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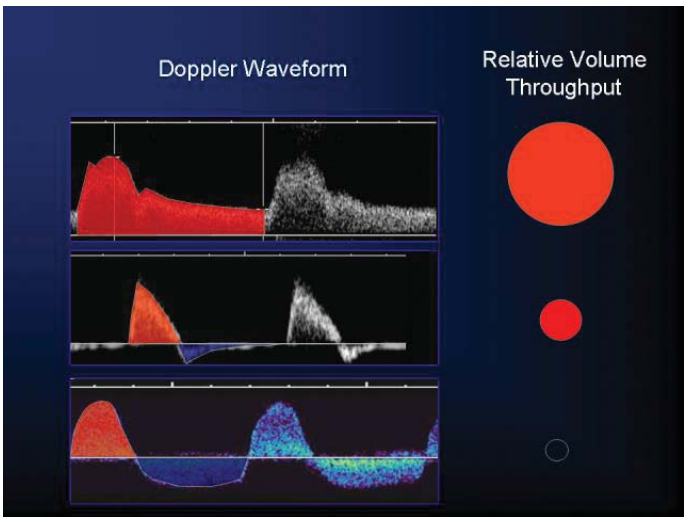
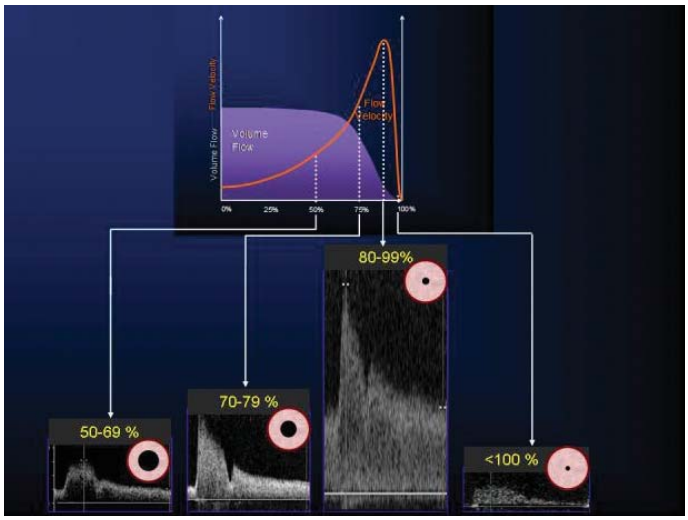
Australasian Society for Ultrasound in Medicine

ULTRASOUND BULLETIN

ASUM Multidisciplinary Ultrasound Workshop 2006
Gold Coast 24–25 March 2006
Obstetric and Gynaecological Ultrasound Symposium
Gold Coast 23–26 March 2006
Vascular Ultrasound Workshop
Gold Coast 24–25 March 2006
DMU Preparation Course
Gold Coast 22–26 March 2006
DDU Technical Seminar
Gold Coast 22–23 March 2006
WFUMB World Congress Seoul
South Korea 28 May–1 June 2006
ASUM (NZ Branch) 2006 Ultrasound Conference
Napier, Hawkes Bay NZ 14–17 July 2006
ASUM Annual Scientific Meeting 2006 Melbourne
Melbourne 14–17 September 2006





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- Tumour angiogenesis
- New technologies in ultrasound
- Fetal ultrasound video compression algorithm
- Quality of compressed ultrasound video

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ULTRASOUND BULLETIN

ASUM Ultrasound Bulletin February 9: 1

Notes from the Editor

The 2006 ASUM members' year has commenced with an outstanding issue containing a fascinating range of articles for readers of the *Ultrasound Bulletin*. Readers' views are always welcome and this year the editorial staff wishes to encourage more ASUM membership feedback. Tell us what you like about the Society's activities and, more importantly, what ASUM can do better. Sometimes, one member's critique can result in a significant improvement in service to many members and letters to the Editor are always thought provoking.

This issue has some solid ultrasound science in a series of articles dealing with fundamental principles of ultrasound practice. Martin Necas has offered a superb treatise on *Arterial spectral Doppler waveforms*. There are two superb articles from Peter Burns, one of the Society's most enjoyed speakers at the 2005 Annual Scientific Meeting: one entitled *Tumour angiogenesis with ultrasound imaging* and the other *Understanding new technology in ultrasound*. Watson, Chan *et al.* have addressed a very important and often neglected area of ultrasound technology, in the articles *What is the best video compression algorithm for digital fetal ultrasound videoclips?* and *Objective quality measure of compressed ultrasound video*.

Readers are as always encouraged to submit their own work for publication, as a Pictorial Essay, Case Report or Scientific Paper. WFUMB 2009 is just around the corner!

Assoc Prof Roger Davies
Editor

ASUM Multidis
Wednesday 22 – Sunday 26 March

Multidisciplinary Workshop Notice

STOP PRESS

Early Bird Deadline Extended – 10th March 2006

Due to technical difficulties with installing the online registration for the Multidisciplinary Workshop, registrants have been unable to take advantage of early bird registrations. Consequently, the early bird deadline has been extended until the close of business on Friday 10th March 2006.

Wednesday 22nd March 2006

DMU Prep Course and DDU Technical Seminar

SESSION 1	Ultrasound propogation and basic transducers Transducer arrays and advanced techniques
SESSION 2	Standards and ultrasonic output Bioeffects and safety
SESSION 3	Imaging artifacts
SESSION 4	Imaging technology

Thursday 23rd March 2006

DMU Prep Course and DDU Technical Seminar (Applied physics, Bioeffects and Safety)

SESSION 1	Doppler principles Doppler instrumentation
SESSION 2	DMU General and Obstetrics: Tutorial DMU Cardiac: Film analysis
SESSION 3	Measurements Phantoms Tissue harmonic imaging contrast agents
SESSION 4	DMU General and Obstetrics: Film analysis DMU Cardiac: Cardiac artifacts

Nuchal Translucency Course

SESSION 1	Principles of screening Practicalities of NT measurement
SESSION 2	NT and chromosome abnormality Screening and multiple pregnancy Biochemical screening 12-week anomaly scan
SESSION 3	Increased NT and normal chromosomes Counselling issues Invasive prenatal testing
SESSION 4	Assessment

Friday 24th March 2006

	O & G	Vascular	Musculoskeletal	General	DMU Preparation Courses
SESSION 1	Role of ultrasound in miscellaneous lumps and bumps in the neck Recognising and correcting Doppler artifacts Shoulder				**General / Obsteric** Your DMU questions Shoulder **Cardiac** Cardiac physiology and haemodynamics
SESSION 2	**Counselling** Shades of grey – what not to say Panel discussion	Central pathology Intimal medial wall Update on carotid	**Workshops** Basic shoulder Alternate shoulder Elbow Hand and wrist	Untrasound of thyroid nodules	**General / Obsteric** Film reading **Cardiac** Comprehensive 2D / Doppler examination and protocols
SESSION 3	**3D developments** Basic techniques 3D volumes in obstetrics 3D gynaecology	**Workshops** EVAR AVF	Elbow Hand and wrist	**Paediatric** Abdominal and renal	**General / Obsteric** Paediatric abdominal and renal **Cardiac** 1 DMU Practical Exam 2 Workshop: The normal adult examination

Multidisciplinary Workshop Faculty

Anil Ahuja
Jon Hyett
Terry Needham
Chris Barry
Stephen Bird
Peter Borzi
Mark Bryant
Yvonne Butcher
Craig Cairns
Andrew Chesham
Robert Cincotta
Teresa Clapham
Debbie Coghlan
David Davies-Payne
Hans Peter Dietz
Paul Dinnen
Greg Duncombe
Kim Forrester
Glenn Gardener
Roger Gent
Karen Goodwin
Jenifer Kidd
Alison Lee-Tannock
Barry Lennon
Pauline McGrath
Lisa Miller
Peter Murphy
Jo Newman
Shaun O'Reagan
Simone Peacock
Lucia Pemble
Madelyn Peterson
Amanda Sampson
Clara Shek
Neil Simmons
Mark Stieler
Bridget Sutton
Christopher Sykes
Cameron Ward

ciplinary Workshop
2006 Conrad Jupiters, Gold Coast

Friday 24th March 2006

	O & G	Vascular	Musculoskeletal	General	DMU Preparation Courses
SESSION 4	Menorrhaghia Infertiltiy / IVF Ovarian cysts and adnexal pathology	The carotid operation / stents Introduction to AVF Peripheral arterial diseases	**Workshops** Basic shoulder Alternative shoulder Elbow Hand and wrist	**Paediatric** Hip, head and spine	**General / Obsteric** 1 Paediatrics 2 Hip, head, spine 3 Ovarian cysts **Cardiac** 1 Prosthetic valves 2 Echo and systemic diseases

Saturday 25th March 2006

	O & G	Vascular	Musculoskeletal	General	CARDIAC	DMU Preparation Courses
SESSION 1	**Fetal cardiology** Normal fetal echo Abnormal fetal hearts and outcomes	**Workshops** Carotids DVT AVF EVAR	Hip / groin hernia	Role of ultrasound in salivary gland lesions	Pericardial and myocardial disease	**General / Obsteric** 1 Testes 2 Mid trimester scan and measurements **Cardiac** Pericardial and myocardial disease
SESSION 2	**Screening** First trimester morphology The genetic sono-gram Death on the soft marker scan – what can we do instead?	Venous reflux Deep venous insufficiency Laser sclerotherapy	**Workshops** Hernia Thigh and knee Ankle and foot DMU Clinical Exam	Legal and ethical issues Genetic counselling Health communic-ations	Congenital heart disease Embryology basic to complex	**General / Obsteric** Legal and ethical issues Genetic counselling Health communic-ations **Cardiac** Congenital heart disease Embryology basic to complex
SESSION 3	**Fetal abnormalities** Fetal therapy – what the sonographer needs to look for Surgical outcomes of fetal abnormal-ities Neonatal outcomes of fetal anomolies	**Workshops** Carotids DVT AVF EVAR	Thigh and knee Mortons neuroma	**Breast ultrasound** Breast anatomy – what you see with ultrasound Benign vs. malignant	Prosthetic valve assessment	**General / Obsteric** 1 Growth 2 Basic vascular – haemodynamics, DVT, carotid **Cardiac** Prosthetic valve assessment
SESSION 4	**Growth and wellbeing** Multiple pregnancies and what to look for IUGR and fetal wellbeing	Follow-up of AVF Thoracic outlet syndrome Aorta Iliac EVAR	**Workshops** Hernia Thigh and knee Ankle and foot DMU Clinical Exam	**Breast ultrasound** Correlation of mammographic and ultrasound lesions Breast implants	Case studies	**General / Obsteric** Basic vascular – haemodynamics, DVT, carotid **Cardiac** Case studies

Sunday 26th March 2006

DMU Preparation Courses

SESSION 1	**General / Obstetric** 1 Workshops on abdominal and 20-week scan **Vascular** 1Scanning Workshops: What to expect in an exam **Cardiac** 1 Exam techniques
SESSION 2	How to approach a written DMU Exam question and case studies
SESSION 3	1 Knobology 2 Quality assurance 3 Liver, gall bladder, bile ducts

Sunday 26th March 2006

Pelvic floor ultrasound 2D, 3D, 4D an interactive educational session including virtual and live scanning

SESSION 1	2D pelvic floor ultrasound – the basics A sonographer's approach to pelvic floor imaging Pelvic floor imaging to guide the O & G surgeon: preop and adult
SESSION 2	3D / 4D pelvic floor ultrasound Clinical and research applications – Peter Dietz Introduction to Voluson hardware and 4D view
SESSION 3	Virtual and live scanning

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Upcoming ASUM Meetings

24–25 Mar 2006 Multidisciplinary Workshop
Gold Coast Australia

14–16 July 2006 ASUM NZ Branch
Ultrasound Conference
Napier Hawkes Bay New Zealand

15–17 Sept 2006 Annual Scientific Meeting
Melbourne Australia

13–17 Sept 2007 Annual Scientific Meeting
Cairns Australia

30 Aug–3 Sept 2009 WFUMB 2009 World Congress
Sydney to be hosted by ASUM

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fax: +61 2 9958 8002
email: asum@asum.com.au

ASUM CEO Dr Caroline Hong
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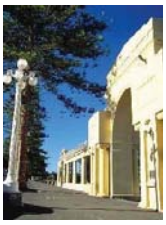

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rowena.tyman@hawkesbaydhb.govt.nz

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Australasian Society for Ultrasound in Medicine

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President's message

Dr David Rogers

Hello and welcome to 2006. I hope the Christmas and New Year period treated you well and that you managed to get a good summer break. Already, we are in February and the year has begun in earnest. The calendar for 2006 looks quite full already with many interesting events planned.

BMUS

Prior to Christmas I took part in the ASUM Presidential Exchange with the British Medical Ultrasound Society. Every second year the ASUM President is invited to the BMUS Annual Conference to present lectures. Similarly the BMUS President attends the ASUM Annual Scientific Meeting in alternate years.

This year I was accompanied by ASUM CEO, Caroline Hong, and Glenn McNally, ASUM recent past president. We took the opportunity of the exchange to develop our relationship with BMUS and to begin promoting the WFUMB 2009 Conference. The trip was an outstanding success. The venue in Manchester was ideal for the conference and even the weather wasn't too bad, albeit quite cold. Manchester is a rapidly developing city with an excellent mix of new and old. Highlight of the conference was the Annual Dinner held at the magnificent Town Hall. The hospitality shown to us by Grant Baxter, current BMUS President, and other BMUS members was very warming and made the trip all that more worthwhile. The meeting itself had an outstanding and high quality program with some presenters who are very familiar to ASUM members, such as Peter Burns and Rhodri Evans. We look forward to returning the hospitality when Grant Baxter attends the ASM in Melbourne this year to complete the exchange. Grant is an accomplished lecturer in Uroradiology.

Vision College

Over the last few years, ASUM has worked with the Vision College in Kuala Lumpur, Malaysia, to develop the DMU Asia. Sonographers are new to the medical workforce in Malaysia and this course is being encouraged by the Malaysian Department of Health to increase sonographer numbers. The first intake of students will graduate in May this year. As you can imagine, a great deal of work has gone into this course from ASUM, especially Caroline Hong, Glenn McNally, Andrew Ngu and Roslyn Savage. In March this year I am going up to Kuala Lumpur for one week to teach vascular ultrasound, and Roger Gent will also be teaching paediatric ultrasonography in the near future. We both look forward to spending some time with Vision College to see the progress they have made in their first year of operation.

ASUM MDW

The first official event on the ASUM Calendar this year is the Multidisciplinary Workshop at the Gold Coast. This meeting has grown steadily in stature since it was first held in 2002 and its size now rivals the Annual Scientific Meeting. Nicholas Bryant and his organising committee have put together an excellent faculty and program. ASUM welcomes back Anil Ahuja, an accomplished specialist in head and neck imaging. Additionally, Terry Needham is welcomed to speak on vascular ultrasound and John Hyett is welcomed to speak on obstetric ultrasound. The meeting will be held at Conrad Jupiters, which has proved a good venue for ASUM events. We hope to see you there.

WFUMB 2006 Seoul

Late in May, WFUMB 2006 will be held in Korea. This is a very important meeting for ASUM as we are hosting the next meeting in 2009. ASUM is sending a large delegation of speakers and staff to support the meeting and to maximise our benefit from it. The meeting in Seoul is very well organised and it should be a show case for world ultrasound. We encourage you to consider attending and ASUM will offer some rebate to members attending.

WFUMB 2009 Sydney

At the Seoul meeting, the promotion for the Sydney WFUMB 2009 meeting begins in earnest with only three years remaining. This is a big task for ASUM, especially the Convenor, Stan Barnett and the Treasurer, Glenn McNally. Congratulations to Roger Davies who has recently accepted the role of Scientific Convenor. All help from members towards this meeting would be greatly appreciated.

ASUM awards

This year, ASUM plans to change the nature of the Giulia Franco and Beresford Buttery awards by turning them into prestigious Lecturing Fellowships to the major cities, complementing the Chris Kohlenberg Teaching Fellowships to regional centres. Luminary ASUM members will be awarded the Fellowships whose focus will be to give a series of lectures around Australia and New Zealand. This will, hopefully, stimulate some local activity in areas in between the major ASUM meetings. We plan to announce the first Fellows within the next few months.

Danish cooperation

Looking further ahead, Rogers Davies and I will be speaking at an interventional conference in Copenhagen in June as part of the exchange we have set up with the Danish Ultrasound Society. Christian Nolsoe will be talking at the ASUM Melbourne Annual Scientific Meeting in September, to complete the exchange.

ISUM Indonesia

Later in the year, in early December, ASUM will be co-hosting a meeting in Indonesia with ISUM which should provide members with the opportunity for a good break away before Christmas.

DMU

Finally, congratulations to those candidates who have recently passed the DMU and a big thank you to all the examiners who have given of their time and expertise. Well, I hope 2006 treats you well. It looks to be a busy and interesting year.

David Rogers
President

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CEO's message

Dr Caroline Hong

Happy New Year and greetings. This is my first message for the new year 2006. I am in my fifth year of service with ASUM as your CEO. At the last Council meeting, which was held on 19th November 2005 in Sydney, I am pleased to advise that it was resolved that my term as ASUM CEO be extended to the year 2011. This gives me enormous pleasure and I am filled with gratitude as it allows me to ensure the continuity of projects and initiatives which have been commenced over the past few years. It also means that I can continue to work with the Council for further progress leading up to the WFUMB 2009 Sydney World Congress and towards a bright and optimistic future.

By now, I hope you have started using the complimentary ASUM wall calendar that we send out to members at the end of each year.

Our ASUM calendar is already full with a lot of exciting work ahead, which will no doubt keep the ASUM secretariat staff busy. Similarly, ASUM volunteers and members of Boards of Examiners, Committees and Council will be embarking on new programs for the new year. Things really happen at ASUM.

BMUS 2005

The President, Dr David Rogers, and the ASUM delegation were well received at the Manchester BMUS 2005 meeting, which was held in December 2005. We learned a good deal at this meeting and made many new friends for ASUM. The President felt it was worthwhile for the ASUM delegation to make the effort to travel the distance to support the BMUS meeting. It was a good meeting, attended by about 800 people, with many interesting scientific sessions and a well-organised large exhibition.

We made many useful contacts and renewed friendships. Dr Grant Baxter, the current President of BMUS, and his team were most hospitable and also put up a great social program to make us all feel welcome as VIPs.

I met briefly with Barry Goldberg and was able to follow up on the

Mrs Sue Rogers, Dr David Rogers, Dr Grant Baxter, Dr Glenn McNally and Dr Caroline Hong at the BMUS meeting in Manchester

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implementation of his proposal for ASUM to support his SonoWorld project, which was approved recently by ASUM Council.

We met with several BMUS council members and we are pleased that the BMUS sonographer scholarship to Australia program is alive and well.

We were also advised that the Euroson meeting will be held in Edinburgh, about a month after the WFUMB 2009 Sydney World Congress dates, from 30th August to 3rd September 2009.

I met the newly appointed General Secretary of BMUS, Ann Tailor, with whom I hope to keep in touch so as to ensure positive collaborative efforts when working together for common goals for our two societies.

I met and spoke with many people, delegates, exhibitors, trade, societies, past and present presidents, councillors and staff of the BMUS secretariat. They were all friendly and most welcoming at all times.

The plenary sessions and the professional issues sessions were popular. *The History of Ultrasound* was interesting as there are so many perspectives on how ultrasound has developed.

I was proud for ASUM to see George Kossoff's and Dave Carpenter's names and photos flashed across the big screen in Manchester, as very important key players in the early days of ultrasound. There were many other familiar faces too, including David Pilling, Jane Bates, Peter Burns, Rhodri Evans, Barry Goldberg and others whom I have met previously.

Although it was cold weather-wise, the warmth of the BMUS people and the festive mood of the pending Christmas season, all created a very lively and happy atmosphere at the meeting.

We will certainly welcome Dr Grant Baxter, BMUS President, who is one of our keynote overseas invited speakers, at the ASUM 2006 Annual Scientific meeting in Melbourne this year.

President Elect

ASUM Council, at its last meeting on 19th November 2005 in Sydney, resolved to appoint Dr Andrew Matthews as the President Elect. In accepting, Andrew also automatically assumes the roles of Chair of Asia Link and Chair of Trade Liaison, in addition to his membership of the Executive and the Finance Committee.

ASUM School of Ultrasound

Council also approved a major and important new initiative, that the ASUM School of Ultrasound be established and that a project director be appointed to start working on this important initiative. In our last issue of the *Ultrasound Bulletin*, a flyer was sent to all members announcing a position as ASUM School of Ultrasound Project Director.

Dr Glenn McNally is appointed as the Chair for the working party. Other members on the working party include Margo Gill, Kaye Griffiths, Matthew Andrews and David Davies-Payne.

WFUMB 2006 Seoul Ultrasound World Congress

The Ultrasound World Congress is a triennial congress and, in 2006, will be held in Seoul from Sunday 28th May to Thursday 1st June. Many ASUM members are expected to be attending this important meeting. Registrations and information can be obtained on the website www.wfumb2006.com

ASUM members are encouraged to register early and are reminded that the early bird registrations are due on 28th February 2006 and hotel reservations are due on 31st March 2006. Tours can also be organised through:

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WFUMB 2009 Sydney Ultrasound World Congress

The new dates for the 2009 WFUMB Sydney Ultrasound World Congress are now set for Sunday 30th August to 3rd September 2009.

ASUM will be launching the 2009 Sydney meeting in Seoul at the WFUMB 2006 World Congress. ASUM will also be hosting an exhibition booth at the Seoul meeting.

Planning is progressing well. Council has resolved to appoint Dr Roger Davies as the Scientific Convenor. The local Organising Committee is now comprised of Dr Stan Barnett (Convenor), Dr Glenn McNally (Treasurer), Assoc Prof Roger Davies (Scientific Convenor) and Dr Caroline Hong, ASUM CEO. The WFUMB 2009 Promotion Committee is comprised of the Convenor, Treasurer, President and the CEO.

Vietnam

This is truly an amazing story of how determination and faith can make miracles happen. It is incredible that in such a short time, starting from an email in September 2005 and one face-to-face meeting with Dr Harley Roberts in October 2005, followed by fund raising efforts led by Dr Harley Roberts in November and December 2005, that a sum of more than $A13,000 has been raised for the ASUM Asia Link Program for Vietnam. This ensures that the scholarship funds will continue for many years.

The first scholarship recipient will receive funding of $A4000 and Dr Nguyen Ha from the TUDU Hospital in Vietnam has been chosen by the Department of Health and the local Imaging Diagnostic Society of Ho Chi Minh City to be placed in the Perinatal Ultrasound Department of Nepean Hospital and various Sydney hospitals for a period of two weeks in February 2006.

Dr Nguyen will receive advanced 3D ultrasound training, which will bring enormous benefits for the Vietnamese community serviced by her hospital. Our thanks go to Dr Harley Roberts, Prof Ron Benzie and the Nepean Hospital for this worthwhile project.

Fiji

Dr Peter Davies will be addressing the ASUM Council on his proposal for ultrasound training in Fiji. Overall in-principle support exists for this project and we will keep you posted on developments.

Sonographer registration

Various bodies are currently addressing the issue of sonographer registration. Margaret Condon and Roslyn Savage have both been appointed as the representatives for ASUM on this issue. They will attend meetings to discuss sonographer registrations and report back to Council.

DMU (Asia)

The ASUM Council resolved to appoint Dr Glenn McNally, Dr Andrew Ngu, Stephen Bird and Ros Savage to the DMU (Asia) Board of Examiners. Vision College has already inducted its second intake of students. The first batch of students is anticipated to graduate around June 2006.

ASUM Certificate in Clinician Performed Ultrasound (CCPU)

Much has progressed in relation to the CCPU since my last message in November. ASUM has been talking to various colleges about this new certificate and there is overall support from the RACS, RANZCOG, and ACEM as well as expressions of interest from various medical college groups. ASUM has been working on this project for at least two years. The courses are now available and this has been possible through the increased cooperative linkages with medical colleges (ACEM, RANZCR, RANZCOG and RACS), which were actively started during the presidency of Dr Glenn McNally. Details are available on the website www.asum.com.au

ECR 2006 Vienna

ASUM is fortunate to have been allocated a complimentary booth at ECR 2006 in Vienna, which is also supported by the RANZCR. ASUM is now considered a friend of ECR and will be hosting a booth each year to promote the WFUMB 2009 World Congress. Members who are attending this meeting are welcome to contact the ASUM CEO if they wish to be involved in promoting the Society at this Radiology Congress. There is no financial support for this but you can be assured of feeling a sense of fulfilment in doing something positive for your professional society.

Denmark and CADUCEUS

The Collaborative Australasian Danish Undertaking for Continued Excellence in Ultrassound (CADUCEUS) was set up by ASUM and the DSDU in 2004. The objectives are twofold:

1 The Danish Society for Diagnostic Ultrasound (DSDU) wishes to work in collaboration with ASUM to further develop the promotion of excellence in ultrasound to a level comparable to the best in the world.

2 The primary purpose is to promote a high standard of professional practice in medical ultrasound and also to promote a mutual exchange of information relating to education and training in medical ultrasound.

Dr David Rogers, Dr Supranee, Dr Dhiraphongs Dr Caroline Hong and Dr Glenn McNally at Bangkok ASUM MUST Meeting

There are several ways for this to progress, including support for seminars, conferences, research, exchange programs and common goals. The first sign of this moving forward is the successful short-term placement of a young Danish doctor to advance his research and PhD relating to musculoskeletal ultrasound in Australia. Dr Cheryl Bass should be thanked for all this, as she was responsible for finding suitable placement, due to some changes to the original plans, at very short notice. Dr Christoffer Brushoj has already arrived in Australia with his family and is enjoying new experiences and ultrasound training during his short stay in Melbourne.

The Danish Society is still trying to get our Australian born Princess Mary of Denmark to be the patron of CADUCEUS.

ASUM staff

Many of you may have communicated with our newest staff member, Helen Cuneo, who joined us late last year as the Education Administration Assistant, replacing Judy Vickress. Helen has already settled in well within the ASUM team and is learning very quickly about the work that we do at ASUM.

I would like to congratulate Keith Henderson, Education Manager, who has successfully completed 10 years working for ASUM. Keith joined ASUM in February 1996 when Dr Peter Warren, then President, saw the need to recruit an education officer. Keith has been working with me since 2001 and I have seen much development, innovation and progress over the years. I am pleased that Keith will be working with me at ASUM for many years to come in his role as Education Manager.

In response to the increasing range and number of projects, which ASUM is developing, there has been a small reallocation of duties in the ASUM Secretariat. Most significantly, James Hamilton is now involved in a broader range of education projects and is no longer the point of contact for DMU enquiries. These should now be directed to Matthew Byron.

ASUM, with eight staff members, is still a very lean secretariat. As more projects develop, additional staff resources will be recruited to produce the outcomes desired by Council for ASUM members. The Ultrasound School Project Director is one such example.

ASUM website

Have you visited our website recently? The site is constantly updated and new information, about our meetings, examinations, courses, clinical handbook and much more, is all to be found at www.asum.com.au.

Next ASUM Meeting at the Gold Coast 24–25th March 2006

I hope to see many members at the next ASUM Multidisciplinary Workshop meeting to be held at the Gold Coast. There will also be pre- and post-workshop courses. All details are available on our website www.asum.com.au.

Wishing all of you a great 2006-year ahead.

Dr Caroline Hong
ASUM CEO
carolinehong@asum.com.au

To the Editor

Non-diagnostic fetal ultrasound for entertainment

I would like to comment on Lachlan de Crespigny's thought provoking letter to the ASUM *Ultrasound Bulletin* 2005, November 8 (4).

He presents a cogent argument that the debate on fetal scanning for entertainment will not be won on the grounds of fetal safety. We should heed his warning on our own use of ultrasound in patients who want fetal images that are not obtained for medical purposes. He supports this opinion with valid examples including that of the ISUOG Journal's publications of Doppler use in the first trimester and ISUOG's policy statement against such use.

We must, however, surely take issue with his view that 'all diagnostic examinations have an element of patient entertainment'. The Macquarie Concise Dictionary defines entertainment as 'something affording diversion or amusement especially an exhibition or performance of some kind'. Patient communication and demonstration of fetal images are important parts of a diagnostic ultrasound examination but do not constitute entertainment. We are not trivialising ultrasound by demonstrating fetal images in our practices. Satisfying patient needs is not the same as providing entertainment.

That providers of entertainment scans are unlikely to pretend they offer a diagnostic service is not the point. The provision of a 'pretty picture' of the fetal face may falsely reassure mothers that all is well.

The practices in shopping mall 'clinics' (an unusual term as they are in no way clinical – perhaps entertainment centres would be more appropriate) are not the same as those in diagnostic practices.

The development of shopping mall fetal ultrasound is not a sign that we must do more to address the needs of our patients. It is a sign that where entrepreneurs see a market they will exploit it for purely commercial reasons.

To take a stand against the non-medical use of ultrasound does not 'reek of self-interest, but rather argues against the abuse of medical technology. I am old enough to remember when x-ray machines were used in shoe shops to show mothers their children's feet snug in their new Clarks. Mothers were assured, then, of the safety of that technology.

A survey of pregnant patients attending the Nepean Public Hospital Perinatal Ultrasound Department was completed this week. We asked them what they thought of fetal scans for entertainment and whether they had safety concerns. Somewhat to our surprise, 77% were not in favour of 'shopping mall' scans and 53 % had worries about safety issues. So perhaps women, themselves, will just avoid entertainment scans.

De Crespigny proposes that we learn lessons from 'shopping mall' fetal ultrasound rather than opposing it. The only lessons that we can learn from shopping mall fetal ultrasound might be in marketing and moneymaking. In the USA where profiteering is commonplace, there has been an outcry against the non-medical use of ultrasound.

The American Institute of Ultrasound in Medicine strongly discourages the nonmedical use of ultrasound for psychosocial or entertainment purposes. Even Tom Cruise's purchase of an ultrasound machine for his partner's home viewing of their unborn baby has been criticised there.

