ASUM website at www.asum.com.au.

The Part I Examination for 2008 will be held on Monday 12th May. Applications will close on Monday 17th March 2008. More information about the DDU examinations and important dates can be obtained in the DDU section of the ASUM website.

CCPU is popular

As of 31st December 2007, two doctors have successfully attained the CCPU (Emergency Medicine). At the time of writing, four CCPU (Neonatal) and one CCPU (O&G) are about to be conferred and approved by the ASUM Council.

The CCPU is gaining popularity and is making progress, with valuable input from distinguished members of the Society. To date, 131 doctors have registered for the CCPU.

Members may recall that in 2006, the CCPU became the first certification for medical specialists who are not imaging specialists for targeted ultrasound at the point of care. The CCPU (O&G), CCPU (Emergency Medicine) and CCPU (Surgical Practice) are possible only with the willing support and assistance of many key members of the Society, who have put in many hours towards developing the curriculum, courses and certification process.

Organisations providing ultrasound courses can apply to ASUM for appropriate recognition towards the CCPU, if the necessary criteria are met. For example, several of the AIU courses are accredited by ASUM as meeting the requirements of the CCPU. More information is available in the CCPU section of the ASUM website at www.asum.com.au.

Dr Coll Fisher 1935–2008

We were sad to learn of the passing of Dr Coll Fisher, who died after New Year's Day. Coll was a popular obstetrician and was at the centre of many changes in the care of pregnant women. He was a loyal member of ASUM from 1976 to 1998.

He had been an expert in the use of ultrasound since the days when grey scale ultrasound was first developed by Bill Garret and George Kossoff in Australia.

On behalf of the Society, we mark the passing of a great man and send condolences to the family and all those whose lives were touched by this extraordinary doctor.

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Changing jobs?
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Australian charts for assessing fetal growth: a review

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Introduction

Monitoring fetal growth is one of the basic goals of antenatal care, for low-risk and high-risk women alike. While the 'large for gestational age' fetus is at increased risk of perinatal complications, the burden of adverse outcomes is overwhelmingly carried by the pathologically small fetus. Fetal growth restriction is accompanied by dramatically increased perinatal mortality, with mortality being eight times higher when weight is below the 10th centile and nearly 20 times higher when weight is below the 3rd centile[1]. In addition to increased mortality, both short term[2,3] and long term morbidity[4,5] are increased in infants affected by intrauterine growth restriction.

The *Ultrasound Bulletin* has previously published a review on the accuracy of sonographic estimation of fetal weight that discusses the sources of error in determining whether or not a given fetal size is 'normal'[6]. This paper seeks to further examine the centile charts in current use in Australia and to describe their derivation. The multitude of biometry and birthweight charts can cause confusion if a fetus is compared against different standards during pregnancy and this has the potential to cause inappropriate management decisions. Finally, the rising interest in individualised birthweight standards and their role in developing intrauterine growth curves will also be covered.

Definitions of SGA/FGR

Various growth percentile thresholds for defining 'small for gestational age' (SGA) babies have been used, but the most commonly accepted standard is the 10th centile[7] for estimated fetal weight (EFW) or abdominal circumference (AC). However, it is important to remember that babies below the 10th centile are a heterogeneous group comprising of constitutionally small normal babies and those with true growth restriction with the accompanying increase in morbidity and mortality. Identifying those SGA babies at increased risk of true fetal growth restriction (FGR) involves incorporating other measures of fetal well-being such as amniotic fluid volume, fetal arterial and venous Doppler measurements and cardiotography[8,9].

Ultrasound estimation of fetal size

There are several discrete steps in the process of ultrasound estimation of fetal growth. Each step is subject to error. An acceptable margin of error for the final EFW is generally accepted to be ± 15%. These steps are:

1 Accurate assessment of dates;
2 Fetal measurements: two-dimensional measurement of biometry;
3 Mathematical calculation of an estimated fetal weight;
4 Charting fetal size – EFW and/or biometry – against population standards for gestation and determining the corresponding percentile band; and
5 Comparing serial measurements if available, to determine whether growth velocity is being maintained along the appropriate centile curve.

Determining intrauterine weight percentile

The ideal chart should be created from a representative sample of the local population. These growth charts can be constructed from birthweight data for preterm and term infants, or from standards derived from ultrasound measurements of fetuses. A third method has been recently investigated using customised term birthweights to develop intrauterine growth curves.

Australian birthweight charts

Until the late 1990s, the most commonly used standards of growth in Australia were derived from hospital-based studies of infants born in Melbourne. The first publications were produced by Kitchen in 1968[10] and Betheras in 1969[11]. Explicit in the publication of Betheras' charts was the caveat that the use of birthweights to define normal growth at preterm gestations contains an inherent fault: 'the obstetrical complication which may have precipitated the premature termination of pregnancy may have affected fetal growth.' These early charts are disadvantaged by the less accurate dating methods, with early ultrasound dating being uncommon. Betheras' chart included women if there was 'reasonable certainty' that the EDC was correct, and if the infant had a weight and head circumference (HC) measured 'shortly after birth'. These early charts also have very small numbers of infants at extremely preterm gestations, and in Betheras' case, only commence from 28 weeks gestation.

There have been significant changes in ethnic composition and socioeconomic factors in the Australian population since the publication of Betheras' chart, which was based almost entirely on women of Anglo-Saxon origin. Kitchen updated early data from 1968 and in 1983 produced revised intrauterine growth curves from livebirth data[12]. Birthweight curves from 24 to 42 weeks were produced from a combination of data from live births at the Royal Women's Hospital in Melbourne in 1979 and from previous publications on those born <35 weeks. An elevation of all centiles compared with births in the same hospital in 1966 was evident, particularly for the 10th centile after 37 weeks. Guaran[13] published data from a much larger number of infants born at the Mercy Hospital, Melbourne in 1994, and similarly found there was generally an elevation of all percentiles when compared with the earlier charts. This trend to increasing birthweight with each generation is a well-recognised phenomenon and periodic review of local standards is recommended to categorise

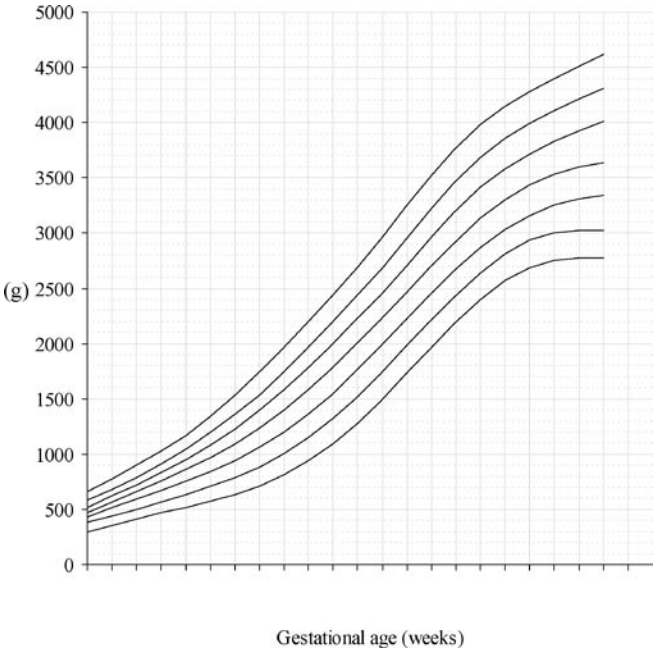

Fig.1: Beeby's population based birthweight percentile chart.

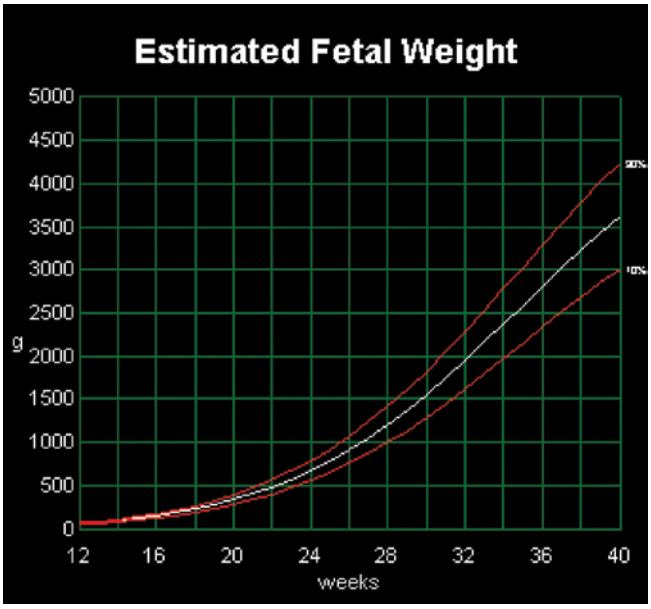

Fig.2: Hadlock's chart.

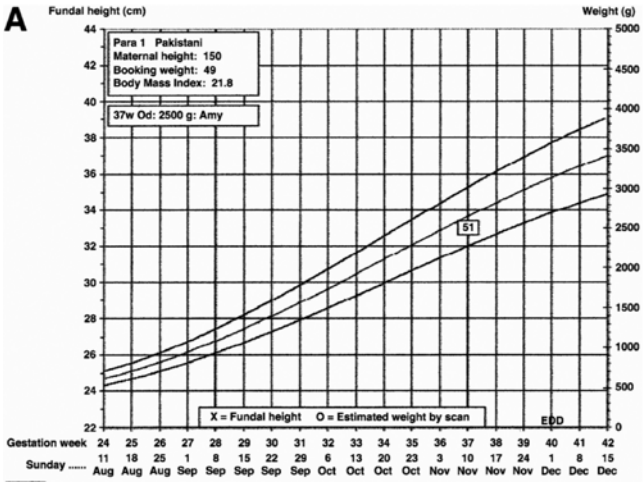

Fig.3: Customised chart.

newborn infants' growth characteristics correctly.

One of the first published population-based charts was produced in Western Australian in 1989 by Kliewer, *et al.*[14]. They extracted data from the WA Midwives' Notification System, which recorded details of all births of 20 weeks gestation or more, or birthweight of 400 g or more from 1980 to 1986. Gestational age was calculated from last menstrual period. The charts were not specifically designed to act as standards of intrauterine growth, but to compare health outcomes between indigenous and non-indigenous babies. They found that the distributions of both birthweight and gestational age were shifted downward in Indigenous infants compared with white infants, a trend that unfortunately persists today. These charts were also gender-specific, with separate charts for male and female babies, recognising the importance of sex on fetal size.

In 1996, Beeby published the first NSW population-based birthweight percentile charts, which was also the largest Australian population-based study at the time. This study included data from 422 139 live born singletons held by the NSW Midwives Data Collection and from King George V Hospital[15]. Separate charts for male and female infants were developed. The charts followed the general trend of increasing birthweights over time and had generally higher percentiles than previously published charts.

The first Australian birthweight percentiles published using national data were published in 1999 by Roberts and Lancaster[16]. They aimed to develop national birthweight percentiles by gestational age (GA) for male and female singleton infants and then to compare BW distributions by GA for indigenous and non-indigenous infants. Using data from the National Perinatal Statistics Unit (NPSU), 761 902 births were analysed and birthweight percentiles for indigenous and non-indigenous Australian-born women were made. They included only singleton live infants delivered by Australian-born mothers in the non-indigenous charts in order to reduce environmental factors associated with migrant populations. In keeping with the WA data, indigenous infants were more likely to be classified as SGA and preterm than non-indigenous infants. More specifically, birthweights of indigenous infants diverged from that of the non-indigenous population after 34 weeks. By 40 weeks, the median birthweight for male indigenous babies was 160 g below that of non-indigenous males and birthweight for female indigenous infants was 130 g below non-indigenous females. More than 17% of indigenous infants born at term were classified as SGA. Separate charts for indigenous births were published, but the authors cautioned that they should not be interpreted as separate population norms until the effect of population and environmental differences could be ascertained.

While the authors acknowledged that birthweight percentiles do not necessarily represent fetal growth standards, the 10th centile on these charts are the current standard used by the NPSU for defining fetal growth restriction in the perinatal mortality data collection system.

Advantages of birthweight charts

- Standards can be derived from very large numbers and are therefore statistically robust;
- Population-based data provides a more demographically representative sample to be obtained compared with hospital or private practice populations;

Table 1: Australian birthweight charts compared with the Hadlock EFW chart.

Author	Date	Population	*n*	GA range	Gender specific	10th C 40w (g)	50th C 40w (g)	90th C 40w (g)
Australian Birthweight Charts								
Kitchen	1968	Royal Women's Hospital, Melbourne	2637	23–44	N	2600	3430	4000
Betheras	1969	Private paediatric practice, Melbourne	7818	28–44	N	2726	3371	4025
Kitchen	1983	Royal Women's Hospital, Melbourne	3120	24–42	N	2980	3507	4040
Kliewer	1989	WA population data	158729	20–44+	Y	3050 (M) 2925 (F)	3585 (M) 3430 (F)	4150 (M) 3980 (F)
Guaran	1994	Mercy Hospital, Melbourne	49,429	22–44	N	3000	3515	4090
Beeby	1996	NSW population	422,139	22–43	Y	3046 (M) 2932 (F)	3576 (M) 3436 (F)	4154 (M) 3993 (F)
Roberts	1999	National, Australian-born population	761,902	20–44	Y	3070 (M) 2950 (F)	3600 (M) 3450 (F)	4170 (M) 4000 (F)
Sonographic Weight Standard								
Hadlock	1991	USA white middle class	392	10–40	N	3004	3619	4234

- Many population-based birthweight charts are gender specific; however this information is often lacking in clinical practice and makes their application difficult. The convention is to assume female gender if the sex is unknown; and
- Using locally-derived birthweight charts facilitates clinical consistency with the newborn assessment by the paediatricians.

Disadvantages of birthweight charts

The fundamental problem with the use of birthweight charts is the assumption that average preterm birthweights can properly be used to determine normal intrauterine fetal size. Preterm infants must be assumed to be affected by some pathological process leading to early delivery, and are known to be disproportionately affected by intrauterine growth restriction. A study of the neonatal outcomes of 7898 preterm neonates found that conventional birthweight standards for preterm infants contained weights from a large proportion of FGR babies and this lead to non-recognition of fetal growth restriction in preterm infants[17]. This raises the interesting question of whether preterm neonates themselves should be assessed against EFW-based intrauterine growth curves from normal fetuses rather than birthweight standards[18].

The accuracy of gestational age assignment may be harder to ascertain in large state-wide data collection than in smaller hospital-based studies.

Sonographic standards for biometry

Ultrasound-derived standards for fetal measurements began to be developed in the 1980s, pioneered by the work of Hadlock[19–21], whose charts and formulae continue to be in widespread use over 20 years later. These curves are created by mathematically modelling data collected on a large number of fetuses after excluding pregnancies with uncertain dates or with known risk factors for abnormal growth such as multiple gestation, fetal anomaly and maternal diseases. There are many differences in the methodology and study populations in the numerous published charts, resulting in many variations of 10th and 90th centile boundaries for normal fetal growth. Some sonographic standards are based on longitudinal studies of individual fetal growth, but the vast majority, including Hadlock charts, use cross-sectional analysis of data.

There are important methodological distinctions between developing charts for determining fetal size for known gestation and charts developed for dating pregnancies according to fetal size. Furthermore, while cross-sectional data is suitable for determining fetal size, longitudinal study is more appropriate for assessing fetal growth patterns. The ideal design for defining normal intrauterine growth curves would be prospectively gathered measurements from serial scans of well-dated normal pregnancies; this has yet to be performed in an Australian population. The correct methodology for creating centile curves for fetal size is rather different and has been discussed in detail by Altman and Chitty[22], who published their own reference charts in 1994[23–25].

Prior to 2001, ASUM recommended the use of Hadlock charts for head circumference (HC)[20] and femur length (FL)[21] and Australian charts from de Crespigny for bi-parietal diameter (BPD)[26]. The Hadlock charts were constructed from data collected on predominately white middle-class Americans in the 1980s. De Crespigny's BPD chart from 1989 was based on measurements on 677 patients at the Royal Women's Hospital, Melbourne. This was designed primarily as a dating chart; however the authors note the wide normal range of BPD in late pregnancy and state that for gestations from 33 weeks the chart values are intended to predict the growth in fetal head size from a known gestation.

Australian sonographic standards for fetal measurements

In 2000, Westerway published the first set of Australian ultrasonic fetal measurement charts[27] and these were subsequently adopted by ASUM as the national standard[28].

Table 2: Commonly used sonographic weight standards.

Author	Date	Country	Subjects	*n*	Parameters
Hadlock	1982	USA	> 95% Caucasian middle class	400	HC
Hadlock	1982	USA	Caucasian middle-class	338	FL
Deter	1982	USA	Caucasian middle class	252	HC, AC
Hadlock	1982	USA	Caucasian middle class	533	BPD
de Crespigny	1989	Aust	Royal Women's Hospital, Melb	677	BPD
Hadlock	1991	USA	Caucasian middle class	392	EFW (Hadlock C formula)
Chitty	1994	UK	London teaching hospital	594	BPD, HC, OFD, CI, CA
Chitty	1994	UK	London teaching hospital	425	AC
Chitty	1994	UK	London teaching hospital	649	FL
Westerway	2000	Aust	NSW wide, 26 practices, Multicultural	3800	CRL, BPD, OFD, HC, AC FL, HL
Schluter	2004	Aust	Brisbane private ultrasound practice	20555	BPD, FL, AC, HC

This study of 3800 pregnancies aimed to establish normal growth curves from an Australian multicultural population for fetuses between 6 and 40 weeks gestation. Public and private patients of over 70 different nationalities were scanned in 28 ultrasound practices throughout country and regional NSW. One hospital, the Royal Hospital for Women in Sydney, provided over 700 of the participants. The inclusion criteria were: singleton gestation 5–40 weeks, known last menstrual period (LMP), no fetal abnormalities seen at ultrasound, and no maternal disease known to affect fetal size. The indications for the scans from which the data was obtained included: dating, routine anomaly scan, or nuchal translucency scan. Third trimester scans were only included if they were for fetal lie, placental location or maternal reassurance in an attempt to exclude those pregnancies in which there was a clinical concern regarding fetal growth. Data collection was cross sectional from 11 weeks.

When compared with existing charts, Westerway found that the mean BPD was not significantly different from the De Crespigny chart, nor the FL different from Hadlock; but that the mean HC was significantly different compared with Hadlock[20], and the AC statistically different to Deter[29].

This publication represented the first attempt to produce fetal measurement graphs using modern ultrasound technology in a multicultural Australian population, but its adoption by ASUM was met with a mixed response. In particular, a group of Victorian sonologists voiced concerns with the new charts, questioning the methodology and stating that they did not correlate with clinical experience and other published standards[30]. Westerway responded to these concerns, and also challenged those dissatisfied with the current ASUM standards to produce their own charts.

A Brisbane group subsequently published another set of charts in 2004. Schulter, *et al.* used patients seen in a private ultrasound practice in Brisbane to construct population-specific charts of fetal biometry for 11–41 weeks gestation[31]. Women attending between 1993 and 2003 were included if their GA was 11–41 weeks, and they had a known LMP and regular cycle. The usual exclusion of fetal abnormalities and maternal disease was applied. Separate scans of 20 555 pregnancies from 17 660 women were used to derived reference ranges for BPD, FL, AC and HC. This represented the largest prospective study in Australia and the authors confidently offered them for adoption by ASUM to replace the Westerway charts. The same group produced a reanalysis of this data to produce a fetal dating chart three years later[32].

Again, there were mixed responses to this new attempt to create standards based on Australian data. Among the concerns were an apparent deviation of the AC from international standards, a suspected bias from menstrual dating and the lack of reported demographic characteristics[33].

Sonographic standards for EFW

In contrast to the several attempts to create Australian sonographic standards for biometry, there has been no Australian chart published for estimated fetal weight. The 1991 Hadlock publication, *A sonographic weight standard for in utero analysis of fetal growth*[34], was the first national study in the USA to devise an in utero fetal weight standard with ultrasound and this chart continues to be in widespread use internationally, including in Australia. This study population consisted of 392 white middle-class women with certain menstrual dates, seen between 10 and 41 weeks for ultrasound. The EFW was calculated from the HC, BPD, AC and FL according to the Hadlock C formula[35]. Comparison of predicted term weights with those observed at delivery was very good: for a fetus at 40 weeks, the 50th centile EFW was 3619 g, the observed 50th centile for BW was 3686 g.

The Hadlock chart is the one currently incorporated into the Viewpoint software program, commonly used for reporting in Australian fetal medicine units. The biometry standards in Viewpoint also come from Hadlock and Deter's work.

Of note is that none of the Australian publications on biometry standards recommend a specific formula for EFW. This is due to the difficulty in identifying a single formula that outperforms others for various populations and gestational ages. ASUM's position is that 'No formula for estimating fetal weight has achieved an accuracy which enables us to recommend its use'[28]. However, this ignores the fact that in clinical practice most of the attention is focussed on the final EFW, not the individual fetal measurements. Thus, while some clinicians may consider individual biometry results, particularly the AC, many will skim over these and base their decisions on the final EFW and percentile range. Many clinicians assume that the final EFW centile is somehow related to the centiles ranges of the individual fetal measurements, when in fact it does not. Hence, the not-infrequent situation when the percentiles of the biometric measurements and the final EFW do not correlate (e.g. all biometry within normal range for local biometry charts, but

Table 3: Features of a well-designed study for determining fetal size for gestation (Altman DG, Chitty LS. Charts of fetal size: 1. Methodology. *Br J Obstet Gynaecol* 1994; 101 (1): 29–34).

Sample selection
- Data should be prospectively collected specifically for the purpose of developing a reference range;
- Each fetus should only be measured once;
- Date of measurement should be randomised so that approximately equal numbers are measured for each week of gestation;
- Data collected late in pregnancy should not include clinically indicated ultrasounds;
- Further sampling near term may be required to obtain sufficient numbers at late gestation;
- Reference data should relate to normal fetuses: ie an unselected population;
- Acceptable exclusions include: congenital anomalies, maternal conditions that affect fetal growth (DM or renal disease), multiple pregnancy, uncertain LMP, ultrasound and menstrual age at 18-22 weeks differing by more than 10 days; and
- Cross-sectional data recommended to develop reference centiles for fetal size (as opposed to centiles for growth where serial measurements may be more appropriate).

Sample size
- The large the sample size, the greater the precision of the resulting centiles; and
- Several hundred observations are necessary to get reasonable estimates of extreme centiles (where most attention is concentrated)

Method of analysis
- Parametric method most common;
- Mean and standard deviation at each gestational age are estimated;
- assumption is that at each gestational age, the data come from a population with a normal distribution;
- 5th and 95th centiles calculated as the mean ± 1.645 SD;
- reference centiles should change smoothly with gestation and they should be a good fit to the data;
- change in variability of the measurement with gestation must be considered: SD usually increases with gestation; and
- scatter diagram of the data with the centiles superimposed should be included.

an EFW that appears small when plotted on the Hadlock EFW chart).

While the debate regarding the best biometry standards for an Australian population continues, in many respects the outcome remains irrelevant so long as clinicians and patients place so much emphasis on the EFW.

Which formula should we use? The ideal formula for estimating fetal weight would show very little bias (<1%) and a high level of precision (<5%), with a high level of consistency across weight ranges. A recent analysis of the sources of error in calculating EFW compared the bias, precision and consistency of 12 different formulae in common use[36]. This prospective observational study included data from a mixed-risk pregnancy population that had an EFW calculated within seven days of delivery. Data from 72 births in 1991 and 208 births in 2000 were assessed and compared. In 2000, only six of the 12 published formulae performed within acceptable limits, with overall bias within 7% and precision within 15% of the EFW. The six equations that performed within these acceptable cut-off points were the Rose[37], Warsof[38], Shepard[39], Hadlock A[40], Hadlock C[35], and Woo[41]. They also confirmed previously established knowledge that estimating fetal weight in very low birthweight infants <1000 g is subject to much greater error (poorer precision) than it is in larger babies. The commonly used Hadlock formulae were particularly poor when used with smaller babies, systematically underestimating the actual weight by 10–14%. The Woo formula was shown to have minimal bias in small babies. Specific formulae for small babies have been developed by other authors[42], but are not in widespread use. Of additional interest is that improvements in ultrasound technology between 1991 and 2000 did not improve the accuracy of estimating fetal weight in this study.

For consistency, if the Hadlock EFW chart is used to plot fetal size, one should use the same Hadlock C formula that was used to construct the chart. If a birthweight chart is used, any formulas can be used.

Determination of growth velocity with serial measurement and charting the course along centile curves, rather than a single estimate of AC or EFW, has been shown by some authors to be superior in the prediction of FGR and poor perinatal outcome[43]. However, at least two weeks must elapse between growth scans in order to reduce false positives due to ultrasound error. Mongelli found that there was a dramatic increase in false-positive rates as the time interval between examinations was reduced[44]. When the initial scan was performed at 32 weeks, the false-positive rate (i.e., no apparent growth in AC between scans) increased from 3.2% for an interval of 4 weeks to 30.8% for an interval of 1 week. Fortnightly scanning still produces a false positive rate of over 10%.

Finally, the most important consideration is not which formula or chart is used, but consistency and transparency of practice. What we wish to avoid is the situation when a fetus is scanned by several different practices and charted against different standards, leading to erroneous conclusions about the growth velocity and inappropriate management decisions. Reports should reference the formula and charts used to report fetal size in order to reduce confusion and to create an awareness in clinicians that differences in fetal size reporting exist.

An Australian EFW chart?

In an ideal world, a prospective longitudinal study of normal pregnancies with serial scans would be undertaken to produce an intrauterine fetal growth chart. In the absence of this type of data, what would it take to develop on Australian EFW graph? Would it be methodologically possible to develop an Australian EFW graph using the ASUM biometry values and an appropriate formula? Those that already choose not to use the ASUM charts will obviously continue to use their own preferred birthweight or EFW chart, while those that have adopted the ASUM recommendation can avoid the inconsistencies in reporting discussed above.

Customised growth charts

Are the days of population-derived charts limited any-

way? There are several well-identified physiological factors affecting birthweight; namely fetal sex, maternal height and weight, ethnicity and parity. Research efforts led by Gardosi in the UK have produced software programs to customise birthweight references for individual women according to these physiological factors (but not pathologicial factors such as smoking or extremes in BMI). These customised charts have been investigated for both birthweight[45–47] and fetal growth assessment[48,49] and were the subject of a systematic review in 2005[50].

Data to date has been mainly confined to retrospective analysis of infants according to assignment as growth restricted by conventional population-based charts or by customised chart. Customised birthweight standards have been shown to more accurately identify infants at increased risk of perinatal mortality and morbidity when compared with conventional local birthweight centiles in the UK[51], Sweden[45], Spain[47], The Netherlands[52], New Zealand[53] and France[52]. Recent Australian interest in developing local programs have lead to coefficients being published by two separate groups in Brisbane[54] and Sydney[55]. However, caution should be used when considering ethnic coefficients for the indigenous population as produced by the Brisbane group as there is almost certainly a strong contribution of socio-economic factors to perinatal outcomes and fetal growth.

The second function of the customised 'term optimised weight' (TOW) is to develop growth curves for use when performing ultrasound estimates of fetal size during pregnancy[56]. Once the TOW is calculated, proportionality curves derived from Hadlock's EFW chart are used to generate a fetal growth curve. This curve contains the assumption that 33% of the TOW should be achieved at 28 weeks, 50% by 31 weeks, 67% by 34 weeks and 100% by 40 weeks. The normal range around the median curve is calculated by using the coefficient of variation of birthweight at term (11%), allowing the normal range to become smaller as the median is reduced. The advantage of this fetal weight curve is that it avoids the negative skewness of birthweight distributions contained in birthweight charts.

The concept of making individual references for fetal growth is a very attractive and promising approach. The Royal College of Obstetricians and Gynaecologists has recommended the use of customised growth charts in its clinical guideline on the management of the SGA infant[9]. However, there is not yet any evidence from prospective studies that they improve perinatal outcomes, though a retrospective study did find them to be more predictive of SGA at birth, operative delivery for fetal distress and NICU admission than conventional birthweight charts[28]. This study also concluded that the 10th centile remains an appropriate cut-off to identify those at risk of adverse outcomes due to size when using customised intrauterine growth charts. Randomised controlled studies are needed to determine the effect of using customised growth charts on perinatal and maternal outcomes.

One of the major hurdles to adopting customised growth curves is the cost and logistical challenges in implementation. Multiple service providers would need to be involved in the implementation process, and probably each patient would need to keep a hand-held record of her own fetal growth chart. Further evidence regarding their effect on substantial outcomes will be necessary to mobilise all stakeholders to support their use.

Conclusion

The task of performing ultrasound assessment of fetal size is a complex one with many pitfalls, inherent inaccuracies and methodological controversies. While ASUM has implemented a standard obstetric chart to ensure uniform reporting of fetal measurements, this set of references does not contain a recommendation for a particular EFW formula, nor does it provide an EFW curve. Currently, most practices use either the Hadlock chart, or state or national birthweight charts; a few centres continue to use hospital-based figures. As long as this lack of an Australian standard for EFW continues, inconsistencies in reporting will continue to occur.

Recommendations for practice

- Examine own practice and understand the various charts and formulae installed on your machines and computers;
- Report consistently with the same charts to avoid errors in assessing interval growth;
- Report the percentile band or SD range for each measurement rather than the 'equivalent GA';
- Provide the reference charts with the fetal measurements and/or EFW plotted on them at the end of the report;
- Biometry and/or EFW from any previous scans from your practice should also be plotted and included in the current report to demonstrate whether growth velocity is being maintained along the appropriate percentile curve; and
- Provide the literature references for the percentile charts and EFW formula in your report.

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What factors are associated with parental desire to find out the sex of their baby?

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Abstract

Objectives: The main purpose of this study was to determine which factors are associated with parental desire to find out the sex of their baby, or not, before birth and to explore the reasons that parents find important in making this decision. ***Methods***: A total of 200 questionnaires were filled in at the Nepean Hospital, Western Sydney. Questions were asked about the mothers' demographic factors, her partner if applicable, this pregnancy, ultrasound examinations, pregnancy history, childbirth plans, maternal and paternal sex preference and desire to find out the baby's sex. At the final question scores had to be given for reasons that may have played a role in the parents' decision to find out or not to find out the sex of their unborn child. ***Results:*** 64% of the mothers and 55.1% of the fathers wanted to know the sex of the baby. Factors related to maternal desire to find out the sex of the baby are; low maternal and paternal education level, low household income, having previous children, having a sex preference, having no partner, knowing the sex of previous children before birth, planning to move based on the sex of the baby, not having more children in the future and not planning to breastfeed. The reason that scored the highest percentage (66.4%) for being an important motive to find out the sex of the baby was 'curiosity'. ***Conclusions****:* Several factors are associated with maternal desire to find out the sex of the baby before birth.

Introduction

During pregnancy, most women will have at least one ultrasound examination, which is the first opportunity for the expectant mother to get an image of her unborn child. Ultrasound is a widely accepted method to detect potential abnormalities in fetal growth and development but is also the most common way to find out the sex of the baby. Attempts in the past to predict fetal sex by fetal heart rate, severity of morning sickness or shape of the maternal abdomen have been proven to have no scientific validity[1].

Recent research proves it is possible to find out the sex of the fetus by ultrasound with a 98–100% accuracy from 12–14 weeks of gestation[2–6].

Having an ultrasound examination involves a decision to be made by the parents, i.e. do they want to know whether they will be having a boy or a girl or will they keep the sex of the baby a surprise until birth? Although this choice affects every expectant parent, little is known about the process of reasoning which leads to a decision. For a number of parents the need to know their baby's sex is clear; for instance a family history of X-linked disease where determination of female gender excludes the disease while male gender gives the fetus a 50% risk of inheriting the disorder[4]. For some parents the preference for having a son is so strong they certainly want to find out their baby's sex. This is especially important in countries like India and China where expecting a girl still leads to sex selective abortion[7]. However, for the majority of parents, the reason will not be that obvious.

Consequences of knowing the sex of the baby before birth and having a sex preference have been studied in the past. One study showed that parents who knew the sex of the baby before birth had significantly lower scores on the Fetal Attachment Scale, even when having a baby of the preferred sex[8]. Having a sex preference and knowing the sex of the baby leads to a higher percentage of obstetric difficulties and feelings of depression, somatisation and anxiety when having a baby of the undesired sex[1,9].

The only recent study of factors that are associated with parents' desire to know the fetal sex was published by Shipp, *et al.* in the USA in 2004. They concluded that specific demographic and socio-economic characteristics predicted whether or not parents chose to know the sex of their unborn child[10].

The main purpose of this research, done among first trimester gravidas, was to determine which factors are associated with parental desire to find out or not find out the sex of their baby before birth. Furthermore, it explored the reasons that parents find most important in making their decision. Determining the factors that are involved in parents' decision to find out the sex of their unborn child, or not, can help health care employees to anticipate problems that may occur by telling parents the sex of the baby before birth.

Methods

A total of 200 questionnaires were filled in at the Nepean Hospital, University of Sydney, in Penrith, Australia. The questionnaire consisted of 40 questions; three open-ended, 35 multiple choice and two five-point numeric scale question.

The three open-ended questions asked for maternal and paternal age and postal code.

The multiple-choice questions concerned:

1 Demographic factors; background, religion, relationship status, education, main daily activity, household income;
2 Partner (if applicable); paternal education, main daily activity and duration of relationship;
3 This pregnancy; planning of pregnancy and method of conception;
4 Previous ultrasound examinations; number of ultrasounds before current examination and whether problems have been discovered earlier;
5 Pregnancy history; previous children, miscarriage, whether previous children had the same father and if the mother knew the sex of her previous children before birth;
6 Childbirth plans; breastfeeding, naming the baby, future childbirth and if parents are planning a move or house renovation based on the sex of the baby;
7 Maternal and paternal desire to find out the sex of the baby, and if yes; would they have an extra ultrasound just to find out the sex and would the parents disclose the sex of the baby to other people; and
8 Maternal and paternal sex preference.

In the five-point numeric scale questions, scores had to be given for reasons that may have played a role in the parents' decision to discover the sex of their unborn child or not to. At this question, the parents could also write down a personal reason that was important to them. The questionnaires were handed out to the women attending for an ultrasound examination and as a result the paternal information is filled in as perceived by the expectant mother.

The research sample consisted of 200 patients who came for a routine nuchal translucency (NT) scan between 11 and 13 weeks gestation at the perinatal ultrasound department. The NT scan is offered to all pregnant women in Australia and is an ultrasound risk assessment based on the measurement of a subcutaneous accumulation of fluid visible behind the neck of the fetus[11]. The collection of data was performed from February until April 2007.

Analysis of data was performed using SPSS for Windows (SPSS Inc Chicago, IL, USA) Basic descriptive statistics were calculated. The influence of multiple factors on maternal desire to know the sex of the baby was tested using the Pearson's Chi-square test. Statistical-significance was set at $P < 0.05$.

Results

Maternal desire

Since the expectant mother filled in the questionnaire, the paternal information provided was as perceived by her. Therefore, the maternal desire to know the sex of the child is used to analyse the results and paternal desire used only when indicated.

Demographic variables:

Sample characteristics of the expectant parents are presented in Table 1.

The expectant mothers had a mean age of 29 years (range 16–43) and the expectant fathers had a mean age of 31 years (range 18–51). The background of the expectant mothers was mainly Australian (81%), 65.2% of the participants were Christian and 30.8% were non-religious. Just over half of the expectant mothers (53.8%) and fathers (55.3%) had a 'school only' education. There is a significant association

Table 1: Demographic variables.

Variable	*n*	(%)
Age mother (yr)		
<22	17	8.6
22–30	117	59.4
31–36	52	26.4
>36	11	5.6
Age father (yr)		
<22	9	4.9
22–30	93	50.5
31–36	53	28.8
>36	29	15.8
Education mother		
School only	107	53.8
TAFE or training	39	19.6
University	53	26.6
Education father		
School only	104	55.3
TAFE or training	56	29.8
University	28	14.9
Household income (AU $/yr)		
Low income (<25 000)	16	8.2
Moderate income (25 000–78 000)	89	45.9
High income (>78 000)	64	33.0
Private	25	12.9
Daily activity mother		
Student	5.0	2.5
At home	69	34.5
<40 hours work a week	101	50.5
>40 hours work a week	25	12.5
Daily activity father		
Student	1	0.5
At home	7	3.7
<40 hours work a week	64	34.2
>40 hours work a week	115	61.5
Background mother		
Australia	162	81.0
UK/Ireland	9	4.5
Croatia	7	3.5
New Zealand	6	3.0
Asia	5	2.5
South America	3	1.5
Other	8	4.0
Religion mother		
Christian	129	65.2
None	61	30.8
Other	8	4.0

Table 2: Maternal sex preference based on previous children.

Sex of children	Prefer a girl *n* (%)	Prefer a boy *n* (%)	No sex preference *n* (%)	Total *n* (100%)
Equal sex or no previous children	12 (14.5)	5 (6.0)	66 (79.5)	83
One girl and no boys	2 (6.3)	6 (18.8)	24 (75.0)	32
One boy and no girls	7 (17.5)	1 (2.5)	32 (80.0)	40
Unequal sex of children	16 (13.7)	11 (9.4)	90 (76.9)	117

between the level of maternal and paternal education and the expectant mothers desire to find out the sex of the baby; 74.8% of the mothers with a 'school only' education wanted to know the sex of the baby versus 49.1% of the university educated mothers (P = 0.002). When the expectant father had a 'school only' education, 70.2% of the mothers wanted to know the sex in comparison with 42.9% for university educated fathers (P = 0.015). As would be expected, income and education are significantly associated with each other in this research sample (P = 0.010) therefore, the same association is found for household income; a significantly higher percentage of mothers in the low-income class wanted to know the sex of the baby (P = 0.009).

Finding out the sex of the baby and sex preference

Overall, 64% of the mothers and 55.1% of the fathers wanted to know the sex of the baby. Of the parents, 29% did not agree with each other about finding out the sex of the baby. Of the mothers, 22% had a sex preference, of which 14% preferred a girl and 8% preferred a boy. Of the fathers, 29.6% had a sex preference, of whom 10.2% preferred a girl and 19.4% preferred a boy.

Of all mothers wanting to know the sex of the baby 29.7% had a sex preference and of all mothers not wanting to know the sex only 8.3% had a sex preference.

Maternal sex preference based on previous children is shown in Table 2. A higher preference for a girl is noticeable when the expectant mother had no previous children or children with equal sex. The percentage of expectant mothers having a sex preference decreases 0.5% when having one boy and no girls and increases to 4.5% when having one girl and no boys and 2.6% when having unequal numbers of boys and girls, compared to having no children or an equal number of boys and girls. Having a sex preference increases the percentage of expectant mothers wanting to know the sex from 57.7% without having a preference to 86.4% for wanting to know and having a preference (P = 0.00).

Current pregnancy

Of the expectant parents, 69% had planned their pregnancy, of which, 85% got pregnant within 12 months and 6.6% needed medical intervention to get pregnant. Planning of pregnancy, the time needed to conceive or the way of conception did not influence the parental desire to find out the sex of the baby, 100% of all expectant mothers without a partner (6.5% of participants) wanted to know the sex of the baby before birth in comparison with 61.5% of expectant mothers with a partner. Being pregnant without having a partner is therefore significantly associated with desire to know the child's sex (P = 0.005).

Ultrasound examinations

Of the Australian expectant mothers, 45% had had no previous scan performed during their current pregnancy when visiting the hospital for NT; 35.5% had had one scan done before and 19.5% had had more than one. In 1.8%, problems were discovered with the baby on previous ultrasounds. None of these factors proved to make a difference in the maternal desire to know the baby's sex.

Pregnancy history

Of the participants, 65.5% had one or more previous children, and of these 79.5% indicated that the previous children had the same father as their current baby. Having one or more children increases the percentage of expectant mothers wanting to know the sex of the baby from 50.7% for mothers without children to 71.0% for expectant mothers with previous children (P = 0.005). Further, 43.9% of the women with children found out the sex of all their previously born children before birth, 18.9% knew in a part of their pregnancies and 37.1% did not know the sex. If the mother knew the sex of all her previous children, 82.8% wanted to know the sex of this baby again, if they knew partially 96% wanted to know and if they did not know 44.9% changed their mind and wanted to know the sex during this pregnancy. Knowing the sex of previous children before birth is therefore significantly influencing maternal desire (P = 0.000).

Women having a previous miscarriage (29.1% of the participants) wanted to know the sex 69% of the time compared with 61.7% of women without previous miscarriage (P = 0.330).

Childbirth plans

Expectant mothers planning not to breastfeed their baby (24% of all participants) wanted to know the sex of the baby more often (P = 0.013). Mothers planning to breastfeed wanted to know the sex in 58.6% of cases and this increased to 76.9% when the mother is planning not to breastfeed. Of the expectant mothers, 51.5% had thought of a name for their unborn child. The majority of mothers who had thought of a name for the child had thought of alternatives for both genders (38%). When the expectant mother had only been thinking about one name, slightly more mothers had thought only of a girl's name (8.5%) rather than a boy's name (5%). Naming the baby is not associated with wanting to know the sex of the baby less or more often (P = 0.974). Of the parents, 8.5% were planning to move based on the sex of the baby and a majority did want to know the sex in 88.2% *v.* 60.8% of cases when not planning to move (P = 0.030). Another factor significantly associated with wanting to know the sex was a lack of desire for

Table 3: Reasons for wanting to know.

Reason	Important (%)	Neutral (%)	Unimportant (%)
Cannot wait	40.9	42.7	16.4
Curiosity	66.4	24.5	9.1
Prepare older siblings[A]	55.4	26.5	19.0
Want no surprises	20.1	36.7	43.1
Shopping	56.3	22.7	20.9
Partner wants to know[B]	49.4	25.3	25.3
Sex preference[C]	36.7	43.3	20.0
Naming the child	34.9	33.9	31.2
Just want to know	60.5	29.4	10.1
Emotional attachment/ bonding	22.2	41.7	36.1
Planning/preparation	63.0	20.4	16.7

[A] Only scores of women with children were used

[B] Only scores of women were the partner wanted to know were used

[C] Only scores of women with a sex preference were used.

Table 4: Reasons for not wanting to know.

Reason	Important (%)	Neutral (%)	Unimportant (%)
Surprise at birth	87.7	9.2	3.1
Does not matter what the sex of the baby is	56.5	27.4	16.1
Partner doesn't want to know[A]	51.0	25.5	23.4
Add to excitement/ more fun	61.5	13.8	4.6
Care only that the baby is healthy	95.3	3.1	4.7

[A] Only scores of the partner didn't want to know were used

more children ($P = 0.001$). Parents wanting more children in the future wanted to learn the sex of the baby less often (49.4%) than parents considering having more children (67.2%) or not wanting more children (78.5%).