Ultrasound for entertainment only is a blot on the Australian medical landscape and should also be strongly discouraged here.

Prof Ron Benzie
University of Sydney, Nepean Hospital

Editor's note

The ASUM Council adopted a statement on 'Ultrasound for Entertainment, Statement on the Appropriate Use of Diagnostic Ultrasound Equipment for Non-Medical Entertainment Ultrasound, in July 2005. This was printed as an interim statement, in *Ultrasound Bulletin* 8 (3): 35, prior to Council adopting it unchanged. This states ASUM's position: 'confining the use of diagnostic medical ultrasound equipment in pregnancy to examinations for the purpose of providing medical information useful to the management of pregnancy' for the following reasons: bioeffects and safety; the trivialisation of diagnostic medical technology; and the potential for misdiagnosis. The statement urges that community discussion regarding the right of the fetus 'not to be exposed to a source of potential harm where no health benefit exists' should ensue.

DDU & DMU 2006 DATES AND INFORMATION

DDU DATES AND INFORMATION

2006 Part I

The Part I Examinations for 2006 will be held on Monday 15th May 2006 with applications closing on Monday 20th March 2006.

2006 Part II

Casebooks for 2006 Part II DDU Examination must be submitted by Monday 16th January 2006 and accompanied by the prescribed fee of A$330.00 for all participants.

The Written Examination for Part II will be held on Monday 15th May 2006 with the closing date being Monday 20th March 2006.

The Oral Examination for Part II will be held on Saturday 17th June 2006 in Sydney. The Oral Exam for Cardiology candidates will be in Melbourne on Thursday 15th June 2006.

RESULTS

Examination results will be mailed to candidates early July following the DDU Board of Examiners meeting.

DMU EXAMINATION DATES

DMU Prep Course – Gold Coast 22nd–26th March
DMU Part II Practical Examination Period May–October
DMU Part I & Part II Written Examinations 29th July
DMU Part II Oral Examination Period 3rd–29th October
DMU Part I Supplementary Written Examination 4th November

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Arterial spectral Doppler waveforms: haemodynamic principles and clinical observations

Martin Necas

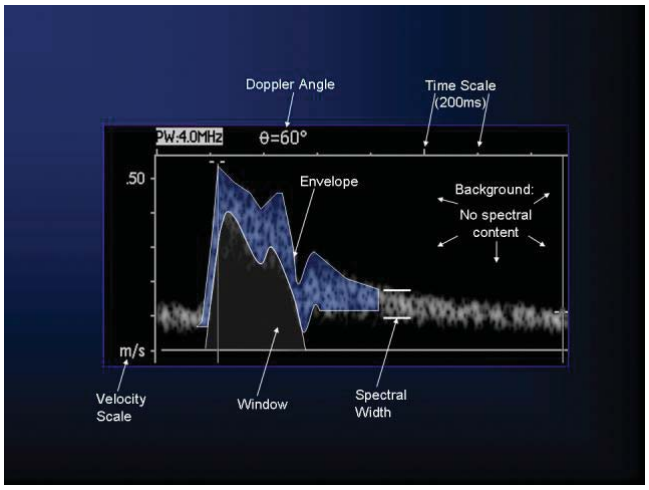

Figure 1: Arterial spectral Doppler waveform descriptors.

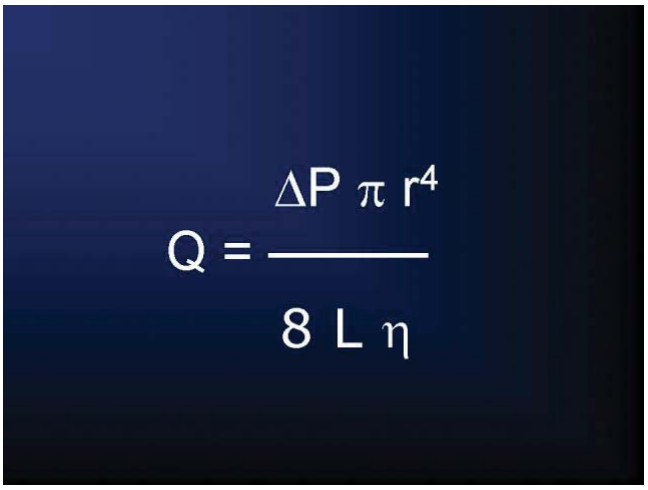

Figure 2: Poiseuille's Law.
In a theoretical model of a straight non-branching smooth walled conduit containing Newtonian fluid, volume flow (Q) is directly proportional to Pressure gradient (DP) and diameter of the vessel to the fourth power (r4), and it is inversely proportional to conduit length (L) and fluid viscosity (h). All factors remaining the same, doubling the conduit diameter results in sixteen-fold increase in volume flow. In the human circulation, this law can be applied only very loosely. However, the law does demonstrate the profound impact that vessel diameter has on volume flow[5,6].

Introduction

Duplex ultrasound is a well established component of current ultrasound practice. Recent years have witnessed an upsurgence of Doppler ultrasound applications in all subspecialties of ultrasound, not just vascular and cardiovascular, but also in abdominal, gynaecologic, obstetric, paediatric, acute and musculoskeletal examination.

Doppler modes (colour, power, and spectral Doppler) are available on virtually all modern ultrasound systems including most small portable hand-carried systems. While colour and power Doppler offer qualitative observations of regional blood flow, spectral Doppler waveforms (Figure 1) provide us with more quantitative means of evaluating, measuring and observing blood flow characteristics[1,2,3]. Understanding arterial haemodynamics and the impact of haemodynamic abnormalities on the spectral Doppler waveform is therefore of significant importance.

Arterial Doppler applications are often discussed as seemingly separate blocks of knowledge: cerebrovascular, abdominal arterial, lower limb arterial, obstetric Doppler, and others[1,2,3,4]. Yet the fundamental principles of human haemodynamics, and the resultant observations on Doppler ultrasound are very similar across the variety of vascular beds, different patient ages (from antenatal to geriatric), and different types of causative pathologies. These basic principles are universal and widely applicable. Understanding these principles can enhance our diagnostic confidence and make learning new applications much easier.

Not all of the principles discussed in this paper will occur in every patient. Differences in vessel location, geometry, degree of pathology, coexisting abnormalities, compensatory processes and inherent variability between individual patients may significantly alter the appearance of spectral Doppler waveforms.

While it is impossible to predict the exact shape of spectral waveforms in a given clinical scenario, this paper proposes to provide awareness of Doppler waveform characteristics, review the factors which influence the appearance of Doppler waveforms and provide general guidance in arterial waveform interpretation.

Instead of taking a system-by-system approach, this paper focuses on causative abnormalities and their effect on spectral Doppler waveforms and includes the following

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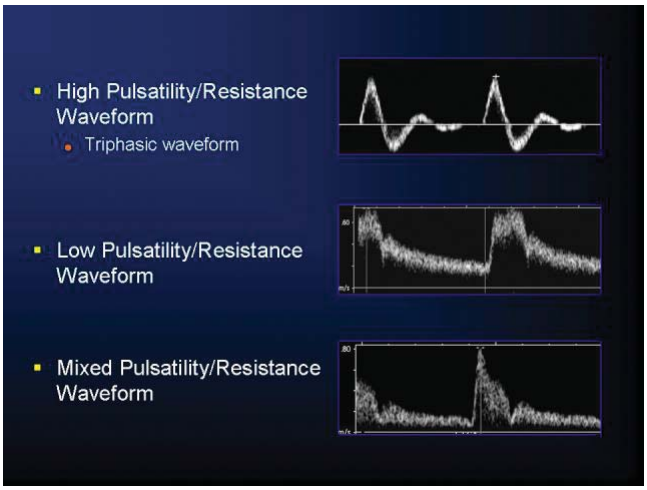

Figure 3: Arterial Doppler waveforms of varying resistance. Arterial resistance pertains to the characteristics of the arterial bed itself. Since the arterial bed determines the shape of the waveform in the afferent vessel(s), arterial waveforms themselves are often described as high resistance or low resistance. Others prefer to use the terms high and low pulsatility. In general, high resistance waveforms are also high pulsatility waveforms and low resistance waveforms are low pulsatility waveforms[1,2,3].

Upstream (Proximal) stenosis in an extremity	↓ R
Downstream (Distal) occlusion of an internal carotid artery	↑ R
High body temperature in extremities	↓ R
Low body temperature extremities	↑ R
Exercise in extremities	↓ R
Inflammatory process accompanied by erythema	↓ R
Organ atrophy	↑ R
Presence of AVM downstream (distal)	↓ R
Presence of AVM upstream (proximal)	↑ R
In dialysis fistula	↓ R

Figure 4: Examples of physiologic and pathophysiologic processes and their effect on vascular resistance[1,2,3].

topics: stenotic and occlusive disease, blind ended channels, steal phenomena, arterio-venous connections and effects of the cardiac pump.

Blood, like any fluid, requires a pressure gradient in order to move. In the human circulation, the pressure gradient is provided by the cardiac pump. The systemic arterial system is a high pressure system (120 mmHg systolic pressure in normal adult) and the central venous system is a low pressure system (near 0 mmHg)[2,5,6]. The branching patterns of the arterial vessels, arterioles, capillaries, and the converging pattern of venules and veins vary in each organ's vascular bed. Each vascular bed therefore offers a different degree of resistance to arterial inflow. Arterioles have a major effect on arterial resistance of a vascular bed since the arteriolar wall is high resistance in smooth muscle and can constrict and dilate in response to a range of stimuli in order to regulate the volume of blood flowing through an arterial bed.

A brief review of Poiseuille's law demonstrates the profound impact that vessel diameter has on volume flow (Figure 2). Arterial beds can be loosely divided into low and high resistance beds. Low resistance beds are present in organs which require constant blood supply during the entire cardiac cycle, such as the brain and the kidneys. A good example of high resistance beds is the extremities[1,2,5,7].

Some arterial beds have the ability to change their resistance significantly and can be referred to as variable resistance beds. This is the case with mesenteric arterial circulation, which demonstrates relatively high resistance during fasting, but low resistance post prandially as the mesenteric arterioles undergo vasodilatation to attract greater volume flow.

Arterial resistance directly affects the appearance of the spectral waveforms. Therefore, high resistance arterial waveforms are present in vessels which supply high resistance vascular beds, and low resistance waveforms are encountered in organs supplying low resistance arterial beds. Arterial Doppler waveforms in large distributing arteries which supply both high and low resistance beds are therefore a mixture of both (Figure 3). Vascular resistance can change dramatically in response to a number of physiologic and pathophysiologic states (Figures 4,5,6). In general, processes which promote vasodilatation decrease vascular resistance[2].

Movement of blood in a straight, healthy, non-branching vessel tends to follow a parabolic (laminar) pattern. This pattern results from frictional forces encountered by blood along the wall of the arterial conduit. The frictional force weakens further away from the arterial wall so that the centre stream of the vessel moves at the highest velocity. Non-laminar (disturbed) flow patterns are encountered at sites of bifurcations or in diseased vessels. Turbulent flows with eddy currents and disorganised flow can generally be seen at sites of high grade stenoses, in post-stenotic regions, and in arterio-venous connections. Examples of arterial waveforms and flow patterns are shown in Figure 7. Note that laminar waveforms show a clear spectral window, whereas non-laminar waveforms are characterised by spectral broadening. Turbulent waveforms demonstrate 'spiky' systolic peaks and reversed systolic flow components which are attributable to disorganised flow and eddy currents. Whether true turbulent flow develops in a stenotic vessel depends quite heavily on flow velocity. For this reason, turbulence is often easier to appreciate in the systolic part of the waveform[2,3,4,5].

Since instantaneous volume flow in a vessel is directly proportional to vessel diameter and flow velocity, volume flow over the course of one cardiac cycle is therefore directly proportional to the surface area underneath the spectral waveform[5]. This simple model will suffice for discussion of spectral waveform shapes. Figure 8 relates the surface area to relative volume flow.

Note that waveforms which demonstrate similar surface area of the forward and reversed flow components effectively lack any flow throughput.

Stenotic and occlusive disease

Arterial stenoses can occur due to a wide variety of causative pathologies. By far the most common cause is atherosclerosis. However, congenital causes, arterial dysplasia, arteritis, kinks, thrombus, embolus, external compression, dissection and other pathologies may lead to the formation of a stenosis or complete occlusion of a vessel1,2,3,8,9.

The effect of varying degrees of stenosis on flow volume and velocity is diagrammatically summarised in Figure 9[10]. As the degree of stenosis increases, the velocity of arte-

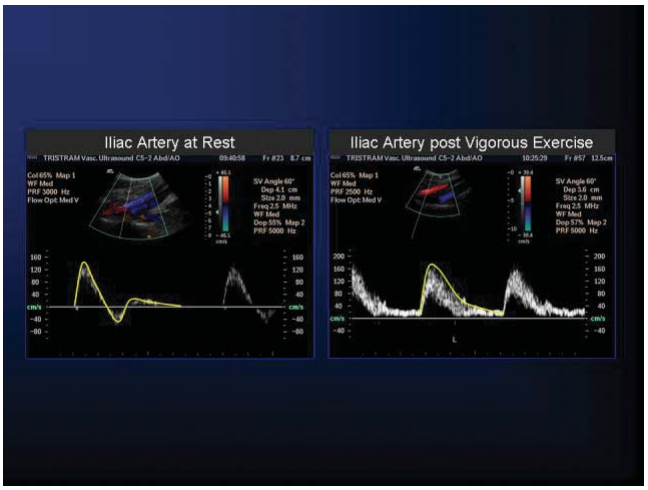

Figure 5: Physiologic change in vascular resistance of the lower extremity induced by vigorous exercise. Normal high-resistance triphasic arterial waveform is seen in the image on the left. Waveform on the right was obtained immediately after vigorous exercise and shows low resistance flow pattern.

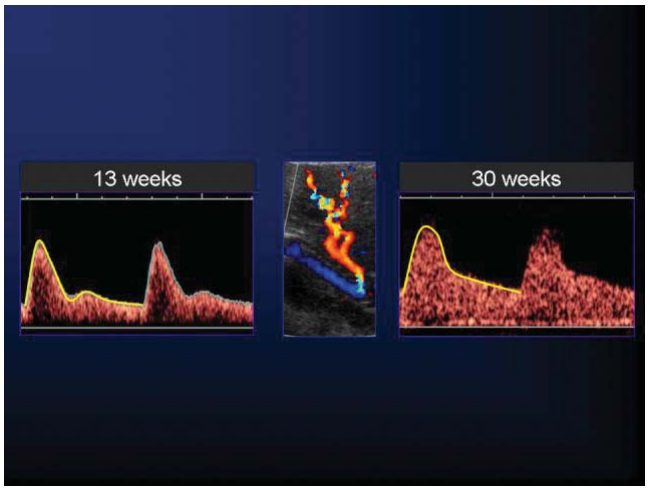

Figure 6: Physiologic change in vascular resistance of the uteroplacental circulation with advancing gestational age as observed on spectral Doppler of the uterine artery.

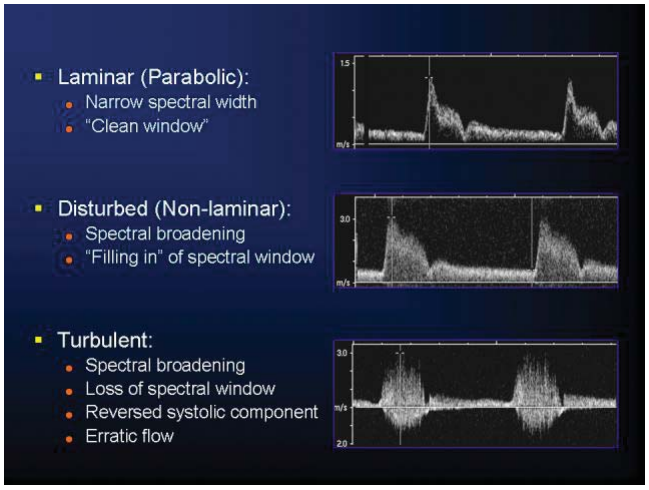

Figure 7: Flow profile characteristics as seen on Doppler waveforms of laminar, non-laminar, and turbulent flows[1,2,3,5].

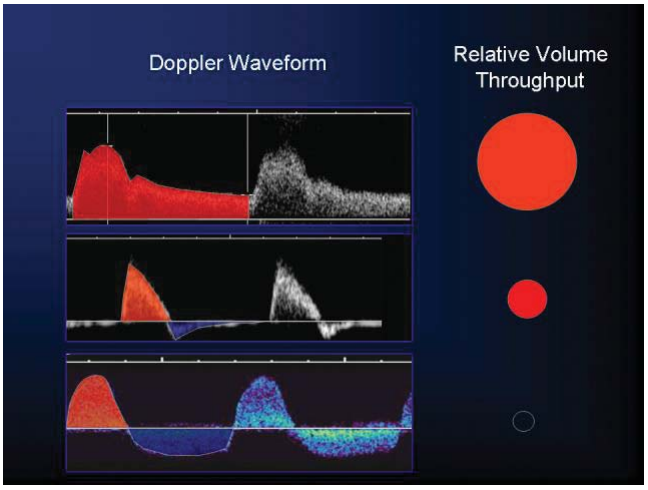

Figure 8: Relationship of waveform surface area to volume flow. If the following waveforms are obtained from vessels of similar diameter and of similar peak systolic velocity, then the top waveform represents a vessel with the largest volume throughput, the middle waveform represents a vessel with much less volume throughput (the blue negative flow component must be subtracted from the red positive flow component), and the effective volume flow in the bottom vessel is nil since the forward and reversed flow components are equal.

rial flow starts to rise. This increase in velocity tends to compensate for the decreasing vessel diameter and volume flow is relatively unaffected until the reduction of the vessel diameter reaches a point of 'hemodynamically significant stenosis' also known as 'flow limiting lesion'. Beyond this point (approximately 50% in many vessels), further narrowing of the artery results in gradual decrease in volume flow despite rising flow velocities. Arterial velocities cannot continue to rise indefinitely. A maximum velocity is reached in high-grade stenoses. Any further reduction in vessel diameter results in rapidly diminishing velocities. It is clear from Figure 9 that, in very high grade stenoses, the flow velocities may be within normal limits or may even be dramatically reduced. Such low flows are sometimes referred to as 'trickle flow'. Since grading of stenosis (in percent diameter reduction) is usually achieved by measuring flow velocities, velocity criteria cannot be applied to assessment of these extreme stenoses. Instead, the diagnosis is usually made on a combination of 2D, colour, and power Doppler findings[3].

At stenosis

Arterial flow velocities generally increase through regions of stenosis. Other observations include development of disturbance which is characterised by spectral broadening, as well as turbulence. A wide range of different criteria exist to grade stenoses in various vessels (Figure 10). Most criteria are based on absolute velocity measurements or on measurements of velocity ratio which is defined as the highest stenotic velocity divided by the immediate normal proximal velocity. An example of velocity ratio is the ICA:CCA ratio or the Renal Artery to Aorta Ratio (RAR). Changes in spectral waveform and velocities with varying degrees of ICA stenosis are shown in Figure 11.

Real-time changes in spectral waveform of a stenosed femoral artery are demonstrated in Figure 12. This spectral display was obtained by performing a sweep of the pulsed wave Doppler gate through the stenotic region and demonstrates the stenotic acceleration, peak jet, and the development of disturbance and turbulence within the stenosis.

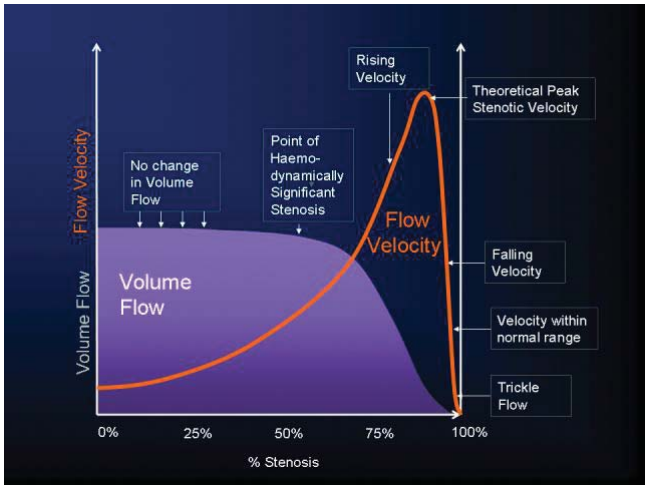

Figure 9: Relationship between stenosis, volume flow and flow velocity. Diagram redrawn and adapted from reference 10.

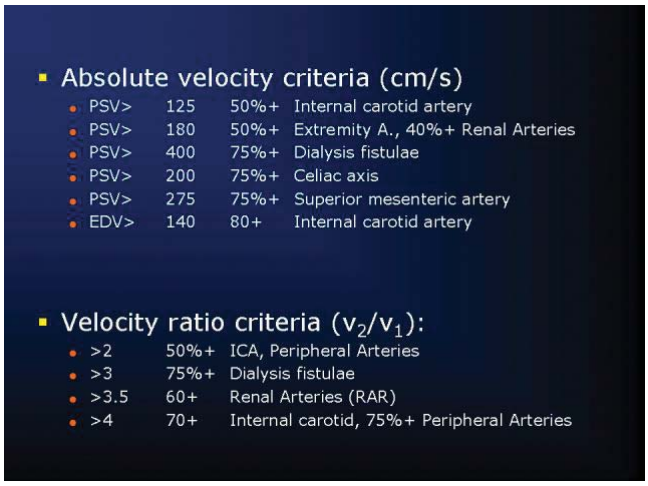

Figure 10: Examples of some common criteria used for grading stenoses in various arteries. Summarised from references 1, 2, 3, 11, 12, 13.

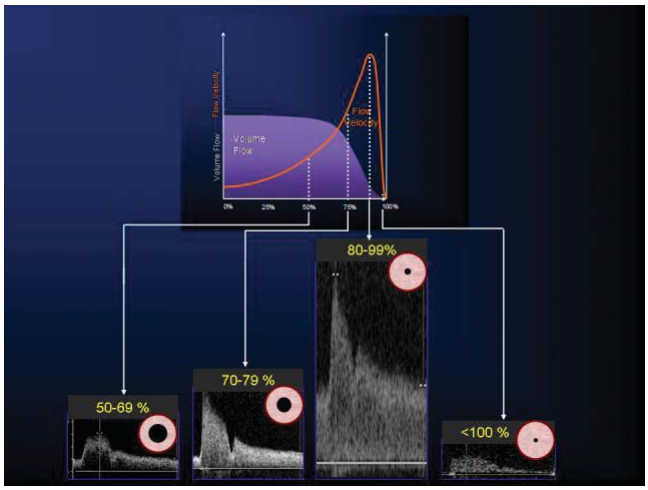

Figure 11: Spectral Doppler waveforms of varying degrees of ICA stenosis. Based on ASUM criteria (reference 11).

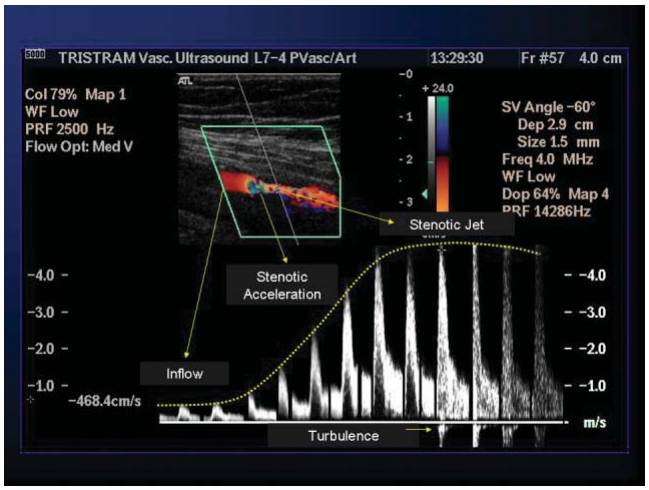

Figure 12: Real-time spectral Doppler sweep through a high grade stenosis in an extremity artery. Systolic flow acceleration is seen as the spectral gate is moved from the normal pre-stenotic vessel segment to the area of maximum stenosis. Flow profile changes from laminar to disturbed and turbulent at the point of the stenosis and immediately downstream.

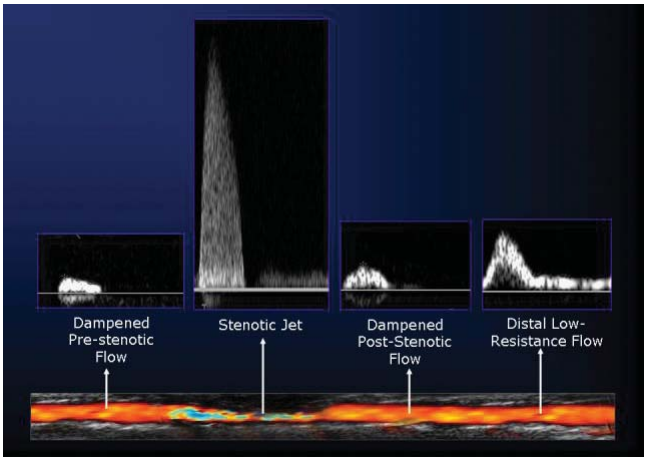

Figure 13: Dampening of flow due to presence of high grade stenosis in the lower extremity. The vessel anatomy (bottom of image) and corresponding waveforms at select points are shown. Both the pre-stenotic and post-stenotic waveforms could be described as 'dampened'. Note that the pre-stenotic waveform shows sharp upstroke whereas the post-stenotic waveform demonstrates delayed acceleration and rounded peak (tardus-parvus waveform).

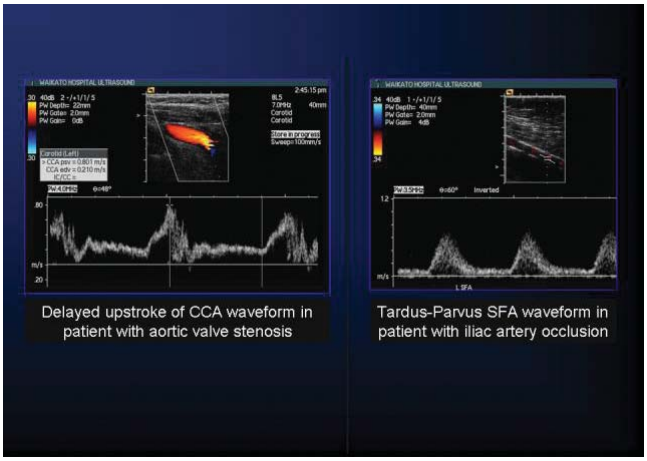

Figure 14: Examples of waveform changes in response to upstream (proximal) disease.

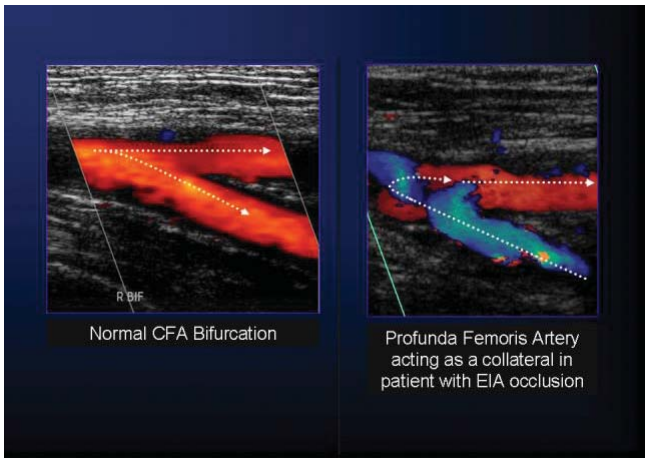

Figure 15: Extremity collateralization ('collaterals in') in response to upstream occlusion.

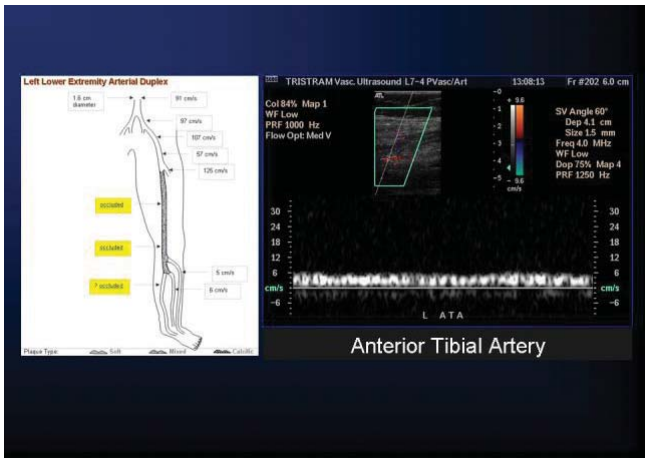

Figure 16: Total loss of peripheral arterial pulsatility due to extensive upstream occlusive disease.

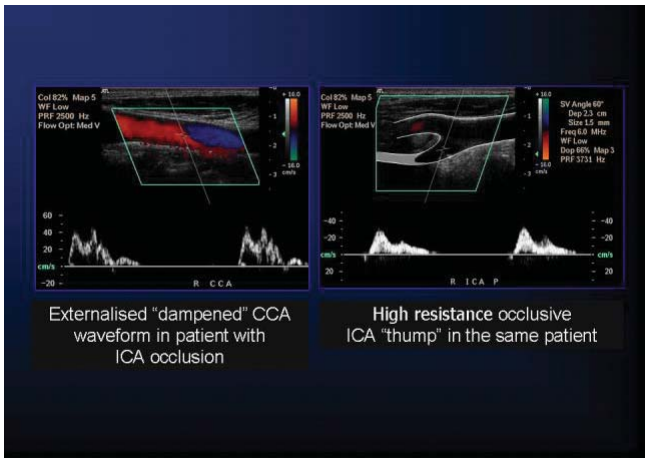

Figure 17: Effect of ICA occlusion on CCA waveform (left) and ICA waveform (right).