Reasons for wanting to know

Table 3 shows the reasons for wanting to know. The three reasons that scored the highest percentage for being important for finding out the sex of the baby for the expectant mothers were; 'Curiosity' (66.4%), 'Planning/preparation' (63.0%) and 'Just want to know' (60.5%). None of the participants wrote down a personal reason.

Reasons for not wanting to know

Table 4 shows the reasons for not wanting to know. The three reasons which scored the highest percentage for being important for not finding out the sex of the baby were; 'Care only that the baby is healthy' (95.3%), 'Surprise at birth' (87.7%) and 'Add to excitement/more fun' (61.5%).

Five expectant mothers gave an extra personal reason for not wanting to know the sex of the baby, for example; 'Husband's excitement of telling me when the baby is born', 'We can't keep our mouths shut' and 'A baby is a blessing in any form'.

Conclusion

The intention of this study was to determine factors that are associated with parental desire to find out the sex of their baby or not before birth and explore the reasons that parents find most important in making their decision. This study has been able to confirm several factors that are significantly related to the desire to find out the sex of the baby before birth for expectant mothers.

The reason that scored the highest percentage for being important for finding out the sex of the baby was 'Curiosity' (66.4%). The reason that scored the highest percentage for being important for not finding out the sex of the baby for the expectant mothers was; 'Care only that the baby is healthy' (95.3%).

The factors associated with a desire to find out the sex of the baby for expectant mothers are; low maternal and paternal education level, low income, having previous children, having a sex preference, having no partner, knowing the sex of previous children before birth, planning to move based on the sex of the baby, not having more children in the future and not planning to breastfeed. Table 5 shows the factors associated with desire to know and the OR.

The reason why a low education level and low income are associated factors is hard to explain but confirms the conclusions from previous research[10,12]. The factor 'not planning to breastfeed' is related to the factor 'low education', because parents with lower socio-economic status bottle-feed more in comparison to highly-educated mothers[13]. The same clarification can be used for the factor having no partner since 100% of the participants without a partner had a low level of education.

Table 5: Factors associated with maternal desire to know.

Factor	*P* value	OR (95% CI)
Maternal low education level 'school only'	0.001	2.84 (1.56–5.16)
Paternal low education level 'school only'	0.008	2.25 (1.23–4.09)
Having previous children	0.005	2.38 (1.30–4.35)
Having a sex preference	<0.001	4.64 (1.86–11.63)
Knowing sex of previous children before birth	<0.001	8.03 (3.44–18.70)
Planning to move based on the sex of the baby	0.025	4.83 (1.07–21.81)
Having more children in the future	0.001	3.74 (1.78–7.84)
Not planning to breastfeed	0.013	3.07 (1.39–6.78)

The factors 'low education level', having no partner and not planning to breastfeed are all related to less well established families. These families might want to know the sex of the baby more often because it may allow them to better control the situation[10].

Having a sex preference and knowing the sex of previous children before birth as well as planning a move based on the sex of the baby are understandable reasons for wanting to know the sex of the baby before birth.

Discussion

Comparing results from other studies

Results from previous studies gave a percentage ranging between 54% and 81% among respondents for wanting to know the sex of the baby. The numbers for having a sex preference varied widely between 16% and 81%[8,10,14,15]. Results from this research are compatible with the lower range percentage.

In the questionnaire from Shipp, *et al.* the participants had to fill in one reason that was most important for them. They found the two most important reasons for wanting to know the sex of the baby were; 'Planning/preparation' and 'Curiosity and emotional attachment/bonding'. The reason 'Emotional attachment/bonding' did not score a high percentage (22.2%) in this research sample.

When comparing results for reasons for not wanting to know the sex of the baby, it was noticeable that only 7% of American women selected 'Care only that the baby is healthy' as the most important reason. This reason had the highest score in Australia (95.3%). The American women found ' Surprise at birth' (73.%) the most important reason not to find out the baby's sex. An explanation for this difference might be that the reason 'Care only that the baby is healthy' is too obvious for women to write down in an open-ended question.

Our study has not been able to confirm all the reasons Shipp, *et al.* found to be associated with parental desire to learn the fetal sex. This could be explained by the fact that Shipp, *et al.* had a larger research sample of 1302 women of all gestational ages. Due to the smaller research sample, numbers in some groups were small.

It remains unclear if gestational age can influence the factors related to desire to know, since women that are further along in their pregnancy might develop other ideas about their plans during and after pregnancy[9,16]. However, Shipp, *et al.* concluded that the percentage wanting to know the sex did not differ between first, second and third trimester.

Limitations of this study

A limitation of this study is that the number of women who refused to fill in the questionnaire is not known exactly. We asked the women who refused to fill in the first page to provide us with their motivation for not co-operating. However, most refusers had bad knowledge of the English language and therefore did not fill in either the questionnaire or the first page.

Since the questionnaire is filled in by the expectant mother one cannot conclude that the same factors are associated with paternal desire to know the sex of the child. To make a conclusion about paternal desire to know the sex of their children the expectant fathers would need to fill in a questionnaire.

Future studies

Future research is needed to determine more possible consequences of finding out the sex of the baby before birth, especially when parents have a sex preference and how to cope with these consequences in health care. Furthermore, the influence of gestational age on and paternal factors associated with desire to find out the sex of the baby should be studied.

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Interventional ultrasound – general principles and applications in gastroenterology

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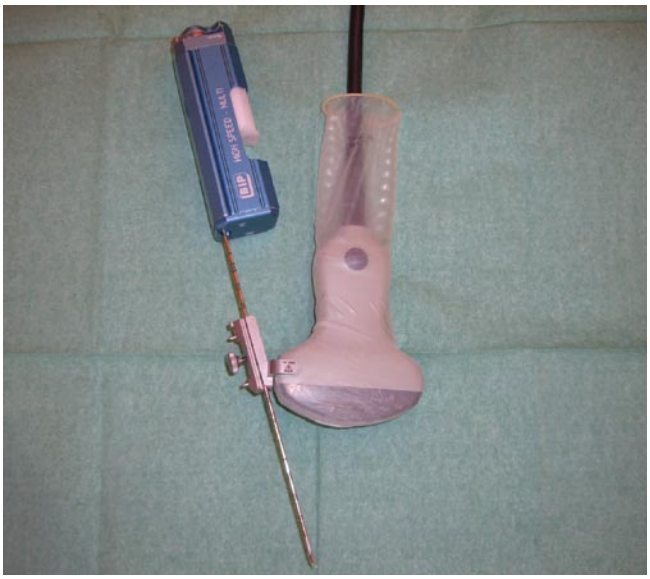

Fig. 1a

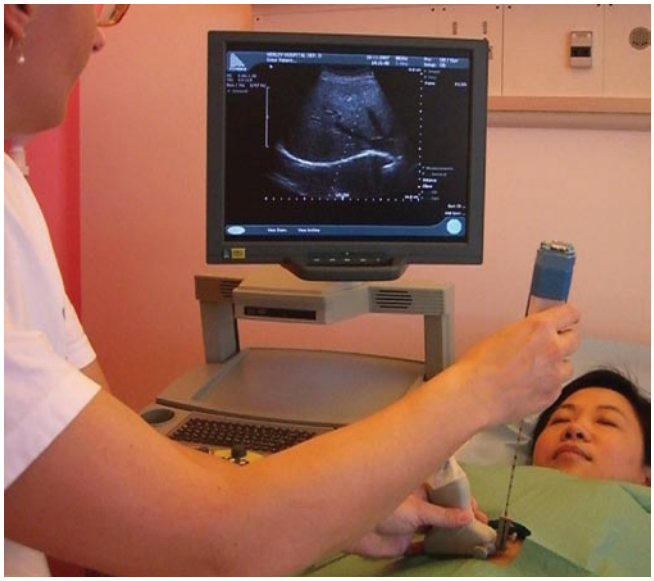

Fig. 1b

Equipment in interventional US. **1a** Needle guide made of metal is attached to the transducer, which is inside a sterile cover. A large cutting needle (mounted in the biopsy gun) is inserted in the needle guide that can be adjusted for different sizes of needles and catheters. **1b** Ready for a liver biopsy. The needle will follow the puncture line seen on the monitor, (modelphoto).

Introduction

Ultrasound (US) imaging, because it is in real time, is an unsurpassed imaging guide for interventional procedures. It is rapid and convenient, all puncture directions are possible and it allows continuous visualisation of the needle tip during a needle insertion. There is no ionising radiation and the equipment is mobile and relatively inexpensive. Because of these advantages, US and US-guided interventional procedures have gained widespread use.

Interventional procedures are minimally invasive, less time consuming and gentle alternatives to, or replacements for, many surgical procedures and have consequently had a great impact on the management of numerous diseases. In this paper, we focus on the general principles of interventional US and give some examples of diagnostic and therapeutic applications in gastroenterology.

The typical US examination in gastroenterology includes abdominal imaging of the liver, gall bladder, pancreas, GI-tract, spleen and retroperitoneum. The liver and pancreas might be examined in more detail with a surgical approach using intraoperative US (IUS), laparoscopic US (LUS), or endoscopic US (EUS). Furthermore, ano-rectal diseases and pelvic fluid collections might be examined with transrectal or transvaginal US. Both the 'classic' abdominal US as well as the surgically US approach can guide interventional procedures.

Guidance technique

A needle guide can be attached to the transducer as seen in Fig. 1a. The needle guides are either sterilised disposable utensils or reusable devices that need to be sterilised between procedures. Using a needle guide provides safer control of the needle during insertion, but at the cost of reduced flexibility of needle manipulation and limited degree of freedom regarding direction of puncture.

The transducer produces two-dimensional images of the scanned object, which is a three-dimensional structure. As the first step in the interventional procedure, the transducer is moved over the area of interest until the scanning sector traverses the target, which is then visualised on the monitor (Fig. 2). When the needle guide button on the scanner display is activated, the puncture line appears on the monitor (Fig. 1b). The transducer is then moved until the puncture line goes through the target, which implies that a needle inserted through the attached needle guide will be able to hit the target.

The point where the needle will penetrate the skin is marked with ink and local anaesthesia is applied. Then, the needle guide is mounted on the transducer and, depending on the size of the device to be inserted, a small skin incision may be made. The planned intervention can now be performed. If necessary, consecutive needle passes may be carried out through the same incision.

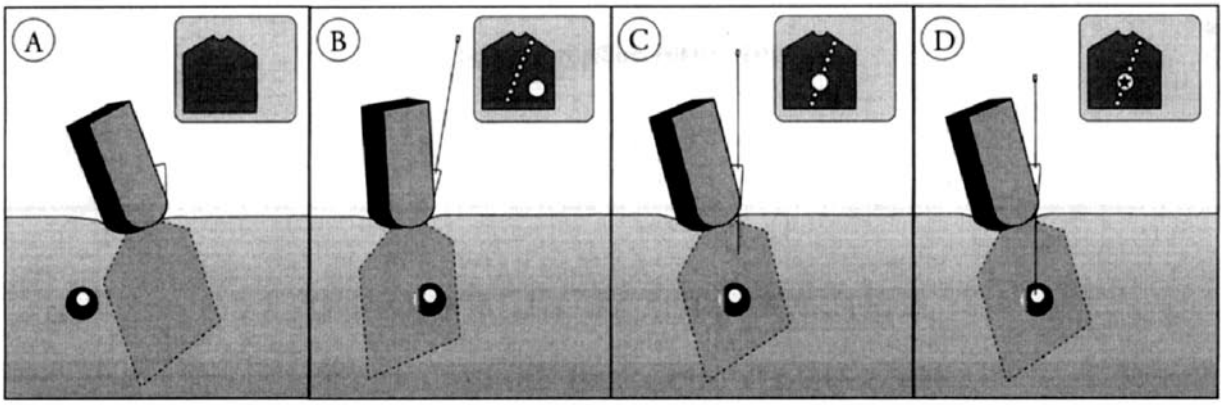

Fig. 2: Principle of US-guided puncture. (A) Target not visualised. (B) Transducer moved and target is seen on the monitor. (C) Transducer tilted until the target is transected by puncture line. (D) Needle inserted through the needle guide attached to the transducer, and the target is hit.

Fig. 3a

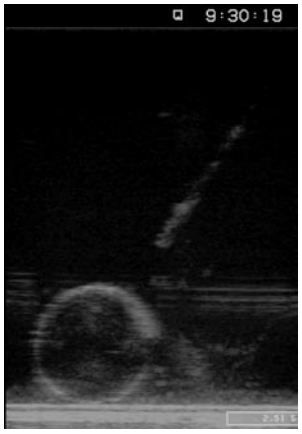

Fig. 3b

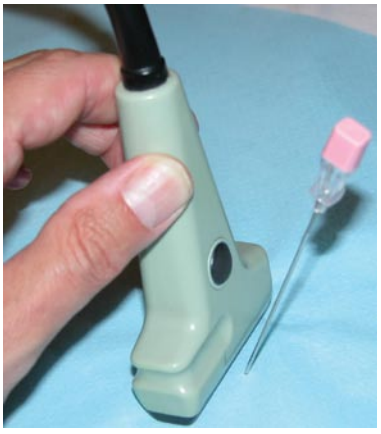

Fig. 3c

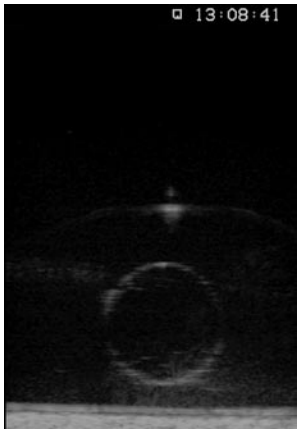

Fig. 3d

Free hand technique. **3a** Oblique needle insertion in the correct scanning plane. **3b** Corresponding US image of biopsy phantom with needle on its way towards the target (a grape), the entire needle shaft visualised. **3c** Oblique needle insertion perpendicular to the scanning plane. **3d** Corresponding US image of the needle above the target (target not hit). Notice that only the part of the needle traversing the scanning plane is visualised as an echogenic spot. One must therefore be sure this spot represents the needle tip before a biopsy is taken.

With the 'free hand' technique there is no physical connection between needle and transducer and therefore no limitations exist regarding point of needle insertion or angle of puncture. There is no puncture line on the monitor to guide the procedure, and the needle may be inserted from any direction parallel or perpendicular to the scanning plane, whichever solution is most suitable according to the situation at hand (Fig. 3). Only the part of the needle that is in the scanning plane can be seen on the monitor. This implies that the entire needle shaft should usually be visualised on the US image if the needle is inserted from the end of the transducer parallel to the scanning plane, whereas with a needle insertion from the side of the transducer, perpendicular to the scanning plane, the needle is only seen as a single or double echo spot at the point where it traverses the scanning plane. This makes it technically more delicate – and sometimes difficult – to perform a perpendicular 'free hand' procedure. If the full path of the needle is not visualised, care should be taken that the needle does not traverse any structures that may cause complications if punctured.

Some will speak strongly in favour of either the 'free hand' or the 'needle guide' technique and disregard the other. In our opinion, this is the wrong attitude.

Both the 'needle guide' and the 'free hand' technique are excellent tools, with advantages and drawbacks. When performing biopsy of a small lesion seated deep in the liver, a needle guide is the obvious choice, but if the target is a large superficial lesion, the 'free hand' technique may be just as safe and also quicker to use. If the lesion is not only superficial but small and located in a region which is difficult to access with full contact between transducer and skin, e.g. a lymph node in the supraclavicular region – the 'free hand' technique may be the only option (physically there may not be room for the needle guide or it may be impossible to make the puncture line go through the lesion). Thus, generally speaking, the two techniques should not be looked on as conflicting with each other but rather as potential alternatives that one can choose between.

Equipment for biopsy

Fine needle/large needle

A fine needle is defined as a needle with an outer diameter less than 1 mm and, consequently, any needle with a diameter equal to or more than 1 mm is defined as a large (coarse) needle.

Cytology/histology

The biopsy needle for cytology is a simple cannula (fine needle size) connected to a 10 cc syringe (Fig. 4). During the biopsy using fine needle aspiration cytology (FNAC), the needle is moved back and forth inside the tumour while

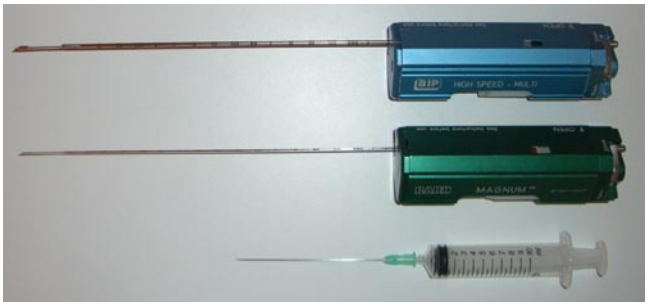

Fig. 4: A 0.8 mm intramuscular cannula mounted on a 10 cc syringe for FNAC. The two above needles (mounted in biopsy gun) are cutting needles for histologic biopsy. The upper needle has a diameter of 2.0 mm (large needle size) and the middle needle has a diameter of 0.9 mm (fine needle size).

tumour cells are aspirated. After the biopsy, the tumour cells are smeared on a mounting glass for air drying or fixating before further processing by the pathologist. FNAC is often fast and easy to perform. The pathologic evaluation of the cellular morphology can provide information about presence of malignant cells, however, specific tumour classification is often not possible.

For the histologic biopsy, a dedicated cutting needle is mounted into a dedicated biopsy gun (Figs. 1a and 4). A spring-load mechanism can remove a tissue core with high power and velocity, which ensures a tissue core of high quality. After the procedure, the tissue core is fixed into formalin. The pathologic evaluation provides information about tissue architecture. Since special stainings, tumour markers, and immunohistochemical technique can be used, specific tumour classification is often possible. Cutting needles are typically in the range of 0.9 mm to 2 mm and, therefore, include both fine needles and large needles (Fig. 4).

Sterility

All interventional procedures should be performed using an aseptic technique, however, not all cases need full draping and transducer cover to comply with this concept. FNAC or diagnostic fluid aspiration carried out with the 'free hand' technique can be completed without the transducer ever touching the needle. With the transducer in place over the area of interest, the chosen site of skin puncture is cleaned of superfluous gel and sterilised with alcohol/chlorhexidine. The needle can now be directed towards the target without contact with the transducer, but still under full US guidance. Cases involving multiple needle passes or catheter placement, or cases more 'complicated' in other ways as well as all cases performed with the 'needle guide' technique require draping of the patient, use of sterile US gel, and sterile transducer surface either obtained by using a sterile transducer cover (Fig. 1a) or by soaking the entire transducer in alcohol/chlorhexidine before the intervention. Please note that most transducers cannot be fully submerged.

Patient preparation and information

Information given to the patient prior to an interventional procedure as well as preparation and follow-up depends on the type of procedure. Specific guidelines for every case cannot be issued, but we will relate some of the recommendations we have used for a number of years.

In our institutions, as a general rule, a fine needle biopsy (cytology or histology) is performed without requiring any blood tests or having blood available for transfusion. The patient need not be fasting and post-biopsy observation is not required, which implies that the procedure can be carried out on an outpatient basis. Pre-medication is not required, and the biopsy may be performed using local anaesthesia or perhaps even without anaesthesia in the case of a simple FNAC with one or two needle passes. The patient is informed verbally and through written correspondence in accordance with medico-legal legislation about the nature of the procedure, the possible discomfort related to it, the potential risk of complications and how to react in the case of unexpected symptoms.

Patients with known coagulation disorders or patients suspected of having a higher risk of bleeding require more restrictive guidelines. In our institutions, the following guidelines are followed: in-hospital patients fast for six hours prior to procedure, a blood test on coagulative system less than three days old with INR <1.5 and thrombocyte counts >40 000 per microlitre and six hours post-procedural observation are required. For the sake of simplicity, these recommendations could also apply to patients undergoing large needle biopsy or procedures requiring the use of large catheters or other utensils.

Most procedures can be performed under local anaesthesia and without sedation. Some patients may be so nervous that sedation or even general anaesthesia is required. Prolonged or complicated cases, as in most RF ablations, are best carried out under general anaesthesia, which is also the method used when performing interventional procedures in paediatrics.

Complications

Haemorrhage after a fine needle biopsy is rare, and the mortality rate is very low, approximately 0.03%[1,2]. Cases of death have been reported after biopsy of every abdominal organ, but the highest complication rates and mortality rates are reported after hepatic or pancreatic biopsies[3].

We have found that the bigger the needle, the higher the complication rate. The diagnosis of medical liver diseases (such as cirrhosis) often requires a very large (cutting) needle (14 gauge). Significant bleeding (requiring blood transfusion) into the peritoneal cavity after such a biopsy is reported in 0.2% of cases, and the mortality rate is reported to be 0.04%[4] of cases.

Tumour seeding in the needle tract is somewhat controversial[5]. Several casuistic reports have been published which may leave the reader with the impression of a fairly frequent and potentially dangerous complication rate[6]. Because of the problems with getting complete follow-up, the actual number is difficult to determine. In a review of eight large studies, the incidence varied between 0.003 and 0.036%[3]. It therefore appears as if tumour seeding is rare, with a frequency comparable to that of other major complications. This minimal risk obviously must be weighed against the major gain in patient treatment obtained by achieving a biopsy.

Diagnostic applications in gastroenterology

A biopsy is often indicated when a tumor-like lesion is discovered on imaging. If the patient has a history of cancer, a lesion in the liver or retrioperitoneum is probably a metastasis, and it is usually sufficient to perform a FNAC to demonstrate

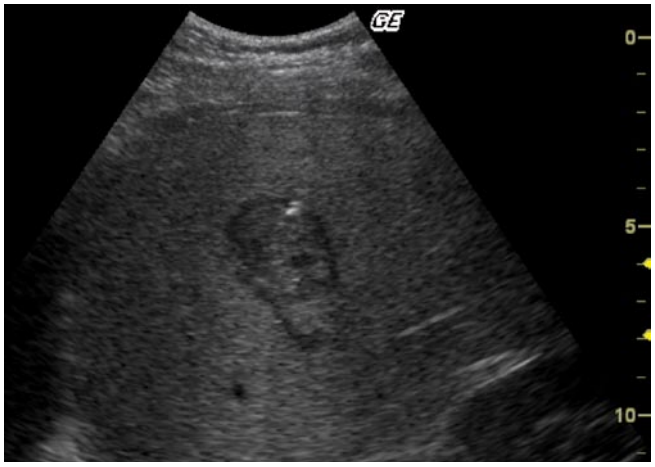

Fig. 5: FNAC from a liver metastasis, the patient had a primary colon cancer. The tip of the aspiration needle (echogenic spots) is seen at the upper rim of the tumor. Since free-hand technique was used, no puncture line is seen. Cytologic examination showed adenocarcinoma cells.

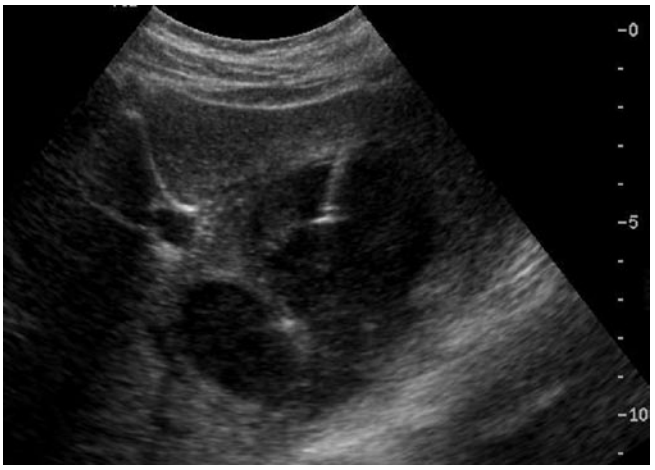

Fig. 6: Test puncture from a fluid collection in the left liver lobe in a patient suspected of an abdominal abscess. A 0.8 mm intramuscular cannula mounted on a 10 cc syringe as seen on Fig. 4 was used and pus could be aspirated.

Fig. 7a

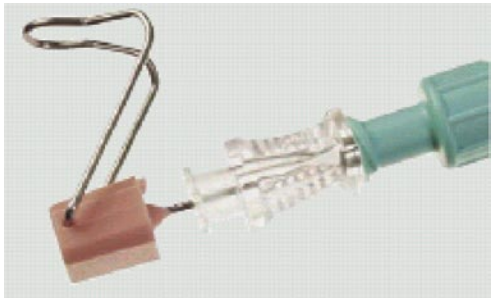

Fig. 7b

Fig. 7c

2 mm pigtail trocar catheter for one-step use in the treatment of fluid collections. **7a** The tip of the catheter during insertion, **7b** the catheter consists of three parts: Inner stylet (left), needle (middle), and outer catheter (right), **7c** when the needle including the inner stylet has been removed, the catheter takes a pigtail shape.

the presence of metastatic deposit (Fig. 5). If, however, the patient has no history of cancer, a lesion in the liver or retroperitoneum must be tumor-classified, which requires a histologic biopsy (cutting needle of 0.9 mm fine needle size or 1.2 mm large needle size). A primary pancreatic cancer can be diagnosed with FNAC, however, some pathologists prefer a histologic biopsy.

A fluid collection of unknown origin might be indicative of an abscess or a cystic tumor depending on the US appearance and the clinical situation. A test puncture using the FNAC technique can determine the nature of such a fluid collection, and the aspirated fluid can be sent for microbiologic and/or cytologic evaluation (Fig. 6).

If a medical liver disease such as cirrhosis is to be diagnosed and properly classified, a large histologic biopsy in the range 1.6 mm to 2 mm is performed. In this case, no specific lesion is to be targeted, but US helps to guide for a safer biopsy of liver tissue.

Therapeutic applications in gastroenterology

Drainage of fluid collections like ascites and pleural effusion can in most cases easily and safely be performed by inserting a small (2 mm) one-step catheter under US guidance. Catheters may be pig-tail type and equipped with an internal string for internal loop fixation or may use a balloon for internal fixation. A one-step catheter consists of an outer non-cutting needle with a trocar stylet for penetration and a catheter pulled over the outer needle (Fig. 7). Once the needle tip is seen inside the fluid to be drained, the stylet is withdrawn and if fluid is flowing out freely, the catheter is inserted by gently pushing it forward, while the needle is kept in a fixed position. If the fluid is not under pressure, it may be necessary to use a syringe or a suction system to drain it.

Percutaneous drainage of abdominal abscesses (i.e. periappendicular abscesses, liver abscesses, and gall bladder empyemas) has become the method of choice since it was introduced more than 20 years ago[7]. Drainage of an abscess is performed following the same guidelines as outlined above regarding US guidance and the puncture itself. Generally, an abscess should be treated by inserting a catheter, emptying the pus by suction and irrigating with sterile saline until the aspirate becomes clear. A relatively thin catheter with an outer diameter of 2 mm to 3 mm is often sufficient. The procedure of aspiration and irrigation should be repeated several times per day till the patient is cured.

If the abscess is small, (less than 3 cm), or if US cannot rule out overlying bowel loops, drainage should be performed with a needle by applying the same rules for emptying and irrigation. In case a large abscess is positioned deeply underneath superimposed intestines, a catheter may be inserted and aspiration and irrigation performed this way, but the catheter must be withdrawn after the procedure to avoid fistula formation. Follow-up US should include

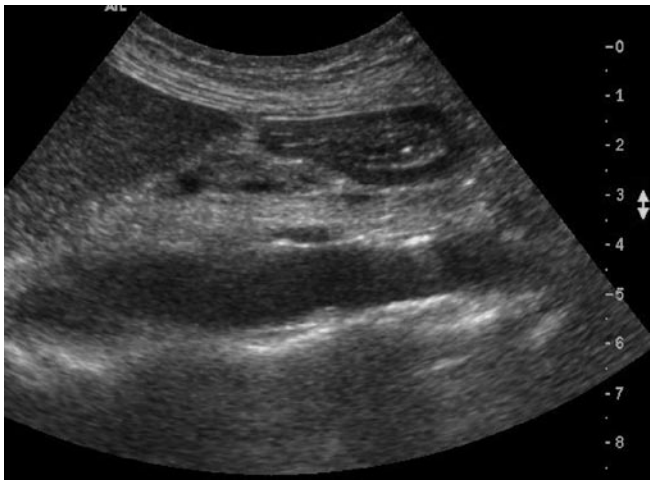

Fig. 8a

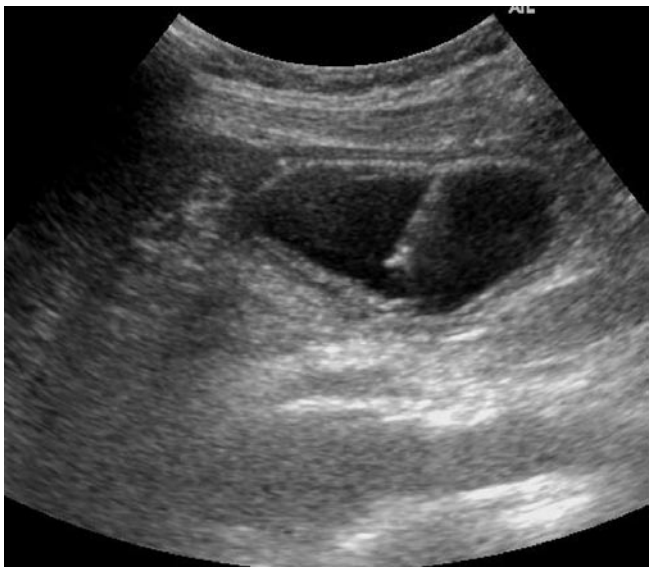

Fig. 8b

Percutaneous gastrostomy. **8a** longitudinal section of upper abdomen where the liver is seen to the left and the empty stomach is seen anterior to the aorta, **8b** the stomach has been distended with 300 cc of tap water via a nasogastric tube and a 1.2 mm lumbar needle has been introduced into the gastric lumen as the first step in the procedure.

repeated puncture and drainage, if necessary.

Percutaneous gastrostomy guided by US and fluoroscopy has been shown to be a safe technique with a high success rate in patients with difficulties in swallowing (Fig. 8). The percutaneous endoscopic gastrostomy and the fluoroscopic guided gastrostomy does not demonstrate the needle puncturing the stomach in the beginning of the procedure, and the liver or bowel loops may be punctured accidentally. US, on the other hand, can safely display this part of the procedure[8].

Conclusion

Interventional US has many applications not mentioned in this paper and, without doubt, will continue to inspire new users to develop new procedures in the future for the benefit of the patients and the medical community[9–12].

Editor's note

The sterilisation procedures described in this article differ from those normally practiced in Australia and New Zealand. ASUM's current guidelines are published at www.asum.com.au.

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Fetal intracranial abnormalities in the third trimester – MRI as a useful diagnostic tool

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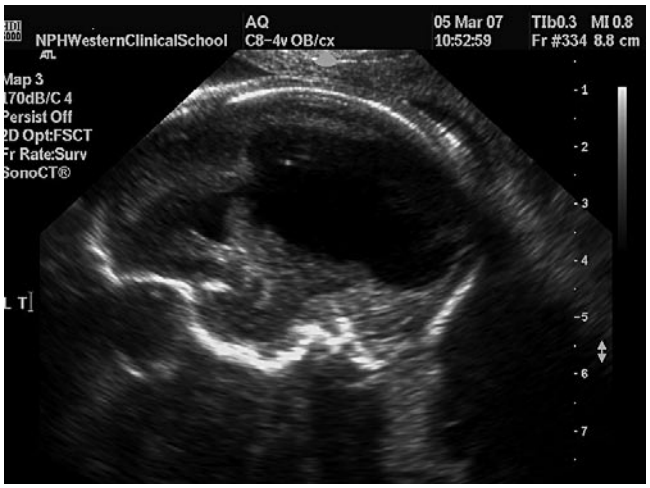

Fig 1: Sagittal transvaginal (TV) fetal brain USS at 26 weeks 6 days demonstrating anechoic space posteriorly.

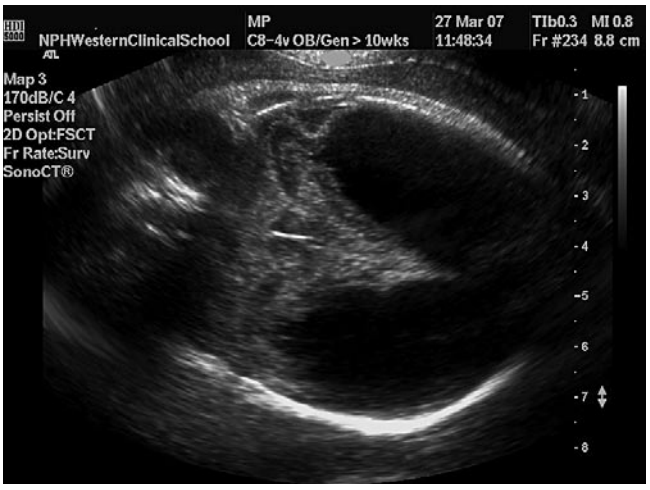

Fig. 2: Axial TV USS demonstrating bilateral anechoic areas posteriorly and preserved frontal brain structures at 30 weeks gestation.

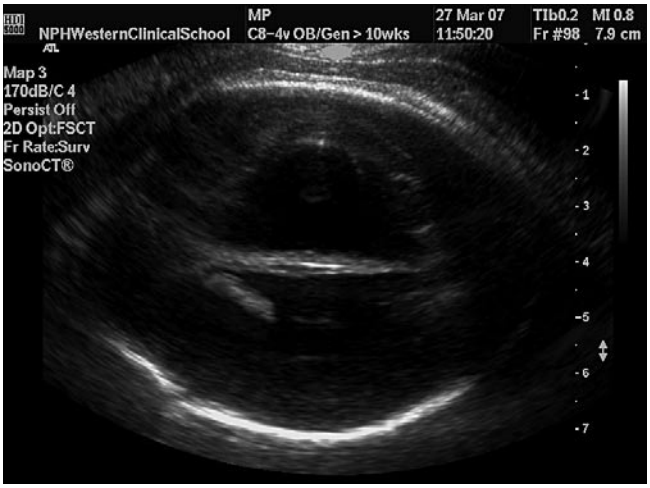

Fig. 3: Axial TV USS demonstrating preserved falx and difficulty in visualising brain structures due to USS reverberation at 30 weeks gestation.

Introduction

Ultrasound has many advantages as an imaging modality as it is relatively inexpensive, does not use ionising radiation, and high resolution images are obtained allowing dynamic real time assessment. It is widely employed in prenatal diagnosis and the assessment of fetal anomalies, however, sonographic evaluation of the fetal central nervous system (CNS) can be hindered by the non-specific appearance of some abnormalities, and by technical factors such as maternal obesity and advanced gestational age[1]. Developments in the field of magnetic resonance imaging (MRI), particularly the use of ultra fast image acquisition which minimises fetal motion artefact, have led to its use as a non-invasive, complementary technique in situations where the extent of the fetal intracranial anomaly cannot be accurately determined on ultrasound scan (USS).

We report three cases of fetal intracranial abnormalities detected late in pregnancy where sonographic visualisation of the structural anatomy of the CNS in the third trimester was found to be inconclusive, and MRI was then used in an attempt to clarify the diagnosis.

Case 1 – Hydranencephaly

A 41-year-old woman in her second pregnancy, booked late for antenatal care and had a routine fetal anatomy scan performed at 26 weeks 6 days gestation. An intra-cranial abnormality was strongly suspected, although structures were difficult to visualise, even with transvaginal scanning, due to fetal position and gestational age (Figs. 1, 2, 3). Amniocentesis was performed and reported a normal 46XY (male) karyotype and negative polymerase chain reaction (PCR) for cytomegalovirus (CMV) and toxoplasmosis. A fetal MRI was performed, which demonstrated absence of normal cortical mantle apart from a thin rim of tissue in the inferior aspect of the frontal lobe and the inferomedial aspect of the temporal lobes. The thalami, falx, cerebellum and brainstem appeared to be intact. These findings were consistent with hydranencephaly (Figs. 4, 5, 6).

Following multidisciplinary discussion regarding the poor prognosis, the patient requested termination of pregnancy. Fetocide was carried out with intracardiac potassium chloride injection at 30 weeks gestation, followed by induction of labour. A stillborn male infant was delivered weighing 1240 g. Postmortem examination confirmed the diagnosis of hydranencephaly.

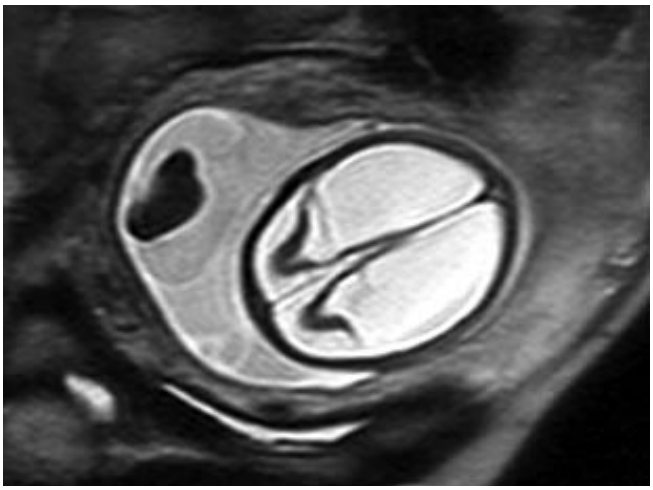

Fig. 4: Prenatal axial MRI of fetal brain demonstrating hydranencephaly.

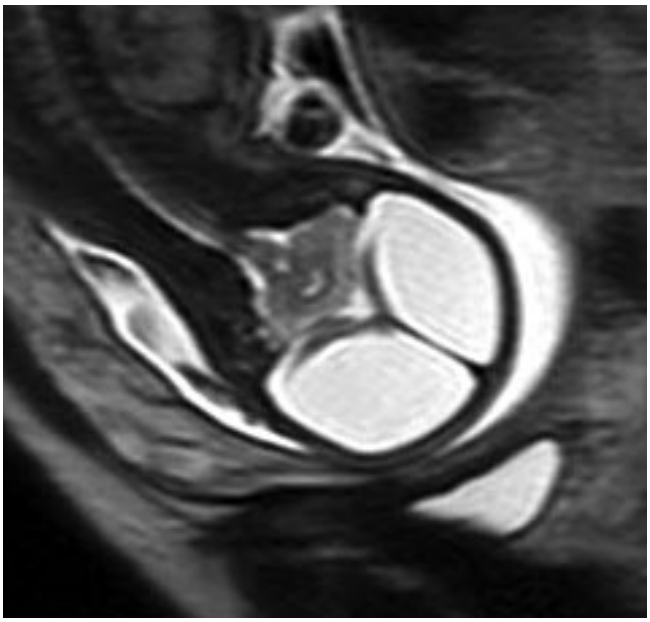

Fig. 5: Prenatal coronal MRI demonstrating hydranencephaly.

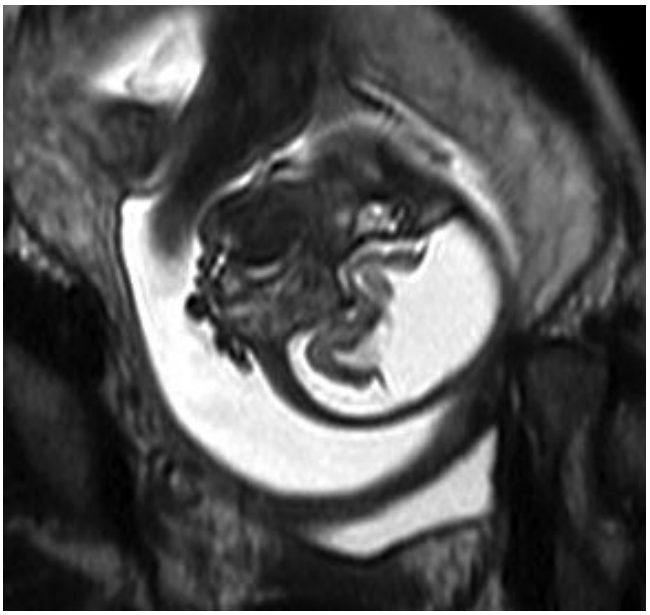

Fig. 6: Prenatal sagittal MRI demonstrating hydranencephaly. Note preservation of inferior aspect of frontal lobe and infero-medial aspect of temporal lobes of brain.

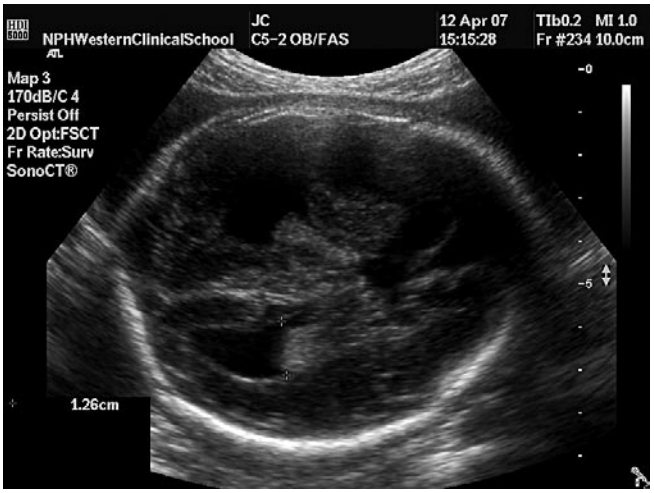

Fig. 7: USS demonstrating mild lateral ventriculomegaly.

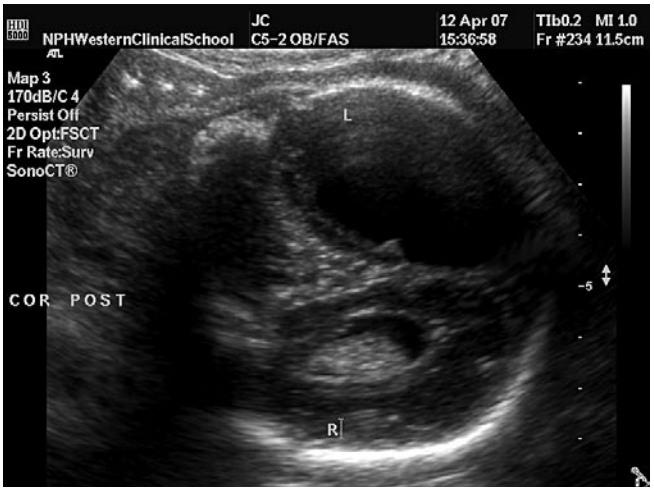

Fig. 8: Coronal USS demonstrating absent left cerebral cortex.

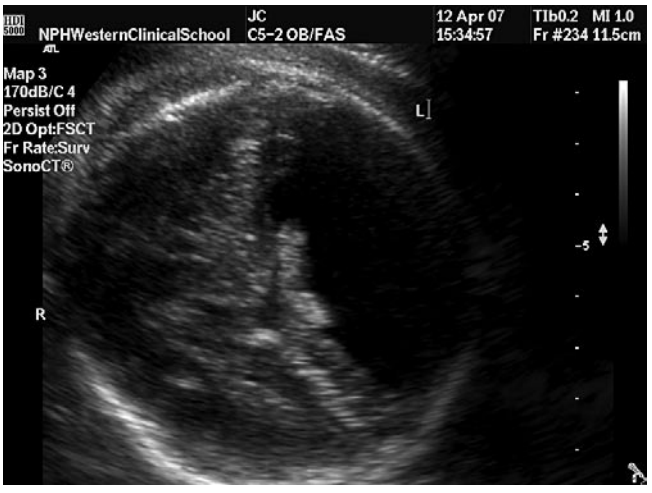

Fig. 9: Axial USS demonstrating absent left cerebral cortex.