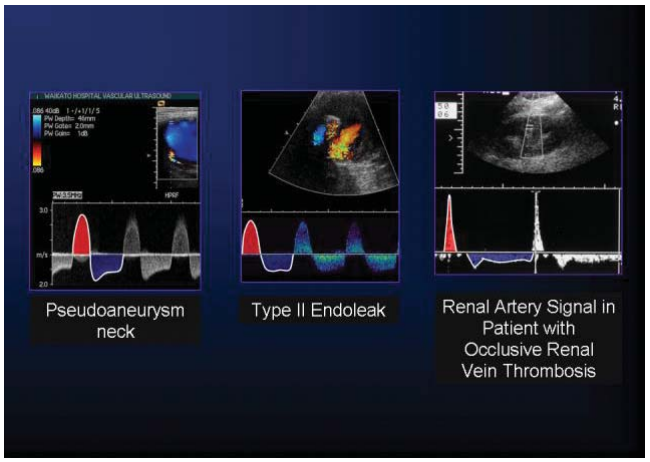

Figure 18: Examples of arterial waveforms typical of blind-ended channels.

High grade stenoses may sometimes result in 'dampening' of waveforms after the stenosis or, less commonly, before a stenosis (Figures 13, 17)[2,3].

Downstream (distal) from severe stenosis or occlusion

Immediately downstream from a stenosis, the stenotic jet continues for a limited distance and post-stenotic turbulence may be present. Given sufficient distance, organised laminar flow pattern tends to resume. In high-grade lesions and occlusions, the downstream waveforms may show delayed systolic peak, tardus-parvus waveform, and decreased velocities (Figure 14). Inward flow of collaterals can also be seen in vascular beds where collateralisation is possible such as in the extremities (Figure 15). Vasodilatory changes in the downstream arterial bed may also result in reduced resistance of the vascular bed with corresponding decrease in the resistance of the arterial waveforms. Such changes are easier to observe in high resistance beds since high resistance beds can become low resistance. Decreased resistance is characterised by reduced pulsatility and increased diastolic flows. In cases of extreme peripheral arterial disease, there may be almost complete loss of arterial pulsatility (Figure 16)[1,2,3,4,14,15,16,17].

Upstream (proximal) to severe stenosis or occlusion

In low resistance beds, increase in resistance and decreased flow velocities can be observed upstream to a severe stenosis or occlusion. A classic example of this phenomenon is externalisation of the CCA waveform which occurs with ICA occlusion (Figure 17). In high resistance beds, there may be no obvious spectral Doppler changes. Outward flowing collaterals can be observed in the extremities, and arterial sampling near large collaterals may show reduced resistance even upstream to a stenosis[2,3,14,18].

Blind-ended channels

Blind-ended channels are areas lacking any effective volume throughput. Vessel compliance allows a bolus of blood to enter in systole, but the entire volume then leaks out of the conduit in the retrograde direction in diastole. All of the following are examples of blind-ended channels: pseudoaneurysms[1,2,4], closed-ended endoleaks[19,20], and venous outflow occlusion of an organ (such as occlusive thrombosis [21,22,23] or venous torsion[24]). The hallmark of blind-ended channels is that the forward systolic component of the spectral waveform shows the same surface area as the reversed (diastolic) component. Figure 18 demonstrates three examples of blind-ended channels and their corresponding waveforms. Forward systolic flows are highlighted in red and diastolic flows in blue. Note that in each example, the red and blue surface areas are roughly equal. Another example of a blind-ended channel is presented in Figure 19. In this example, an extremity bypass graft made of native vein is sampled at its origin. The proximal part of the graft is patent, it demonstrates a high-resistance waveform, and flow velocities are within normal limits at 80 cm/s (left image). These findings

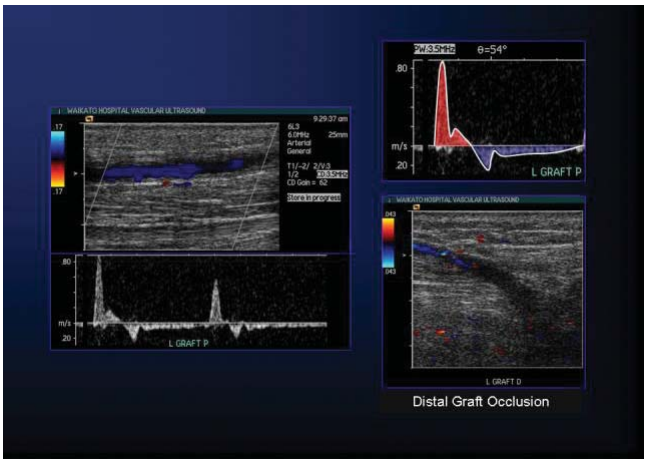

Figure 19: Distal occlusion of a lower extremity bypass graft. The origin of this native vein graft is patent and demonstrates normal velocities and high resistance waveform. Careful examination of the waveform (top right) reveals that systolic forward flow surface area (red) is similar to diastolic reversed flow area (blue). This waveform suggests the lack of effective volume throughput in this graft. View of the distal graft confirms the presence of graft occlusion.

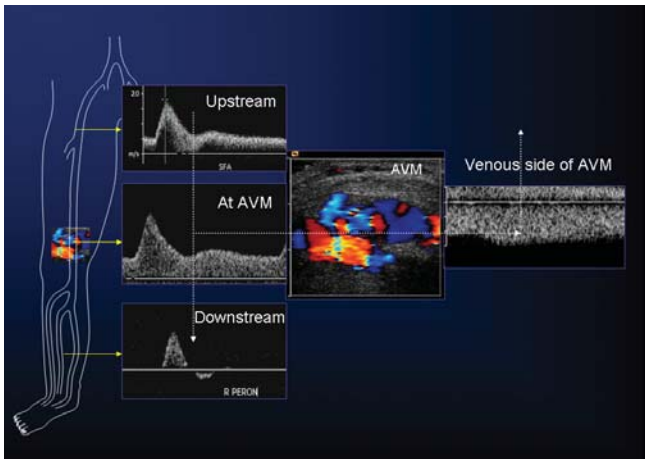

Figure 20: Effect of AVM on spectral Doppler waveforms. In the lower extremity upstream waveforms in the femoral artery demonstrate high velocity low resistance flows. High velocity, low resistance, and turbulence are found at the site of the AVM. Downstream from the AVM, high-resistance triphasic flows resume. Venous outflow of the AVM is hyperdynamic and may be pulsatile.

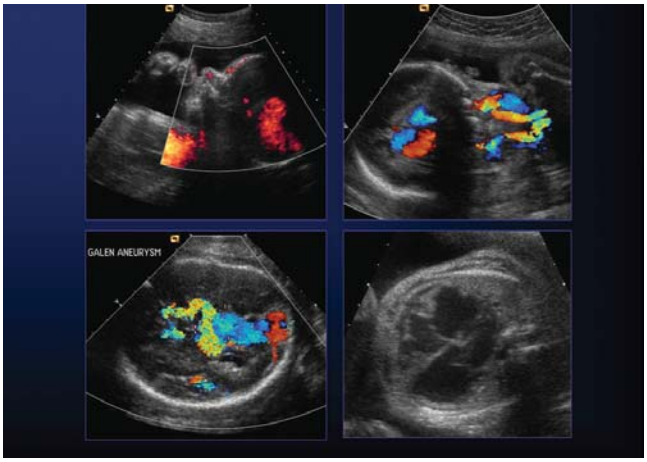

Figure 21: Sonographic findings associated with fetal vein of Galen aneurysm. Highly vascular intracranial lesion is seen (left upper, lower). Neck vessels are grossly dilated (right upper). Cardiomegaly (bottom right) secondary to high output cardiac failure is present. Associated polyhydramnios and hydrops can be seen in severe cases.

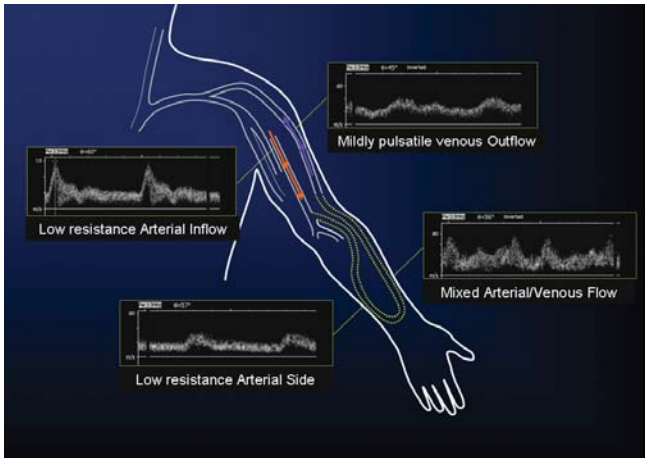

Figure 22: Changes in flow characteristics at various points within dialysis fistulae. An example of a synthetic brachio-cephalic dialysis loop is shown (dotted yellow lines). Inflow through the native artery is of high velocity and low resistance. As flow travels though the dialysis graft from the arterial to venous side, the flow gradually acquires more venous characteristics[28].

would normally be reassuring. Note, however, that the systolic and diastolic flow components are equal in terms of their surface area (top right). This represents a blind-ended channel with no effective volume throughput. As suspected on the basis of this waveform, distal occlusion of the graft was confirmed on colour Doppler (right lower).

Arterio-venous connections

An arterio-venous connection (AVC) can be thought of as any abnormal or artificial connection between an artery and a vein where the capillary bed is bypassed[3,4]. Often, the terms malformation or fistula are applied rather interchangeably. AVCs include:

1) Congenital lesions such as vein of Galen aneurysms, haemangioendotheliomas and other arterio-venous malformations
2) Iatrogenic fistulae such as dialysis fistulae or incidental fistulae resulting from vessel punctures.
3) Acquired lesions due to trauma or tissue ischemia, inflammation, and necrosis[2,3].

Since AVCs bypass the arteriolar and capillary beds, their presence is associated with a dramatic loss of vascular resistance. The great pressure differential between the feeding arteries and the efferent veins results in large volume throughput (recall Poiseuille's law in Figure 2). Spectral Doppler changes upstream (proximal) to the lesion include very high velocities and unexpectedly low resistance. The lesion itself is hypervascular on colour Doppler interrogation. Perivascular colour artefact (colour bruit) is frequently seen. Spectral Doppler again shows high velocities, low resistance, and turbulence. Spectral waveform observations downstream from AVC may demonstrate variable characteristics ranging from little observable change, to an increase in resistance, and steal phenomena. The veins draining an AVC show venous engorgement (dilation), pulsatility, turbulent flows and increased flow velocities[1,14,25,26,27]. An example of a congenital AVC and its effect on waveforms in the lower extremity in a young adult patient is presented in Figure 20.

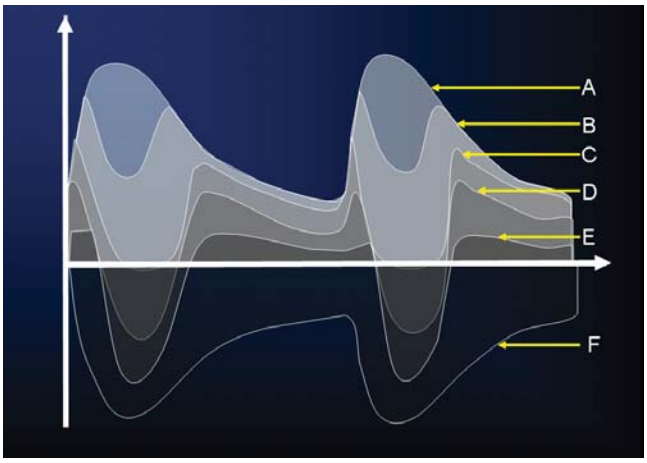

Figure 23: Vertebral artery waveform changes with advancing steal Normal vertebral artery waveform demonstrates continuous forward flow (A). In presence of early steal, the peak of the vertebral artery begins to invert during systole (B). Progression of subclavian disease results in increasing systolic peak inversion (B, C) until the peak reverses below the baseline (D). To-and-fro flow patterns (D, E) are seen when the systolic peak falls below the baseline while the diastolic flow continues in the forward direction. In the final stages of the steal the entire waveform shows continuous flow reversal (F).

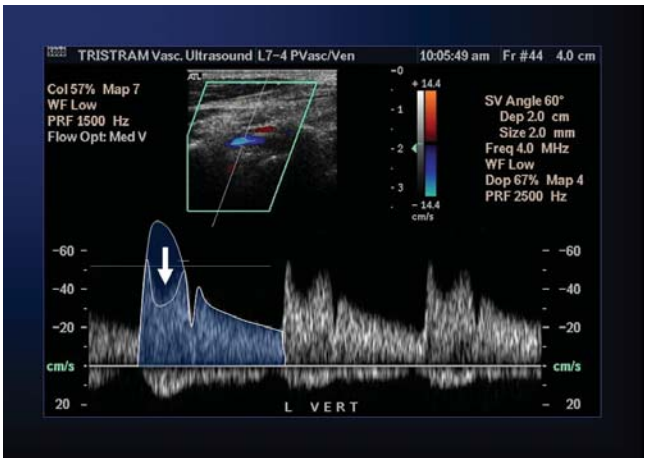

Figure 24: Early subclavian steal waveform with continuous forward flow and systolic peak inversion.

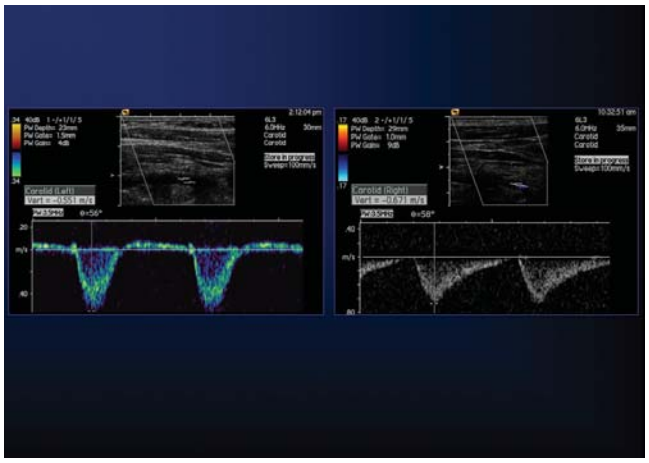

Figure 25: Vertebral waveforms in subclavian steal syndrome. To-and-fro vertebral artery waveform (left), and waveform with continuous flow reversal (right).

AVC, where the volume of shunting is sufficiently great, may even lead to cardiac compromise and the development of high output cardiac failure. These effects can be seen in a number of large congenital AVCs detected antenatally (Figure 21). Fetal heart failure may, in turn, lead to polyhydramnios and hydrops.

A classic example of an AVC which clearly demonstrates the changes in spectral waveforms between the arterial and venous systems is the dialysis graft. The normal high resistance triphasic arterial waveform of the extremity is replaced by high velocity low resistance waveforms. As flow continues through the dialysis loop, the flow characteristics tend to change from a purely arterial waveform to a mix of arterial and venous waveforms. At the venous end, the waveforms continue to exhibit high velocities but the signal signature is more venous (Figure 22)[28].

Steal phenomena

Steal phenomena occur when reduced resistance of a vascular bed results in sufficient pressure drop to attract flow from vessels (or parts of vessels) which do not normally supply this arterial bed. Sometimes this process may have detrimental effects on the surrounding vascular beds from which it 'steals' flow. Arterial steals typically occur in association with occlusive arterial disease or at sites of AV connections.

The best known steal phenomenon is the subclavian steal which results from a high grade stenosis or occlusion of the proximal subclavian (or brachiocephalic) artery. The lesion must be proximal to the origin of the vertebral artery since this vessel is implicated in the steal phenomenon. As disease of the subclavian artery progresses, flow in the ipsilateral vertebral artery preferentially reverses and supplies the arm. Before full reversal of the vertebral artery occurs, the vertebral artery undergoes progressive changes corresponding to the severity of the subclavian artery disease. These changes are shown diagrammatically in Figure 23. Note that in milder forms of subclavian disease, the systolic peak of the vertebral artery waveform begins to invert despite there being no flow reversal (Figure 24). With further progression of subclavian disease, the peak inverts deeper until it 'dips' below the baseline in systole while the diastolic flow is still in the forward direction. Only in the final stages of subclavian steal does the entire waveform demonstrate continuous reversed flow (Figure 25)[2,3,14,29,30].

Steal phenomena can also be observed at the sites of AV fistulae[31]. Figure 26 demonstrates the anastomosis of a radiocephalic dialysis fistula to the radial artery. Note the reversal of the distal radial artery as the fistula steals blood from the distal circulation.

Similar steal phenomena may occur at sites of congenital arterio-venous malformations such as in association with cerebral AVM – vein of Galen aneurysm[32]. The AVM reduces tissue perfusion of the surrounding brain parenchyma and contributes to brain ischaemia. This process is captured on images in Figure 27. Note the profound difference in arterial Doppler waveforms between the vessels feeding the malformation (left) and those which supply the rest of the brain parenchyma (right). The waveform on the right is being denied forward diastolic flow due to the siphoning and stealing of the flow by the AVM, which itself shows highly elevated diastolic flow.

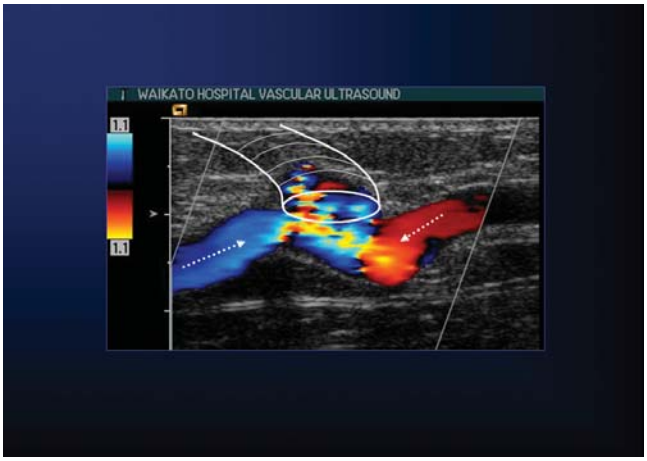

Figure 26: Steal effect caused by dialysis fistula colour flow image of the anastomosis of a dialysis graft onto a native artery demonstrates a steal effect with flow reversal of the distal native artery.

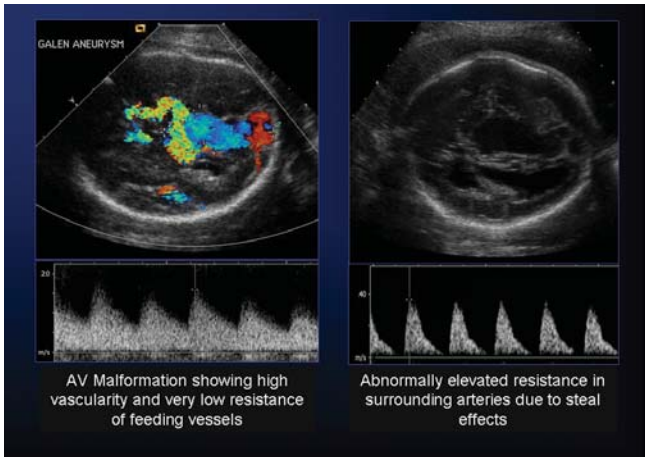

Figure 27: Steal effect caused by AVM in the fetal brain.

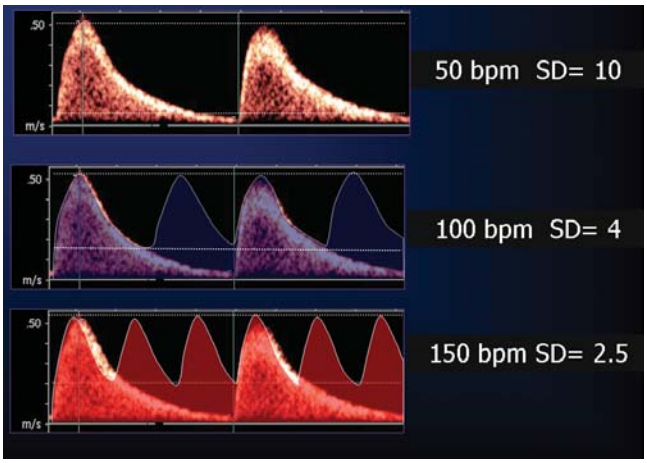

Figure 28: Effect of heart rate on SD ratio. Top image represents grossly elevated SD ratio in a normal-size fetus with congenital complete heart block. If the heart rate was artificially elevated to 100bpm, the SD ratio would theoretically fall to approximately 4. If the heart rate was normal at 150bpm, the SD ratio from this waveform would also be normal at 2.5 While in this case correction for heart rate was only estimated, this figure demonstrates the dependence of ratios on heart rate.

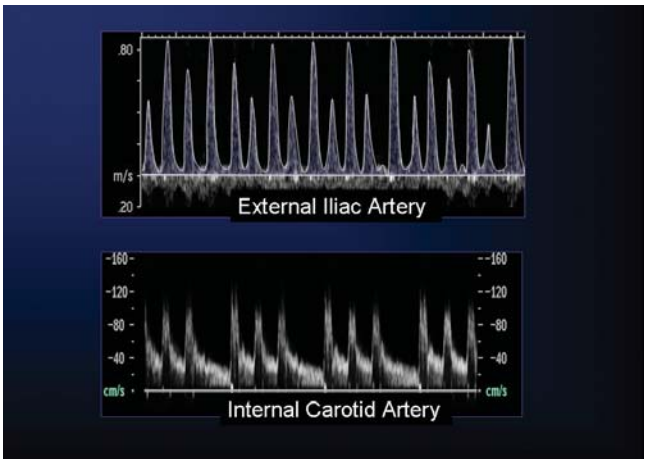

Figure 29: Arrhythmias seen on spectral Doppler waveforms
Irregular arrhythmia is seen in the waveform of the external iliac artery (top image). Also note the presence of rounded peak and forward diastolic flow in this waveform. These features are consistent with severe upstream (proximal) disease. Bottom image shows regular arrhythmia (trigeminy) in an otherwise normal ICA waveform. The sonographer should avoid measuring the highest peaks, as they may give impression of elevated velocities and suggest the presence of stenosis.

Effects of the cardiac pump

While the heart drives blood flow by providing a pressure gradient, the characteristics of spectral waveforms are influenced mainly by vascular resistance and vessel disease. However, there are several important considerations with respect to the cardiac pump.

First, heart rate alone has a major influence on waveform ratios (RI, SD, and PI) as demonstrated in Figure 28. The top image in this figure represents a spectral Doppler of the fetal umbilical artery in a third trimester fetus with heart block. The SD ratio is grossly elevated to SD = 10. In normal circumstances we would consider this a negative prognostic sign. However, the fetal heart rate is very low. If the heart-rate of this fetus was theoretically doubled from 50 to 100, the ratio would have dropped from 10 to approximately 4 (middle image). A rate of 100 bpm in a fetus is still too low. Tripling the original rate from 50 to 150 bpm (the mean heart rate in 3rd trimester) would reduce the SD ratio to within normal limits (2.5 in this example). Therefore, heart rate should be taken into consideration when measuring SD, RI, and PI. All factors remaining the same, increased heart rates lower waveform ratios, while decreased heart rates increase ratios.

Cardiac arrhythmias also influence spectral waveforms in terms of spacing of systolic peaks on the time axis (X-axis), and influencing the peak systolic velocities which are a reflection of the strength of cardiac contraction[1]. Figure 29 shows examples of spectral Doppler waveforms from patients with irregular and regular arrhythmias. Variability of waveform peaks has some implications on peak systolic velocity measurement. In practice this does not pose a significant diagnostic problem as long as the operator attempts to record representative velocities and avoids measuring the highest or lowest peaks of the waveforms.

Stenosis of the aortic outflow (sub-aortic stenosis or aortic valve stenosis) may also have an effect on downstream waveforms. These changes have been discussed in detail in the section on stenoses. In particular, delayed acceleration

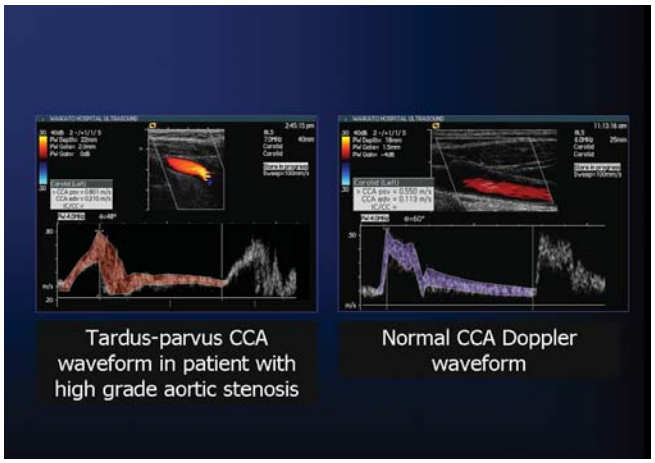

Figure 30 CCA waveform in patient with high grade aortic stenosis versus normal CCA waveform

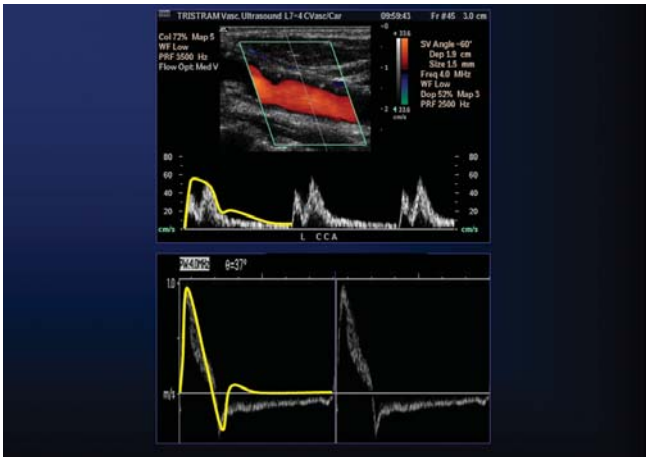

Figure 31 Possible effects of severe aortic regurgitation on carotid and subclavian spectral waveforms. In each example the expected normal waveform is indicated by yellow line. The top image demonstrates a bisferious (double peaked) CCA waveform, while the bottom image shows a subclavian artery waveform with holodiastolic reversal.

of all distal waveforms may be observed. Figure 30 demonstrates a comparison of CCA waveforms obtained from a patient with aortic valve stenosis and normal patient. Effects of aortic regurgitation (AR) are often difficult to observe. In very severe AR, bisferious (double-peaked) carotid artery waveforms and holodiastolic subclavian artery reversal may be seen (Figure 31)[1,14,33,34,35].

Finally, systemic peak systolic flow velocities tend to rise in patients with hypertension, whereas they tend to be reduced in patients with low cardiac outputs[1,2,3,36,37].

Conclusion

Spectral Doppler waveforms provide a wealth of information about arterial flow abnormalities and hold vital diagnostic clues applicable to a wide range of clinical scenarios. Familiarity with haemodynamic principles and the effects of pathophysiologic processes on spectral waveforms are of increasing importance to sonographers across a variety of ultrasound subspecialties.

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Tumour angiogenesis with ultrasound imaging

Peter Burns

Introduction

Of those emerging areas of diagnostic application for ultrasound, one of the most intriguing is the challenge of imaging angiogenesis. Angiogenesis is the term used to describe the development of a tumour's blood supply, an important component of its malignant progression[1–3]. Without such a supply, a breast cancer *in situ*, for example, will grow to a few millimetres and remain harmless. It is estimated that about 40% of women aged 40–50 have such lesions, yet less than 1% go on to have clinical cancer[4]. This minority of lesions undergoes a process known as malignant angiogenesis, in which new vessels grow from the host into the cancer. The vessels provide a supply of oxygen and nutrients for the cancer cells to grow, as well as a conduit through which they can metastasise to distant organs in the body. From a diagnostic point of view, it is these angiogenic lesions, not every breast lesion, that we need to be able to identify. Although known for many years, it is only recently that advances in the understanding of angiogenic transformation, and particularly the potential to modulate it using new drugs, have propelled this field into the forefront of cancer research[5]. Angiogenesis in breast cancer, for example, has implications for diagnosis, prognosis and treatment. Identifying those breast cancers, which have new blood vessels, may help to distinguish ductal carcinomas *in situ* from the much smaller number among them which are exhibiting malignant progression and presumably need to be treated more aggressively. Once a cancer has been identified, it is been shown that the number and density of blood vessels provides additional prognostic information which is independent of clinical staging, perhaps offering potential to better tailor therapy to an individual patient's disease. Finally, a large number of new treatment strategies target the proliferating vasculature of a developing cancer, including drugs specifically designed to inhibit the angiogenic transformation itself. For these reasons, the ability to provide imaging information on the status of blood supply to breast cancer is of enormous clinical significance.

Imaging angiogenesis

Direct imaging of the angiogenic circulation is extremely challenging as the vessels are small, pathological and beyond the resolution limit of conventional radiological imaging[6]. However, the pathological characteristics of these vessels, which influence both morphology and the dynamic properties of blood flowing within them, offer several possibilities for identification by non-invasive means. Magnetic resonance imaging, for example, appears to be capable of revealing the presence of these vessels by virtue of their increased permeability.

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Principle of pulse inversion imaging

A sum is formed between the echoes from two consecutive pulses of opposite phase. Linear echoes from tissue are inverted copies of each other and cancel. Even nonlinear components of microbubble echoes sum constructively, producing a harmonic signal.

Ultrasound imaging may be able to show changes in the volume of tumour tissue occupied by blood, as well as changes in overall flow rate at the microvascular level by means of ultrasound contrast agents. These agents comprise microbubbles of gas stabilised by a shell of biocompatible material, creating a particle, which is smaller than a red blood cell and harmless to the patient. The bubbles are induced into nonlinear oscillation by a sound field, causing them to emit echoes which can be identified and distinguished from those due to ordinary tissue. Two approaches can be used for contrast imaging; both of which have recently become available for breast diagnosis on commercial ultrasound systems. In the first, very low ultrasound intensities (MI < 0.1) are used to excite resonant bubbles in a pulse inversion mode. In this mode, now commonly used for tissue harmonic imaging, a series of pulses of alternating phase or amplitude are sent into tissue[7]. The resulting echoes are combined so that those from normal (that is, linear scattering) tissue cancel, whereas those from oscillating bubbles do not. The result is a real-time image in which the tissue appears dark and the bubbles are bright. In spite of the fact that the bubbles are only a few microns across, this method is so sensitive that it can identify individual bubbles. For diagnosis, however, many cancers have a similar bulk flow rate and volume as normal tissue. What is needed is some indication of the morphological changes to the vasculature brought about by malignant transformation.

Although the angiogenic vessels lie below the resolution of the ultrasound image, the ability to detect individual bubbles is exploited further in a new method designed specifically for contrast breast vascular imaging known as microvascular contrast imaging (MVI). Here, individual bubbles are tracked as they pass through the tumour, building an image reflecting morphological structure in the tumour. Dramatic differences are evident between benign vascular lesions in the breast, such as fibroadenoma and cancers.

In the second method, bubbles are allowed to fill the tumour vascular space (this takes about 5–10 seconds fol-

lowing their arrival) and then scanned for a brief period at high MI (MI > 0.5). The bubbles are subjected to strong harmonic oscillation resulting in their disruption. When they disintegrate, the bubbles emit a strong nonlinear signal, resulting in a single frame flash image. This image reflects the total vascular volume of the tumour and forms the basis of its use in liver and cardiac perfusion imaging[8]. Scanning is then initiated at low MI and the refilling of the cleared vascular space by fresh bubble monitored. The rate at which this refilling takes place reflects the flow rate into the microvessels. This microbubble destruction-reperfusion method for measuring flow rate at the microvascular level has been validated against the laboratory standard method of radio labelled microspheres.

This method is being applied successfully to the quantitative monitoring of anti-angiogenic therapies in animal models, in anticipation of the significant number of clinical trials of new anti-angiogenic agents awaiting assessment[9].

The first results from the anti-vascular tubulin-rounding agent ZD6126 have been published in *Cancer Research*[10]**.** If, as is to be hoped, the low toxicity of such drugs coupled with their dramatic effect on the growth of cancer can be demonstrated in human subjects, it is likely that the unique ability of contrast microbubbles to measure tumour blood flow in an easy and inexpensive manner will create a new and exciting area of application for ultrasound imaging.

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Understanding new technology in ultrasound

Peter Burns

Introduction

The clinical application of ultrasound imaging continues to be propelled by innovation in its technical instrumentation, which in turn follows improvements in our understanding of the fundamental mode of action of ultrasound: ultrasound physics. Of course, there are refinements in the presentation of images, such as 3D and extended field of view imaging, which are attractive and may add to the clinical utility of the ultrasound examination. Perhaps more exciting, however, are technical developments that have arisen from new understanding of sound itself and its interaction with tissue. It is some of these that we consider in this presentation.

High frequency imaging and Doppler ultrasound

The most obvious impact of raising the frequency of an ultrasound scan is to improve its resolution: a 100 MHz image can resolve structures of about 15 mm, revealing detail at the cellular level. Of course, penetration is also reduced to the millimetre range, restricting studies to superficial tissue. Transducer technology, which has successfully constructed both linear, phased and mechanically driven transducers on the tips of catheters of less than 1 mm diameter, mean that intravascular, intraductal and even biopsy needle ultrasound imaging is likely to become more commonplace in the future.

Recent studies examining the limits of flow detection of the microvasculature with high frequency Doppler indicate that 50 MHz can detect flow in individual arterioles of diameters of about 15 mm[1]. At this frequency, flow velocities of less than 1 mm/s (corresponding to capillary flow) can be detected non-invasively and in real-time, to a maximum depth of approximately 6 mm.

Combining high resolution imaging with high frequency Doppler produces colour Doppler images that can depict, for example, the chaotic vasculature of a superficial melanoma of the skin or eye. Such studies have a special relevance to the current generation anticancer drugs which target this angiogenic vasculature and for which at present there exists non-invasive means of assessment. They may also herald a new scale of ultrasound imaging for a curious new patient: the mouse. Genomic research creates genetic models of disease in the mouse – 50 million in the US alone this year – the imaging of which presents a unique problem to biomedical research which high frequency ultrasound seems to be able to address.

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Bubbles and flow imaging

Back in the human body, how can organ flow at the capillary level be imaged, not 6 mm but 16 cm from the transducer? Detecting flow velocities 1000 times slower than those of the aorta in vessels with one millionth of the cross-sectional area would seem an impossible task, yet the combination of micro bubble contrast agents and non-linear imaging have achieved real-time imaging of tumour blood flow and capillary perfusion of the myocardium in the beating heart; a first in medical imaging.

It was Lord Rayleigh who first described the non-linear radial motion of a gas bubble in an acoustic field at the turn of the last century. His theory, subsequently elaborated by a series of investigators, predicted that a bubble, driven into non-linear resonant oscillation by an incident sound field, gives rise to a scattered signal that contains higher harmonics of the incident frequency. This observation, made to explain the creaking noise his kettle made as he boiled water for a cup of tea, led one hundred years later, to the development of a method which forms an image from the components of the echoes around the second harmonic of the transmitted frequency. These first harmonic images were made as part of an attempt to improve sensitivity to micro bubble contrast agents in very small vessels[1]. They have, however, stimulated fresh investigation of non-linear acoustic phenomena in tissue and an interest in non-linear imaging methods which is sure to be sustained into the new millennium.

Contrast harmonic imaging: seeing perfusion

For micro bubble contrast agents, harmonic imaging led to the first contrast enhanced images of blood at the microvascular level, including myocardial perfusion. Harmonic Doppler imaging, in which Doppler detection is performed on the second harmonic component of the echo, provides an entirely new method of tissue motion (or 'clutter') rejection which combines radio frequency and Doppler frequency filtering. The specificity of such a method to bubbles over moving tissue led to the detection of vessels down to the diameter of about 40μm[2]. At the same time, some unanticipated properties of these images became apparent. First, with high incident sound pressure, the harmonic signals from micro bubbles were found to be transient in nature. This was subsequently shown to be a result of bubble destabilisation and fragmentation caused by successive pulses of the incident ultrasound field. Echoes from the first few pulses are strong and particularly rich in harmonics. These echoes, which can be detected by Doppler schemes even when the micro bubbles are almost stationary in tissue, now provide the basis for perfusion imaging of the myocardium[3]. Second, ordinary tissue could be seen on a grayscale harmonic image, even if the bandwidth of the image was

restricted to a narrow region around the second harmonic. First considered as an artefact in harmonic contrast imaging these 'tissue harmonic' images have since been shown to have peculiar characteristics which render them in many cases superior to conventional ultrasound images.

Tissue harmonic imaging

Harmonic imaging for micro bubble contrast agents was originally developed under the assumption that tissue is linear and all harmonic echoes are generated by the bubbles. In fact, tissues like bubbles are non-linear systems. Whereas the harmonic echoes from bubbles have their origins in non-linear scattering, those from tissue are a result of non-linear propagation and subsequent linear scattering. In non-linear propagation, the propagation speed of a wave, c, is not constant as is assumed in linear acoustics, but it is a function of the particle velocity due to the wave disturbance, $c = c_0+bu$, where u is the particle velocity and b is the coefficient of non-linearity of the medium[4]. Thus, the positive peak of the wave where the particle velocity is high has a faster propagation speed than the negative peak of the wave where the particle velocity is low. This variation of the propagation speed results in a waveform distortion also referred to as wave 'steepening', which shifts energy from the fundamental to the higher harmonic components. It is analogous to the sharpening of a wave as it approaches the beach; drag from the bottom slows the bottom of the wave as the part above it continues at its original velocity.

Non-linear propagation of sound waves from the focused beams in tissue used to make images has some interesting properties that contribute to the characteristics of tissue harmonic images. The fundamental beam is generated at the transducer whereas the harmonic beam is generated continuously along the propagation path as a consequence of the local instantaneous amplitude. The harmonic beam can be considered as a volume source that starts at the transducer and extends out to the point of interest. Because it has double the frequency, the harmonic beam is narrower than that of the fundamental energy. Its side lobes, responsible for degradation of image contrast, are lower than those of the fundamental. These properties result in increased lateral resolution, reduction of the multiple reflections due to a poor acoustic window, and overall reduction of haze or 'clutter'. Inhomogeneities of the speed of sound in superficial tissue layers causes phase aberration in the fundamental beam, distorting the resulting image. The harmonic beam is not fully generated until the focus and beyond and consequently suffers less from aberration in superficial tissue. This explains the reduction of 'haze' in abdominal images and the improved border delineation in echocardiography. In tissue harmonic imaging we can consider the echo to be replaced by a volume source that extends from the transducer to the point of interest. Progress in this area hinges on our ability to understand and control the formation of this source. The image improvements realised so far may well herald the beginning of a new era in beam forming in tissue.

Pulse inversion imaging

Harmonic imaging forces an inherent compromise between image resolution and contrast that limits its sensitivity to non-linear signals. Overlap in frequency between the fundamental and harmonic echoes results in linear echoes being detected in the harmonic signal, reducing contrast. Narrowing both the transmit and receive bandwidths reduces these effects, but at the expense of image resolution. This compromise limits both the resolution and contrast of harmonic imaging, and is especially significant at low transmit pressures when harmonic echoes are weak.

Pulse inversion imaging overcomes these limitations of harmonic imaging by detecting non-linear echoes over the entire transducer bandwidth[5]. It exploits the fact that second harmonic non-linear echoes from both micro bubbles and tissue are caused by an asymmetric response to regions of high and low pressure in the transmitted sound. In pulse inversion, two ultrasound pulses are transmitted down each line of sight, with the phase of the second pulse inverted. When the corresponding echoes are added together, the linear component cancels but the non-linear even harmonic components reinforce to produce a strong signal. By exploiting differences between echoes rather than within a single echo, pulse inversion imaging removes the fundamental components (and other odd harmonics) even when the fundamental and second harmonic overlap, thus overcoming the limitations of harmonic imaging. In particular, it allows micro bubbles to be detected with high resolution at low transmit intensities, making possible real-time contrast perfusion imaging. At higher transmit pressures, pulse inversion imaging also offers benefits for tissue harmonic imaging.

Target motion between pulses results in incomplete removal of the fundamental echoes, introducing a fundamental component into the pulse inversion signal that is approximately proportional to target velocity. While motion sensitivity aids in the detection of moving or disrupting micro bubbles, it may introduce artefacts from moving tissue in cardiac applications. The principles of pulse inversion imaging may be extended by transmitting more than two pulses of alternating polarity along each line of sight, a generalisation which we call pulse inversion Doppler[5]. Doppler frequency filters can now be applied to the detected echoes to provide improved suppression of moving tissue compared to the two-pulse method. Filters can be tailored for specific applications, such as contrast perfusion imaging, tissue harmonic imaging or bubble disruption imaging. At low incident pressures pulse inversion Doppler has provided the first real-time perfusion images of the myocardium.[6]

Trends

Non-linear imaging has had an extraordinary impact on ultrasound imaging already. Tissue harmonic imaging has decreased the technical failure rate in transthoracic cardiac studies and set new standards for border definition in abdominal imaging[7]. With ultrasound contrast agents, it has shown the first ever real-time images of capillary perfusion in tissue, with obvious implications for the future role of sonography. For bubble imaging, non-linear imaging methods have opened diagnostic ultrasound to the detection of blood at flows at least an order of magnitude below that achievable to date. These may place ultrasound in a unique position to assess, for example, tumour blood flow both diagnostically[8] and following drug or thermal intervention[9]. The liver and the breast suggest themselves as promising sites. New bubbles have been developed with a Kupffer cell specific post vascular phase that show sensitivities comparable to CT for the detection of liver metastasis[10]. In the meantime, high frequency duplex ultrasound imaging is

rapidly becoming a standard for imaging small animal and transgenic models of disease[11,12]. In addition, exploitation of the non-linear propagation of sound in tissue has provided a powerful new tool to manipulate beam properties and tackle tissue aberration problems, which are responsible for the 10–15% of patients whose body habitus is 'bad' for ultrasound imaging. Angiogenesis imaging has just begun in superficial cancers, such as those of the breast, lymph nodes, thyroid and cervix, and holds new promise for atherosclerosis imaging. In all of these cases, the ability of an ultrasound contrast study to act as a surrogate for angiogenesis offers the possibility that it may be the imaging method of choice to assess pro- and anti-angiogenesis therapies. This is an exciting possibility that will take ultrasound bubble imaging from the diagnostic stage, through guidance of therapeutic intervention, to follow-up of new molecular strategies to modulate blood flow in diseased tissue. The bubbles themselves are likely to become active players in this process, with surface ligands targeted to specific molecular entities (such as activated endothelium) and the shell itself housing therapeutic agents or even genetic material such as plasmid DNA. All of these potential applications have been demonstrated in animals already.

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What is the best video compression algorithm for digital fetal ultrasound videoclips?

D Watson, I Kromin, L Kastanis, A Lee-Tannock, G Duncombe, G Gardener, A Chang and FY Chan

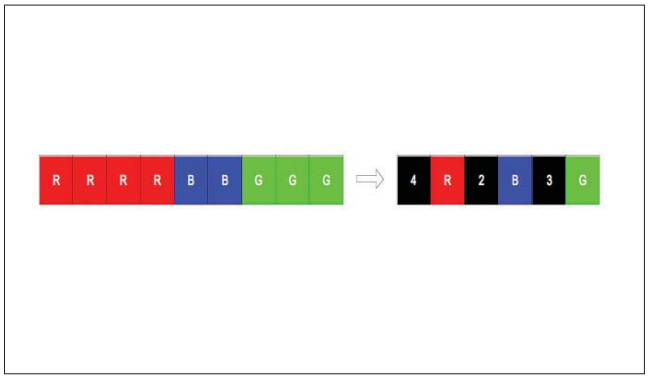

Figure 1: Lossless run length encoding (RLE).

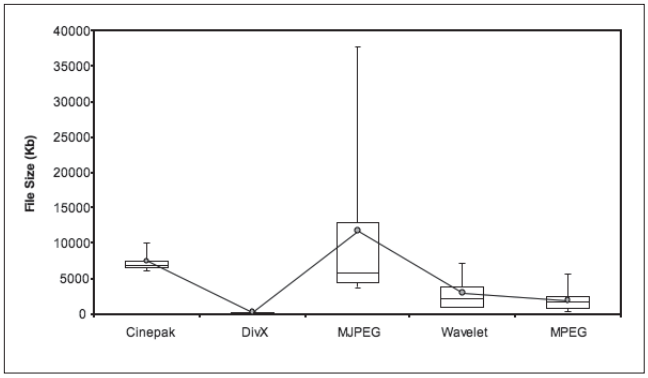

Figure 2: analysis of file sizes versus CODEC.

Background

Australia is a large country with low population density. Telemedicine offers remote specialist care to regional communities, and is especially suitable for health care in Australia.

Real time teleultrasound for remote fetal diagnosis has been shown to be both accurate and cost effective. However, it requires two clinical teams to be simultaneously present and high bandwidth for transmission.

The newer generation of ultrasound machine can acquire videoclips of fetal images digitally, which can then be sent to remote specialists for consultation.

Uncompressed videoclips are, however, large (file size about 190MB for a 5 second clip), making storage and transfer difficult.

Compression

- Static image compression.
  - Lossless: All data preserved with compression rates of 2:1 to 10:1.
    - Two techniques: Huffman or Run length encoding (RLE).
  - Lossly: Reduces the number of visible colours or number of grey scale with compression rates of 10:1 to 100:1 and can loose large amounts of data.
    - Two techniques: Discrete cosine transformation (DCT) to Discrete wavelet transformation (DWT).
- Temporal compression: Codes changes from image to image only.

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Aim

To find the best videocompression algorithm for fetal ultrasound videoclips, without compromising clinical image quality.

Methods

Six five-second digital videoclips of normal fetal cranial morphology were obtained at 20 weeks gestation.

Three clips were then compressed using five contemporary and commonly available compression/decompression algorithms (CODEC): PICVideo™ M-JPEG, PICVideo™ Wavelet2000, Cinepak, MPEG0-1, and DivX5.2.

For each CODEC, except Cinepak, four quality settings (1–4) were selected to yield different file sizes (increasing quality settings increases file size). A total of 17 compressed files per videoclip were produced (file size range: 120 KB to 32 MB). Compressed file sizes for five CODECs were chosen for testing**.** The processed videoclips were de-identified and shown in random order to five experienced clinicians. Each clinician assessed the quality of the clips using a seven point scale for anatomy, sharpness, greyscale and overall assessment.

Analysis of interobserver variability was conducted using Wendall W test for concordance.

Comparison of the image quality between the com-

Table 1 Ratings of compression systems

CODEC	Quality setting 1 – worst	Quality setting 2	Quality setting 3	Quality setting 4 – best
Cinepak	Default quality settings for black and white video compression			
DivX	pre-processing = off change threshold = 50% max keyframe interval = 300 single pass avg bitrate = 1 kbps performance = standard	pre-processing = off change threshold = 50% max keyframe interval = 300 single pass avg bitrate = 1333 kbps performance = standard	pre-processing = off change threshold = 50% max keyframe interval = 300 single pass avg bitrate = 2667 kbps performance = standard	pre-processing = off change threshold = 50% max keyframe interval = 300 single pass avg bitrate = 4000 kbps performance = standard
MJPEG	compression quality = 1 luminance quality = 95 chrominance quality = 100 subsampling = 4:2:2	compression quality = 7 luminance quality = 65 chrominance quality = 70 subsampling = 4:2:2	compression quality = 13 luminance quality = 35 chrominance quality = 38 subsampling = 4:2:2	compression quality = 20 luminance quality = 0 chrominance quality = 0 subsampling = 4:2:2
Wavelet	compression quality = 1 filter = b09 colour space = YUV subsampling = H2:1 V2:1 luminance quality = 400 chrominance quality = 210	compression quality = 3 filter = b09 colour space = YUV subsampling = H2:1 V2:1 luminance quality = 320 chrominance quality = 190	compression quality = 8 filter = b09 colour space = YUV subsampling = H2:1 V2:1 luminance quality = 120 chrominance quality = 100	compression quality = 10 filter = b09 colour space = YUV subsampling = H2:1 V2:1 luminance quality = 40 chrominance quality = 40
MPEG	force framerate = 60 FPS bitrate = 80 kbps standard quantization standard motion search	force framerate = 60 FPS bitrate = 1306kbps standard quantization standard motion search	force framerate = 60 FPS bitrate = 2694kbps standard quantisation standard motion search	force framerate = 60 FPS bitrate = 4000kbps standard quantization standard motion search

Table 2: Ratings of compression systems

Compression	File size	Size of original
Original	194 MB	100.0%
DivX (4)	0.4 MB	0.2%
Wavelet (4)	6.4 MB	3.4%
Cinepak	7.3 MB	3.8%
MJPEG (4)	31.8 MB	16.4%

pressed videoclips was performed using Kruskal-Wallis one-way analysis of variance.

Results

There was a very close agreement between the observers: Concordance was 0.92 ($p < 0.0001$). As a whole, compression reduces the overall quality of the video clips ($p = 0.0004$).

When image quality using specific CODECs were compared to the uncompressed clip, there were significant reduction in quality for the following clips: DivX (1) $p < 0.0001$, DivX (2) $p < 0.001$, Wavelet (1) $p = 0.001$, Wavelet (2) $p = 0.001$, MPEG (1) $p = 0.001$, MPEG (2) $p = 0.01$, MPEG (3) $p = 0.05$. There were four compressed video clips that scored similar to the uncompressed originals: – Cinepak, DivX (4) MJPEG (4) and Wavelet (4). For file size see Table 2.

Conclusion

The best videocompression algorithm for fetal ultrasound videoclip that results in no significant deterioration of clinical image quality, and with the smallest file size is DivX (4), followed by Wavelet (4), Cinepak, and MJPEG (4).

Further work is in progress to automate the compression process, so that it can be easily applied in the clinical setting.

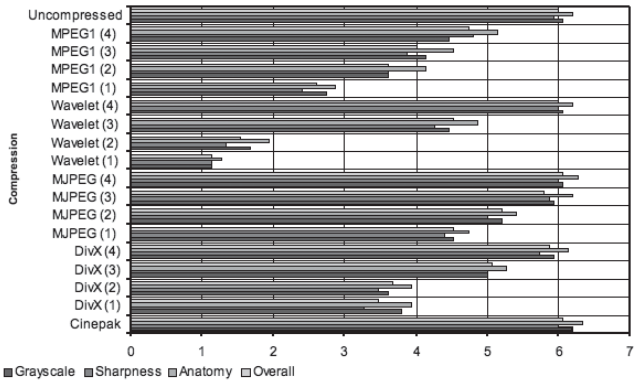

Figure 3 Summary of subjective evaluations for video quality

Acknowledgement

We acknowledge the statistical support received from the Mater Research Support Centre.

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Objective quality measure of compressed ultrasound video

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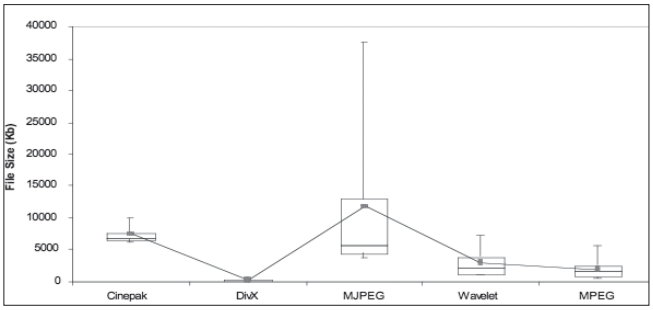

Figure 1: Compressed file sizes for five CODECS.

Aim

To develop an objective method for assessing the quality of compressed fetal ultrasound video clips as compared to its original uncompressed version and to compare the performance of this objective method of assessment with subjective clinical evaluation of the video quality.

Background

Video quality evaluation was based on the difference between compressed and uncompressed video.

Small differences indicated a compressed video of high quality, and significant differences indicated low quality. Quality statistics were developed based on this principle.

Two main methods were used, aiming to arrive at a single 'number' to indicate quality of the compressed video. (e.g. '10' indicates excellent quality, '1' indicates poor quality.

These methods were based on:

a) Root Mean Square (RMS) calculation of a video and;
b) A Smoothed Convoluted Pixel difference based on acuity (PDA) between video frames.

Methods

Analysis was based on extracting the first, middle and last frames of each loop. Frame extraction was done using automated scripts in VirtualDub. Analysis was performed using a custom built tool (vdrank).

A helper application (vdhelper) was developed to generate the automatic VirtualDub scripts.vdrank used four steps to calculate quality measurement.

These were:

- Load compressed frame;
- Load original (uncompressed) frame;

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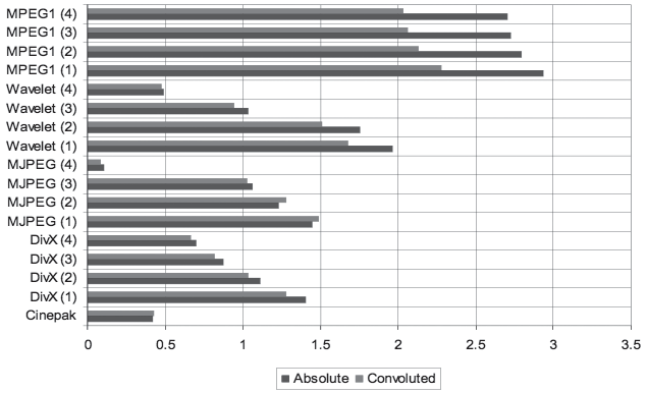

Figure 2: RMS quality measure results averaged over six videos.

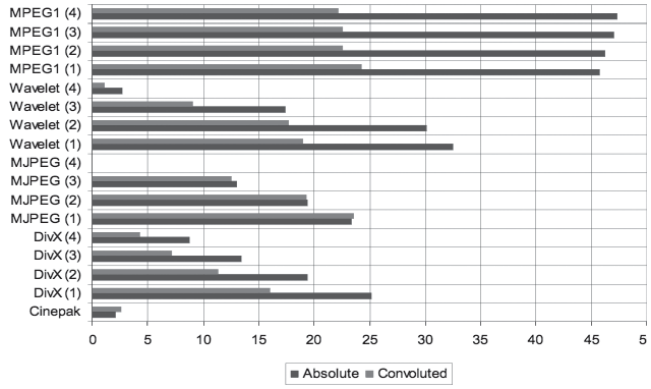

Figure 3: Pixel difference count averaged over six videos.

- Calculate difference matrix; and
- Compute quality rank on the difference matrix.

When calculating the difference matrix, either the absolute difference between pixel intensities in an image or a 3 x 3 convolution matrix can be used. When computing quality rank, either the pixel difference count can be used to generate a measure of quality or the RMS of the difference matrix.

The results of these objective assessments were compared to clinical subjective evaluations performed in a separate experiment.

Results

The two objective methods of analyses were significantly correlated to each other, with correlation coefficient r = 0.99 ($P < 0.0001$).

RMS tended to have less deviations in intensity errors across the difference matrix, and therefore was determined not to be proficient in determining vast changes in video quality.

PDA results were closer to the subjective observations. The range of quality ranks also varied from 0% difference between compressed and uncompressed frames, to over 45% difference.

Comparing RMS and PDA, it appears that PDA tends to represent the difference between compressed and uncompressed frames more realistically. Since RMS gives the average luminosity error, it fails to portray the amount of change between frames.

PDA counts the number of changes between frames, therefore it estimates the difference on an image basis and not an error basis as with RMS.

Conclusions

Both the RMS and PDA methods of quality assessment showed significant correlation to subjective clinical assessment of videoclip quality.

PDA may be a better differentiating algorithm when compared to RMS.

Acknowledgement

We gratefully acknowledge the statistical support received from the Mater Research Support Centre.

ASUM POLICIES AND STATEMENTS

The following decisions were made relating to ASUM's Policies and Statements by the ASUM Council in 2005. Full texts of all policies and statements can be seen at www.asum.com.au.

1 **Policy B2: Guidelines For Disinfection Of Intracavitary Transducers** was substantially amended and published in ASUM *Ultrasound Bulletin* May 8 (2): 22.

2 **Policy B3: Policy on Providing Ultrasound Images of the Fetus to Prospective Parent During an Ultrasound Examination** was amended by the addition of Point 3 under the heading "Comments" with the following:

- *"3. Such practice should comply with the statements relating to ultrasound safety (Statements A1-A7 inclusive, with particular emphasis on adherence to the ALARA principle).*

3 **Policy C2: The Role of the Sonographer** was amended by:

- the deletion of the sentence *"No binding determinations have yet been made, but it is likely that the Role of the Sonographer document will apply to all of these graduates."* from the paragraph under *"Recognition and Equivalence of Qualifications"*.
- the addition of *"and be registered as a student with the ASAR."* to the paragraph under *"Sonographer as a term to define a qualified and ASAR accredited professional"* after the words *"under the supervision of a qualified person"*.
- The addition of *"embryology"* after *"Human anatomy,"* under the second bullet point of the paragraph *"Requirements of the Sonographer"*.

4 **Policy D1: Guidelines for Standards of Practice in Paediatric Echocardiography (SPPE)** was reaffirmed.

5 **Policy D2: Guidelines for the Mid Trimester Obstetric Scan** was amended by replacing paragraph 1 under the heading "Equipment" with the following:

- *"Studies should be performed using high quality real time equipment. M mode should be available. The availability of Colour, Power and Spectral Doppler is advisable."*; and by replacing paragraph 3 under the heading "Gestational Age" with the following:
- *"The biometry charts (see **Policies and Statements D7 Statement on Normal Ultrasound Fetal Measurements)** distributed by the Australasian Society for Ultrasound in Medicine (ASUM) are recommended."*

5 **Policy D11: Guidelines for the Performance of First Trimester Ultrasound** was amended and published in the *Ultrasound Bulletin* August 8 (3): 33

6 **Policy F1: Statement on the Appropriate Use of Diagnostic Ultrasound Equipment for Non-Medical Entertainment Ultrasound** was adopted as published in the *Ultrasound Bulletin* August 8 (3): 35.

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Abstracts 35th Annual Scientific Meeting 2005 Adelaide, South Australia – Part 2

Diagnostic ultrasound – biological effects

Ms Tania Griffiths, Monash University, Vic, Australia

Technological advances in ultrasound equipment have led to changes in the examinations and techniques used in diagnostic sonography, particularly in obstetric sonography. The use of Colour Doppler, 3- and 4-D ultrasound have resulted in more comprehensive foetal examinations. Improved resolution allows the fetus to be scanned at an increasingly early gestational age. Some studies have shown indirect evidence that depending upon the gestational age at the time of the examination the increasing power outputs now available to sonographers may produce an effect on the fetus. There are some human studies showing subtle effects such as decreased birth weight, other handedness and delayed speech. Studies on animal models have reproduced some of these same effects. To date there are no studies reported on human exposure at the current high power levels in the first trimester.

This presentation aims to review the current literature on the biological effects of diagnostic ultrasound including a discussion of the limitations surrounding the current epidemiological data. The literature relating to power outputs on modern ultrasound equipment will be appraised. In the process the role of thermal and mechanical indices as indicators of risk will be discussed. The presentation will conclude with an evaluation of the existing professional guidelines for the safe use of medical ultrasound in light of the strengths and weaknesses of the current state of knowledge about this issue.

Equity and reproducibility issues in practical assessment of student sonographers

Ms Jenny Parkes, MIA, Vic, Australia

Practical assessment of student sonographers is an important component to many, but not all, ultrasound courses in Australia. It is generally creates great anxiety for the student and is often mentioned in discussion with students as the most intimidating and stressful component of their ultrasound training. Perhaps more importantly though, as this presentation will suggest, is that such assessments are performed under similar guidelines to be equitable to the students, and provide similar standards for new graduates.