Case 2 – Schizencephaly

A 16-year-old female in her first pregnancy, presented late for antenatal care. A routine fetal anatomy scan performed at 29 weeks 2 days gestation demonstrated apparent absence of the cerebral cortex on the left side of the fetal brain, with mild right-sided lateral ventriculomegaly (12 mm) (Figs. 7, 8, 9). Amniocentesis was performed and reported a normal 46XY (male) karyotype, and

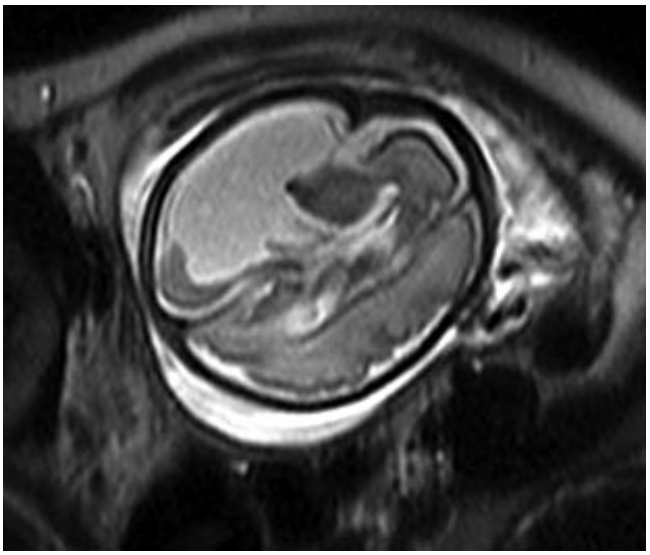

Fig. 10: Axial prenatal MRI demonstrating unilateral left 'porencephalic cyst'.

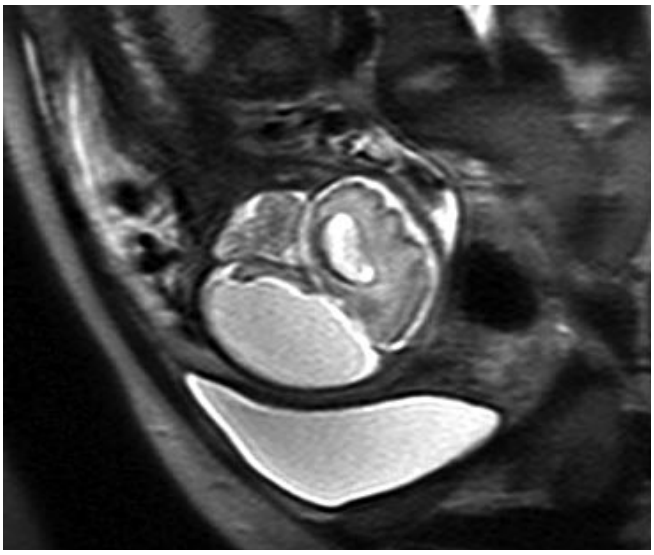

Fig. 11: Coronal prenatal MRI demonstrating mild ventriculomegaly

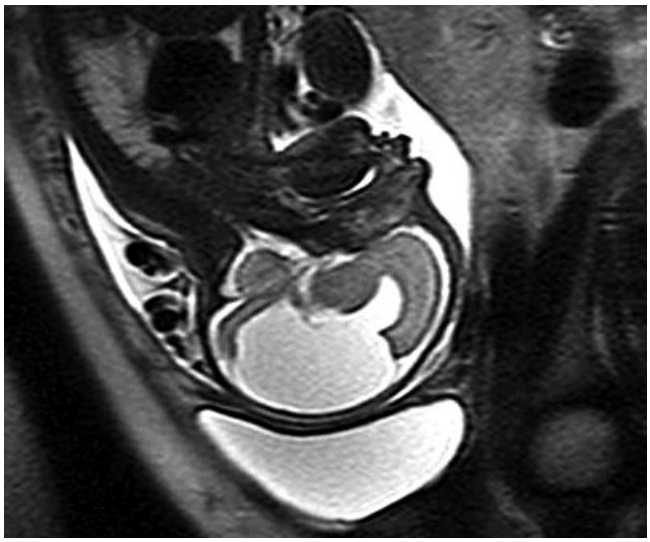

Fig. 12: Sagittal prenatal MRI demonstrating preserved antero-medial left frontal lobe.

negative PCR for CMV and toxoplasmosis. Fetal MRI reported a unilateral left porencephalic cyst, consistent with intrauterine ischaemic insult and resultant infarction in the left middle cerebral artery territory. There was ventriculomegaly of the normally formed right cerebral hemisphere, which was felt to be most likely secondary to some degree of global ischaemia (Figs 10, 11, 12). Following consultation with a paediatric neurologist, it was felt that the most likely outcome would consist of contralateral weakness and sensory loss, with mild to moderate intellectual impairment, the severity of which was difficult to estimate. Multidisciplinary discussion was undertaken with the patient and she elected to continue with the pregnancy. Regular two weekly scans were performed throughout the remainder of the pregnancy and did not demonstrate any significant changes in the appearance of intracranial structures. The patient developed preeclampsia at 37 weeks 5 days gestation and a live male infant was delivered by emergency caesarean section, weighing 3180 g with Apgars of 4 at one minute and 7 at five minutes.

On initial neurologic examination, there was mild hypotonia in all limbs with normal reflexes. Intermittent orogastric tube feeds were required at first, however, sucking gradually improved and full breast feeds were achieved on day nine. Genetic consultation noted a few dysmorphic features (large mouth, broad nasal bridge, small upturned nose and hypertelorism). A repeat karyotype was normal. Eye check showed bilaterally small optic discs with normal retinas.

Postnatal MRI of the baby, performed at seven days, demonstrated a large left sided cystic space lined by grey matter and an absent septum pellucidum, consistent with a large open-lip schizencephaly. There was also a lipoma adjacent to the right caudate head. There was no evidence of any structural abnormality on the right side and the remaining brain parenchyma was normal. The overall appearance was felt to be most likely due to an early vascular insult in the left middle cerebral artery territory (Figs 13, 14, 15).

The infant was discharged on day 11 of life, and follow up was arranged with a paediatric neurologist, an ophthalmologist and genetic services.

Case 3 – Intracranial haemorrhage

A 31-year-old woman, in her second pregnancy, presented at 29 weeks 4 days gestation with upper abdominal pain. The pregnancy had otherwise been uneventful. An abdominal ultrasound was performed, and as an incidental finding, fetal intracranial anatomy appeared to be abnormal with head measurements significantly increased.

Ultrasound in our unit at 30 weeks 1 day gestation demonstrated features highly suggestive of fetal intracranial haemorrhage (Figs 16, 17), with a markedly enlarged head size above the 95th centile (biparietal diameter of 115.5 mm and head circumference of 413.5 mm). Liquor volume was also increased (amniotic fluid index of 29.6 cm with maximum vertical pool of 12.3 cm), which was postulated to be the reason for the initial presentation with abdominal discomfort. Fetal intracranial anatomy was extremely difficult to visualise adequately.

Blood was sent for investigation of feto-maternal alloimmune thrombocytopenia (FMAIT), CMV and toxoplasmosis serology and thrombophilia screen, all of which were negative. In view of the polyhydramnios, the patient was commenced on oral sulindac 200 mg TDS. Amniocentesis was

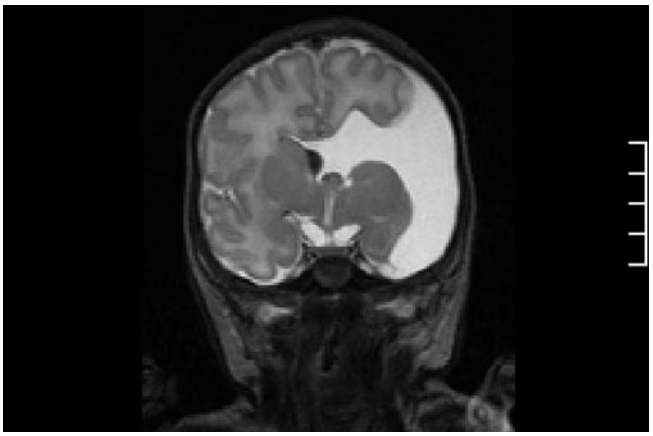

Fig. 13: Coronal postnatal MRI demonstrating left sided open-lipped schizencephaly.

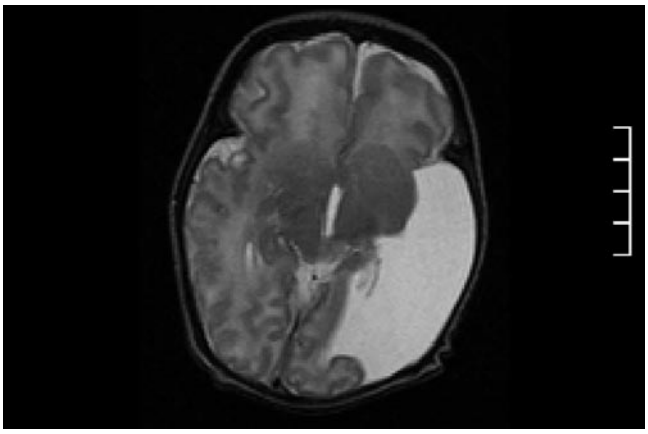

Fig.14: Axial postnatal MRI demonstrating left sided cystic mass.

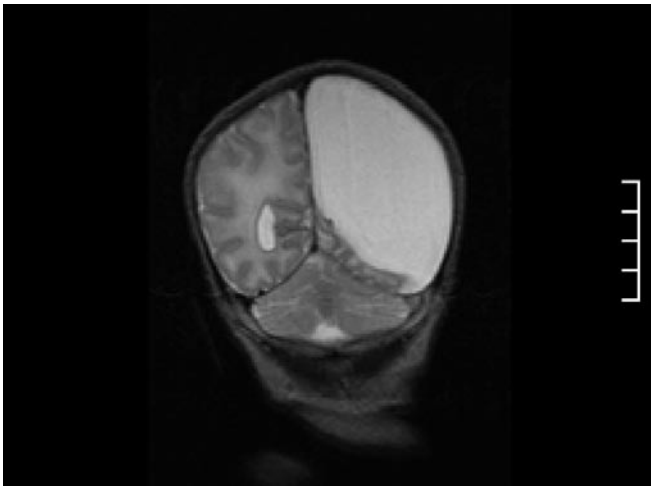

Fig.15: Coronal postnatal MRI demonstrating cystic mass posteriorly.

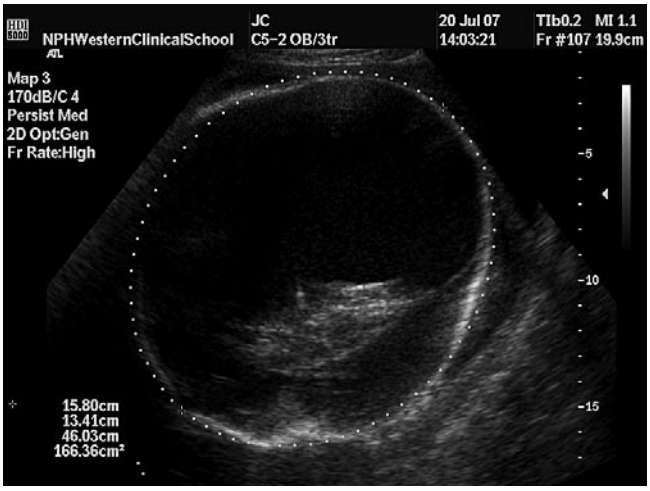

Fig. 16: Prenatal USS demonstrating large intracranial mass with fine low level echoes suggestive of a haemorrhage.

performed and reported a normal 46XY (male) karyotype and negative PCR for CMV and toxoplasmosis. Due to the difficulties with visualising intracranial structures and in order to determine whether there was any other underlying aetiology, a fetal brain MRI was performed. The MRI images were reviewed by both paediatric radiological and neurosurgical teams and the appearances were felt to be consistent with a large, inoperable intracranial tumour, with the unlikely possibility of this being a bleed *per se* (Figs 18, 19, 20).

Following multidisciplinary discussion and counselling, planned preterm delivery by caesarean section was performed in view of the rapidly enlarging head size, with subsequent palliative care of the neonate. A live male infant weighing 3280 g was delivered at 31 weeks 5 days gestation with subsequent peaceful demise at 3 hours, 32 minutes of age. Head circumference at birth was 48.5 cm, with no other dysmorphic features noted on external examination.

Postmortem examination was carried out with findings of severe hydrocephalus with a large subarachnoid haemorrhagic mass adjacent to the falx cerebri in the region of the sagittal sinus posteriorly.

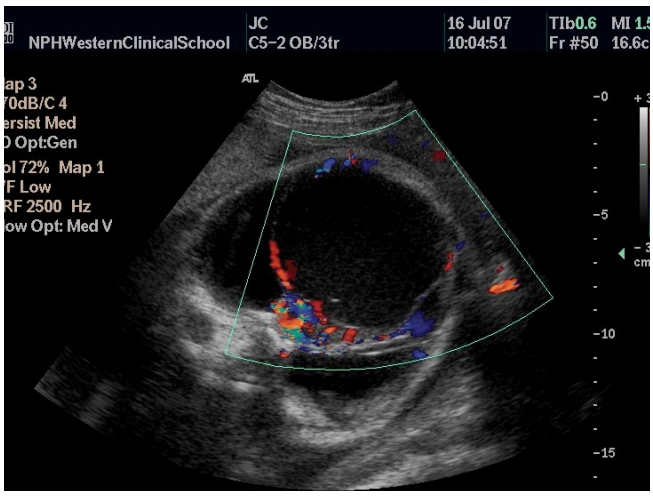

Fig. 17: Colour Doppler USS demonstrating no flow within the mass.

Discussion

Compared to USS, MRI techniques have less spatial resolution, lack real time imaging capabilities, are costly and less versatile[2]. However, the advantages of MRI are that it provides a larger diagnostic window allowing total fetal imaging with excellent resolution of tissue composition. It provides visualisation of a precise anatomical plane, allows easy interpretation of several planes and permits computer-aided reconstruction of multiple planes following a single study[2] including three-dimensional modelling of the fetal brain in utero[3]. MRI does not use ionising radiation and at present, there is no evidence that short term exposure to electromagnetic fields harms developing fetuses[4,5].

In using MRI to assess CNS abnormalities of the fetus, many of the technical artefacts of sound wave transmission

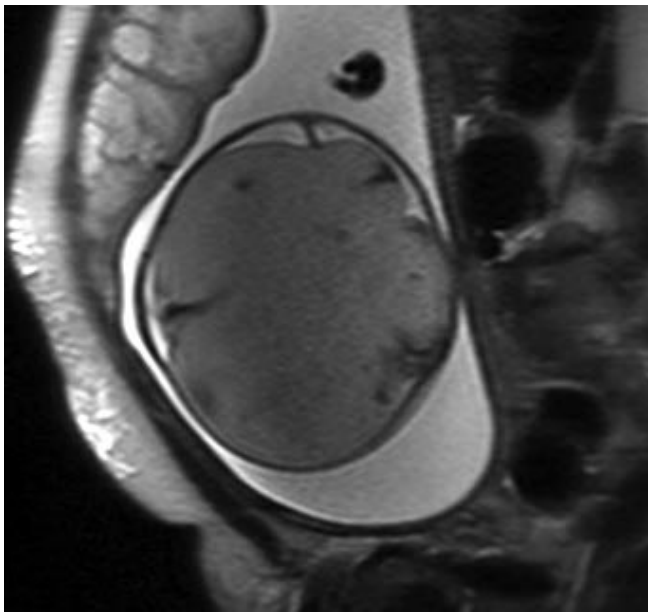

Fig. 18: Prenatal MRI demonstrating mass occupying almost the entire cranium.

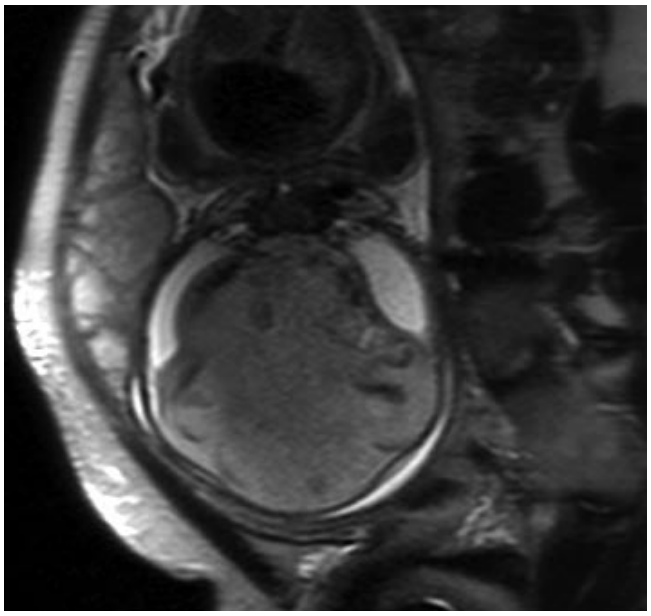

Fig. 19: Prenatal MRI demonstrating large intra-cranial haemorrhage.

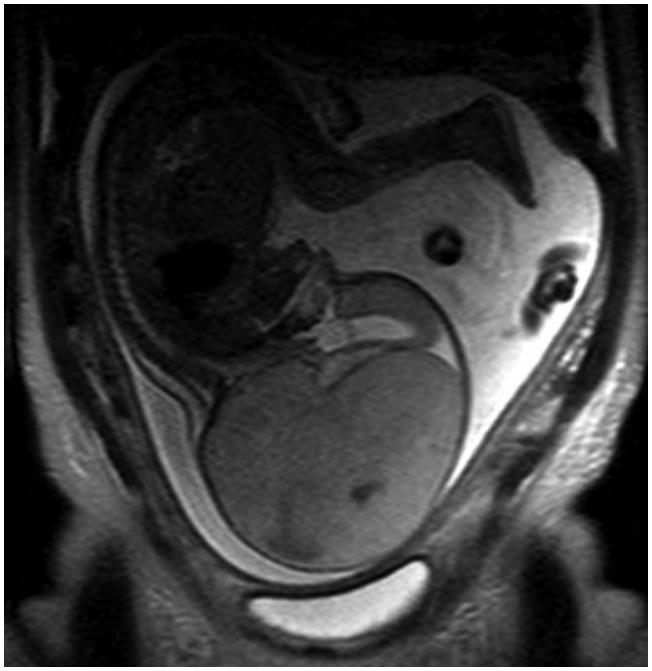

Fig. 20: Prenatal MRI. Note size of head relative to body.

are eliminated[6]. Difficulties experienced with USS include poor visualisation of the non-dependent cerebral hemisphere due to reverberation from the calvarial wall. Sonography of the posterior fossa anatomy may be impaired by shadowing from the fetal skull, particularly in the third trimester[1], and fetal positioning can pose problems with obtaining coronal and sagittal views on USS[6].

Compared to ultrasound, MRI has been widely reported to be most useful in evaluating ventriculomegaly (in particular, anomalies occurring in conjunction with ventricular dilatation, which account for most morbidity and mortality)[7,8], abnormalities of the posterior fossa or corpus callosum, and in the detection of parenchymal or migrational disorders which are too subtle to be visualised sonographically[1,9,10]. MRI also permits diagnosis of encephalomalacia prenatally, with increased sensitivity compared with USS, which has important implications in counselling and management in cases of intra-uterine death of a monozygotic twin[1].

One study by Malinger, *et al.* has challenged the concept of MRI as a useful adjunct to ultrasound in the assessment of fetal CNS abnormalities. They found that in 42 fetuses referred with suspected intracranial anomalies, detailed neurosonography performed by a dedicated neurosonographer in the setting of a Fetal Neurology Clinic was equal to MRI in the diagnosis of fetal brain anomalies[11].

In all three of our cases, the fetal intracranial abnormality was not detected until the third trimester (in two of the cases this was as a result of women presenting late for antenatal care), which made sonographic imaging of CNS anatomy difficult. In all cases, the ultrasound findings were available to the MRI personnel, and neither maternal sedation nor muscular blockade of the fetus were performed.

In the case of hydranencephaly, unfavourable fetal position contributed significantly to the problems we encountered with visualisation of intracranial structures and was mainly responsible for the referral for MRI. The accuracy of diagnosis achieved with MRI had a major impact on counselling and the subsequent decision to terminate the pregnancy.

In the case of schizencephaly, additional information from the MRI enabled us to obtain multidisciplinary input from a paediatric neurologist, thus providing the patient with more accurate counselling regarding likely outcome and prognosis. Although the postnatal MRI diagnosis of schizencephaly differed from the antenatal report of porencephalic cyst, these conditions are thought to have a similar underlying pathophysiology, occurring as a result of ischaemic insult in the territory of the middle cerebral artery. Schizencephaly is thought to occur as a result of early brain injury during the second trimester and is differentiated from porencephaly by the absence of scar tissue around the defect. Porencephaly is caused by local ischaemia after 26 weeks of gestational age. The injured brain tissue subsequently dissolves, leaving a fluid filled cavity or cyst, which can resemble the cleft seen in schizencephaly. These two conditions may be distinguished by the fact that in schizencephaly, the cyst cavity is lined by grey matter, whereas in porencephaly

the cyst is lined by white matter. This case highlights the limitations of USS and MRI prenatally, and demonstrates how it may not be possible to make a definitive diagnosis until after birth.