The following issues will be discussed in this presentation:

- discussion and comparison of competency assessment in Australian ultrasound training;
- related issues in the equity of one course's competency assessment to another, and from one student to another;
- reproducibility issues of competency assessment such as;
- use of standardised patients versus the use of an unknown, everyday patient;
- examiner issues in reproducibility of assessments; and
- discussion of other medical and paramedical competency assessment with comparison with ultrasound.

Conclusions will be drawn as to the reproducibility and equity of utilising non-standardised patients and examiners in ultrasound examination competency assessments.

University based education for sonographers – issues and challenges for the profession

Ms Jill Clarke, University of Sydney, NSW, Mrs Margo Gill, Sydney Ultrasound for Women, NSW, Australia

University based, postgraduate ultrasound courses have been available in Australia since the early 1980s. Since the1980s there has been a significant growth in the number of sonographers in Australia, and the number, range and complexity of clinical ultrasound examinations. Since November 2000 the Commonwealth Department of Health and Aged Care has required formal accreditation of sonographers, via the mechanisms of the Australasian Sonographer Accreditation Registry (ASAR). This has led to a greater imperative for sonographers to obtain an accredited status at a very early stage of their career.

The increase in professional demands on the sonographer has come at the same time as a significant reduction in federal Government funding to the higher education sector, with a consequent increase in the expectations of, and demands on, academic sonographers working in the university system. A conflict then arises. On the one hand, increasingly novice students require greater resources, but there is a reduction in university staffing levels and funds for courses. Most sonographer academics insist on also retaining their clinical skills, but are stretched by the requirement to attain research degrees (masters and/or PhD) and a research track record. Many universities are therefore struggling to attract and retain experienced sonographers to academic positions.

While the profession has little influence on university funding, it can play a role in encouraging talented and experienced sonographers to attain higher degrees, be involved in research and appreciate the many benefits of an academic career. In the not too distant future, as the experienced university based sonographers leave their positions, there is the potential that at least some of the existing courses may become non-viable. The challenge for the profession is to ensure this potential does not become reality.

The importance of the mastoid fontanelle view for routine cranial ultrasounds of preterm infants

Dr Sheryle Rogerson, Royal Womens Hospital, Vic, Dr Olivera Erac, Royal Womens Hospital, Vic, Dr Colm O'Donnell, Royal Womens Hospital, Vic, Dr Peter Davis, Royal Womens Hospital, Vic, Australia

Background

Cranial ultrasound examinations are performed from the anterior fontanelle on premature infants to detect cerebral abnormalities, haemorrhages or cysts. Attenuation of the ultrasound waves diminishes the quality of views of the cerebellum from the anterior fontanelle. The mastoid fontanelle can visualise the posterior fossa without these limitations.

The true incidence of cerebellar abnormalities is uncertain.

Aims

To evaluate the mastoid fontanelle view in routine cranial ultrasound.

Methods

Subjects

All infants born less than 33 weeks gestation admitted to the Royal Women's Hospital from January 2001 to November 2004.

Manoeuvre

Scans were performed using a GE Logic 9 ultrasound machine with a 10 MHz broadband sector probe.

Examinations comprised: five sagittal/parasagittal, five coronal views.

A mastoid fontanelle view: the cerebellum was imaged in its entirety and views recorded at the widest dimension. Serial scans performed on days 1, 3, 7, 28 and monthly thereafter until discharge.

Results

During the study period, 1060 infants were admitted, 918 infants had 2501 examinations. Their mean (SD) gestational age 28.6 (2.3) weeks. Eleven (1.2%) infants had cerebellar haemorrhages. Five occurred without other intracranial haemorrhage. Three of the eleven cerebellar haemorrhages could be seen on views taken from the anterior fontanelle. Haemorrhages were seen on a mean of day 3.9 (SD 3.2).

MRI scans in three of the infants confirmed cerebellar haemorrhage.

Two further infants had cerebellar abscesses in association with meningitis.

Conclusions

The mastoid fontanelle is a better ultrasound window for viewing the cerebellum than the anterior fontanelle.

It allows more accurate determination of the true incidence and nature of abnormalities in this region, which at present are poorly understood and likely under-reported.

Mastoid fontanelle views should be part of the standard cranial ultrasound examination.

Extension of ultrasound use to determine soft palate shapes

Ms Tania Griffiths, Dr Gordon Troup, Dr Michal Schneider-Kolsky, Dr Imants Svalbe, Assoc Prof Trevor Finlayson, Monash University, Vic, Australia

Preamble

In speech and song, the soft palate shape changes in a now well-known way to produce the different vowels and consonants. The average shapes for the vowels are due to changes mainly in tongue shape. Average vowel tongue shapes are well known from research using x-ray fluoroscopy. Since the upper jaw can be considered as only opening or closing the soft palate, it is possible to deduce vocal tract shape from observing soft palate shape only. The use of ultrasonography can be extended to give valuable information about the shape of the soft palate, to be used for clinical purposes (eg. sleep apnoea, speech impediment investigation) and for research in vocal and wind instrument work. This implies that, although not all of the tongue can be observed, a sufficient portion can be examined to differentiate between shapes for different vowels.

The aim of this preliminary study was to:

1 determine the most efficient method for viewing the shapes of the tongue;
2 establish if the shape of the tongue, as observed on ultrasound can predict vocal sounds; and
3 to compare results using ultrasound with those using X-ray

Methods

Three participants were recruited. All participants are professionally trained or experienced singers, who were able to repeat the requested vowel shapes and pitches accurately. Using a 4–7 MHz transducer, three recordings of each single-syllable (Italian) vowels will be made. Each vocalisation was documented in the sagittal the coronal plane using the geniohyoid muscles both as a landmark and ultrasonic window.

Analysis

The recordings were checked for internal consistency for each vowel. Comparisons between different vowel shapes made for each subject, using the vowel 'ah' as the basis of comparison. Vowel shapes will then be compared between each of the subjects. Finally, comparisons made between subject vowel shapes and the 'known' average vowel shapes.

Duration of examination for the 18–20 week fetal morphology ultrasound examination can be shortened using digital video clips capture rather than conventional still image capture

Dr David Watson, Mater Mothers Hospital, Qld Professor Fung Yee Chan, University of Queensland, Qld, Miss Jillian Gibson, Mater Mothers Hospital, Qld, Mrs Donna Amaraddio, Mater Mothers Hospital, Qld, Mr Sinh Lee, Mater Mothers Hospital, Qld, Ms Alison Lee-Tannock, Mater Mothers Hospital, Qld, Professor Alan Chang, Mater Misericordiae Health Services, Qld, Australia

Background

In conventional fetal ultrasound imaging, still images are usually acquired for medico-legal and record purposes. Since fetuses are very mobile, the need to acquire these 'perfect' still images could lengthen the duration of examination. Newer generation ultrasound machines can allow digital acquisition of short (5–10 sec) ‘video clips’, which can be used for both reporting and archival purposes.

Aim

To compare the duration of examination for an 18–20 week fetal morphology examination using either conventional still image or digital video clip capture methods.

Methods

18–20 week morphology examinations were performed by four experienced sonographers. Ultrasound images were saved as still pictures from 123 patients (Phillips ATL 5000). Ultrasound images from 49 patients were saved as 5-second digital video clips (Toshiba Aplio). Kolmogorov–Smirnov test was used to assess whether the examination durations were normally distributed and t-test for unequal variance was used to compare the examination durations. Regression analysis was used to assess factors that may influence the duration: maternal BMI, age, view obtained (good, average, restricted),and diagnosis (normal or soft markers of anomaly present).

Results

The time taken to conduct the 18–20 week morphology

examination was normally distributed for both videoclip and still image capture methods (p = 0.37 and p = 0.1 respectively). The examination was significantly shorter induration using video clip capture compared to still image capture (mean duration 20.7 min. versus 32 min.). The mean difference was 11.2 min (95% CI 8.4–14.0, p = 0.0001). The view obtained was independently correlated to the duration: a shorter duration was associated with improving view (t = -2.45, p = 0.01). Maternal BMI, age or diagnosis, had no effect on the duration.

Conclusion

Video clip capture of standard images taken during the 18–20 week morphology examination can significantly shorten the duration of examination

The screening fetal echocardiogram: how and for whom

Dr Peter Muller, Women's and Children's Hospital, SA, Australia

Congenital heart disease (CHD) is one of the most common structural abnormalities in live born infants. The benefits of prenatal diagnosis of congenital heart disease include counselling the parents about the detected defect, allowing time for the family to prepare medically, emotionally and financially, and referral to a tertiary care centre for delivery and early intervention.

The last decade has seen significant interest in the prenatal diagnosis of CHD. Various methods have been proposed in screening for this relatively common congenital defect. Although initially the four-chamber view was seen to have a high sensitivity for the detection of CHD, others have found this not to be the case. The addition of the left ventricular out flow tract view improved the detection rate in the screening of CHD in some studies, but not in others. Thus patients at high-risk for having a baby with congenital heart disease are commonly referred for fetal echocardiogram even after having a normal comprehensive anatomy ultrasound. Often this fetal echocardiogram is performed at a different appointment at a different location. There are a number of proposed indications for referral for fetal echocardiogram. These include family history of congenital heart disease, pregestational diabetes, fetal hydrops, fetal arrhythmia, aneuploid fetus, fetal anomaly, as part of the genetic sonogram, drug exposure, and abnormal cardiac views on routine morphology ultrasound. Because of the association of increased nuchal translucency with CHD, we may expect 1–5% of patients undergoing first trimester screening to be counselled and possibly referred for fetal echocardiogram. We must analyse the most efficient and cost effective means for the prenatal diagnosis of CHD. The proposed five short axis views and improved training of sonographers has been shown to improve the detection of congenital heart disease and may obviate the need to refer all high risk patients for formal fetal echocardiogram.

Detailed fetal cardiac scan

Professor Pippa Kyle, Christchurch Women's Hospital, New Zealand

A systematic approach for performing a detailed fetal cardiac scan is necessary. However due to fetal movements and position, a step-by-step routine may not always be possible, but all aspects must be complete to be able to document that a scan is normal.

Ultrasound settings are important to maximise the quality of the scan to optimise interpretation. Video recording is necessary if an abnormality is suspected to allow later review. Complete detailed anatomy is also required to exclude extracardiac abnormalities.

The basis of the systematic approach includes:

1 Assessment of fatal position, determining Left and Right.
2 Determination of position of heart within the fatal chest and position of stomach.
3 Maximise ultrasound settings – ongoing adjustment is usually necessary.
4 Size of heart.
5 4-chamber view.
6 Systemic and pulmonary inflow.
7 Atria and AV valves.
8 Offsetting of AV valves.
9 Colour flow across AV valves.
10 Check ventricular size and ventricular septum.
11 Left ventricular and R ventricular outflow tracts position and size 12 flow across aortic and pulmonary valves and check valve movement.
13 Aortic Arch and Ductal Arch size and position.
14 IVC / SVC if not viewed previously.
15 Rhythm.
16 Diaphragm intact.

B-mode, Colour Doppler will be required in all examinations. M-mode when concerns about rhythm arise.

Abnormal fetal heart – the cardiologist prospective

Dr Terry Robertson, Women's and Children's Hospital, SA, Australia

Fetal diagnosis of any congenital defect can offer major benefits to the mother and family. However, for someone to fully benefit from such a diagnosis, the diagnosis needs to be as accurate as possible and the person counselling should have a good understanding of the likely outcomes, of that particular diagnosis, both short and long term.

This is particularly true in the area of congenital heart disease, where apparently similar defects can have very different outcomes. The outcome for a particular diagnosis will often depend on other less obvious features, for example the presence and size of the branch pulmonary arteries will have major short and long term implications in pulmonary atresia with VSD. Also, a seemingly simple diagnosis of a single lesion may turn into something more complicated if other less obvious but possible associated problems are looked for and found.

The purposes of this talk will be (a) to briefly discuss the basic principles of managing many of the congenital heart conditions we see antenatally and (b) to focus on a few of the more common conditions to discuss features that can be looked for in the antenatal scan that will affect prognosis.

Nonlinear imaging in ultrasound: the breaking wave

Prof Peter Burns, University of Toronto, Canada

No sonographer can have failed to notice the sudden and ubiquitous appearance of tissue harmonic imaging; yet many use the method without a clear understanding of what precisely it does. In fact, it addresses one of the weaknesses that have dogged ultrasound imaging from its outset: its inability to provide consistent image quality in all patients. So called 'technical failures' in ultrasound exceed those from, CT,

for example, and reflect the relative unpredictability of the behaviour of ultrasound in a particular body habitus. Two principal sources of this unpredictability are the distortion, or aberration, of the ultrasound beam by the different velocities with which it propagates in different tissues, and the tendency of sound to undergo multiple reflections between layers of tissue, particularly fat. It was an entirely accidental discovery that harmonic imaging, originally developed for microbubble contrast agents, dramatically helps with these problems. Harmonic imaging was made under the assumption that tissue is linear and the bubbles generate all harmonic echoes. In fact, tissue, like a bubble, is a nonlinear system. Whereas the harmonic echoes from bubbles have their origins in nonlinear scattering, those from tissue are a result of nonlinear propagation and subsequent linear scattering. Nonlinear propagation simply means that the crest of a sound wave travels faster than its trough. The variation of the propagation speed results in wave 'steepening' which shifts energy from the fundamental to the higher harmonic components. It is analogous to the sharpening of a wave as is approaches the beach: drag from the bottom slows the bottom of the wave as the part above it continues at its original speed.

References in whole text version in *Ultrasound Bulletin* 8(4) November 2005.

Ultrasound assessment of the ankle

Dr Rethy Chhem, LHSC – University Campus, United Kingdom

The purpose of this talk is to discuss the clinical indications of ultrasound in the assessment of ankle disorders. The role of ultrasound as a frontline method of imaging, along with conventional radiography, will be stressed. The normal sonographic anatomy of the joint, tendons and ligaments will be described. Basic abnormal ultrasound features will be reviewed. A gamut approach for ankle disorders will be explained and used to establish the final diagnosis. Ankle disorders discussed in this lecture include tendinopathy, ligament injury, plantar fasciitis and arthropathies.

Relationship of high-resolution musculoskeletal sonography to clinical findings in early rheumatoid arthritis

Dr Anita Lee, Royal Adelaide Hospital, SA, Dr Susanna Proudman, Royal Adelaide Hospital, SA, Ms Maureen Wilkinson, University of South Australia, SA, Ms Leah McWilliams, Royal Adelaide Hospital, SA, Prof Leslie Cleland, Royal Adelaide Hospital, SA, Australia

Aims

To assess the relationship of ultrasound (US) parameters to clinical findings in the metacarpophalangeal (MCP) joints of patients with recent onset synovitis and to assess changes after disease modifying therapy.

Methods

Subjects with recent onset rheumatoid arthritis (RA) and at least one swollen and tender MCP joint were recruited from the Early Arthritis Clinic at the Royal Adelaide Hospital. All MCP joints were assessed by high resolution US for synovial swelling, effusion, measurements and joint space vascularity using power Doppler (PD). Clinical and US assessments were repeated after 12 months therapy.

Results

Twenty-nine subjects, median age 57 years and mean disease duration four months, were assessed. Clinical joint swelling was associated with US inflammation, including synovitis, effusion or tenosynovitis (81% of swollen joints vs. 53% of non-swollen joints, $P < 0.0001$). Only 61% of all MCP joints with US synovitis were assessed as clinically swollen. Clinical joint swelling also correlated with US synovial measurements and PD positivity ($P = 0.001$ and < 0.0001 respectively). US measurements and PD findings were both significantly associated with US inflammatory changes ($P = 0.01$ and < 0.0001 respectively). In 13 subjects reassessed after 12 months, PD positivity was reduced in most (mean 0.7 MCP joints compared with baseline mean 2.8 joints per subject). Abnormal US measurements and synovial swelling persisted.

Conclusions

Clinical examination underestimates synovitis when compared with US examination suggesting significant subclinical synovitis. US measurements may be most useful in very early RA when appearances of definite synovial proliferation and effusion are not yet evident on US images. Power Doppler may be a better marker of active synovial inflammation than abnormal US measurements or synovial changes.

Ultrasound of the ulnar nerve at the elbow: what are normal values?

Ms Kerry Thoirs, University of South Australia, SA, Dr Marie Williams, University of South Australia, SA, Ms Maureen Wilkinson, University of South Australia, SA, Australia

Purpose

High-resolution sonography (HRS) has emerged as a useful tool to assist in the diagnosis of ulnar nerve entrapment at the elbow (UNEE). Previous studies have reported the diagnostic value of HRS measures of ulnar nerve diameter and area in UNEE. The difficulty in comparing measurements between previous studies relates to differences in measurement definitions and scanning protocols. The aim of this study is to use a clearly defined scanning protocol and specific measurement definitions to investigate differences between people with and without symptoms of UNEE.

Methods

We are currently completing a prospective HRS study of people with and without signs and symptoms of UNEE. A two group comparison is underway which uses a measurement protocol demonstrated to produce reproducible measures of ulnar nerve diameter and cross-sectional area at the elbow. All sonographic images have been reviewed and measured by a sonographer blind to whether the individual has symptoms of UNEE or not.

Results

To date, 100 elbows of asymptomatic people have been imaged. Preliminary normative data will be presented with comparisons of data published from previous studies.

Conclusions

The usefulness of measures of ulnar nerve diameter and area as an indicator of UNEE depends upon whether these measures can be used to discriminate between symptomatic and asymptomatic subjects.

'Sound and light' ultrasonic and opthalmological views of the eye

Dr Barry Chatterton, Royal Adelaide Hospital, SA, Dr Grant Raymond, Royal Adelaide Hospital, SA, Australia

Generally, ophthalmologists using clinical techniques with visible light can examine the eye adequately. There are, however, many conditions in which detail is obscured by opaque ocular media (from the cornea, anterior chamber structures, lens, vitreous, retina and structures behind). Ultrasound sees many abnormalities in these structures in detail, independent of the optical properties. Common conditions examined include the confirmation of normal structures prior to replacing dense cataracts, examination of the status of structures behind traumatic or spontaneous intraocular haemorrhage, assessment of retinal detachment, trauma and characterisation and serial follow-up of intraocular naevi and tumours. In the retro-bulbar structures of the orbit, CT and MRI are usually more applicable. To provide the best service to the patient and the referring ophthalmologist, it is important to understand the information required, the information obtainable and how best to communicate it. This presentation describes some common ophthalmological conditions, their ultrasound findings and management decisions made from an ophthalmological and ultrasound perspective.

Can the use of ultrasound improve the management of women who present to an acute gynaecology unit?

Dr George Condous, Dr Zara Haider, Dr Asma Khalid, Dr Emma Kirk and Dr Tom Bourne, St Georges Hospital Medical School, United Kingdom

Objective

Assessment of acute gynaecology patients is usually based on history and clinical examination. Ultrasound is not generally available in the emergency room. The aim of this study was to look at the impact of the availability of transvaginal ultrasound (TVS) at the point of contact with the emergency gynaecology patient.

Method

Prospective observational study. Doctors assessing women over a five-month period completed questionnaires. The doctors were required to detail intention to treat before ultrasound and then once the ultrasound had been performed for each woman.

Results

One thousand consecutive women were assessed. Data sheets were available on 920 (92%) (Mean age 31.1 years S.D. 9.81 years) and 84 (9.1%) women did not require a scan. Of the 521 women with a positive pregnancy test, 27.4% were thought to have an ectopic pregnancy before scan compared to 4.8% after. 75.6% were reassured immediately that their pregnancy was intrauterine. The ultrasound examination altered clinical management for 54.1% of pregnant patients, reduced admissions (40.3% to 17.1%) and decreased follow up (41.1% to 35.5%). In 90 non-pregnant women an ovarian cyst was suspected clinically, 28 (31.1%) were confirmed on TVS. Ultrasound examination altered clinical management for 38.1% non-pregnant women, reduced admissions (37.1% to 19.4%) and decreased follow up (25.7% to 18.1%).

Conclusion

Availability of transvaginal ultrasound improves diagnostic accuracy and a clearer management plan can be made. It reduces patient admissions and follow up. We believe that TVS is an essential adjunct in assessment of emergency gynaecology patients.

What is the optimal approach to classifying failing pregnancies of unknown location (PULs)?

Dr George Condous, Dr Emma Kirk, Dr Zara Haider and Dr Tom Bourne, St George's Hospital Medical School, United Kingdom

Background

When it is not possible to visualise an intra- or extra-uterine pregnancy using transvaginal ultrasonography in the first trimester, these women are classified as having a pregnancy of unknown location (PUL). In this situation there are three clinical outcomes: failing PULs, intra-uterine pregnancy or ectopic pregnancy. Banerjee *et al.* (2001) have previously developed a logistic regression model to predict failing PULs. In the same study, this model did not outperform serum progesterone < 20 nmol/L taken at presentation. We compare these diagnostic tests to the human chorionic gonadotrophin (hCG) ratio for the prediction of failing PULs.

Methods

Retrospective observational study. We compared the performance of three models for the prediction of falling PULs. 1) Logistic regression model (Banerjee *et al.*, incorporating vaginal bleeding, endometrial thickness; 2)serum progesterone level and serum hCG level), 2) Serum progesterone < 20 nmol/L at 0 hour (hr); and 3) hCG ratio (hCG48 hr/hCG 0 hr) < 0.8. The performance of these models was evaluated using receiver operating characteristic curves (ROC) curves and p values calculated using DeLong *et al.* method, for comparison of AUC curves.

Results

A total of 4698 consecutive women were scanned and 370 were classified as PULs.

For the prediction of failing PULs, the area under the ROC curves(AUC) for the logistic regression model was 0.944; the AUC for serum progesterone < 20 nmol/L at 0 hr was 0.963; and the AUC for hCG ratio < 0.8 was 0.972. The hCG ratio outperformed the logistic regression model (P = 0.0371); while the serum progesterone also outperformed the logistic regression model (P = 0.0322).

Conclusions

The hCG ratio is the optimal test for the prediction of failing PULs.

Can we improve the performance of diagnostic tests to predict the outcome of pregnancies of unknown location (PULs)?

Dr George Condous, St Georges Hospital Medical School, United Kingdom, Dr Emma Kirk, St Georges Hospital Medical School, United Kingdom, Dr Zara Haider, St Georges Hospital Medical School, United Kingdom, Mr Ben Van Calster, University Hospital Gasthuisberg, Belgium, Prof Sabine Van Huffel, University Hospital Gasthuisberg, Belgium, Dr Dirk Timmerman, University Hospital Gasthuisberg, Belgium and Dr Tom Bourne, St Georges Hospital Medical School, United Kingdom

Background
When it is not possible to visualise an intra- or extra-uterine pregnancy using transvaginal ultrasonography in the first trimester, these women are classified as having a pregnancy of unknown location (PUL). The aim of this study was to generate and evaluate a new logistic regression model from simple demographic, hormonal and ultrasonographic data to predict the outcome of PULs.

Methods
Data were collected prospectively from women classified as PUL. The final diagnoses were: failing PUL, intra-uterine pregnancy (IUP) or ectopic pregnancy (EP). The Logarithm (log) of serum human chorionic gonadotrophin (hCG) average and hCG ratio (hCG 48 hrs/hCG 0 hrs) were encoded as variables following multivariate analysis. One multi-categorical logistic regression model (M4) contained log of hCG average, hCG ratio and its quadratic effect. The performance of this model was evaluated using receiver operating characteristic (ROC) curves. M4's performance was compared to model M1 (hCG ratio alone), which has been published previously.

Results
376/3996 consecutive PULs were recruited in this study – 201 in the training set and 175 in the test set. 109 (55.3%) failing PULs, 76 (38.6%) IUP and 12 (6.1%) EPs were used in the training set to develop the new models. 94 (54.3%) failing PULs, 64 (37.0%) IUP and 15 (8.7%) EPs were intest set.M4 gave an area under ROC curve 0.978 for failing PUL, 0.974 for IUP and 0.900 for EP. This performed better than M1, which gave an area under the ROC curve of 0.965, 0.969 and 0.842 respectively. Only the improvement in the detection of EPs was statistically significant (p = 0.0317).

Conclusions
Model M4 significantly outperforms model M1 in the detection of EPs. Additional serum hCG information can improve mathematical models used to predict the outcome of PULs. In the future, the authors believe that the clinical application of this model will help to remove the need for significant experience when interpreting hormone values in the management of PULs.

Can we reduce the number of follow up visits for pregnancies of unknown location (PULs)?
Dr George Condous, Dr Emma Kirk, Dr Zara Haider, and Dr Tom Bourne, St Georges Hospital Medical School, United Kingdom

Background
When it is not possible to diagnose an intra- or extra-uterine pregnancy using transvaginal ultrasound, women are classified with a pregnancy of unknown location (PUL). At present women classified as having PULs often have to undergo multiple clinic visits until the location of the pregnancy is known. The aim of this ongoing prospective study is to try and reduce the number of visits.

Methods
Women classified with PULs have hCG levels taken at 0 and 48 hours. These levels are entered into a logistic regression model present on a desktop computer in the Early Pregnancy Unit. The model gives the most likely predicted outcome. Depending on the prediction women are managed accordingly. If it predicts an intra-uterine pregnancy (IUP) or an ectopic pregnancy (EP) the woman returns on day 7 for a repeat scan and hCG levels if indicated. If the model predicts a failing PUL she returns on day 7 for a repeat hCG. The endpoints for diagnosis are the visualisation of a pregnancy on scan for IUPs and EPs and a decrease in hCG > 20% for a failing PUL (hCG ratio 0.8).

Results
One-hundred-and-ten women have so far been managed according to the model. The final clinical outcomes are: 59 failing PULs, 42 IUPs and 9 EPs. The model predicted 53 failing PULs, 31 IUPs and 26 EPs with sensitivities of 89%, 69% and 78% for failing PUL, IUP and EP respectively. In the failing PUL group, the mean time until diagnosis is 2.3 days (range 2–9 days). Women need a mean of 2.2 blood tests (range 2–4) and 1.3 scans(range 1–4). In the IUP group the mean time until diagnosisis 7.2 days (range 2–14), the mean number of blood tests 2.1 (range 2–4) and the mean number of scans 2.1 (range 2–3). In the EP group the mean time until diagnosis is 9.4 days (range 2–29 days), the mean number of blood tests 3.3 (range 2–5) and the mean number of scans 2.9 (range 2–5).

Conclusion
Use of this model will potentially reduce the number of follow-up visits for women classified with PULs who are at low risk of EP.

Malignant liver tumours: ultrasound
Prof Byung Ihn Choi, Seoul National University Hospital, Korea

Each of the cellular components of the liver can give rise to malignant tumours. Hepatocytes can give rise to hepatocellular carcinoma (HCC), as well as fibrolamellar carcinoma. Biliary epithelium can give rise to cystadenocarcinoma, and cholangiocarcinoma (CAC). Mesenchymal tissue may produce angiosarcoma, liposarcoma, and epithelioid hemangioendothelioma.

In this review, sonographic findings of most common malignant hepatic neoplasms including HCC, CAC, and metastasis are discussed.

MRI as an adjunct to fetal ultrasound in fetal anomalies
Dr J Kaye, Department of Medical Imaging, Women's & Children's Hospital, SA, Australia

MRI is a safe, non-ionising imaging modality which is an excellent adjunctive tool in investigating fetal anomalies. The use of rapid acquisition sequences precluding fetal/maternal sedation, and the increased resolution MRI offers particularly in imaging intracranial and thoracic abnormalities, has provided a complimentary modality to ultrasound in the further investigation of feta abnormalities. It is particularly helpful in those cases where patient size and fetal position preclude good sonographic visualisation, but is also excellent in further assessing difficult cases. In conjunction with ultrasound, it can significantly improve our ability to more definitively diagnose fetal anomalies, which is helpful in parental counselling, antenatal care, as well as perinatal delivery and surgical planning. This presentation describes some cases where fetal MRI was invaluable in confirming sonographic findings, as well as improving the diagnostic accuracy of ultrasound in many cases. Fetal MRI has also been very helpful in the post-mortem evaluation of fetal anomalies and will probably be utilised more in the future in screening for genetic/hereditary anomalies.

Ultrasound in non-rheumatoid arthropathy

Dr Wes Cormick, Canberra Imaging Group, ACT, Australia

Swelling around a joint may be fluid, soft tissue or bone. Fluid and or soft tissue swelling indicate arthropathy but not the type. Categorising the type of arthropathy is important, as the treatments are different.

Arthropathies can be categorised pathologically as:

1 synovial disorders;
2 cartilage failure;
3 enthesopathy; and
4 crystal deposition disease

The important features on ultrasound are the character of the synovium, changes to the cartilage, changes at the entheses, pattern of erosions and adjacent boney and soft tissue changes. A comprehensive report will describe each of these features.

Ultrasound can then be used both to help categorised arthropathy, and to assess changes over time (ie. progression of disease or response to therapy.)

This presentation will focus on two new areas.

1 With high resolution probes the changes in arthropathy that we are used to seeing in large joints can also be demonstrated in small joints.
2 The recent understanding of the primary role of the enthesis in some arthropathies. I will review the anatomy and pathology of the enthesis and the use of ultrasound in imaging the abnormal enthesis.

Ultrasound of musculoskeletal infection

Dr Rethy Chhem, LHSC – University Campus, United Kingdom

Musculoskeletal infections are highly curable if the treatment has been initiated in their early phase. Unfortunately, x-ray study is usually normal or non-specific at that early stage. The purpose of this talk is to review the role of US in the detection of MSK infection that include cellulitis, soft tissues abscess, septic arthritis, septic tenosynovitis, acute and chronic osteomyelitis and post-operative infections. The unique role of US among other imaging modalities such as NM, CT or MRI will be stressed. Finally, US may be used as a guide for joint or soft tissues collection aspiration to identify the pathogen.

Tumour angiogenesis with ultrasound imaging

Prof Peter Burns, University of Toronto, Canada

Of those emerging areas of diagnostic application for ultrasound, one of the most intriguing is the challenge of imaging angiogenesis. Angiogenesis is the term used to describe the development of a tumour's blood supply, an important component of its malignant progression. Without such a supply, a breast cancer in situ, for example, will grow to a few millimetres and remain harmless. It is estimated that about 40% of women aged 40–50 have such lesions, yet less than 1% go on to have clinical cancer. This minority of lesions undergoes a process known as malignant angiogenesis, in which new vessels grow from the host into the cancer. The vessels provide a supply of oxygen and nutrients for the cancer cells to grow, as well as a conduit through which they can metastasise to distant organs in the body. From a diagnostic point of view, it these angiogenic lesions, not every breast lesion, that we need to be able to identify. Although known for many years, it is only recently that advances in the understanding of angiogenic transformation, and particularly the potential to modulate it using new drugs, have propelled this field into the forefront of cancer research. Angiogenesis in breast cancer, for example, has implications for diagnosis, prognosis and treatment. Identifying those breast cancers, which have new blood vessels, may help to distinguish ductal carcinomas in situ from the much smaller number among them, which are exhibiting malignant progression and presumably need to be treated more aggressively. Once a cancer has been identified, it is been shown that the number and density of blood vessels provides additional prognostic information which is independent of clinical staging, perhaps offering potential to better tailor therapy to an individual patient's disease. Finally, a large number of new treatment strategies target the proliferating vasculature of a developing cancer, including drugs specifically designed to inhibit the angiogenic transformation itself. For these reasons, the ability to provide imaging information on the status of blood supply to breast cancer is of enormous clinical significance.

Management of isoimmunisation with middle cerebral artery Doppler

Dr Chris Wilkinson, Women's and Children's Hospital, SA, Australia

The theoretical basis of the use of middle cerebral artery Doppler studies in the assessment of fetal anaemia will be discussed. The utility of the technique will be illustrated with clinical cases managed at the Fetal Medicine Unit at the Women's and Children's Hospital. A standardised protocol forth technique will also be proposed and debated.

Multiple Pregnancy

Prof Pippa Kyle, Christchurch Women's Hospital, New Zealand

Perinatal mortality and morbidity is increased in multiple pregnancy compared with singletons. Causes include increased risk of congenital abnormalities, preterm delivery, growth restriction, and monochorionic twin complications. Incidence of twinning has increased, in particular dizygotic fertilisation, which can be attributed to assisted fertilisation. With IVF it appears it is the number of embryos replaced which is the major factor affecting incidence of multiple pregnancy. Current information suggests that transfer of two embryos is ideal to balance the aim of achieving a pregnancy versus the risk of multiple pregnancy.

Antenatal assessment that may improve perinatal outcome in multiple pregnancy include:

- Chorionicity assessment.
- Nuchal translucency measurement.
- Preterm labour risk assessment.
- Monitoring of fetal growth.
- Mode of delivery Chorionicity determination can be accurately performed prior to 14 weeks gestation and can help in:
- Risk assessment for chromosomal abnormality.
- Early identification of twin-to-twin transfusion syndrome.
- Management of discordant intrauterine growth restriction.
- Management of death of one fetus in-utero

Fetal outcome is related to chorionicity rather than zygosity. Cervical length measurement will predict cases at higher risk of pre-term delivery. No evidence that cervical

cerclage reduces this risk. At present elective caesarean section is appropriate for noncephalic leading twin pregnancies at term.

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The role of sonography in paediatric abdominal trauma

Mr Roger Gent, Women's and Children's Hospital, SA, Australia

Progressive improvement in the resolution achievable from ultrasound imaging, coupled with a desire to minimise ionising radiation dose, has resulted in increasing use of ultrasound in the imaging of abdominal trauma in paediatric patients. Depending on the severity of the trauma and clinical state of the patient, ultrasound may have a role in the initial investigation and/or in the follow-up of these patients. In non-severe trauma cases, when the clinical suspicion of serious injury is low, ultrasound is reliable in excluding significant damage to liver, spleen, kidneys and pancreas, and in the exclusion of significant haemoperitoneum. In patients with more severe injuries, initial imaging is always undertaken with CT, but ultrasound can usually be used to adequately show resolution of most types of damage to the solid abdominal organs, such as haematoma or laceration of the liver and spleen. In cases of renal transection or laceration, ultrasound is reliable for showing that vascular supply remains intact and monitoring resolution of any perinephric haematoma. Complications such as hydronephrosis or sequestration of part of the collecting system are readily diagnosed and can be monitored to determine the need for intervention. Pseudocyst formation as a result of pancreatic trauma is readily diagnosed by ultrasound and can also be monitored. Patient guarding, tenderness and a reduced ability to take deep breaths can make these examinations technically challenging but the relatively small size of most patients usually allows good views of the relevant structures to be obtained.

Investigation of abdominal pain in children

Mr Lino Piotto, Women's and Children's Hospital, SA, Australia

Introduction

Ultrasound is increasingly being used in the investigation of children with abdominal pain, which has many causes. An important role in the ultrasound study is to confirm or exclude surgical conditions that require urgent attention. Frequently however ultrasound can go further than this and provide an alternative diagnosis. In some cases the ultrasound examination is replacing the plain radiograph as the primary imaging.

Discussion

The surgical conditions which need to be excluded are intussusception, appendicitis, volvulus with or without midgut malrotation and Meckels diverticulum. In the search for surgical conditions, various medical conditions may be diagnosed, including, Crohn's disease, pancreatitis, renal tract disease, gastro-enteritis and mesenteric lymphadenopathy. Gut wall thickening caused by less common conditions such as haemolytic uraemic syndrome and Henoch Schonlein purpura can also be demonstrated, even before the clinical diagnosis is made.

Conclusion

The continuing improvement in the ultrasound image quality increases the usefulness of ultrasound in identifying conditions that were previously better imaged with CT.

Fetal facial bones in the mid trimester assessment: can they help screen for trisomy 21?

Dr Gary Pritchard, Brisbane Ultrasound for Women, Qld, Australia, Professor Philip Schluter, Auckland University of Technology, New Zealand, Prof Andreas Lee, Brisbane Ultrasound for Women, Qld, Australia, Ms Teresa Clapham, Brisbane Ultrasound for Women, Qld, Australia, Dr Michaela Lee, Royal Brisbane and Women's Hospital, Qld, Australia

Purpose

A pilot study

1 To assess the feasibility of measuring fetal face proportions from standardised volume data sets (VDS) off-line.
2 To investigate inter-observer error in measuring these proportions.
3 To determine whether the facial proportions of Down Syndrome (DS) affected fetuses are significantly different from unaffected fetuses.

Method

A protocol was established to obtain VDS of the fetal face in a standardised fashion at the mid trimester examination. A series of 26 randomly selected unaffected cases were matched for gestation with 12 proven to have DS by amniocentesis. The facial measurements of these cases were collected by off line analysis by experienced sonographers with the use of 4D View. The examiners did not know the karyotypes.

Results

- Fetal facial bones were measured.
- Inter-observer error was calculated.
- Facial features of DS affected fetuses were compared to unaffected fetuses at mid trimester scan.

Conclusions

Down syndrome people have a characteristic facial appearance. It is increasingly recognised that this difference may commence at a very early stage, enabling detection as early as 12 weeks. The mid trimester studies that have been reported in relation to mid trimester nasal bone appearances and size suggest that this difference may also apply then. Our study takes a unique approach in that data sets that had been collected for other reasons prior to the knowledge about this finding have been used to assess its significance at some later time.

Learning curve for fetoscopic laser surgery for severe twin-to-twin transfusion syndrome can be shortened

Prof Fung Yee Chan, University of Queensland, Qld, Assoc Prof Robert Cincotta, Ms Barbara Soong, Mater Mothers Hospital, Qld, Ms Pat Bornick, Ms M Allen and Dr R Quintero, Florida Institute for Fetal Diagnosis & Therapy, United States

Background

Fetoscopic laser coagulation of placental anastomoses in severe twin-to-twin transfusion syndrome has been shown by randomised controlled trial to improve perinatal survival especially in the most severe cases. Until recently, this has only been available in a few centres worldwide, and the learning curve is expected to be long.

Objective

To assess whether the learning curve for fetoscopic laser surgery could be shortened with the aid of telemedicine.

Methods

The clinical teams in the expert site (Tampa, Florida) and novice site (Brisbane) met and agreed on a clinical protocol. The novice team visited the expert site and observed surgery over two weeks. A dedicated tele-link was set up between the two sites. Live surgery performed at the expert site was transmitted and viewed by the novice team over an 18 month period. The results of fetoscopic laser surgery at the novice site were compared to that reported in the literature.

Results

The novice team has performed 58 fetoscopic laser surgeries to date. Results from the first 50 cases are reported here. The overall survival of babies is 84%. At least one baby survived in 92% of pregnancies, with both babies surviving in 76% of pregnancies. In a large report of 200 consecutive fetoscopic laser surgeries, the reported overall survival improved from 61% to 68% after 70 procedures, suggesting a long learning curve. Overall perinatal survival rate reported by some recent series include: 65% from another novice site in Netherlands on 49 patients, and 56% in 72 patients treated with laser surgery from the randomised controlled trial in Europe. Our overall survival rate of 84% is significantly better than all of these series (P values range from < 0.003 to < 0.0001), suggesting that our learning curve has been significantly shortened.

Conclusions

There may be many factors involved in shortening the learning curve for a new operative procedure. Telemedicine appeared to have assisted in this.

Perinatal outcomes with laser therapy for severe twin-twin transfusion syndrome

Assoc Prof Peter Gray, Mater Mothers Hospital, Qld, Prof Fung Yee Chan, University of Queensland, Qld, Assoc Prof Robert Cincotta, Mater Mothers Hospital, Qld, Ms Barbara Soong, Mater Mothers Hospital, Qld, Australia

Objective

Twin-twin transfusion syndrome (TTTS) is the commonest major complication of monochorionic twin pregnancy, with very significant perinatal mortality and morbidity. The objective of this study is to determine the perinatal outcome and neonatal morbidities before and after the introduction of a laser program for treatment of TTTS pregnancies in a tertiary hospital.

Methods

Twenty-seven pregnancies with stage II–IV TTTS treated with amnioreduction were identified before the laser program was introduced (pre-laser group). Data were obtained from the first 31 pregnancies with stage II–IV TTTS managed with laser ablation of placental communicating vessels (laser group). The groups were compared for perinatal survival, survival of at least one infant to hospital discharge and neonatal morbidities including abnormalities on brain imaging.

Results

The median gestation at delivery was significantly greater in the laser treated group (34 vs. 28 weeks, $P = 0.002$). The perinatal survival rate was higher in the laser group (77.4% vs. 59.3%, $P = 0.03$) with this group also having a higher proportion of pregnancies with at least one neonatal survivor (87.1% vs. 66.7%). Neonatal morbidities including acute respiratory distress, chronic lung disease, requirement for ventilatory assistance, patent ductus arteriosus, hypotension, and oliguric renal failure had a lower incidence in the laser group. On brain imaging, ischaemic brain injury was seen in12% of the pre-laser group and none in the laser group of infants ($P = 0.01$).

Conclusions

These findings indicate that perinatal outcomes are improved with less neonatal morbidity for pregnancies with severe TTTS following introduction of a laser program. It is suggested that laser ablation of communicating placental vessels may be the preferred treatment, consistent with the recent results from a randomised controlled trial.

Benign liver mass: ultrasound

Professor Byung Ihn Choi, Seoul National University Hospital, Korea

Benign tumours can arise from each of the cellular components of the liver; hepatocytes, biliary epithelium and mesenchymal tissue. The following classification summarises the cellular origin of the principal lesions:

- Hepatocellular origin
  - Hepatocellular adenoma
  - Hepatocellular hyperplasia
    - Focal nodular hyperplasia (FNH)
    - Nodular regenerative hyperplasia
- Cholangiocellular origin
  - Hepatic cyst
    - Simple hepatic cyst
    - Congenital hepatic fibrosis or polycystic liver disease
  - Biliary cystadenoma
- Mesenchymal origin
  - Mesenchymal hamartoma
  - Hemangioma
  - Peliosis hepatis
  - Infantile hemangioendothelioma
  - Lipoma, Angiomyolipoma, Myelolipoma

Most benign tumours are discovered incidentally during abdominal ultrasound, and the most common entities are simple cysts, cavernous hemangiomas, FNH and adenomas.

In this review sonographic findings of most common benign tumours are discussed.

Ultrasound assessment of ovarian veins

Mr Martin Necas, Tristram Clinic, New Zealand

There are generally three situations where sonographers may be asked to evaluate the ovarian vein. These clinical scenarios overlap a range of ultrasound fields and may be of interest to general, obstetric, and vascular sonographers alike.

1 Ovarian vein thrombosis

Post-partum ovarian vein thrombosis is an uncommon, but potentially serious disorder. When complicated by post-partum infection, the condition results in a combination of thrombosis and ovarian vein phlebitis and can lead to sepsis. Extension of clot into the IVC with subsequent pulmonary embolus can occur in severe untreated cases.

2 Pelvic venous congestion

Ovarian vein reflux may lead to pelvic venous congestion resulting in a wide variety of clinical symptoms and presentations. While many patients with ovarian vein reflux are well and asymptomatic, those presenting with venous congestion symptoms report: chronic unexplained pelvic pain, pelvic fullness, heaviness, fatigue, dysmenorrhoea, dyspareunia, bladder irritability with urinary urgency, pelvic floor varices (vulval, perineal), and lower extremity varices from pelvic sources. Pelvic sonography is usually requested in patients with chronic pelvic pain, but detailed survey of the pelvis is often unremarkable even when patients have clinical signs of congestion. Pelvic venous engorgement can be difficult to judge on transvaginal scanning. In these patients, ovarian vein assessment may be useful.

3 Lower limb varicose veins of pelvic origin

The superficial veins of the lower extremity form a wide range of anastomoses with pelvic veins. These communicating vessels can result in reflux of the upper GSV tributaries (such as superficial pudental, circumflex iliac, or inferior epigastric branches) and ultimately may give rise to lower extremity varices along the distribution of the GSV and often elsewhere as well. It is therefore useful to evaluate the state of ovarian veins in patients with atypical varicose veins of the lower extremity where pelvic sources are suspected.

Scanning ovarian veins is fraught with technical difficulty, but the scan can be successfully completed in the majority of patients. Knowledge of ovarian vein anatomy, familiarity with acoustic windows, and careful system optimisation are required for successful ovarian vein assessment.

Male infertility evaluation

Dr Charles Lott, Perrett Medical Imaging, SA, Australia

This presentation discusses the potential problems of sperm delivery from the testis to the penile meatus. Up to 50% of cases of infertility are due to the male problems. Ultrasound (US) is most appropriate imaging method for investigation of many causes of male infertility.

The testes are accessible to high-resolution US for structure assessment and exclusion of pathology.

The epididymis often suffers inflammation easily diagnosed by US. Cysts, varicoceles and dysgenesis are easily defined. Spermatozoa can be aspirated from the epididymis. Varicocele prominence is the only surgically treatable cause of poor sperm quality.

The vas deferens can be followed in the extra-inguinal region and post-vasectomy changes can be seen by US.

The seminal vesicles are accessible to transrectal ultrasound (TRUS) and should be hypoechoic and symmetrical. Increasingly Magnetic Resonance Imaging (MR) is being used as a single-stop imaging technique for this region. Previous pathology and trauma such as radiation treatment will often leave them echogenic. US-guided needle aspiration biopsy for spermatozoa is a test for combined testis-epididymus-vas deferens function and avoids the radiation and pain of a vasogram.

The prostate, also accessible to TRUS, can be examined for inflammation, tumour and structure. The ejaculatory ducts and neurovascular bundles should be visible on most studies. MR also has an increasing use in this region.

The penis can suffer injury, inflammation, structural and functional problems. Plaque formation of Peyronie's disease, shaft fracture, haematoma, catheter injury, stone formation and urinoma are readily seen on US. Gel injection US urethrography shows, without radiation, not only strictures, but false passages, stones and peri-urethral abnormality up to the membranous urethra.

References

1 Schwartz AN, Lowe M, Berger RE, Wang Ky, Mack LA, Richardson ML: Assessment of normal and abnormal erectile function: colour Doppler flow sonography versus conventional techniques. *Radiology* 1991; 180: 105–109.

Ultrasound and female infertility

Ms Christine Kirby, Repromed, SA, Australia

Ultrasound and Infertility

Ultrasound is an integral part of the management of infertility. A ratio of 1:7 couples present with an inability to conceive. Standard investigations require demonstration of ovulation with normal endocrinology, tubal patency testing and semen analysis.

Initial baseline ultrasound performed day 3–5 of the cycle can diagnose the presence of ovarian and uterine pathology including PCO, ovarian cysts, fibroids, endometriosis and endometrial pathology. Of increasing importance is the assessment of ovarian reserve. It is increasingly clear that the chronological age of a woman may not match her ovarian reserve and that rising FSH is a late marker. Reduced reserve is a cause of infertility, pregnancy loss and a greater incidence of fetal abnormality. Use of ultrasound in this assessment will be described. Correct timing of the scan is critical.

The 'Gold Standard' of tubal patency testing is laparoscopy and dye studies together with hysteroscopy, however baseline scanning and HSG or HyCosy using Levovist as the contrast medium provides invaluable information. Discussion of these investigations and their contribution will occur.

In the situation where intrauterine pathology is suspected Saline sonogram is useful and can define polyps, intrauterine adhesions, fibroids and uterine abnormalities. Performing this procedure prior to surgical intervention can assist in pretreatment counselling and treatment planning.

Follicle scanning is an integral part of the management of IUI/IVF programs. In the former it assists in the minimisation of multiple pregnancies. In IVF the growth and maturation of follicles as determined by ultrasound, is critical in the timing of egg retrieval, now performed under ultrasound

guidance with neurolept anaesthetic. OHSS is a serious complication affecting 5% of IVF patients.

Ultrasound of the painful adult hip emphasising the lateral hip

Dr Steven Zadow, Dr Jones & Partners Medical Imaging, SA, Australia

Ultrasound can play a useful role in investigation of the painful adult hip. Often lateral hip pain is described as trochanteric bursitis. Although bursitis may be present tendinosis and tears of the gluteus medius and minimus tendon insertions onto the greater trochanter may also occur and can be assessed with ultrasound. The anatomy and ultrasound appearances of the greater trochanter, the gluteal insertions and adjacent bursae will be discussed. Ultrasound case examples with MRI correlation will be presented. Less common causes of lateral hip pain will also be discussed. Ultrasound guidance can be used to efficiently and accurately perform interventional procedures at the lateral hip and examples will be demonstrated. Ultrasound may also be used to assess pain at the anterior hip. Anatomy and pathology at the anterior hip, including perilobar cysts and iliopsoas tendinopathy will also be reviewed.

Ultrasound of the knee

Dr Rethy Chhem, LHSC – University Campus, United Kingdom

The purpose of this talk is to discuss the clinical indications of US in the assessment of knee disorders. The role of US as a frontline method of imaging, along with conventional radiography, will be stressed. The normal sonographic anatomy of the joint, tendons and ligaments will be described. Basic abnormal US features will be reviewed. A gamut approach for knee disorders will be explained and used to establish the final diagnosis.

Knee lesions that will be discussed in this talk, include arthropathies, intra and extra-articular masses, tendons, muscles and ligament injuries.

Sonographic assessment of hamstring pain in athletes

Mr Sean McPeake, Benson Radiology, SA, Australia

The muscular anatomy of the posterior thigh and gluteal region is complex. However, since sporting injury of the hamstring muscles is common and gluteal pain and symptoms of sciatica affect patients of all ages it is important that the musculoskeletal sonographer (and sonologist) is familiar with imaging this area. This anatomy and its ultrasound appearance will be reviewed in detail.

Achieving a clinically relevant diagnosis is very much dependant upon how well the anatomy of interest is seen. Put plainly, our ability to make a diagnosis is directly related to the size of the patient's buttock. I will review my scan technique and transducer selection for this challenging area.

Case studies of hamstring muscle and tendon pathology will be presented. Other pathologies that cause gluteal and posterior thigh pain will also be presented.

Having diagnosed ectopic pregnancy using transvaginal ultrasound: can the trend in hCG levels help decide when to give methotrexate?

Dr George Condous, Dr Emma Kirk, Dr Zara Haider, Dr Tom Bourne, St Georges Hospital Medical School, United Kingdom and Mr Olivier Gevaert, Department of Electrical Engineering (ESAT), Belgium

Introduction

The decision to give methotrexate to asymptomatic women with ectopic pregnancies (EP) cannot always be made on initial serum hCG and progesterone levels alone. The aim of this study was to determine which women need methotrexate on the basis of trends in hCG levels.

Methods

Asymptomatic women with EP had hCG levels taken at 0 and 48 hours. Management decisions (expectant, medical or surgical) were made at 48 hours. The hCG ratios (hCG 48hours/hCG 0hours) were calculated and correlated with success of management to determine a cut-off above which methotrexate should be given.

Results

Seventy-nine women had hCG levels taken at 0 and 48 hours, 34 women were subsequently managed expectantly, 38 medically and seven surgically. The hCG ratios were significantly different between those managed expectantly and those managed medically ($p < 0.05$). In the expectant group the success rate was 64.7% (22/34). When a simple cut-off model for the hCG ratio was developed, a cut-off hCG ratio of 0.8 maximised probability of success of expectant management. The success rate of methotrexate was 76.3% (29/38). A cut-off of an hCG ratio around 1.5–1.6 was found to maximise the probability of success of methotrexate.

Conclusion

Expectant and methotrexate treatment perform equally well when hCG ratio < 0.8. As there is a decrease in success of expectant management when hCG ratio > 0.8 its use should be avoided in such cases. However methotrexate performs reliably well up to hCG ratio < 1.6. Therefore women should be managed expectantly if hCG ratio < 0.8 and be given methotrexate if > 0.8.

Changing pattern of tertiary referrals for prenatal diagnosis in a major centre, Australia 1993–2002

Prof Fung Yee Chan, University of Queensland, Qld, Ms Barbara Soong, Mater Mothers Hospital, Qld, Ms Megan Brady, Mater Mothers Hospital, Qld, Ms Lynette McCann, Mater Mothers Hospital, Qld, Australia

Background

Prenatal diagnosis is a rapidly evolving specialty. It is important to collect and understand the service statistics to plan for the future.

Objective

To describe the changing patterns of tertiary referrals for prenatal diagnosis in a major centre over a 10-year period.

Methods

Data from all patients referred to the Mater Centre for Maternal Fetal Medicine were prospectively collected and entered into a database. The indications for referral were categorised into: high risk (e.g. previous abnormal baby), ultrasound markers (e.g. Choroid plexus cyst), single fetal anomalies (e.g. gastroschisis), complex fetal anomalies (involving multiple systems), and third trimester complications. Diagnostic procedures performed were recorded, and pregnancy outcomes were sought.

Results

Over the 10-year period, annual tertiary referral to the Centre increased from 42 in 1993 to 1082 in 2002 (total

4814). Overall, the proportions are: 38.5% high risk, 22% ultrasound markers, 21.4% single anomalies, 13% complex anomalies and 5% third trimester complications. When divided into two 5-year periods, the rate of rise is most rapid for high-risk patients (13.5 fold), followed by markers (6.8 fold), complex anomalies (3.7 fold), third trimester complications (3.1 fold), and single anomalies (2.7 fold). Overall, 787 invasive procedures were performed (16.3%). The rate of diagnostic procedures decreased from 21.4% to 15.6% over the two 5-year periods ($p < 0.0001$). The proportion of procedures that were amniocentesis increased from 35% to 67%, and for CVS decreased from 46.9% to 30.9% ($p < 0.001$). Pregnancy outcomes were obtained in 70% of patients. 5% of pregnancies were terminated, and 5% had a perinatal death.

Conclusions

The tertiary referral pattern for prenatal diagnosis has changed significantly. The pattern of invasive diagnostic procedures has also changed. Future service planning needs to take these patterns into consideration.

Is it safe to perform dilatation and curettage in women with no signs of an intra- or extra-uterine pregnancy on transvaginal ultrasound?

Dr George Condous, Dr Chuan Lu, Dr Emma Kirk, Dr Zara Haider and Dr Tom Bourne, St Georges Hospital Medical School, United Kingdom

Background

When it is .not possible to diagnose an intra-or extra-uterine pregnancy using transvaginal ultrasound, women are classified with a pregnancy of unknown location (PUL). Current diagnosis of ectopic pregnancy (EP) in a PUL population is based on documenting no intra-uterine pregnancy (IUP). This is definitively done via dilatation and curettage (D&C), which shows absence of chorionic villi. The aim was to assess whether women with PULs can safely undergo D&C.

Methods

We developed a new protocol (Protocol 1) and tested three existing ones. Protocol 1) was developed based on use of D&C as diagnostic tool to differentiate EP from miscarriage in women with no signs of IUP on ultrasound.1) was weighted to ensure that no cases of viable IUP were terminated. 1) Was developed on retrospective analysis (n = 500).

Protocol 1): stable PULs with serum hCG ≥ 2000U/Land progesterone < 45 nmol/L at 0hr, or women with serum hCG < 2000U/L and an hCG ratio (hCG 48hr/hCG 0hr) < or = 1.15.1) was tested prospectively (n = 505). Results were compared to established protocols for use of D&C as diagnostic tool to classify location of PULs.

Protocol 2) American Society of Reproductive Medicine (ASRM) recommends that D&C performed at hCG > 2400U/L;

Protocol 3) advises D&C at hCG > OR = 2000U/L or when initial hCG < 2000U/L with an hCG ratio < 1.35; and

Protocol 4) advises D&C with an hCG ratio < 1.50. Number of viable IUPs that would have potential terminations of pregnancy (TOPs) was recorded.

Results

1005/12572 (8.0%) classified PULs. Training set 500 PULs: 277 (55.4%) failing PULs, 176 (35.2%) IUPs and 47 (9.4%) EPs. Test set 505: 256 (50.7%) failing PULs, 205 (40.6%) IUPs and 44 (8.7%) EPs.

When developing protocol 1), n = 500, 294 D&Cs would have been performed, resulting in no TOPs.

When 1) was tested prospectively, n = 505, 273 D&Cs resulted in no TOPs. The other three protocols were tested on 1,005 patients. 2) 36 D&Cs resulted in three TOPs; 3): 611 D&Cs resulted in seven TOPs; 4): 617 D&Cs resulted in three TOPs.

Conclusions

Currently ASRM guidelines will lead to clinicians potentially performing inadvertent TOPs in the PUL population. A review of ASRM guidelines is urgently required in order to avoid further damage to wanted pregnancy.

Changing pattern of advanced maternal age and prenatal diagnostic procedures in a tertiary referral centre, Australia

Prof Fung Yee Chan, University of Queensland, Qld, Dr Jenny Bryan, Mater Misericordiae Health Services, Qld, Ms Barbara Soong, Mater Mothers Hospital, Qld, Professor Allan Chang, Mater Misericordiae Health Services, Qld, Australia

Objective

To describe the changing pattern of patients with advanced maternal age (35 or over) seen in a tertiary referral hospital in Australia, and the diagnostic procedures performed.

Methods

Maternal age characteristics were retrieved from the obstetric database on all public patients delivered in the Hospital for an eleven-year period (1993–2003). Similar data were retrieved from the prenatal diagnostic database over the same period. Computerised cytogenetic results were available from 1998 onwards, and the data was similarly extracted and analysed.

Results

Over the 11-year period, a total of 49,910 public patients had delivered at the hospital, and 5658 tertiary referrals were seen. Of the total 55,568, 13.9% patients were aged 35 or over, and the proportion of these women increased significantly from 8.5% in 1993 to 16.5% in 2003 ($p < 0.0001$). From 1998 to 2003, the total number of invasive diagnostic procedures performed at the hospital was 2407. The number of procedures done per year was roughly stable at approximately 400 and 1231 (51.1%) of these invasive procedures were done for advanced maternal age. The proportion of invasive procedures done for advanced maternal age decreased from 66.5% in 1998 to 39.5% in 2003 ($P < 0.0001$). Overall, the proportion of women aged 35 or over that had an invasive diagnostic procedure decreased from 39% in 1998 to 21% in 2003 ($P < 0.0001$). Amongst women with advanced maternal age, 82.1% of the diagnostic procedure performed was amniocentesis (17.9% chorionic villus sampling). This proportion had not significantly changed over the six-year period. Overall, the rate of chromosomal anomalies in the prenatal diagnostic samples was 10.1%, with no statistically significant change over the period.

Conclusions

While the proportion of women aged 35 or over has significantly increased over the years, their uptake rate for invasive diagnostic testing has decreased significantly. The reasons behind this trend will be discussed.

Can we use the ultrasonographic appearance of an ectopic pregnancy to predict the likelihood of success for expectant and medical management?

Dr George Condous, Dr Emma Kirk, Dr Zara Haider, Dr Tom Bourne, St Georges Hospital Medical School, United Kingdom and Mr Ben Van Calster, University Hospital Gasthuisberg, Belgium

Background

The aim of the study was to identify variables, which are important in predicting likely success of conservative management of ectopic pregnancies (EP).

Methods

Data was collected prospectively on women with EP managed expectantly or medically with methotrexate. All women were followed up until success of treatment known. Variables examined were: gestation, reason for presentation, size of EP mass, appearance of EP mass on TVS (transvaginal scan), initial hCG and progesterone levels, 48 hour hCG and progesterone levels if taken and hCG ratio (hCG 48 hours/hCG0 hours). Data was analysed using Mann-Whitney/Fisher exact tests and univariate logistic regression.

Results

During the study period 98/329 (29.8%) EP were managed conservatively and 23/39 (59.0%) had successful expectant management. 43/59 (72.9%) had successful medical management. The only statistically significant variables for predicting success of expectant management were: the hCG and progesterone levels at 48 hours and the hCG ratio (all $p < 0.05$). For methotrexate management the only significant variable was the hCG level at 0 hours ($p < 0.05$). For all of conservative management (expectant and medical) the significant variables were: the hCG levels at 0 and 48 hours and the hCG ratio ($p < 0.05$).

Conclusion

The ultrasound appearances and size of EPs do not seem important in predicting likely success of conservative management. The most important variables are the hCG levels at presentation and at 48 hours if repeated before making a management decision.