In the case of massive subarachnoid haemorrhage, the resulting compression of the fetal brain made ultrasound assessment of CNS anatomy difficult, and MRI was performed to ascertain whether the haemorrhage was the primary event responsible for the rapidly enlarging head size, or whether the bleed was secondary to some other underlying abnormality such as a tumour. The antenatal MRI images were subsequently reviewed by paediatric radiologists and neurosurgeons, and the area of haemorrhage (which was subsequently confirmed on post-mortem examination) was mistakenly reported as an intracranial tumour. This case demonstrates the advantages of real time imaging and dynamic assessment achieved with ultrasound, and the importance of combining information obtained from all imaging modalities to increase diagnostic accuracy.

In summary, fetal MRI has been reported as a valuable diagnostic aid when investigating intracranial pathology, and it had a major impact on the decision making processes and eventual pregnancy outcomes in all three cases we have reported. Fetal MRI has only recently been undertaken in our institution and perhaps this at least partially accounts for why there was a minor diagnostic discrepancy in one case (schizencephaly) and misdiagnosis in another (intracranial haemorrhage).

Acknowledgements

The authors gratefully acknowledge the assistance of the medical imaging department at Nepean Hospital and Professor Albert Lam at Westmead Children's hospital.

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Gaining greater accuracy and efficiency

Realizing the benefits of volume ultrasound imaging

Who/where
Dr. Simon Elliott
Freeman Hospital,
Newcastle upon Tyne, U.K.

Challenge
Freeman Hospital was looking to advance past two dimensional imaging and take on new technologies that would allow them to scan more patients, with greater accuracy.

Solution
From clinical benefits, to improvement in operational efficiencies, Philips volume imaging is changing the way Freeman Hospital's radiology department works.

Over the past three decades, ultrasound has undergone dramatic shifts in technology. There are many drivers influencing this evolution including the need for rapid throughput, greater efficiency within the radiology department, tighter department budgets and the need to focus on care cycle in disease management. As a result, clinicians are demanding more from ultrasound as they look to improve workflow and diagnostic capability.

Philips has responded to these market changes with volume imaging, a newer approach to the way that ultrasound data is acquired, visualized, and quantified. Volume imaging enhances workflow in the radiology department, allowing physicians to do more in a given period of time. Additionally, it aids disease management through advances in image visualization.

Freeman Hospital, in Newcastle upon Tyne, U.K., is an 800-bed tertiary referral center and teaching hospital with specialties including renal, liver, pancreas, heart and lung transplantation work. The bulk of the hospital's general ultrasound work is abdominal and small parts imaging.

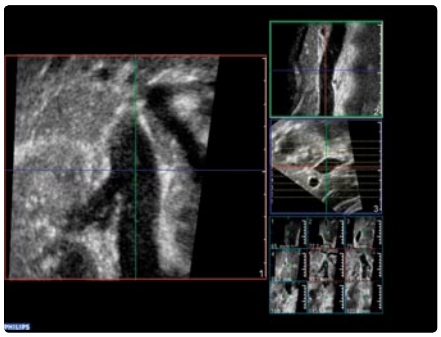
"We've been using two-dimensional ultrasound for as long as anyone can remember," said Dr. Simon Elliott, consultant radiologist at Freeman Hospital. "However, ultrasound is now facing a lot of new challenges. At Freeman Hospital, we need to scan more patients with greater accuracy, particularly against other modalities like CT and MR."

"One thing we've been looking for is a model where we can acquire data with a great deal of security so that we know we've got all the tissue that we want on the scan and then review it at a later date just as we do with CT and MR," continued Dr. Elliott. "Volume ultrasound has enabled us to get some way into that sort of work, plus it's a modality with which radiologists are already familiar."

What is volume imaging?

In conventional ultrasound, the operator acquires a series of two dimensional (2D) static images and real-time clips to evaluate a region of interest. At minimum, structures are viewed in two orthogonal (usually sagittal and transverse) planes, although other intermediate planes are often imaged as well. However, 2D images and clips do not permit examination of structures in planes that cannot be directly interrogated by the ultrasound beam, nor do they provide 3D representations of anatomy.

"The biggest impact for me of using volume imaging is its efficiency."



MPR of IVC right renal vein

"We now see a 50 percent overall reduction in the total exam time."

Volume imaging is a more efficient method for acquiring optimal 2D images. Physicians have the ability to obtain a variety of views that are richer than conventional imaging. Additionally, its greater accuracy improves the evaluation of relational anatomy by allowing radiologists to analyze surface anatomical structures and assess global motion and functional information.

Improvements in efficiency and throughput equal faster scan time, positive impact on bottom line

The ability to obtain volumes and review and manipulate those images at a later time is helping Freeman Hospital realize a reduction in overall examination time.

"We've seen significant reductions in the time the patients spend on the exam table and the actual scan time," said Dr. Elliott. "The question then is 'are we spending a lot of time manipulating the images?' Having looked at all of our data, we've found that we are not spending a lot of time manipulating images. Even if you take into account not only the scan time, but also the patient's time on the table, manipulation and measurement time, there is still an overall 50 percent reduction across all the studies that I've looked at, in the total exam time. This offers huge advantages in the way we work."

Dr. Elliott also cites the quicker scan times in helping improve the hospital's patient throughput, which means a positive impact on the bottom line.

"What we're finding in terms of efficiency in the rooms is that we can have somebody doing a quick volume acquisition, another perform the interpretation, while somebody else is getting another patient onto the bed and scanned. So we actually have an overlap now, which is enabling us to increase throughput in that one room.

The acquisition phase of exams has the greatest potential for positive workflow impact. Conventional workflow requires the acquisition of 2D image after 2D image, followed by printing and archiving of the images. With volume imaging, volume interrogation follows volume acquisition, making it possible to shorten acquisition time.

"We'd been using 3D imaging, seeing images of surface rendering, when I suddenly realized that we could actually take the volume of data and use it for something we'd been doing every day in 2D measuring," said Dr. Elliott. "In one particular case, a simple abdominal aortic aneurism, I realized we had the potential to acquire volume data and do very simple measurements in a fraction of the time."

In addition to changing the way his department works, Dr. Elliott also cites the efficiency of volume imaging as a real benefit of the technology.

"The biggest impact for me of using volume imaging is its efficiency. I can scan more patients in a unit of time and then review the data later. I can acquire the data instead of having to analyze it and measure images on the machine. I can also review data another day after the patient is long gone. So it offers the potential for me to change the way I work."

"It also has an impact in the UK where the sonographers are scanning and reporting independently or I've got trainees who are scanning," continued Dr. Elliott. "A good example of that would be out of hours. There's always that doubt with two-dimensional ultrasound when you're scanning in fixed planes that something may have been missed. With 3D imaging, I know that they've acquired that data and we can go back and review that later as a team.

Patient benefits

Volume imaging also has a significant benefit to patients, who no longer endure lengthy scan times or the need for call backs as the result of a missed scan.

"The first thing patients will probably notice, and ours do, is that some scans take a fraction of the time," said Dr. Elliott. "We're seeing a mean reduction between 80 and 90 percent in time that the patient spends on the exam table. We operate a number of one-stop clinics, so patients coming to see a surgeon will come to see us for the ultrasound. For example, patients attending for abdominal aortic aneurism assessment are coming in for surveillance scans and can then go straight to the clinic. Now, scan time is just a very small portion of the patient's visit.

"There are other areas such as critical care and neonatal work, pediatric work, where you really do want to acquire the data as quickly as possible and put the patient or the children through as little trauma as possible," continued Dr. Elliott. "We can be up to intensive care, perform the scans very quickly, with minimal intrusion on the patient and on their care."

Clinical impacts

Advances in quantification technology now allow radiologists to perform true volume measurements of structures such as cysts and tumors. Volume imaging allows clinicians to assess normal and abnormal structures to aid in patient management and therapy planning by viewing structures in new scan planes.

"A good example of what volume imaging can provide would be identifying the location of a gall stone, which is critical prior to surgery or patient's treatment plan to be able to identify where the stone might be sitting. With 3D imaging, we can acquire that volume block and then lock onto that stone as our central pivot point in that image and rotate around the stone. What we get is a picture of where that stone is sitting related to the adjacent structures; in one very early case we weren't sure if a stone was embedded in the cystic duct. What we found with manipulation of the volume data was the stone was actually sitting in the common duct and blocking both left and right intrahepatic ducts, a finding which had an immediate effect on that patient's management. That crucial diagnostic plane was one that is unachievable with conventional 2D ultrasound."

Another key application is an automated volume renal ultrasound exam. For this exam, the user gathers a volume of the kidney, slices the volume to obtain sagittal views, transverse views, and even coronal views, which are important in viewing the hilus of the kidney. Radiologists could go a step further to detect the edges of the kidney and any other abnormality and then automatically generate volume measurements.

Imaging advances

Volume imaging has the capability to play a critical role in oncology as clinicians are able to assess tumors with greater accuracy. The real-time visualization of ultrasound is also providing improved guidance for non-invasive tumor ablation procedures.

"We can learn a certain amount from doing 2D measurements, particularly on things like tumors, but we know now that that's not telling us the whole story about the tumor," said Dr. Elliott. "One of the greatest assessments of knowing the response to chemotherapy or any other therapy is the reduction in tumor bulk, and if we can measure tumor volume, we can get a more accurate assessment of that response to therapy. Of course the advantages over other modalities, even if using contrast or not, are that this is very rapid, it's not using ionizing radiation, it can be done very quickly after any other procedures have been done. I think volume imaging's role, not only in initial tumor assessment, but in response to therapy will increase."

In conclusion, Dr. Elliott lauds volume imaging in changing the way he and his department work.

"The more I use volume ultrasound, the more I find that it's redefining the work that we've been doing for years. We're looking at new ways of working, which I think is very important with the pressures on ultrasound as a modality within overall cross-sectional imaging. We've got a model here that works—I believe it is the next big thing in ultrasound."

"That crucial diagnostic plane was one that is unachievable with conventional 2D ultrasound."

Abstracts 37th Annual Scientific Meeting Cairns, 2007: Part 2 – *Part 1 published 2007 vol 10 (4)*

410 Ultrasound of chronic liver disease

Richard B Allan, Flinders Medical Centre, Australia

Objective

To review the use of ultrasound in chronic liver disease.

Chronic liver disease is a common disease and the eighth leading cause of death in the developed world. Scanning the liver can be technically difficult due a variety of problems and the use of small foot print transducers, tissue harmonic imaging and spatial compounding will all improve image quality.

Ultrasound is relatively insensitive to mild cirrhosis and there is a poor correlation between the ultrasound appearances and histological severity. The ultrasound appearances of cirrhosis are variable but a coarse, heterogeneous echo pattern is commonly seen. Surface irregularities may be seen and alteration of the liver architecture due to regenerating nodules may be present. Appearances may be complicated by the presence of fatty infiltration. Increased attenuation and increased echogenicity may be seen if there is an acute fatty component to liver disease. While fatty liver has variable appearances these generally fit into easily recognised patterns.

Common complications of chronic liver disease are portal hypertension (PHT) and hepatic malignancy. PHT is a common sequela of chronic liver disease and ultrasound is used extensively in its diagnosis and monitoring. Of patients, 1–5% will develop HCC and ultrasound is commonly used as a screening modality.

Ultrasound contrast media are used extensively in Europe and Asia and offer major improvements in the accuracy of ultrasound. Unfortunately, these agents are not available for general use in Australia and great opportunities for improved assessment are not being utilised.

411 Peyronie's disease: the long and the short of it

Michelle K Pedretti, Australia

Objective

This presentation will cover the causes, risk factors, signs, symptoms and treatment variations of Peyronie's disease. Sonographic demonstration and appearances will be presented, although Peyronie's s disease is generally a clinical diagnosis.

Cases of Peyronie's disease have been documented from as early as 1687. First described by Francois de la Peyronie, a French surgeon, in 1743. Peyronie's disease had previously been classified as a form of sexual incompetence but is now recognised as a component of erectile dysfunction.

Peyronie's disease is a benign condition that affects approximately 1% of the male population. It is most commonly seen in males between the ages of 45 and 60 years of age. It can, however, occur in the young and elderly male population. Thought to have genetic links, its exact nature and etiology remain uncertain. The condition may spontaneously resolve in 1–2 years from onset. Surgical intervention is required for those in whom the condition does not resolve.

A hard lump, comprised of plaque, in the tunica albuginea of the penis characterises Peyronie's disease. The plaque is thought to originate as local inflammation and develop into a hardened scar. Plaque development may be on any surface of the penile shaft, though more commonly is located on the superior surface of the penis. With penile erection the plaque causes the penis to bend and can be associated with pain and distortion.

412 Interventional ultrasound: the basics

Matthew W Andrews, ASUM President, Australia

Objectives

Knowledge of the ultrasound principles and skills underpinning all ultrasound-guided interventional ultrasound procedures.

The initial common pathway of all ultrasound-guided procedures involves the placement of a needle tip into a target within the body. Once the needle has been placed, a wide variety of procedures can then be performed.

This talk reviews the current status of the multiple steps and factors which all contribute to successful needle placement. Examples of particular procedures will be demonstrated. The construction of phantoms for developing skills will also be described.

413 Liver Doppler

Richard B Allan, Flinders Medical Centre, Australia

Objective

To review the portal venous system and outline the most effective methods for investigating common abnormalities with ultrasound.

The liver has complex vascular arrangements and a good understanding of the anatomy and physiology is essential when performing a Doppler ultrasound assessment.

Liver Doppler is a technically challenging examination due to the difficulties encountered in scanning the diseased liver and the abnormal flow states often present. Sound techniques utilising a thorough understanding of the technical parameters of Doppler ultrasound is necessary to obtain clinically useful information.

The most common pathological processes found in the portal venous system are portal vein thrombosis (PVT) and portal hypertension (PHT).

PVT can be accurately diagnosed with ultrasound with a reported sensitivity of 93% and specificity of 99%.

Ultrasound is also used extensively to diagnose PHT and a number of ultrasound findings have been described although these have very variable performances.

While commonly used, both portal vein dilatation and reversal of flow in the portal vein are relatively poor indicators of PHT with sensitivities of only 40% and 1–8% respectively.

The presence of portosystemic collaterals is the most sensitive indicator of PHT with a sensitivity of 70–83%. Identification of collaterals is aided by their predictable positions and clues from flow patterns found in the por-

tal system. The most commonly seen with ultrasound are paraumbilical, splenorenal and gastroesophageal collaterals. A systematic evaluation for collaterals is the most reliable method for the ultrasound diagnosis of PHT.

414 The pivotal role of ultrasound in assisted reproduction

Robert Miller, Gynaecologist, Australia

This presentation will review the major role that ultrasound plays in the management of infertility, where the ultrasound vaginal transducer has replaced the digital examination – almost.

The preliminary investigation of infertility, both to measure and assess the ovarian and endometrial biophysical profile, as well as looking for abnormality.

The assistance that ultrasound gives to superovulation monitoring and assisted reproduction treatment. Then to help sort out the potential complications and outcomes of such treatment; that can raise some interesting diagnostic conundrums.

415 Update in fetal surgery

Yves Ville, Université Paris, France

Timely diagnosis of many congenital anomalies has paved the way for developing or re-assessing indications and efficacy of fetal treatment, particularly fetal surgery. Fetal surgery is usually envisaged when the natural history of a fetal condition is either lethal or leads to severe postnatal impairment.

In Europe, open fetal surgery became poorly accepted because of its invasiveness and the high incidence of postoperative premature labour and rupture of the fetal membranes.

Since the 1990s, advanced video-endoscopic surgery has set the ground for endoscopic fetal surgery. The outcome of a randomised clinical trial demonstrating that fetoscopic laser coagulation of chorionic plate vessels is the most effective treatment for twin-to-twin transfusion syndrome (TTTS) has started the development of endoscopic fetal therapy.

Operating on the fetus itself is yet another challenge. Clinical fetal surgery programs were virtually non-existent in Europe until minimally invasive fetoscopic surgery, mainly within the Eurofoetus program, made such operations clinically possible as well as maternally acceptable.

At present, most experience has been gathered with fetal tracheal occlusion as a therapy for severe congenital diaphragmatic hernia. Whereas minimal access seems to solve the problem of preterm labour, all procedures remain invasive, and carry a risk to the mother and a substantial risk of preterm prelabour rupture of the membranes (PPROM), but preventive and therapeutic modalities may become available.

Therapeutic modalities involving needle access to the fetus have allowed the guidance of probes into the fetal heart with the potential of reverting potentially poor natural history of a severe reversing of the main outflow tracts. Preliminary results seem to confirm the feasibility of the procedure although selection criteria need to be refined and long-term outcome identified. The relatively long history of fetal shunting procedures has primarily led to deceptive results. However, the re-appraisal of fetal indications based on a combination of multiple imaging techniques and biochemistry may prove useful at selecting cases in which vesico-amniotic shunting will be beneficial.

Open fetal surgery is a practice mainly confined to the United States and implies a more invasive approach to the mother. Open surgery for congenital diaphragmatic hernia has proven unsuccessful and indications are likely to remain scarce unless treatment of fetal spina bifida proves successful at decreasing postnatal neurological morbidity.

The probabilistic nature of fetal medicine and surgery calls for the specialists in this field themselves to clarify ethical issues and, often, dilemmas surrounding fetal therapy. One can distinguish between at least four main components within this field that will be reviewed including potential opposition between potential benefit to the fetus and the woman abortion preferences when therapy fails, the obligation of competence does account for the difference between experimental medicine and a real therapeutic perspective, the transition from innovation to standard of care for maternal-fetal surgery. All issues mentioned above are now confronted to a greater mobility of women/patients who more often seek advice or care from another country/legal system. Ethics should not be left aside when moral / ethical/legal obligations are increasingly being overruled by economically or intellectually based principles providing unequal access to care.

501 Imaging of the Essure Permanent Birth Control Device: a review

Frances E Miceli, Nepean Hospital, Australia

Objective

To evaluate the diagnostic ability of 3D transvaginal ultrasound with hysterosonography to assess the placement and function of the Essure device compared to radiography.

Materials and methods

Review of the current literature and our experience with this procedure.

Conclusion

3D transvaginal ultrasound with hysterosonography is a suitable method to assess this device and may be preferable to radiography.

502 Periodic intermittent absent and reversed end diastolic flow in the umbilical artery in monochorionic twin pregnancy

Lesleigh S Baker, Monash Medical Centre, Australia

Monochorionic twin pregnancy represents a complex haemodynamic phenomenon. Arterio-arterial anastomoses (AAA) are common in monochorionic placentas with only a small percentage of the anastomoses causing haemodynamic disturbances. AAA result in the collision of two opposing umbilical artery blood flows. AAAs are more commonly seen in the setting of selective IUGR and in placentas with a short distance between cord insertions. They represent a direct vascular communication between the umbilical arteries arising from each fetus.

Ultrasound examination shows a characteristic periodic form of intermittent, absent, or intermittent reversed end diastolic flow in the umbilical artery. This is seen as repeated short periods, usually only lasting a few seconds, of absent or reversed end diastolic flow, followed by a brief return to forward distolic flow.

This presentation describes two cases of classic intermittent umbilical artery Doppler changes due to the phenomenon of AAA.

503 The safety meter tool: a positive performance measurement system for sonographer and patient occupational health and safety

Grant R Bradly, Paula L Robson, Erina Diagnostic Imaging, Australia

Background

At our new imaging centre, sonographers and management devoted considerable resources to ensure the safety and wellbeing of staff and the patients in our care. Benchmarks for best safety practice were derived from The NSW Work Cover Authority and Sonographer Practice Guidelines. However, these agencies did not propose avenues for implementation or pathways for auditing, education and management.

A validated safety meter tool developed for manufacturing industries promised to meet these objectives. To our knowledge, it is the first time the Safety Meter Tool has been implemented in a healthcare setting.

Objective

To implement a safety measurement system that can be easily used, encourages participation and meets regulatory requirements.

Process

Staff consultation for design, participation and implementation; review of healthcare injury statistics to identify areas for safety improvement for sonographers; development of categories representing safety concern and criterion indicative of correct work practices, process and outcome indicators; incorporation of a scoring sheet for point of inspection; implementation of a corrective action sheet enabling scoring against a Hazpac Matrix and auditing of actions required within a given timeframe. Design of an Excel documentation system.

Results

Staff consultation and participation in the safety meter design and development increased safety awareness and a keen desire to advance occupational health and safety (OH&S) in ultrasound practice.

Conclusions

Staff willingness to participate and the similarity of many categories and criterion will enable safety assessments in areas other than ultrasound.

It is anticipated that dissemination of departmental OH&S performance via charts will encourage positive competition between areas.

504 Sonographic diagnosis of fetal lipoma: a case report

Jacqueline L Cartmill, Australia, Ann Quinton, Nepean Centre for Perinatal Care and Research, NSW, Michael J Peek, University of Sydney, NSW, Australia

Introduction

We present the antenatal sonographic findings of a case of fetal lipoma. A 28-year-old woman in her first pregnancy was referred with a solid left posterolateral fetal abdominal mass detected on routine anatomy scan at 17 + 5 weeks gestation. The mass measured 25 x 19 x 19 mm and appeared to be separate from intraabdominal organs and the spine. Serial ultrasounds initially showed an increase in size of the mass with a feeder vessel arising from the left iliac artery. The mass appeared highly vascular with low resistance, high velocity flow. As the pregnancy progressed, the mass became increasingly difficult to differentiate on ultrasound and appeared as a thickening of the skin.