Can we predict the outcome of medical management of ectopic pregnancies earlier than one week?

Dr George Condous, Dr Emma Kirk, Dr Zara Haider, Dr Tom Bourne, St Georges Hospital Medical School, United Kingdom, Mr Ben Van Calster, Prof Sabine Van Huffel and Dr Dirk Timmerman, University Hospital Gasthuisberg, Belgium

Introduction

Currently the success of single-dose methotrexate (50mg/m2) is determined by > 15% decrease in hCG from days 4–7. The aim of this study was to see if it is possible to develop rules to predict likely success before day 7.

Methods

Women receiving methotrexate for ectopic pregnancies had hCG levels taken on days 1, 3, 4, 5 and 7. Statistical analyses were performed looking for correlations between hCG levels and treatment success.

Results

A total of 49 women were in the study group: 34 successful treatment and 15 unsuccessful. 15% day 4–7 rule correctly separated 90.9% successful and unsuccessful patients ($P < 0.001$). Rules developed: (1) hCG no change or decrease day 3–5, (2) > 3% decrease day 4–5 (3) < 20% increase day 1–5 to predict successful outcome were correct in 84.2%, 83.3% and 82.2% of cases respectively ($p < 0.0007$).

Conclusion

All three rules developed, significantly separated the successful and unsuccessful. With more patient numbers we should be able to develop a rule to predict likely outcome within five days.

Surgery and preoperative imaging in primary hyper-parathyroidism

Dr Bill McLeay, Flinders Medical Centre, SA, Australia

Primary hyperparathyroidism (HPT) has become a relatively common condition for which surgical intervention is usually recommended. The incidence and indications for surgery have dramatically increased over the last decade. HPT may be asymptomatic in a small percentage of patients but usually presents with a myriad of symptoms, which may be profound or subtle.

With the advent of minimal access surgery accurate preoperative localisation has become critical to successful management.

An understanding of the anatomy and embryology of the parathyroid glands is important for those involved in diagnostic imaging and will be discussed.

This paper reports the results of a prospective series of 58 cases of HPT which were imaged by one ultrasonographer and had sestamibi scans done in a single nuclear medicine facility and were treated by one surgeon. The two imaging methods were done blind to avoid interpretation bias. Most studies in the literature do not report imaging results independently and reasons for the widely varying sensitivities of these two imaging modalities will be discussed.

Communication and feedback between surgeons and imaging staff is paramount for improving successful outcomes.

Thyroid nodules

Dr Rhodri Evans, The Clinical School at Swansea University, United Kingdom

Thyroid ultrasound still receives a bad press in some circles with incorrect statements such as, "Ultrasound can distinguish between solid and cystic lesions ... but cannot distinguish between malignant and benign thyroid nodules. 'Such ignorance has to be dispelled and this session will address many of the contemporary issues facing Sonographers and Radiologists when faced with thyroid nodules.'

Thyroid nodules are incredibly common, they are seen in over 50% of individuals on ultrasound examination. Thyroid cancer is rare; in the UK there are 1000 new cases per annum, i.e. approximately 1 new case per 50,000 population per annum. In a normal hospital based population serving a population of 500,000 – this would mean a theoretical incidence of just 10 new cases per year.

How can you sort through the plethora of thyroid nodules and direct your surgeons to those patients in whom you suspect malignancy and how best should you integrate fine needle aspiration cytology into your practice? This session will address these points and in particular:

1 The ultrasonic signs of papillary carcinoma.

2 Characteristic features of benign colloid nodules.
3 Diagnostic features of medullary carcinoma.
4 Hashimoto's disease and lymphoma.
5 Fine needle aspiration or core biopsy?

3D ultrasound in small parts: testicle, thyroid and parathyroid

Dr Leandro Fernandez, Laboratorio de Ecografica Vascular, Venezuela

Unfortunately, most people still tend to believe that 3D ultrasound (3DUS) is only about getting nice and amazing pictures of baby faces, legs or genitalia. It is precisely this belief and lack of information what has driven us to present to you a set of some different and updated applications that have proved to be useful as well as a range of other feasible and promising uses of this outstanding technology, not only in the already known applications in obstetrics and gynaecology, but also in the rest of the medical specialties.

3DUS can be widely used in diagnostic ultrasonography for small parts, among other medical areas.

The assessment of the testicle, parotid, thyroid and parathyroid glands is properly achieved with 3DUS. We can discriminate normal anatomical structures from pathological ones. The multiplanar presentation and niche mode (Echo-Tomography) are quite useful to determine the extension – inside or outside the organs – of nodules, cysts or tumours.

The evidence of neovascularisation is better viewed with 3DUS and probably can suggest malignant origin of a neoplasm. Allowing for the spatial orientation and the number of vessels, it could be possible to determine the degree of potential malignity in a given tumor.

The volume measurement is better assessed with 3DUS and given this, we can perform studies that follow growth in order to decide medical or surgical treatment.

The VOCAL(r) makes it possible to obtain a proper after-treatment follow-up of focal disorders in thyroid and parathyroid.

Three-dimensional ultrasound is a new and outstanding technique that opens a new vision in diagnostic ultrasonography. It offers a more comprehensive image of anatomical structures and pathological conditions and also permits to observe the exact spatial relationships.

New applications in internal medicine, surgery and radiology are daily emerging, coming from the curiosity of many doctors from all over the world and from the necessity to assess the human body in an accurate and non-invasive approach.

High-resolution ultrasound in the evaluation of the scrotum: a pictorial essay

Dr Wai Lee, Ms Faye Temple, Dr Kirsten Gordon and Prof Oliver Hennessy, St. Vincent's Hospital, Vic, Australia

Purpose

This pictorial essay aims to demonstrate the sonographic anatomy of the contents of the scrotum and to demonstrate the sonographic features of common scrotal diseases.

Methods

A five-year retrospective analysis of 831 patients, who underwent sonography of the scrotum, performed at a tertiary level adult university teaching hospital was reviewed for cases of scrotal pathology.

Results

A pictorial essay of the sonographic features of a diverse range of scrotal pathologies, including infections, inflammatory conditions, tumours, trauma, vascular abnormalities, collections and congenital abnormalities, is presented.

Conclusion

High-resolution sonography remains the imaging modality of choice for scrotal diseases. A diverse range of scrotal pathologies is encountered in daily clinical practice and familiarity with the sonographic features of these pathologies is essential.

Prenatal diagnosis of a duplex kidney and ureterocele by 2D and 3D ultrasound – a case review

Mrs Deborah Wye, Christopher Kohlenberg Department of Perinatal Ultrasound, NSW and Professor Ron Benzie, Nepean Hospital and University of Sydney, NSW, Australia

Duplex kidney is a common congenital anomaly of the urinary tract, which is more frequent in females. There are two collecting systems with the upper pole ureter being prone to obstruction. If obstruction occurs it may result in cystic dilatation of the distal ureter producing an ureterocele within the bladder. Accurate prenatal detection of this anomaly, its severity and progression of obstruction throughout the pregnancy enables informed decisions to be made about antenatal care and allows early postnatal treatment.

In this case an anechoic structure in the upper pole of the right kidney was seen on the 19-week morphology scan. There also appeared to be a normal renal pelvis in the middle of the kidney and these findings suggested either a dilatation of the collecting system or possibly a duplex kidney. Follow-up was recommended and at 27 weeks a prenatal renal scan diagnosed a duplex right kidney and an ureterocele within the bladder. 3D sweeps enabled calculation of kidney, bladder and ureterocele volumes. Subsequent scans were performed at 29 and 33 weeks gestation and showed similar findings with no increase in the upper pole dilatation.

Due to maternal insulin dependent diabetes, proteinuria and hypertension, the female baby was delivered by caesarean section at 34.5 weeks gestation. A postnatal renal ultrasound and micturating cystourethrogram confirmed the prenatal diagnosis.

This case provides an excellent example of the classical sonographic features of a duplex kidney and ureterocele. These features and the potential role of 3D ultrasound in the diagnosis of renal abnormalities will be discussed.

First trimester thick nuchal translucency karyotypic abnormality rate

Mrs Donna Amaraddio, Mater Mothers Hospital, Qld, Mrs Lynette Arnesen, Mater Mothers Hospital, Qld, Dr Jenny Bryan, Mater Misericordiae Hospitals, Qld, Prof Fung Yee Chan, Mater Mothers Hosptial, Qld, Australia

Introduction

Thickened nuchal translucency (NT) in the first trimester is associated with increased risk for fetal aneuploidy, especially Trisomy 21.There is also an association with higher rates of structural abnormalities and poor outcome.

Objective

To determine the rate of aneuploidy in patients with

increased NT measurements and the relative change in karyotypic abnormality rate with increasing NT.

Method
Nuchal translucency scans using FMF guidelines, were performed by accredited staff, and those working towards accreditation. A cut-off risk of 1:300 was used to offer invasive testing. Karyotype and pregnancy outcomes were entered to the database as they became available. Prospective follow up was performed by asking patients to return outcome letters after delivery. Cases lost to follow up were cross-referenced with cytogenetic registers in Qld, for confirmed cases of trisomy 21. Multiple pregnancies, missed abortions and terminations with no karyotype, were excluded from analysis.

The rate of karyotypic anomalies were determined for NT results of 3 mm or more, 4 mm or more, 5 mm or more, and 6 mm or more.

Results
5241 NT scan results were collected from 1999 to 2003. 131 patients had NT measurements of 3 mm or more (2.5%). 16 had no karyotype performed, and were excluded from further analysis, leaving 115 cases. As NT thickness increased from 3 mm or more, to 6 mm or more, the rate of abnormal karyotype increased from 38% to 67%. The rate of trisomy 21 increased from 21–29%. The rate of 45, XO from 3% to 17%. Highly statistically significant using Chi-Square linear regression, $P < 0.0001$.

Conclusion
As NT thickness increased, the rate of abnormal karyotype increased significantly. Most increase occurred in Trisomy 21 and 45, XO cases. As the NT thickness increased from 3 mm or more to 6 mm or more, the risk of 45, XO increased almost five fold, while that for trisomy 21 increased 38%.

First trimester screening by maternal age and fetal nuchal translucency (NT) – five year audit of a tertiary centre in Australia

Mrs Donna Amaraddio, Mater Mothers Hospital, Qld, Dr Jenny Bryan, Mater Misericordiae Hospitals, Qld and Professor Fung Yee Chan, Mater Mothers Hospital, Qld, Australia

Background
Prenatal screening tests for Down syndrome have evolved over the years. Maternal age and NT screening has been reported to have a detection rate of ~75–80% with false positive rate of 5% in a low risk population.

Aim
To audit the effectiveness of NT screening in our centre.

Method
NT scans using FMF guidelines, were performed by accredited staff, and those working towards accreditation. A cut-off risk of 1:300 was used to offer invasive testing. Prospective follow up was performed by asking patients to return outcome letters after delivery. Cases lost to follow up were cross-referenced with cytogenetic registers in Qld, for confirmed cases of trisomy 21. Multiple pregnancies, missed abortions and terminations with no karyotype, were excluded from analysis.

Results
From 1999–2003, 5556 patients were seen, 325 cases were excluded leaving 5241 cases. According to the FMF software, the distribution of our NT measurements are good. Mean maternal age was 33 years, with 44.8% of patients having a baseline risk of 1:300 or more. The expected number of trisomy 21 cases using the FMF software was 28.

Prospective follow-up rate was 67.8% overall. Further linkage with laboratory data was performed. To our knowledge, 34 fetuses had confirmed trisomy 21 in this cohort, of which 31 were detected; giving a detection rate of 91.2%. 8.3% of patients had final adjusted risks of 1:300 or more. 502 patients proceeded to invasive testing. (about 50% CVS and 50% amniocentesis). For the invasive procedures performed, positive diagnostic rate was 1 in 8 overall.

Conclusion
Of our population, 44.8% were high risk by maternal age criteria. After NT screening, 8.3% remained high risk, and the detection rate for trisomy 21 is 91.2%.

NT screening in our population appeared to be highly effective.

Heterotaxy Syndromes (HS) – first and second trimester: three case reports

Mr Sinh Le, Mater Mothers Hospital, Qld, Mrs Donna Amaraddio, Mater Mothers Hospital, Qld, Miss Jillian Gibson, Mater Mothers Hospital, Qld, Dr Cameron Ward, Mater Mothers Hospital, Qld, Prof Fung Yee Chan, Mater Mothers Hospital, Qld, Australia

Background
Heterotaxy syndromes (HS), also known as isomerism, refer to abnormal arrangement of viscera across the left/right axis. This poster will outline terminology, keywords, associated anomalies, three cases and the importance of early detection.

- Case 1, referred to us for short maternal long bones. At 17 weeks, fetal stomach was seen on the right, cardiac apex to the left, with azygous continuation of the IVC, draining to the SVC. Postnatal tests showed normal cardiac structures with interrupted IVC and azygous continuation, polysplenism, horizontal liver, right-sided stomach. Baby was discharged with no further testing.
- Case 2, had normal NT scan with us at 12 weeks, but no fetal stomach was visualised. Cardiac anomaly was suspected at 19 weeks in private practice, and sent for review. We found a complex cardiac anomaly. Fetal stomach was small and right sided. Diagnosis-Isomerism. The pregnancy was terminated. Autopsy declined.
- Case 3, NT scans with us showed a nuchal thickness of 5.3 mm. Fetal stomach was left sided, cardiac apex to the right. Combined NT screen showed increased risk of trisomy 21. CVS showed normal karyotype. Fetal echo at 17 weeks 5 days showed complex cardiac anomaly. Cardiac apex was to the right and stomach on the left. Diagnosis-Isomerism. The pregnancy was terminated, autopsy pending.

Discussion
It is important to routinely determine the left and right aspect of the fetus, and attempt to establish cardiac and stomach positions, even in NT scans. Abnormal position of

the fetal heart could be an indication of HS, diaphragmatic hernia or chest masses. HS are uncommon, but can have serious consequences. Early suspicion should facilitate tertiary referral, detailed counselling, and discussion of pregnancy management options.

Outcome of chromosomally normal fetuses with nuchal translucency of 3.5 or more

Dr Saeeda Albalooshi, Christopher Kohlenberg Department of Perinatal Ultrasound, NSW, and Prof Ronald Benzie, Christopher Kohlenberg Department Of Perinatal Ultrasound, NSW, Australia

Introduction

The purpose of the study was to determine the outcome of chromosomally normal fetuses with a nuchal translucency of 3.5 and more.

Study Design

All patients from Jan 2000 until March 2005 who had antenatal screening test for Down syndrome in the first trimester (11–13 + 6 weeks) were reviewed. Patients with a nuchal translucency of 3.5 cm or more, with a serum screening test in the high risk range, were offered genetic counselling and prenatal diagnosis test either a chorionic villous sampling or amniocentesis.

Results

Of 4870 patients that had nuchal translucency and serum antenatal screening testing, 92 (1.9%) cases of fetal chromosomal abnormalities were found. Twenty-seven (0.6%) fetuses had enlarged nuchal translucency of 3.5 or more with normal chromosomes. These 27 fetuses were followed up till delivery. No abnormalities were noted in 22 babies, however three were born preterm due to maternal reasons. Five (19%) fetuses had abnormalities, three with cardiac defects and two had musculoskeletal defects.

Conclusion

In chromosomally normal fetuses, increased nuchal translucency is associated with a wide range of feta defects and genetic syndromes. Of this group, 81% were apparently normal at birth, however, where no anomaly is detected at birth, careful follow up is essential to avoid missing rare genetic or other defects.

Is it a boy or a girl: a case of congenital adrenal hyperplasia

Ms Alison Lee-Tannock and Dr Glenn Gardener, Mater Mothers Hospital, Qld, Australia

This is a case of antenatal diagnosis of congenital adrenal hyperplasia (CAH). The aetiology of this condition, diagnostic factors, management options and long-term outcome will be presented.

References

Sonography in prenatal diagnosis of congenital adrenal hyperplasia. Saada J *et al. Prenatal Diagnosis* 2004: 24 (8); 627–630.

First reported case of identical anomalies in monochorionic monoamniotic twins

Ms Alison Lee-Tannock and Qld Prof Fung Yee Chan, Mater Mothers Hospital, Qld, Australia

This poster demonstrates a case of monochorionamniotic twins with identical spina bifida lesions. This is the first reported case of identical fetal anomalies in monoamniotic twins. The poster will present a literature review, the ultrasound features of this case and the postmortem findings.

To TV or not to TV

Ms Amanda Lansdowne, Waikato Hospital, New Zealand

The purpose of this study was to audit best practice for pelvic ultrasounds and whether transvaginal ultrasound should be a routine part of the pelvic ultrasound. For every pelvic ultrasound performed in our department for the months of May, June and July a transvaginal scan, where possible, was also performed. This was to see if pelvic ultrasounds that yielded normal results on transabdominal imaging demonstrated pathology or added information on transvaginal imaging. As this is an ongoing study the results have not yet been tabulated.

Objective quality measure of compressed fetal ultrasound video clips

Dr Igor Kromin, University of Queensland, Qld, Dr David Watson, Mater Mothers Hospital, Qld, Dr Laz Kastanis, Mater Womens Hospital, Qld, Prof Fung Yee Chan, Mater Mothers Hospital, Qld, Prof Alan Chang, Mater Misericordiae Health Services, Qld, Australia

Background

When a compressed ultrasound videoclip is assessed, it is important to ascertain whether the image quality seen has deteriorated because of the compression, or is related to inadequate quality in the original acquisition. The aim of the current project is to develop an objective method for assessing the quality of compressed fetal ultrasound video clips as compared to its original uncompressed version.

Methods

Six 5-second digital video clips of normal feta cranial morphology were obtained. The analysis of each video was done by extracting the first, middle and last frames. Video quality was assessed as the difference between a compressed and an uncompressed version. Two main methods of quality difference were assessed: one was based on the root-mean-square (RMS) calculation of a video and the other on a smoothed (convoluted) pixel difference between video frames. These two methods of objective assessment were compared to the subjective scores obtained by five experienced clinicians. Analysis of correlation was conducted using Pearson's correlation coeffcient.

Results

The mathematical analysis of the videos showed signifcant correlation to the subjective analysis. The correlation coeffcient was 0.59 for RMS ($P = 0.01$) and 0.51 for pixel difference algorithm ($P = 0.03$). The two objective methods of analyses were significantly correlated to each other, with correlation coefficient of 0.93 ($P = 0.0002$). However, RMS tended to show less variation, with the highest values just below 3% intensity error across the difference matrix, while pixel difference showed a range of quality ranks that varied from 0% difference between compressed and uncompressed frames to over 45% difference. This suggested that pixel difference maybe a better differentiating algorithm.

Conclusions

Both the RMS and pixel difference algorithms showed significant correlation to the subjective assessment of videoclip quality. Pixel difference may be a better differentiating

algorithm to assess the difference of video quality after compression. Further work is in progress to automate the quality assessment process so that it can be easily applied in a clinical setting

Nasal ossification sonar evaluation

Mrs Rachael Martin, Nepean Hospital, NSW, Australia

Currently there are criteria established by the Fetal Medicine Foundation in London for the risk assessment of fetal aneuploidy in T21 (Down Syndrome), T13 and T18. These criteria are offered to Australian population for Down Syndrome Screening at 11–13 weeks 6 days. The risk can then be recalculated at 18–20 weeks after the fetal morphology scan.

There is a shift from second trimester 'soft signs' of aneuploidy toward sonographic markers in the first trimester. Recent literature and research worldwide is discussing nasal bone detection in the first trimester as one of these sonographic markers. Currently there is no published data in the Australian population.

Staff in our department is currently involved in examining the fetal nasal bone and formulating a data set for 'normal' nasal bone length at the time of Nuchal Translucency Screening and routine Morphology ultrasound examinations. We will have measured the nasal bones of approximately 700 first trimester and 1300 second trimester fetuses. Nomograms including the 10th, 50th and 90th percentiles will be shown. Normative data from 11–22 weeks gestation will be shown and discussed.

A review of upper abdomen and pelvic/vaginal ultrasound operating procedures in Australia

Mrs Maureen Farrelly, Radar Medical Imaging, Vic, Australia

The aim of this research was to survey the 1366 Australian Sonographer's Association members to assess all the accredited sonographer's scanning procedures in the evaluation of a normal upper abdominal and pelvic/ vaginal scan. The results will provide an insight into current scanning procedures in Australia. This research will establish:

1 The number of images acquired in different departments for a normal upper abdominal and pelvic/ vaginal scan.
2 The time normally taken to complete the scanning and imaging for a normal upper abdominal and pelvic/ vaginal scan.
3 The variation in scanning protocols and sonographer reporting forms in public and private departments in normal examinations.
4 Whether the radiologist/ sonologist reviews each case before the patient leaves the practice.
5 Whether the new privacy law requirements for patient access to all documented information has created a high percentage of documentation in public and private departments, as shown by departmental protocols and Sonographer reporting forms.

The specific question/ answer close-ended questionnaire has provided precise survey results and enabled an analysis of normal scanning procedure for a normal upper abdominal and pelvic/ vaginal ultrasound. The medico-legal requirements of the appropriate standard of care for a sonographer can only be evaluated by surveying peer group accredited sonographers who perform similar procedures in Australia.

Hydrops Fetalis: current thoughts

Prof Pippa Kyle, Christchurch Women's Hospital, New Zealand

Hydrops Fetalis is a serious condition in fetal life. The presentation diagnosed on ultrasound includes abnormal fluid accumulation in two physical spaces including: skin oedema, ascites, pleural effusions, pericardial effusions, polyhydramnios, and placental oedema. Occurrence is approximately 1:2000 cases. Immune hydrops caused by RBC alloimmunisation (RhD, Rh c, Kell antigens) is now uncommon (< 10%), whereas non-immune hydrops contributes to the majority of cases (90%).

Studies attempting to quantify the origin of the underlying cause in the non-immune hydrops group, suggest the following rates: Cardiac (25%), Chromosomal (13%), Genetic (11%), Thoracic (7%), Anaemia (6%), Idiopathic (aetiology not determined) (up to 20%), but such reports are dependent on the population studied.

The precise pathogenesis of hydrops will depend on the underlying aetiology.

Survival is dependent on the underlying aetiology, gestation and presentation. Immune hydrops survival is approximately 75%, whereas non-immune hydrops is close to 20%. Nevertheless, those cases amenable to in-utero therapy (intrauterine transfusion for anaemia, pleuro-amniotic shunt for congenital chylothorax, drugs for fetal arrhythmia) up to 70% may survive. Early targeted searching of such cases is important to produce the best outcome. To facilitate this, the following steps should be taken:

1 Assessment of medical and family hx.
2 Detailed high-quality anatomy scan including cardiac anatomy.
3 Pattern recognition of fluid accumulation.
4 MCA Doppler velocity to exclude fetal anaemia.
5 Maternal examination to assess for preeclampsia.
6 Targeted maternal and fetal investigations.
7 Treatment is available.

Remember, hydrops is a sign rather than a diagnosis. Initial recognition is the just the beginning of the diagnostic work up to maximise survival and information for future pregnancies.

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Pancreatic ultrasound – is it still useful in 2005?

Prof Robert Gibson, University of Melbourne and Royal Melbourne Hospital, Vic, Australia

Pancreatic ultrasound (US) is still very useful in 2005 but the patterns of clinical usage have changed.

Improved resolution of multi-detector CT has placed more imaging reliance on CT. It has also, however, increased

the detection rate of pancreatic cystic disease including cystic tumours and intraductal mucinous papillary tumours (IPMT). Diagnosis of the nature of cystic disease is often difficult and ultrasound, including endoscopic US (EUS), may help with diagnosis and monitoring size.

EUS is more available and allows high-resolution imaging of most parts of the pancreas and is of value in characterising focal lesions, guiding aspiration, detection of pancreatic endocrine neoplasms (PENs), and in tumour staging.

Intraoperative and laparoscopic US are used in many centres especially for staging of pancreatic tumours and in localising PENs.

Contrast enhanced US (either transcutaneous or endoscopic) may provide additional diagnostic information in detection or characterisation of a pancreatic mass lesions.

US remains the most efficient guidance for most interventional procedures, including biopsy guidance and cyst aspiration, although complex pancreatic collections require CT.

ES also provides guidance for a number of procedures.

Some conventional roles of US remain important:

- acute pancreatitis – the main role is detection of gall bladder stones as the aetiology;
- in evaluation of the jaundiced resulting from obstructing pancreatic head masses;
- in staging pancreatic carcinoma;
- monitoring the size of pancreatic pseudocysts;
- in clarifying the nature of equivocal finding son CT, such as the 'bulky pancreatic head'; and
- forming part of the work-up of PENs.

Finally, since the pancreas is included in so many abdominal ultrasound studies it is still critical to understand the normal appearances, including variants, and common pathologies.

Fetal hearts – sorting outflows out and how to see that VSD

Dr Wes Cormick, Canberra Imaging Group, ACT, Australia

From a cardiological point of view, the important lesions to pick up prenatally are the ductal dependant lesions (e.g. Transposition, Tetralogy of Fallot) as they may affect management at the time of delivery. Mostly, finding other lesions does not affect management. Screening for these requires a good knowledge of the cardiac outflows.

Isolated VSDs are the most common congenital defect, but are usually missed. Many close spontaneously and from a cardiological point of view can be diagnosed after birth. In the context of other soft findings however, the addition of a minor heart defect significantly increases the risk of aneuploidy. In addition, with a suspicion of trisomy 18 a 'thorough' normal study significantly reduces the risk.

Because of the high association of AVSD with trisomy 21, it is also an important lesion to demonstrate.

Therefore it is important to be able to demonstrate or confidently exclude outflow abnormalities, and the various VSDs.

In this presentation I will use pathological specimens and images to help develop an understanding of cardiac outflows and the various types of VSD.

Venous ultrasound, value in upper extremity DVT

Dr Joseph Polak, Tufts University School of Medicine, New England Medical Center, United States

Purpose

To review the importance of upper extremity deep vein thrombosis in the context of thromboembolic disease and to describe the imaging technique of upper extremity venous ultrasound.

Methods

Review of the literature on upper extremity deep vein thrombosis and its' risk factors. Case review highlighting the technique and its limitations.

Results

The prevalence of upper extremity venous deep vein thrombosis is increasing. It is now recognised as a significant source of pulmonary embolism. It was thought that upper extremity deep vein thrombosis was more of a nuisance than a true medical entity. This perception has dramatically changed. It is now recognised that upper extremity deep vein thrombosis can account for at least 10% and as high as 30% of incident cases of pulmonary embolism. In addition, the increased used of chronic venous access catheters such as PICS (Peripherally Inserted Central venous catheters), and various tunneled catheters has been associated with an increased incidence of upper extremity deep vein thrombosis. This is compounded by the fact that many of these patients have a malignancy, a major risk factor for lower and upper extremity thrombophlebitis. Ultrasound imaging of the upper extremity veins relies on compression ultrasound distal to the subclavian. A combination of grey scale and colour Doppler imaging is used for suspected lesions in the middle subclavian and at the brachiocephalic vein junction. Changes in cardiac phasicity are used for suspected central lesions.

Conclusion

Upper extremity venous ultrasound is a valuable first examination in patents with suspected upper extremity deep vein thrombosis.

Sonography of the foot and ankle

Dr Neil Simmons, Dr Jones and Partners, SA, Australia

Rather than give an exhaustive (and exhausting) overview of the entire foot and ankle region, I should like to focus on several areas on which sonography has a part to play in the clinical management of the patient.

These include:

1 Assessment of the painful forefoot.
2 Staging of tibialis posterior tendon abnormalities.
3 Neural entrapments on the dorsal aspect of the foot.
4 The role of sonography in assisting orthopaedic surgeons in patient management.

Reference will be made to particular cases demonstrating the relevant points. The dynamics of the tibialis posterior tendon and the consequences of its failure will be discussed.

Diagnosis and treatment of metatarsophalangeal joint instability

Ms Julie Gregg, Mayne Health Diagnostic Imaging, Vic, Assoc Prof Morry Silberstein, Monash Universtiy, Vic, Dr Paul Marks, Mayne Health Diagnostic Imaging, Vic, Mr Timothy Schneider, Melbourne Orthopaedic Group, Vic, Australia

Acute trauma or chronic microtrauma can cause disruption of the plantar plate. Often associated with women who wear

high-heeled shoes, is also found in athletes. The presence of a short 1st ray and long 2nd ray predisposes patients to metatarsophalangeal joint instability. Although metatarsophalangeal joint instability may be associated with hallux valgus, it may also be present without any hallux deviation.

Ill-defined pain at a lesser metatarsophalangeal joint orintermetatarsally is the most common clinical presentation of metatarsophalangeal joint instability. Swelling plantar to the metatarsal head or base of the proximal phalanx has been reported. Intermetatarsal fibrosis or bursitis are differential diagnoses or co-existing pathologies. Underdiagnosis of the spectrum of pathologies has lead to treatment of conditions that haven't relieved the pain. Imaging tools such as ultrasound and MRI to assist in the diagnosis of the plantar plate rupture is helpful when the clinical presentation is unclear.

When conservative treatment has failed and the patient's pain is significant, the surgical repair of the plantar plate has been performed. Techniques in the repair of the plantar plate include tendon transfers or primary plantar repair. A new technique of bony decompression in combination with plantar plate repair will be described. Early reports are promising with satisfactory results in most patients.

Ultrasound of arthritis

Dr Rethy Chhem, LHSC – University Campus, United Kingdom

A quick review of the imaging of arthropathies will be discussed first in order to put US in a broader perspective among other imaging modalities. The role of US in the management of patient with rheumatoid arthritis (RA) will then be discussed. This include the review of the specific role of US in the early detection of early RA, the description of the US features of rheumatic disease in its early and late stages, the differential diagnosis between synovitis, tenosynovitis and bursitis, as well as the assessment of the response to local/systemic therapeutic interventions. Finally, US will be also helps in detecting complications of RA such as tendon rupture and joint infections.