The patient had a forceps delivery at term of a live male infant in good condition, weighing 3470 g.

Postnatally, the left sided fetal mass appeared as a raised area measuring 60 x 50 x 10 mm, which was partially mobile and did not seem to be attached to the skin or underlying structures. Ultrasound showed an isoechoic well-defined area subcutaneously measuring 39 x 18 x 40 mm, which was felt to be a lipoma. The spinal cord and intracranial structures appeared normal. Neurosurgical follow-up with MRI was arranged.

Discussion

Establishing a diagnosis is important for accuracy of prenatal counselling, as lipomas usually have a favourable outcome. Differential diagnoses in this case included haemangioma, neural tube defect (although this was excluded as the lesion was separate to the spine and intracranial structures appeared normal) and neoplastic lesion.

505 Fetal intracranial abnormalities in the third trimester – MRI as a useful diagnostic tool

Jacqueline L Cartmill, Australia, Ann Quinton, Nepean Centre for Perinatal Care and Research, Michael J Peek, University of Sydney, NSW Australia

Case 1 Hydranencephaly

A 41-year-old woman in her second pregnancy booked late for antenatal care and had a routine fetal anatomy scan performed at 26 + 6 weeks gestation. Intracranial structures were difficult to visualise, even with transvaginal scanning, due to fetal position and gestational age. Amniocentesis reported a normal 46XY (male) karyotype, and negative PCR for CMV and toxoplasmosis.

A fetal MRI was performed, which demonstrated findings consistent with hydranencephaly. Following discussion regarding the poor prognosis, the patient requested termination of pregnancy. Fetocide was carried out with intracardiac KCl injection at 30 + 0 weeks gestation, followed by induction of labour. A stillborn male infant was delivered weighing 1240 g. Postmortem examination confirmed the diagnosis of hydranencephaly.

Case 2 Unilateral left porencephalic cyst

A 16-year-old female in her first pregnancy, presented late for antenatal care. A routine fetal anatomy scan performed at 29 + 2 weeks gestation demonstrated apparent absence of cerebral cortex on the left side of the fetal brain. Amniocentesis reported a normal 46XY (male) karyotype, and negative PCR for CMV and toxoplasmosis. Fetal MRI reported a unilateral left porencephalic cyst and right hemispheric brain atrophy. Following consultation with a paediatric neurologist regarding the likely prognosis, the patient elected to continue with the pregnancy.

Discussion

Fetal MRI has been reported as a valuable diagnostic aid when investigating intracranial pathology. It provided us with an accurate anatomical assessment in both cases and had a major impact on the decision-making processes and eventual pregnancy outcomes.

506 Antenatal diagnosis of cloacal exstrophy

Jacqueline L Cartmill, Australia, Ann Quinton, Nepean Centre for Perinatal Care and Research, Michael J Peek, University of Sydney, NSW, Australia

Introduction

We present a case of cloacal exstrophy diagnosed on antenatal ultrasound.

Case report

A 31-year-old woman in her second pregnancy was referred following detection of a fetal omphalocoele at a nuchal translucency scan. Ultrasound performed at 16 + 3 weeks demonstrated a moderate omphalocoele containing bowel. The liver, gall bladder and stomach appeared normally situated. It was difficult to visualise the region between the omphalocoele and the perineum. Normal bladder and genitalia could not be adequately visualised. Amniocentesis confirmed a normal male karyotype (46XY).

A further ultrasound performed at 17 + 5 weeks demonstrated findings highly suggestive of cloacal exstrophy. The bladder was not visualised and there was a large infraumbilical omphalocoele with appearances typical of a prolapsed ileum ('elephant trunk'). The patient was counselled regarding the findings and requested termination of pregnancy.

Postmortem examination of the fetus confirmed cloacal exstrophy with omphalocoele and imperforate anus (likely representing omphalocoele-exstrophy-imperforate anus-spinal defects (OEIS) complex).

Discussion

Cloacal exstrophy is a rare complex anomaly caused by a defect in the formation of the urorectal septum, which occurs in 1/200 000 births. This case demonstrates how an omphalocoele with unusual sonographic features may represent a more serious underlying defect with a less favourable prognosis. The 'elephant trunk' appearance of the prolapsed terminal ileum has previously been reported, and it was this feature that assisted us in making the diagnosis of cloacal exstrophy antenatally.

507 Intraabdominal lymphangiohaemangiomas

Amaranthi Y De Silva, Monash Medical Centre, Vic, Australia, Surekha Kumbla, Australia

Objective

To discuss a rare case of recurrent and multiple intussusceptions due to intraabdominal lymphangiohaemangiomas.

Lymphangiohaemangiomas are rare, and we present a case of extensive systemic lymphangiohaemangioma presenting as recurrent intussceptions.

Neonatal intussusception is a common condition, however, intussusception occurring in the older child requires evaluation for a lead point.

Our patient presented with two episodes of recurrent abdominal pain and vomiting on the background of multiple subcutaneous lymphangiohaemangiomas, and was found to have multiple intussusceptions on both occasions.

Ultrasound examination demonstrated a complex, multiloculated cystic mass anterior to the left kidney and two intussusceptions with similar looking smaller lesions acting as lead points. Correlative ultrasound examination of the left flank soft tissue mass demonstrated similar appearance. These findings were similar to CT findings at the patient's previous presentation.

Although, lymphangiohaemangiomas are rare, they can occur intra-abdominally and, if located in the bowel wall, may present with intussusception.

508 Epiploic appendagitis: a case report

Tim D Huynh, Austin Health, Vic, Australia

Objective

To demonstrate the use of ultrasound in the diagnosis of epiploic appendagitis.

Epiploic appendagitis is a benign self limited inflammatory condition secondary to the infarction of an epiploic appendage, due to spontaneous torsion or venous thrombosis. It normally presents as a sudden onset of focal abdominal pain and most commonly occurs in the left lower quadrant.

This is a case where ultrasound was used in conjunction with CT in the diagnosis of epiploic appendagitis. The patient was a 25-year-old male who presented with left lower quadrant abdominal pain. His blood tests were normal and his pain was controlled with analgesia. The question was whether he had an abdominal hernia.

Ultrasound of this patient demonstrated an echogenic ovoid structure, deep to the anterior abdominal wall, directly beneath the area of focal pain. No vascularity was demonstrated within the structure. No hernia was seen. A subsequent CT was also performed which demonstrated an area of increased density of fat, with a hyperdense rind, adjacent to the descending colon. These appearances were consistent with the diagnosis of an epiploic appendagitis.

509 The normative ranges of amniotic fluid single deepest pocket, two-diameter pocket and amniotic fluid index in an Asian population

Lai Mok, Sook-Ling Lee, Stephanie Fook-Chong, Singapore General Hospital, Singapore, Wei-Ching Tan, Hak-Koon Tan, Singapore

Introduction

Ultrasonography serves as a useful modality for the evaluation of amniotic fluid volume, but different techniques of evaluation may produce significantly different results. As amniotic fluid volume may be associated with adverse outcomes in pregnancy, the identification of an accurate technique for its evaluation is important.

Objective

To establish the normal ranges of single deepest pocket, two-diameter pocket and amniotic fluid index throughout gestation.

Method

Two-hundred-and-eighty patients with gestational ages between 14 and 40 weeks were recruited for this cross-sectional study. Inclusion criteria included patients with well-established dates (confirmed by earlier ultrasound) and singleton, non-anomalous fetuses. Two sonographers performed the cases. The protocol for examination was as follows:

i) The single deepest pocket was identified and measured;
ii) The 2-diameter pocket was calculated by multiplying the depth and the width of the single largest pocket; and
iii) The amniotic fluid index was obtained by dividing the abdomen into four quadrants, measuring the largest pocket in each quadrant and summing these values. Linear regression models were fitted to the data for analysis. Polynomial regression models were utilised to

predict the normal values of amniotic fluid index, single deepest pocket and two-diameter pocket.

Results

Mean maternal age was 30.6 years The cohort included 70% Chinese, 22% Malay and 8% Indian. The predictive values of oligohydramnios or polyhydramnios from the three techniques were significantly different.

Conclusion

Normal ranges from the three semi-quantitative techniques were established.

510 An effective technique for antral follicle count

Cheng Phoon, Sook-Ling Lee, Roland Chieng, Singapore General Hospital, Singapore, Su-Ling Yu, Singapore

Introduction

Antral follicle count has been found to be a useful predictor of pregnancy outcome in patients undergoing in-vitro fertilistaion (IVF).

Objective

To evaluate the usefulness of 3D inversion mode for antral follicle count.

Method

Fifty-two patients undergoing IVF were recruited. They had antral follicle count on day 2 of the menstrual cycle. Two techniques were utilised:

1) Conventional transvaginal two-dimensional (2D) scanning. Follicles were counted and classified into the following groups: (a) less than 4 mm, (b) 4–7 mm, (c) 8–11 mm.
2) On completion of the evaluation in (1), a three-dimensional (3D) volume data was collected on a GE Voluson 730 Expert ultrasound system. The patient was sent home before analysis of the 3D data was performed. Inversion mode was utilised on the rendered image, the chroma was set on 'copper' tone. The follicles were counted by rotating along the X and Y axes. They were classified according to the groupings in (1).

Results

With the conventional 2D transvaginal technique, the examination time ranged from 5–10 minutes for each ovary. The timing required for the 3D inversion mode technique was almost the same, but the patient need not be present when the counting was in progress. This significantly reduced the discomfort for the patient and the stress on the sonographer

Conclusion

3D inversion mode is an effective technique for antral follicle count.

DDU FEES AND DATES 2008

Applicants must be a member of ASUM to sit the DDU examination. Application forms for both the DDU exam and ASUM membership may be downloaded from our website at www.asum.com.au

DDU FEES 2008

Part I A$990.00 (includes GST) Examination fee for ASUM members sitting in Australia
Part I A$900.00 (ex GST) Examination fee for ASUM members sitting in NZ
Part II A$1760.00 (includes GST) Examination fee
Part II A$330.00 (includes GST) Casebook fee
Part II Part II Candidates sitting exam for second time, oral portion only A$880.00 (includes GST) Examination fee for oral portion of exam to approved candidates only

DDU DATES 2008

2008 Part I
The Part I Applications close on Monday 17th March 2008
The Part I Examination will be held on Monday 12th May 2008

2008 PART II

Casebooks for 2008 Part II DDU Examination must be submitted by Monday 14th January 2008 and accompanied by the prescribed fee of A$330.00 for all participants.

The Part II Applications close on Monday 17th March 2008.
The Written Examination for Part II will be held on Monday 12th May 2008.

The Oral Exam for Cardiology candidates only will be in MELBOURNE on Thursday 19th June 2008.

The Oral Examination for Part II candidates (excluding Cardiology) will be held in SYDNEY on Saturday 21st June 2008.

RESULTS

ALL examination results for both Part 1 and Part 2 candidates will be mailed to candidates at the same time, two weeks after the final Part 2 exams (4th July 2008).

DMU FEES AND DATES 2008

DMU FEES 2008

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
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DMU DATES 2008

Part I and Part II Applications Open (1st December 2007)
Part I and Part II Applications 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 March to 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

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An ultrasound solution for the technically difficult patient

Gaining penetration, resolution and diagnostic confidence

Who/Where
St. Paul's Hospital
Downtown Vancouver
British Columbia, Canada

Cathy Fix, RDMS
Ultrasound Supervisor,
St. Paul's Hospital
Clinical Instructor,
Department of UBC in Radiology

Challenge
Significant increases in the number of failed ultrasound exams as a result of higher rates of obesity, limited acoustical access and fatty liver disease.

Solution
The Philips C5-1 transducer. Through state-of-the-art, clinically proven PureWave crystal technology, the C5-1 provides unparalleled image clarity. Tissue aberration correction technology and special algorithms compensate for the change in the speed of sound when imaging through adipose tissue.

St. Paul's Hospital is an acute care, academic and research hospital located in downtown Vancouver, B.C. With over 500 acute care beds in use, and home to many world-class medical and surgical programs, the hospital serves both the local community and patients from across B.C. Its downtown location brings many of Vancouver's tourists and visitors to its doors for care. St. Paul's also has a longstanding history of providing care to disadvantaged populations.

Obesity impeding ultrasound examinations

Like others in the global healthcare industry, St. Paul's Hospital's ultrasound practitioners are seeing a significant increase in the number of failed ultrasound exams as a result of higher rates of obesity, limited acoustical access and fatty liver disease. Failed ultrasound exams are leading to higher costs of healthcare due to delayed or equivocal diagnoses, the need for additional exams, and a decrease in patient throughput. The increased work-related musculoskeletal disorders (WRMSDs) among sonographers as the result of lengthier, more difficult procedures is also a factor. Staff shortages caused by WRMSDs can mean a loss in revenue with an increase in medical bills, payout for workers' compensation claims and new staff recruitment.

"Approximately 20 to 50 percent of our case load involves technically difficult patients," said Cathy Fix, ultrasound supervisor, clinical instructor with the Department of UBC in Radiology, St. Paul's Hospital. "This has a significant impact to our lab in having to spend more time on each patient, making fewer exams possible. This increase in difficulty is also placing more physical strain on our sonographers, which can lead to injury, as well as creating the need for more tests since the ultrasound cannot easily penetrate to gather clear images."

Many patients are referred for CT or MR exams when imaging with ultrasound does not provide diagnostic data, delaying the diagnosis and adding to healthcare costs.

"Approximately 20 to 50 percent of our case load involves technically difficult patients"

Improved image quality means more accurate diagnoses

To help address these challenges, St. Paul's recently upgraded its lab to include two Philips iU22 ultrasound systems featuring the new C5-1 transducer. The C5-1 is designed specifically to address challenges associated with imaging technically difficult patients. Through state-of-the-art, clinically proven PureWave crystal technology, the C5-1 transducer provides exceptionally clear imaging to help ultrasound practitioners save valuable time and obtain greater diagnostic confidence.

The C5-1's new tissue aberration correction technology compensates for the speed of sound as it passes through adipose tissue, improving penetration when imaging technically difficult patients. As a result, sonographers are getting better detail, better contrast resolution, less speckle, and reduction in side lobes or reverberation.

"Eighty percent of our work here at St. Paul's is abdominal work," said Fix. "Of that 80 percent, 25 to 30 percent can be technically difficult, meaning not only the size of the patient, but also the kind of pathologies we see in the liver. For example, we see a lot of hepatitis patients and a lot of patients with very fatty livers. From an ultrasound perspective, these targets can be very technically challenging because they attenuate the sound.

"We found with the C5-1 we don't have to work the probe as hard," added Fix, "we're getting anterior [images] from the front of the liver to the back wall penetration as well as good pixel size. In other words, we have really good contrast and spatial resolution. This is critical when we're looking at livers that have hepatitis or fatty infiltration, since we are looking for primary cancers in the liver. To make these diagnoses, we need penetration and good spatial and contrast resolution and the C5-1 has those."

Obstetrical work is another area in which image quality is crucial in making diagnoses. Fix says the C5-1 has helped staff diagnose conditions that may otherwise have been missed.

"About 20 percent of our work flow is obstetrics for which we do detailed 18-week and dating scans," said Fix. "With the C5-1, I now have staff fighting to get into that particular room because the quality of the echo in viewing the heart is so much better. The valves are crisper; the chambers are better—so much so that we picked up two congenital anomalies we might otherwise have missed before. In one case scanned earlier, we had a feeling there was something wrong with the heart. After further evaluation by imaging with the C5-1, it became clearly evident that there was a transposition of the great vessels, which is a huge impact to the patient. We now have more confidence when scanning detail obstetrics, especially the fetal heart, as well as imaging the fibroid uterus."

Fix also cites the improved image quality in saving time typically spent by radiologists needing to rescan patients.

"We show all of our cases to our radiologists prior to letting our patients go. In a lot of our cases they have to come in and scan the patients themselves as the images do not display the pathology that we describe, especially with technically challenging patients. With the C5-1, not only is our technical confidence high, the image quality is better, which has reduced the number of rescans required by our radiologist since they have a better sense of the underlying pathology."

Reducing time imaging technically difficult patients

Patient throughput is important to a hospital's bottom line. The C5-1 is helping St. Paul's sonographers to save time on each exam, while obtaining high-quality images on technically challenging patients.

Staff at St. Paul's Hospital, Department of UBC in Radiology.

"We do about 160 exams a day. When you have technically challenging patients you're taking more time to optimize the system to get the best image resolution, which really affects the flow of our department and reduces patient throughput. With the C5-1, we have that penetration so we're spending less time than normal on system optimization. We also noticed a big reduction in our artifacts, including silo-artifacts. So those factors really help give us better patient imaging and better quality examinations for our radiologists when they're preparing their reports.

"We also have a more efficient patient workflow pattern and less wait time for our patients as we are able to acquire more diagnostic exams in less time," reported Fix. In Fix's department, ultrasound has become the first line of imaging, based on the image clarity they've been able to achieve with the iU22 system and C5-1 transducer.

Ergonomic benefits reduce sonographer strain

Philips C5-1's ability to obtain exceptionally high quality images means sonographers don't have to press as hard during exams, reducing stress on their bodies.

"When you have technically challenging patients you're using your shoulder more and pushing harder to get to the back wall of the liver," said Fix. "With the C5-1, you've got the penetration you need so you're not pressing as hard, therefore reducing the ergonomic issues associated with the increased pressure on the shoulder and wrist.

"When I ask our sonographers what they think of the new probe, their replies are 'I don't have to work as hard with the probe, and I get the image I want with less stress on my shoulder from not having to push as hard, and less pressure on my hand from not having to optimize the system' meaning we should see fewer repetitive strain injuries."

Fewer referrals to other exams

Fix said the C5-1 gives them the diagnostic confidence to reduce or eliminate referrals to other examinations.

"We recently had a case in which a patient presented with quarry right upper quadrant pain. In scanning the patient with another machine, it appeared that the wall of the gall bladder looked abnormal, but we weren't sure. We then imaged the patient with the C5-1 and it became clearly evident that there was a small degree of calcium in the wall of the gall bladder. Using our other machine, we wouldn't have picked that up. If we had not imaged that patient with the C5-1, that patient probably would have gone for CT.

"In another case, two of our radiologists reported that the image quality of the C5-1 helped them confirm a hemangioma in the posterior segment of the right lobe that was much better visualized with the C5-1. This prevented the patient from going to CT."

Overall, Fix and her staff have realized significant benefits using the C5-1 in obtaining high quality images that provide more information on the anatomy of technically challenging patients than they could obtain before.

"The C5-1 is best for penetration, spatial and contrast resolution, which for us is the best of everything because it gives us high diagnostic quality. The spatial and contrast resolutions are superb and it has all the features that make a good probe work. I would like all my systems to have a C5-1, as I think that's going to be the future."

Contact us today

Visit www.philips.com/pushingtheboundaries for more information. Or contact us to see the iU22 at work in your lab:
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"We found with the C5-1 we don't have to work the probe as hard"

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Scanning the journals

Antenatal diagnosis of placenta previa accreta in patients with previous caesarean scar

Paparaj R P *et al. J Obstet Gynaecol Res* 2007; 33: 431–37.

This Malaysian team studied 21 patients with previous caesarean scar, partial or total placenta praevia diagnosed after 28 weeks gestation. Gray scale B-mode transabdominal sonography and colour Doppler transvaginal scans were done on each patient. Criteria suggestive of placenta praevia accreta on gray scale were:

- Loss of retroplacental hypoechoic zone;
- Multiple lakes representing dilated vessels extending from the placenta through the myometrium;
- Thinning or disruption of the uterine serosa-bladder wall interface; and
- Focal elevation of tissue with placental echogenicity beyond uterine serosa.
- Color and power Doppler criteria included:
- Dilated vascular channels with diffuse lacunar flow;
- Abnormal vessels linking placenta to bladder; and
- Dilated subplacental vascular channels with pulsatile venous flows over the cervix.

At least one of these features was found in seven patients (33%) with a mean gestational age of 29 weeks at diagnosing.

Hypervascularity linking placenta to bladder in color Doppler was the most reliable sign (7/7) with the presence of multiple lakes seen with grayscale being less reliable (6/7).

They found that the transabdominal approach was superior to the transvaginal.

This is an important study highlighting the importance of ultrasonographic diagnosis of this maternal life-threatening condition.

Prenatal ultrasound diagnosis of vasa praevia and analysis of risk factors

Baulies S, *et al. Prenat Diag* 2007; 27: 595–99.

And another article on a potentially lethal condition, this time of the fetus. All cases of vasa praevia were diagnosed during the second trimester scan and so they had no prenatal deaths related to this condition. They also emphasise the importance of checking placental cord insertion at the fetal morphology scan, as marginal or velamentous insertions are risk factors for vasa praevia.

Paradoxical movement of abdominal contents – a real-time sonographic finding indicating a congenital diaphragmatic hernia

Sista AK and Filly RA. *J Ultrasound Med* 2007; 26: 1617–19.

The authors describe paradoxical movement of the intra abdominal contents in congenital diaphragmatic hernia. The video clips available at www.jultrasoundmed.org illustrate the movement of intra-abdominal contents during fetal breathing, especially on inspiration.

Real time observation and recording in this difficult diagnostic area might be invaluable in arriving at a correct diagnosis.

Prevention of spontaneous preterm birth: the role of sonographic cervical length in identifying patients who may benefit from progesterone treatment

Romero R, *et al. Ultrasound Obstet Gynaecol* 2007; 30: 675–86.

This editorial is an exhaustive review of the topic. It merits reading because it reinforces the fact that measuring cervical length is a valuable part of the mid trimester ultrasound examination. Preterm birth is still an enigma. We can help provide information as to the likely risk for preterm delivery in primigravidae when we check cervical lengths at the fetal morphology scan. It is reassuring that ASUM guideline D2 includes sonographic evaluation of the cervix at the fetal morphology scan.

A Review of findings in fetal cardiac section drawings part 1: the four-chamber view

Jeanty P, *et al. J Ultrasound Med* 2007; 26: 1601–10.

It is not often that we see an article in an ultrasound journal with no sonographic images. But this presentation had as its goal a review of some common and some rare fetal heart anomalies using drawings to illustrate the main features.

Fetal cardiac scanning is difficult and any help the general sonographer can get is welcome. This is the first of a three-part series and is well worth reading carefully. If you come across an unusual finding on the four-chamber view it could help with the differential diagnosis before referral to the paediatric cardiologist.

Are metastases really hypovascular in the arterial phase?

Murphy-Lavalee J, *et al. J Ultrasound Med* 2007; 26: 1545–56.

The question is a good one. Received wisdom from contrast-enhanced CT and MR work would seem to suggest that liver metastases are hypovascular. This work from Toronto using contrast-enhanced ultrasonography (CEUS) shows that most hepatic metastases show arterial hypervascularity and rapid complete wash-out. The technique might be helpful in differentiating mestastases from primary liver tumours. And in the future CEUS might have a place in management of patients after drug therapy.

Comparing differential tissue harmonic imaging with tissue harmonic and fundamental gray scale imaging of the liver

Chiou SY, *et al. J Ultrasound Med* 2007; 26: 1557–63.

While I did not understand the physics (especially the inclusion of the Khokhlov – Zabolotskaya – Kuznetsov equation) it appears that differential tissue harmonic imaging (DTHI) and tissue harmonic imaging do better than fundamental sonography for liver scanning. In particular, the lateral resolution of DTHI was superior and better penetration was achieved. This argues well for improvements in image quality and may be especially useful in obese patients.

The Gleaner

Book reviews

Clinical Sonography: A Practical Guide
Authors/Eds Roger C Sanders and Tom Winter
Lippincott Williams and Wilkins
Approx Cost $A140

This text will be familiar to sonographers, being a prescribed text for a number of local ultrasound courses. The 4th edition, in which Roger Sanders shares principle authorship with Thomas Winter, and 27 other contributors, has been published nine years after the third edition, and developments in the profession, and in ultrasound technology and systems have been reflected in the text.

As is remarked on in the preface

- Attributes of a sonographer are increasingly being defined, as befits a growing profession
- Criteria for accreditation of ultrasound laboratories have been defined
- Guidelines for virtually all sonographic examinations have been laid out; and
- The Society of Diagnostic Medical Sonographers has approved a code of ethics.

Reference to new technologies has been made throughout, with mention being made to higher frequency transducers (up to 20 MHz), 3D imaging, harmonics, compound imaging, extended field of view imaging and PACS.

The book aims to provide practical guidance to sonographers and radiologists. It is divided into 62 chapters and 44 appendices, an increase from the 57 and 36, respectively, of the 1998 edition. There are chapters on physics and instrumentation, abdominal imaging, small parts, obstetrics and gynecology, pediatrics and neonates, vascular, musculoskeletal, procedures preliminary reporting, malpractice, and accreditation.

New chapters have been included on ankle and feet, malpractice accreditation and ergonomics.

Rather than approach a topic anatomical region by region, where pathologies are listed and discussed, the authors have looked at the presentation, placing the patient and the pathology into an actual clinical context, therefore, we have chapters entitled *Right Upper Quadrant Pain*, *First Trimester Bleed*, and *Pain and Swelling in the Limbs*

Each chapter contains a brief list of ultrasound abbreviation, keywords and definitions and a list of relevant lab values. It is then divided as follows: *The Clinical Problem, Anatomy, Technique, Pathology, Pitfalls, Where to look,* and a suggested reading list, in short, each of the components one would need to complete a successful diagnostic examination

The inclusion of laboratory values (LFTS and their differential diagnoses, renal function tests, thyroid function test, etc), was particularly pleasing, given that many departments now have more ready access to this information via their computer systems, and a familiarity with abnormal pathology results can only enhance our ability to tailor the examination to the clinical problem.

To paraphrase the author, such additional information elevates the average sonographer to 'Top Flight' – one who continues to exercise intellectual curiosity.

Some chapters have been almost completely rewritten, in particular, there is a superb revision of the *Breast* chapter, with reference to AT Stavros (*Breast Ultrasound*, Lippincott Williams and Wilkins 2004), also the *Neonatal head*, *Spine, Pediatric Abdominal Masses* and *Carotid* chapters.

A notable change from the previous edition has been the inclusion of ultrasound images. These replace the diagrams previously used and include 800 black and white, and 48 full color images.

All of the chapters have been enhanced by the addition of these images, the obstetric and gynecology chapters in particular.

The musculoskeletal chapters were beautifully presented with transducer placement and pathology diagrams and photographs, high resolution sonograms, even intraoperative images accompanying the text.

There is so much more to admire about this text, despite a very small number of the ultrasound images being a little dark, and some of the color image pages being bound out of sequence. The Couinaud Bismuth designation of segmental liver anatomy was described, but an actual diagram would have been useful.

A notable part is the Appendices. In the previous edition, they were printed at the back and included biometric tables, as well as very detailed AIUM guidelines for completing most examinations, including equipment, scanning protocols, and documentation. All very useful, especially for the student. They are mentioned throughout the book, but were only available through an online student resource centre.

The idea, as suggested by the author, was that the student could assess the resource centre at any time and print them up as needed. This could only be accessed by logging on and entering a 12 unit code on the inside page of the cover, which was revealed by scratching off a concealed panel – meaning the faculty resources are restricted to the adopter of the text.

I was able to successfully log on to the site, but was denied access, despite repeated attempts using the code in the review copy I was given. I am not sure how students using copies borrowed from libraries would be able to use this system, given the restrictions described.

This minor issue aside, Clinical Sonography is a text one will return to again and again, simply because of its day-to-day usefulness. It gives the technical information, the lab workup, scan techniques and the differential diagnoses.

It advocates an approach whereby the patient is looked on as a whole rather than pathology in isolation.

Judy Lees (GDU)
Royal Melbourne Hospital

2007 Giulia Franco Teaching Fellowship report

There is now advanced Doppler capability on all ultrasound equipment and a thorough ultrasound examination of any anatomy or pathology involves documentation of vascularity. It was for this reason, that a vascular sonographer was chosen by ASUM for the Toshiba Giulia Franco Teaching Fellowship, 2007.

I am a DMU (vascular) sonographer at Royal Perth Hospital. I have worked in the public health system and also been heavily involved in sonographer education in WA for many years. Working with patients with vascular disease, particularly diabetics and indigenous patients, I see first-hand the devastating effect on individuals as well as their families.

My professional interest in vascular ultrasound includes the ultrasound service our department provides to renal patients on dialysis. Imaging of the dialysis fistula is a complex and time consuming exercise, which is crucial to patient management.

Providers of health care in the remote areas visited by the Travelling Fellow are more than familiar with these types of ultrasound service requirements. The relevance of the presentations and workshops, which were first delivered in Alice Springs, ensured a committed and enthusiastic response from the sonographers there. The presentations covered a variety of vascular applications, including the arterio-venous fistula, which was also the subject of one of the workshops.

A first time visit to Alice Springs with such an insight into the immediacy of health care in isolation, made this a valuable and memorable experience for me and I enjoyed meeting Virginia Loy and her team, who made me most welcome. Their dedication and professionalism despite the isolation impressed me.

I next travelled to Townsville and isolation of a different sort. Here, there is a greater diversity in both patient demographic and service providers. The presentations and workshops were none-the-less topical and I welcomed the opportunity to meet with so many colleagues. I visited both the Mater and Townsville Hospitals, with a joint meeting as well.

The final segment will be in Darwin in 2008.

As the Giulia Franco Teaching Fellow, It has been my privilege and pleasure to share my knowledge, experiences, and fascination for Doppler ultrasound. It has been a unique experience and the highlight of my professional career.

I would like to thank ASUM and Toshiba for this opportunity, and also the sonographers who went out of their way to accommodate me.

Elvie Haluszkiewicz

Changing jobs?
Changing address?
Be sure to tell the Society
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DMU 2007 report

2007 has been a year in which the DMU Board of Examiners has begun a major project to improve and reinvigorate the DMU processes. This restructuring represents generational change in the DMU and will result in candidates experiencing a much more structured and guided learning and examination process.

The restructuring of Part 1 examinations is completed and will be implemented in the 2008 exam cycle, while the improved Part 2 learning and examination process will be ready for implementation in the 2009 exam cycle.

The previous DMU recommended texts and suggested reading lists have been replaced by a much shorter list of relevant, modern core texts supported by specialist texts to cover niche knowledge requirements. The DMU curriculum has also been reviewed and substantially updated to reflect current knowledge requirements and maintain consistency with the new recommended texts.

In 2008, for the first time, DMU Part 1 candidates will have access to comprehensive learning guides, which provide valuable assistance by outlining the detail and depth of knowledge that is required. The learning guides are available for General, Cardiac, Vascular and Obstetric DMU Part 1 candidates. Incorporated in the learning guides are clear learning objectives and suggested learning activities to assist the learning process and allow the candidate to test their own knowledge.

Part 2 recommended texts, syllabi and learning guides are currently being reviewed and developed for implementation in 2009.

Another significant event which will impact upon the DMU is the decision of ASAR to formally adopt a new Program Accreditation Guidelines (PAG) document which the DMU will have to comply with for reaccreditation in 2008. ASAR has made a number of significant changes to the PAG and during 2008 the DMU Board of Examiners will make further modifications to the DMU processes in order to fulfill our re-accreditation requirements. The restructure that has already been completed for Part 1 and the planned restructure of Part 2 will be undertaken to facilitate the re-accreditation of the DMU by ASAR.

DMU Diploma awarded 2007

DMU Cardiac
Andrew Hall NZ
Simon Undrill Vic
Lisa Courtney NSW
Nicholas Palmieri Vic
Christine Wong NSW
Katie Maslin WA
Linda Passfield SA
Emily Reed Vic
Julia Zantvoort SA
Anthony Morris WA
James Harley Vic
Glenn Hastings Vic
Daniel Colombini WA
Michael Gorman WA
Kristy Dawson NT
Emilie Rasheed SA
Keren Glasson NZ
Stuart Cox Vic
Freya Lees Qld
Renelle Nisbet NZ
Susan Perkins NZ

DMU General
Jenene Green NSW
Jessica White NSW
Juliet Watson NZ
Joy Hunt NZ
Lucienne Mckinnon NZ
Stuart Mcgregor NZ
Joanne Mewes NZ
Melanie Younger NSW
Amy Mcgill NZ
Sally Begley NSW
Sarah SeagerNZ
Elliot Bruce NZ
Joanna Frost NZ
Jacqueline Kok NSW

DMU Vascular
Ross Christie NZ
Aletta Landman NZ
Huw Jones Qld
Jacqueline Flavell Vic
Daniel Traves Qld
Jamie MaunderQld
Kirsten Fowler Qld

I would like to thank Margo Gill, Rob Gill, Lucia Pemble, Keith Henderson and Raghib Ahmed for their tireless efforts in coordinating the Part 1 review process. I would also like to thank the many individuals who gave of their time to assist behind the scenes producing material for this project. The generosity of the team working on this project for ASUM and more broadly the sonography profession is breathtaking.

2007 saw a total of 62 new candidates entering the DMU process by attempting the Part 1 Examination. From this group of 62 new student sonographers 55 (88%) were successful and will now go on to hone their clinical skills and gather theoretical knowledge in preparation for the Part 2 Examination.

Part 2 Examinations are now available in a modular format with candidates choosing to attempt all or just some of the components during the exam cycle. A total of 50 candidates attempted the written examinations, 48 attempted the practical exams and 52 attempted the oral examinations. From this group, it is my pleasure to welcome 42 new Accredited Medical Sonographers holding the ASUM DMU to the profession of sonography.

I would like to thank all the volunteers who helped with the examinations during the 2007 examination cycle. Without the help of our excellent and loyal team of volunteer examiners, the DMU could not exist. I encourage anyone who is able to help in some way with the DMU to contact the ASUM office as the more volunteers we have the smoother and more flexible the process becomes.

If you are in a position where you can put a little back into your profession by helping the credentialling of the next generation of sonographers, please do. It is a very satisfying and enjoyable process. Those who have been involved experience great personal professional development from the process as well as great friendships with like minded professional sonographers who are willing to share their knowledge with the future of their profession.

Finally I would like to congratulate Margaret Condon on her appointment as the new Chairperson of the DMU Board of Examiners. Margaret is a long standing and highly regarded DMU Board of Examiners member and ASUM Federal Councilor making her the perfect person to take the DMU process forward in 2008.

Stephen Bird

Saving time while increasing revenue

University of Colorado Hospital increased productivity with efficient protocol driven ultrasound exams

Who/where
Julia A. Drose, BA, RDMS, RDCS, RVT
Associate Professor
Department of Radiology
Chief Sonographer
Division of Diagnostic Ultrasound
University of Colorado
Health Sciences Center
Denver

Challenge
Increase productivity and improve efficiencies in performing patient ultrasound exams

Solution
The new 'Protocols' feature on the Philips iU22 ultrasound system

Top medical professionals, superior medicine and progressive change make the University of Colorado Hospital one of the leading hospitals in the nation. Consistently ranked among the top hospitals in the country by *U.S. News & World Report's* annual survey of "America's Best Hospitals," University of Colorado Hospital is internationally respected for its exceptional teams of medical specialists.

In keeping with the University of Colorado's mission of being a state-of-the-art teaching and research hospital by delivering comprehensive medical care, the Ultrasound Division sought to increase productivity and improve efficiencies in performing patient ultrasound exams.

Previously, the department had in place a procedure manual that ensured all images necessary for accreditation and billing of a specific exam were being acquired. However, there were a number of issues within the department related to consistency in image acquisition, annotation, and calculation of measurements. Each sonographer had his or her own way of acquiring images, which ranged from the order in which images were taken to the number of images acquired for a specific exam. As a result, valuable PACS space was wasted, doctors questioned the accuracy of some images, and the lack of consistency in acquired images was difficult for clinicians to ascertain the data being presented. This also made pulling images for accreditation cases problematic since there was inconsistency in the acquired images.

Annotation and calculation of measurements also were a challenge. Sonographers were annotating in a variety of ways, meaning radiologists were spending time deciphering codes, as well as evaluating and trying to compare different views of the pathology. The location of measurements and the number of measurements taken also varied among sonographers.

Since the University of Colorado Hospital, Division of Ultrasound has a large sonographer training program, inconsistency among sonographers also proved very confusing to our students. The 14 sonographers on staff presented a broad variety of interpretations regarding what the procedure manual was requiring. This made it difficult for the students to understand exactly what constituted a complete and correct exam.

"Philips' Protocols feature is helping University of Colorado Hospital meet its primary objective to deliver comprehensive, quality medical care."

Abdominal exams are streamlined at the University of Colorado. Using Protocols, each sonographer sees the required views in the on-screen display.

"With Protocols, sonographers now know exactly which images are necessary as the system guides them through a list of images for a specific exam and automatically annotates the data."

Department gains

- Consistency
- Fewer missed views
- Reduced PACS space
- Shorter exams
- More patient focus

In January 2007, the University of Colorado implemented Philips Ultrasound's iU22 Protocols feature to standardize our operations and eliminate inconsistencies within our department. By implementing Protocols, radiologists and sonographers now have a tool to ensure consistency of exams, more accurate annotation, greater accuracy and ease of use in acquisition and diagnosis, time savings in individual exams, as well as a tool that follows industry and accreditation guidelines.

The Protocols technique

The Protocols feature is designed to enable consistency from patient to patient and across the department. When the Protocols feature is launched, an on-screen display shows a list of required views. At the University of Colorado, we entered our specific protocols for abdominal, vascular, and OB/GYN exams. These protocols are utilized by everyone in the department when using the iU22 systems, which ensures consistency of imaging when scanning patients.

Results at University of Colorado

In the beginning, there were concerns throughout the department related to an outside entity dictating how exams were to be performed. However, Philips' Protocols system is customizable – allowing us to incorporate our existing procedures into the system. Once we showed sonographers how Protocols would save them time, we achieved 100% acceptance within a few days.

With Protocols, sonographers now know exactly which images are necessary as the system guides them through a list of images for a specific exam and automatically annotates the data. This has decreased our overall scan time – and some exams by up to 50%. The Protocols feature has eliminated the need to rescan patients due to forgotten images, which used to occur approximately 10% of the time.

With abdominal scans, we have reduced the time spent performing the exam by 38%. This has been achieved by having a list readily available on the system that reminds the sonographer which images have been acquired and which images still need to be acquired. The Protocols feature can be set to ask for as many images as you deem appropriate for an individual organ. For example, our protocol manual stated three longitudinal images of each kidney (lateral, mid and medial) and three transverse images (superior, mid and inferior). However, sonographers would frequently take many more scans because they liked how a specific patient imaged, they weren't sure if they had already acquired a certain image, or they just felt like it. With the Protocols feature they are prompted to acquire only the required images and then move on. However, it is also possible to pause the program and take as many additional images as necessary when pathology is encountered. The number of unnecessary images acquired has dropped substantially.

The Ultrasound Department staff at the University of Colorado Hospital.

Exam	Time savings
Abdominal	38%
Vascular	52%
OB	43%

The same is true with our vascular imaging, where we have realized a 52% reduction in exam time. The Protocols feature is always right in front of you to remind you what images have been acquired and which images are still needed. The Protocols feature has also been helpful in reminding staff which Doppler measurements we require, as well as the level of the vessel a specific measurement should be taken. This is particularly useful to our students who are often overwhelmed with the amount of information they are expected to retain regarding specific requirements of each exam type.

OB has been a little more challenging since a fetus doesn't necessarily cooperate in letting us acquire images in a specific order consistently. Despite the inherent challenges in acquiring fetal images, we have realized a 43% reduction in exam time and find that the Protocols feature acts as a useful tool in reminding sonographers which images still need to be taken.

An additional benefit is the reduced number of keystrokes as the result of the automatic annotation. We anticipate that this feature will help reduce sonographers' repetitive motion injuries of the hand, wrist, elbow and/or neck, as well as decrease the time it takes to type a word or locate the annotation feature on a machine.

Accreditation procedures

Though our department's procedure manual addressed accreditation guidelines, these guidelines were not consistently met as the result of varying scanning styles. The iU22 Protocols will be an essential element to our lab in meeting accreditation requirements and assuring quality control. Sonographers now know exactly which views are required for specific exams and annotation is automatically entered when a given view is accepted. We will no longer have to review numerous cases looking for those appropriate to submit for accreditation, only to find that a required image or measurement was not obtained.

Bottom-line business benefits

As a result of the time savings realized, the University of Colorado has realized a 20% increase in patients seen each day. We anticipate that our workload will be further increased as we acquire more systems capable of performing this feature.

This time savings also means a stronger focus on quality patient time, as Protocols automate many of the time-consuming, repetitious moves.

Philips' Protocols feature is helping the University of Colorado Hospital meet its primary objective to deliver comprehensive, quality medical care. The increase in revenue realized by increasing the number of patients seen makes justifying the investment in the new technology that much easier.

About the Author:

Julia A. Drose, BA, RDMS, RDCS, RVT, is Manager, Divisions of Ultrasound and Prenatal Diagnosis & Genetics, Associate Professor, Department of Radiology, University of Colorado Hospital.

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Calendar of ultrasound events

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1st Mar 2008
CCPU Course Early Pregnancy
St Vincent Hospital, Melbourne
Contact ASUM CCPU Coordinator

1st Mar 2008
CCPU Advanced Course – Acute Gynaecology and 1st Trimester Bleeding
Venue Melbourne TBA
Contact ASUM CCPU Coordinator

15th Mar 2008
CCPU Basic Emergency
Venue Melbourne TBA
Contact ASUM CCPU Coordinator

26th–30th Mar 2008
ASUM Multidisciplinary Workshop 2008
Venue Sydney, Australia

26th–27th Mar 2008
DDU Technical Seminar (Physics)
Venue Sydney, Australia
Contact ASUM DDU Coordinator

26th–30th Mar 2008
DMU Preparation Course
Venue Sydney, Australia
Contact ASUM DMU Coordinator

27th Mar 2008
Nuchal translucency Course
Venue Sydney, Australia
Contact ASUM

28th–29th Mar 2008
O&G Symposium
Venue Sydney, Australia
Contact ASUM

26th July 2008
ASUM DMU Part I & Part II Written Examination Provisional
Venue as allocated. Candidates receive individual notification
Contact DMU Coordinator

18th–21th September 2008
ASUM Annual Scientific Meeting 2008
Venue SkyCity Auckland Convention Centre
New Zealand
Contact ASUM

2009

30th Aug–3rd Sept 2009
ASUM hosts WFUMB 2009 World Congress Sydney Australia
Venue Sydney Convention and Exhibition Centre
Contact Dr Caroline Hong
ASUM CEO

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for intormation

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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PO Box 943 Crows Nest
NSW 1585 Australia
Authors must provide current email address, telephone number and street address.

2008 ULTRASOUND BULLETIN PUBLICATION DATES

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

✓18 reasons (at least) why you should join ASUM

ASUM is a unique professional society dedicated to excellence in ultrasound and the professionals who work in this vital and constantly evolving medical specialty.

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