Sonography of appendicitis in children

Mr Roger Gent, Women's and Children's Hospital, SA, Australia

With appropriate technique, ultrasound is very reliable in the diagnosis of appendicitis in paediatric patients.

Use of a linear array for these examinations has been advocated for many years but a high frequency tightly curved array has several advantages. Pressure can be applied over a smaller region, assisting with displacement of gas, while the curved face is likely to cause less discomfort when this is necessary. The curved array also allows better access to an appendix extending deep into the pelvis or lying in a retrocaecal position.

The entire appendix should be visualised before appendicitis is excluded, as in many cases, only the tip is inflamed, with the base being normal. Associated signs such as an abnormal amount of free fluid or increased echogenicity of mesenteric and omental fat often assist in confirming the diagnosis.

Ultrasound is particularly of value in those cases where the clinical diagnosis is equivocal, not uncommon when the appendix is in an unusual position. A search for the appendix should always extend beyond the confines of the iliac fossa when it is not identified there. Views through a full bladder are useful for demonstrating pelvic structures and may be the best way of showing an appendix extending well into pelvis. In most cases, however, the appendix is more easily identified after the bladder is emptied.

When the appendix is identified and normal, the ultrasound examination often allows an alternative diagnosis to be made, including such conditions as inflammatory bowel disease, ovarian pathology, pyelonephritis, omental infarct and Meckel's diverticulum.

The use of ultrasound in the diagnosis of thoracic outlet syndrome

Dr Denise Roach, The Queen Elizabeth Hospital, SA, Australia

Aim

To discuss the role and use of ultrasound in diagnosis of Thoracic Outlet Syndrome (TOS).

Methods

The topic of TOS will be introduced. The types of TOS, aetiology, anatomy, presentation, signs and symptoms will be discussed. The role of ultrasound will be discussed in relation to venous, arterial and neurogenic TOS. Our technique and protocol for ultrasound in TOS will be presented. Ultrasound will be compared to other modalities of imaging such as MRI, CT scanning and digital subtraction angiography. Case studies will be presented using various modalities for imaging. The literature on US in TOS will also be reviewed.

Conclusion

The current role of ultrasound in TOS diagnosis and management has been reviewed.

Exercise induced leg pain and entrapment

Mr Robert Ziegenbein, Monash University, Vic, Dr Andrew Garnham, Deakin University, Vic, Australia

Popliteal entrapment, iliac fibrosis and kinking of the iliac artery are non-atherosclerotic conditions causing exercise induced leg pain in athletes.

Popliteal entrapment is usually found in sports or occupations involving running, jumping or marching. Iliac artery fibrosis and kinking appears to be largely confined to cyclists and triathletes using repetitive high intensity hip and thigh flexion.

These non-atherosclerotic conditions can produce symptoms of pain, weakness and numbness only during exercise and may also be similar to non-vascular causes of leg pain such as stress fractures, tendon pathology, nerve entrapment or compartment syndrome. Non-vascular causes may coexist with vascular causes, making it difficult to discriminate the predominant problem.

To discriminate vascular and non-vascular causes of leg pain, ultrasound and ankle/brachial indices are used to identify significant pressure loss or velocity increases which identify areas of stenosis. However, this requires measurements to be recorded while the patient reproduces their symptoms. In popliteal entrapment, various foot movements can be used to mimic the plantar flexion which occurs during running but it is difficult to consistently provoke muscular contractions which cause effective external compression of the popliteal artery. Similarly, cyclists can assume a

crouched aerodynamic position but performing ultrasound in this position is challenging. In both groups, exercise is used to replicate the symptoms normally experienced by the patient. Performing ultrasound during or after exercise is also technically difficult and our knowledge of the expected changes in exercise is limited.

This presentation will highlight the clinical features and technical aspects of diagnosis in these conditions and discuss the changes which occur in duplex measurements and Ankle/brachial indices.

Ultrasound guided intervention in skeletal disease

Prof Wayne Gibbon, University of Queensland, Qld, Australia

Ultrasound-guided interventions in the skeletal system maybe divided into 'diagnostic' and 'therapeutic' procedures. These mainly relate to soft-tissue interventions, however, due to sonography's ability to demonstrate the surface of bone (and metalware) it can, in certain circumstances, be use to target bony interventional procedures such as percutaneous bone biopsy close to areas of prior surgical instrumentation. Diagnostic procedures mainly include variations on needle aspiration of synovial fluid from joints and bursae, biopsy of abscess collections or infected granulation tissue and local anaesthetic in filtration to assess the possible anatomical site of symptoms. Therapeutic procedures mainly relate to steroid inltration, barbotage of calcific deposits, hydrostatic over-distension to breakdown adhesions and guidance of shock-wave therapy.

Occasionally it is possible to perform a procedure with both diagnostic and therapeutic components as when a combination of local anaesthetic and steroid are injected into a tendon's heath or bursa. Here the local anaesthetic provides a degree of diagnostic confirmation of symptomatic site independent of whether any therapeutic effects occur with the steroid agent. Different methods for sonographic needle localisation will be described with discussion as to their relative advantages. Possible future applications will also be suggested.

Power Doppler ultrasound in rheumatoid arthritis: reliability, stability, validity and responsiveness

Dr Fred Joshua, St George Public Hospital, NSW, Mr Rohan De Carle, St George Private Hospital Mayne Health, NSW, Mr Michael Rayment, St George Private Hospital Mayne Health, NSW, Dr Paul Bird, St George Private Hospital Mayne Health, NSW, Dr Ronald Shnier, St George Private Hospital Mayne Health, NSW, Dr Carl Bryant, St George Private Hospital Mayne Health, NSW, Prof John Edmonds, St George Private Hospital Mayne Health, NSW Assoc Prof Marissa Lassere, St George Private Hospital Mayne Health, NSW, Australia

Background

Power Doppler ultrasound (PDUS) can determine blood flow to synovial tissue and may measure rheumatoid arthritis disease activity. The performance characteristics of PDUS must be ascertained before widespread use.

Objectives

Determine (1) reader reliability (2) acquisition reliability, (3) stability through the day (4) validity of PDUS against clinical and laboratory measures, Health Assessment Questionnaire (HAQ) and MRI (5) responsiveness of PDUS.

Methods

Twenty-eight rheumatoid arthritis patients were studied with PDUS of the dominant hand MCP 2–5; images scored 0–10. 21subjects, also had an MRI of the same joints, scored presence or absence of synovitis. Twenty were rescanned by MRI and PDUS2 weeks later, 10 after receiving prednisone. Seventeen patients were scanned by two sonographers, 11 patients were rescanned 30 minutes later, and 10 patients were scanned in the morning and evening.

Results

Reliability: (intra class correlation coefficient) reader inter observer 0.99, intra 0.99, acquisition inter 0.86, intra 0.97, diurnal intra 0.95. Validity: (Spearman) PDUS score vs. swollen and tender joints rho = 0.39 (p = 0.04), PDUS vs. ESR/CRP rho = 0.372 (P = 0.8) rho = 0.211 (P = 0.3), PDUS vs. HAQ rho = 0.30 (P = 0.2). PDUS score are positively associated with MRI synovitis; significantly higher scores when MRI detects synovitis, 3.00 vs. 0.51 $P < .001$. Responsiveness: (paired t-test) after prednisone significant change in HAQ (P = 0.04), swollen and tender joints (P = 0.02), ESR (P = 0.01), PD score (0.03). No significant change in group that did not receive prednisone. ESR was most responsive (standardised response means) (1.30), swollen and tender joints (0.94), PDUS score (0.82), HAQ (0.74) and CRP (0.57).

Conclusion

Power Doppler ultrasound was found to be a reliable measure for image acquisition, scoring, and stable through the day and PDUS score (four joints) modestly correlated with measures of disease activity particularly swollen and tender joints and ESR. Power Doppler ultrasound score was significantly higher for joints with synovitis on MRI. PDUS was found to be very responsive and to significantly change after prednisone.

Work-up of the jaundiced patient

Prof Robert Gibson, University of Melbourne and Royal Melbourne Hospital, Vic, Australia

The major role of imaging in the work-up of the jaundiced patient remains the identification and detailed assessment of major bile duct obstruction. Ultrasound should still be the preferred initial imaging modality, but will often be supplemented with CT, MRCP, direct cholangiography, and in some centres endoscopic and/or intraoperative ultrasound.

The questions that need addressing with various combinations of these modalities are:

1 Is there bile duct obstruction? Criteria for bile duct dilation need to be used carefully;
2 Where is the obstruction anatomically?;
3 What is the cause of the obstruction?;
4 If the obstruction appears to be malignant; and
5 Is there evidence of non-resectablity?
6 With non-respectable malignant hilar obstruction what approach should be taken to palliative stenting?

Attention to these questions at the initial ultrasound allows selective and expeditious use of the supplementary modalities to address the unanswered questions.

Causes that can be identified, or at least suggested, at initial ultrasound include:

Benign: choledocholithiasis, sclerosing cholangitis, Mirizzi syndrome

Malignant: Hilar obstruction – cholangiocarcinoma, gall bladder carcinoma, metastases.

Low obstruction: carcinoma pancreas, periampullary carcinoma, metastases

In malignant hilar obstruction evaluation should assess the proximal extent of structuring into the right and left hepatic ducts, the patency of the portal veins, the presence of lobar atrophy and intrahepatic or local extrahepatic metastases.

In malignant low obstruction, usually due to pancreatic carcinoma, the main issues for US are tumour size, vascular involvement (portal vein, superior mesenteric vein, and superior mesenteric artery) and lymph node metastases.

Some new developments in breast imaging

Prof Peter Burns, University of Toronto, Canada

Though the first organ to be imaged with ultrasound, the breast has presented one of the most intractable challenges to ultrasound imaging technology. Yet, as has been pointed out on many occasions, a non-invasive means for the detection, diagnosis and monitoring of this most important cancer, without the use of ionising radiation which is itself carcinogenic, would be a tremendous advance in diagnostic medicine. From a technical point of view, the combination of fibrous and fatty tissue in the vesicular form typically found in the breast causes refraction and beam distortion, which can be overcome only by sacrificing spatial resolution to an unacceptable extent. Following numerous, mainly failed, attempts to construct dedicated water-path scanners, most workers now use hand-held linear array transducers. The advent of tissue harmonic imaging and the addition of real-time compounding have finally elevated image quality in many patients to a point at which ultrasound can be used for differential diagnosis rather than simple cyst detection. In this presentation, two more recent developments will be discussed. In the first, we return to the attempts, first made 25 years ago using Doppler, to extract functional information concerning blood flow from the breast. As discussed elsewhere in this ASM, the significance of the process of angiogenesis extends not only to diagnosis but also the response of breast tumours to therapies, including the new anti-angiogenesis drugs but also radiotherapy, chemotherapy and ablation methods. Microbubble contrast agents offer the prospect of assessing angiogenic flow quantitatively, both by measuring flow rate, vascular volume and transit time, and by showing vascular patterning within the tumour. Many modern scanners have been equipped with the software for contrast breast studies. Such methods are in the early stage of application but the results to date, some of which will be shown, seem to show promise.

Salivary glands and the larynx

Dr Rhodri Evans, The Clinical School at Swansea University, United Kingdom

The search for stones in the salivary glands requires some knowledge of key anatomy. A systematic approach to the examination of the salivary glands will be presented. Themylohyoid muscle is key to assessment of the submandibular gland, but there are significant numbers of anatomical variants that will cause problems for the sonographer. Sublingual pathology may present in the submandibular space if variants are present and we need to be wary of the potential pitfalls.

The search for stones in the salivary glands requires some knowledge of key anatomy. A systematic approach to the examination of the salivary glands will be presented. Themylohyoid muscle is key to assessment of the submandibular gland, but there are significant numbers of anatomical variants that will cause problems for the sonographer. Sublingual pathology may present in the submandibular space if variants are present and we need to be wary of the potential pitfalls.

Tumours of the salivary glands are straightforward in that the vast majority are benign (up to 90% in most series) and fortunately the two most common benign tumours (Pleomorphic adenoma and Warthin's tumour) have characteristic appearances. The role of fine needle aspiration cytology in the management of parotid tumours is discussed.

The larynx is the last bit of the jigsaw in the ultrasound examination of the neck. While ultrasound does not feature in many radiologists' toolbox for assessing the larynx – a little key knowledge will allow howlers to be avoided and major pathology to be recognised. It can be a useful adjunct to assessment once the key anatomy is mastered. A short series of video clips will be shown to try and convince the wary that it is not too difficult a technique to master.

Breast prosthesis and complications

Dr Wes Cormick, Canberra Imaging Group, ACT, Australia

When breast implants are inserted, the body forms a fibrous capsule around the outside of the implant. The implant may be filled with silicone, saline or both.

If a saline implant ruptures it will deflate. If a silicone implant ruptures the thick silicone gel does not completely leak out. This will result in partial collapse of the implant. While the silicone gel is often contained by the surrounding fibrous capsule, it can leak into the adjacent tissues and cause a granulomatous reaction. Some prostheses can leak silicone out in small amounts even though the implant is intact, known as gel bleed.

When used properly ultrasound is very helpful in assessing implants for rupture and other complications. The majority of the important information is obtained at the edge of the fibrous capsule with a high resolution probe.

I will present the appearance of the different types of implants and examples of the normal and abnormal findings with ultrasound.

Gas as a contrast agent in MSK ultrasound

Dr Wes Cormick, Canberra Imaging Group, ACT, Australia

From a clinical point of view, a musculoskeletal ultrasound examination is an extension of the clinical assessment of a patient. A history of type of injury and duration of symptoms may be required to interpret the clinical significance of imaging findings. Focal tenderness, range of movement and pain on movement are all assessed while performing an ultrasound examination. When a needling for injection is done this also can give more clinical information. Deep tenderness can be better localised with the tip of the needle and resolution of pain with injection of local anaesthetic are both helpful features.

Watching the movement of fluid at the time of injection can add useful information about the integrity and communications of structures.

Air injected into the tissues acts as a contrast agent and allows demonstration of tears to tendons and ligaments, defects in joint capsules and communications of fluid collections.

I will present examples of how injection of gas as a contrast agent an add additional information to the musculoskeletal examination.

Ultrasound detection of mechanisms underlying overuse injuries. The 'cause of the cause' for pain

Prof Wayne Gibbon, University of Queensland, Qld, Australia

Tendon injuries are common cause of work or athletic activity-related disability. Their affect on the nation's burden of disease relates not so much to them occurring as a single acute episode but their persistence and/or recurrence and their subsequent indirect effect on an individual's work productivity and earning capacity. Repetitive injury to skeletal soft-tissues often produces typical sonographic changes both in terms of appearance and anatomical distribution. These include injuries to a range of tendons, fasciae bursae and joint structures and may be purely chronic injuries or acute exacerbations of chronic injuries. The pattern of these changes provides a valuable clue as to, not only the cause of a patient's pain, but also the underlying mechanical problem predisposing to that injury. It is important to recognise this biomechanical fault in order to guide injury rehabilitation and avoid subsequent recurrence of symptoms on return to the causative physical activity. The talk will concentrate on particular injuries to illustrate these points including injuries to the heel, ankle and knee extensor mechanisms and also how injury patterns vary with patient age. Once these underlying principles are recognised, however, they can be extrapolated to any soft-tissue structure and associated repetitive soft-tissue injury. This understanding allows the ultrasound examiner, not only to demonstrate the cause of a patient's symptoms, but the 'cause of the cause' thus providing very important additional information on which to base clinical management.

Ultrasound evaluation of the triangular fibro cartilage complex

Mr Christopher Sykes, St Francis Xavier Cabrini Hospital, Vic, Australia

The term Triangular Fibro Cartilage Complex (TFCC) was first used by Palmer and Werner in 1981 to describe the major ligamentous stabilising structures of the distal radioulnar joint and the ulnar carpus. The TFCC is made up of five components, a central disk, the dorsal and volar radioulnar ligaments, the extensor carpi ulnaris sheath and the meniscus homologue.

Injury to the TFCC can result from falls onto the outstretched hand, distraction force applied to the volar forearm or wrist, fractures of the distal radius or torsional injuries from the use of power drills. Patients typically present with ulna sided pain and may have clicking of the wrist. In addition to acute injuries, the TFCC is prone to degeneration, which progressively increases in prevalence and severity from the third decade of life. From the fifth decade of life, the TFCC is invariably abnormal but may remain asymptomatic.

Although sonography is useful for evaluation of ligaments and tendons of the wrist, the TFCC is a difficult structure to image adequately. A recent study by Keogh et al. has suggested the sensitivity of ultrasound in the detection of TFCC tears is comparable to MRI.[1]

This paper will discuss the anatomy of the TFCC, the sonographic appearance of the normal TFCC and clinical examination for TFCC tears. In particular, the 'press-test' will be discussed.[2] This simple clinical test has a published sensitivity of 100% for the diagnosis of TFCC injuries and should form an integral part of all ultrasound examinations of the wrist.

References

1 Keogh CF, Wong AD, Wells NJ, Barbarie JE, Cooperberg PL. High-resolution sonography of the triangular fibrocartilage: initial experience and correlation with MRI and arthroscopic findings. *AJR*. 2004; 182 (2): 333–336.

2 Lester B, Halbrecht J, Levy IM, Gaudinez R. "Press test" for office diagnosis of triangular fibrocartilage complex tears of the wrist. *Ann Plast Surg*. 1995; 35 (1): 41–45.

Ultrasound of non-rotator-cuff lesions of the shoulder

Dr Rethy Chhem, LHSC – University Campus, United Kingdom

The assessment of rotator cuff tendon represents the most common clinical indication of MSK US in many radiology departments. Unfortunately, sonographers have neglected the study of shoulder lesions beyond rotator cuff injuries. Indeed, US can detect many more abnormalities like soft tissues pathology, or lesions beyond those affecting the rotator cuff tendons themselves. Shoulder's disorders that may be diagnosed by US include soft tissue masses, arthropathies, joint and bursal infection, other tendons injuries or bursal abnormalities as well as bone abnormalities in a few selected cases. When appropriate, US will be correlated with conventional radiography and other cross-sectional imaging modalities like MRI. This talk was designed to raise awareness about the possibilities of expanding the clinical indications of US of the shoulder beyond the assessment of rotator cuff injuries.

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Peripheral Vascular Ultrasound How, Why and When (Second Edition)

Authors Abigail Thrush and Tim Hartshorne
Publisher Elsevier Churchill Livingstone 2004
ISBN 0-443-07283-3
Cost $A95.00

Peripheral Vascular Ultrasound, How, Why and When is a book that every vascular sonographer would appreciate. This second edition is of similar size and format to the first edition published in 1999. It aims to 'provide an understanding of the principles and practice of vascular ultrasound' and it achieves its goal.

The subjects covered relates to the periphery and thus abdominal or pelvic applications of duplex ultrasound are not discussed. The current edition has more colour tables, diagrams and images. All of the chapter headings are identical to the first edition, except that this edition does not contain the chapter on 'Providing a vascular ultrasound service'.

Basic information is provided on the physics of ultrasound, pulsed wave and colour Doppler, spectral analysis, haemodynamics and optimisation (Chapters 1–7). Chapters 8–14 systematically cover different peripheral vascular ultrasound applications, techniques, diagnostic criteria and troubleshooting.

Much of the text and images are the same as in the first edition, the additional content in this edition incorporate: advances in technology including harmonic and compound imaging, Doppler velocity measurements and associated errors; image artefacts; repetitive strain injury; arterial stents; dialysis access grafts and AVFs; endoluminal graft repair; treatment of pseudoaneurysms and entrapment of grafts. Each chapter's reference list has been updated and extended and the diagnostic criteria presented have a wider literature based approach.

This is a valuable text for the vascular sonographer although it is limited to peripheral vascular ultrasound applications; it is easy to read has useful diagrams, images and references. If you missed the opportunity to purchase the first edition you should consider this one.

Lucia Pemble PhD DMU (vasc)
Griffith University
Nelson Queensland

DMU Video Subscription Series

The DMU Video Subscription Series, available to all ASUM members who are DMU candidates, is intended to support preparation for the DMU examinations. Please note this is not a comprehensive program and will not, in itself, adequately cover all aspects of the DMU Syllabus. This list is provided by the ASUM Education Department, which is separate from the ASUM DMU Board of Examiners.

ASUM is offering candidates the choice of hiring eight videos for a total subsidised cost of $A33.00 (this includes GST and postage), to be dispatched at two per month. Videos must be returned within the month so that the next loan instalment may be processed. Please number the eight titles in the order you would like to receive them and fill in the payment details below.

Please note to receive all eight videos before the exam you will need to subscribe before the end of February.

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153 (CR ROM) Anna Parsons Lecture Series – 1. Endometrial Assessment (Anna Parsons, April 2002) ❑

123 (VHS) Normal Female Pelvis (Ethna Phelan, 1999) ❑

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134 (VHS) Sonography of the hip joint in paediatric patients (Roger Gent 2000) ❑

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Abdominal

76 (VHS) Upper Abdomen Scan Technique (M Harkness) ❑

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Cardiac

87 (VHS) 'Basic echocardiographic examination techniques' (B. Anderson, 1997); 'Advanced echographic techniques – assessment of valvular stenosis and valvular regurgitation' (B. Anderson, 1997) ❑

Plenary Session

61 VHS General Plenary Session 1996 'Should all pregnancies have a transvaginal ultrasound? What would it tell us? (W. Holzgreve, 1996); 'Significance of fetal renal pelvic dilation' (T. Chudleigh, 1996); 'Ultrasound in the emergency room' (E. Grant, 1996); 'Managing your image in the network age'. (P. Burns, 1996) ❑

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ASUM DMU Examinations Report

First, I would like to thank all the examiners and, in particular, those on the ASUM DMU Board of Examiners for their tireless work. Without the hours that all these people volunteer, it would be impossible to maintain the Diploma.

I would like to welcome Margaret Condon, Robert Zeigenbein, Rob Phillips and Alison White to the ASUM DMU Board of Examiners. They will be replacing Lucia Pemble, Rebecca Neish, Cathy West and Denise Ladwig. I would like to thank Lucia, Rebecca, Cathy and Denise for their dedicated support, hard work and professionalism. The high standard of the DMU examinations is due to the active contributions of board members who ungrudgingly volunteer many hours to ensure that examinations are set, supervised, graded and reviewed. Their contributions have been truly invaluable. I would also like to thank James Hamilton for his hard work as DMU Coordinator. It is a difficult and often thankless job but I was always grateful for his guidance. James is now working on the ASUM *Ultrasound Bulletin* and a number of other education projects. The first point of contact for DMU inquiries is now Matthew Byron whom James has ably inducted into this role over the past year.

After two years of transition, the DMU Part II Examinations will be in their intended form for the 2006 examinations. They will consist of the Practical Examination, two Written Papers and two Oral Examinations. One of the written papers will comprise 50% multiple-choice questions and 50% short answer questions relating to clinical situations. The other written paper will consist of questions requiring specific written answers. The Oral Examination will consist of two informal interview situations that will test physics and diagnostic situations and will cover Applied Physics and Clinical areas.

Practical Examiners will continue to travel to each candidate's place of work for the Practical Examination. Candidates will be required to travel to a major centre for their Oral Examinations. The Oral Examinations' venues will be decided when all applications have been received.

Physics

	Candidates	Passes	Pass rate %	Mean
Cardiac	29	26	89.65	62
General	35	28	80	56
Obstetric	4	3	75	63
Vascular	4	3	75	51

Anatomy

	Candidates	Passes	Pass rate %	Mean
Cardiac	29	28	96.55	68
General	32	26	81.25	59
Obstetric	3	2	66.66	55
Vascular	5	4	80	67

Part II Examination breakdown by specialty

	Cardiac	General	Obstetric	Vascular
Written, Prac & OSCE	40	24	2	8
Prac & OSCE	6	2	–	–
Prac	–	3	–	–
OSCE	2	4	–	2
All Candidates	48	33	2	10

Part II Written Examination result results by specialty

	Candidates	Passes	Pass Rate %
Cardiac	48	26	54
General	33	20	60
Obstetric	2	–	–
Vascular	10	10	100
All Candidates	93	56	60

Part II Practical Examination results by specialty

	Candidates	Passes	Pass Rate %
Cardiac	31	28	90
General	23	15	65
Obstetric	1	–	–
Vascular	6	6	100
All Candidates	61	49	80

Part II OSCE results by specialty

	Candidates	Passes	Pass Rate %
Cardiac	39	30	76
General	29	25	86
Obstetric	2	1	50
Vascular	8	8	100
All Candidates	78	64	82

Despite concerns that university courses may affect the number of candidates applying to sit the DMU, the number of candidates for 2005 compares favourably with those in recent years. While the mix of specialties changes, the overall numbers remain steady.

As always, we have several applications for examination re-marking and these will be considered at the meeting scheduled for 3rd and 4th March 2006.

Since it is standard practice that all papers given a fail grade are re-marked before the results are posted, the ASUM DMU Board of Examiners feels that it is best to consider these applications as a group.

DMU Diplomas conferred in November 2005

Cardiac
Sean Allwood
Richard Allwood
Michelle Anderson
Erin Baumgartel
Dane Beck
Anne-Maree Brandner
Kellie D'Orsa
Gail Doyle
Matthew Faint
Jane Henzell
Erin Honeysett
Michelle Hoy
Matthew Ischenko
Kate Loveday
Scott Manning
Peter Nowill
Marnie Peacock
Tanya Pilgrim
Kimberley Prince
Janie Puah
Jodie-Anne Sibley
Marcus Silbery
Catherine Swann
Bianca Tucker-Bohlin
Seamus Walker
Emily Yong,

General
Rima Al-Odeh
Relda Beere
Stacey Day
Jayne Doolan
Stanica Dulovic
Lucy Hellberg
Jennifer Hunter
Andrew Korobov
Linda Lott
Geradine Louis
Kathryn MacKinlay
Rosemary Mason
Christopher Miller
Milomir Mojsilovic
Tasma Scott
Leisa Skinner
Angela Stamp
Maria Steenkamp
Renay Thorp
Sharyn Woodhouse

Vascular
Christine Bolton
Carol Duncan
Jason Fong
Susan Gibb
Eric Grebert
John Lyons
Josie Macfarlane
Beverly McKenzie
Susanne Walton
Katarina Zegarac

ASUM TEACHING FELLOWSHIPS 2006

Chris Kohlenberg Teaching Fellowship

Proudly sponsored by
GE Healthcare

Since its foundation, GE Healthcare has constantly been at the forefront of research and technical innovation, with GE today being recognised as a world leader in the supply of diagnostic imaging systems.

The Chris Kohlenberg Teaching Fellowship was established by ASUM in association with GE Healthcare to increase the opportunity for members outside the main centres to have access to quality education opportunities. It has been awarded annually since 1998 to commemorate Dr Chris Kohlenberg, who died while travelling to educate sonographers.

This year we will be running two fellowships. One is planned for regional South Australia/Victoria. The second is planned for the southern regions of New South Wales.

Changes to the Giulia Franco Teaching Fellowship

Proudly sponsored by
Toshiba Medical

Since the introduction of ultrasound, Toshiba has been at the technological forefront of this diagnostic imaging technology. Throughout the years, Toshibas innovations have set new standards and created new applications that have significantly extended ultrasound capabilities.

The Giulia Franco Teaching Fellowship was established by ASUM in association with Toshiba Medical to provide educational opportunities for sonographers in all parts of Australia and New Zealand. It is named to commemorate Giulia Franco whose passion for ultrasound took her to all parts of Australia and New Zealand, and continued as she moved into a business career with Toshiba. It was first awarded in 2004.

In 2006, The Giulia Franco Teaching Fellowship will focus on major city centres.

Changes to ASUM Beresford Buttery Overseas Traineeship

Proudly sponsored by
GE Healthcare

The Beresford Buttery Overseas Traineeship was established in 1996 in conjunction with GE Healthcare in memory of Beresford Buttery FRACOG, DDU, COGUS who passed away in China in 1995 while serving as ASUM's representative on WFUMB.

Beresford worked tirelessly for ASUM throughout most of his professional career.

From 2006, the Beresford Buttery Overseas Traineeship will be replaced with a teaching fellowship which will focus on major city centres in either Australia or New Zealand.

We are very excited about these new arrangements as more of our members will be able to benefit by attending these workshops and meetings.

Applications invited for ASUM Research Grants

ASUM seeks applications for funding for research to be presented at WFUMB 2009 in Sydney

Applications for research funding by the ASUM Research and Grants Committee should be received by 1st April and 1st October.

Applications, which involve a presentation of results at WFUMB 2009 in Sydney, will be prioritised, but must meet normal criteria outlined in the ASUM Research and Grants Policy.

Applicants will be notified of the decision with respect to their application two months after these deadlines. Applications must be in writing addressing all the criteria outlined in the ASUM Research and Grants Policy and should be addressed to:

The Chairman
ASUM Research and Grants Committee
2/181 High Street
Willoughby NSW 2068 Australia

ASUM is seeking to support research that builds on the body of existing research findings and extends our knowledge of the applications, efficacy and safety of clinical ultrasound. Applications are particularly invited in the areas of:

1 High frequency ultrasound
2 Therapeutic ultrasound applications
3 Tissue elasticity
4 Obstetric growth parameters pertinent to the whole Australian and/or New Zealand population
5 Flow Mediated Dilatation and/or Intima Media Thickness Studies

Projects in other areas will be considered, however it is unlikely that applications for projects that duplicate existing findings, or studies, will be successful except where it is judged that these are necessary to validate the findings of other studies.

Enquiries to Mr Keith Henderson tel +61 2 9958 6200 email khenderson@asum.com.au

2005 ASUM Chris Kohlenberg Teaching Fellowship

Sponsored by GE Healthcare

The Chris Kohlenberg Teaching Fellowship was established by ASUM in association with GE Healthcare to increase the opportunity for ultrasound practitioners outside the main centres to have access to quality educational opportunities. ASUM and GE are to be commended for providing this initiative. In 2005, I was very pleased to receive this award and to contribute to ultrasound education in the Northern Territory and Queensland.

The planned program was ambitious, substantive and covered a diversity of themes. I left Melbourne early on Thursday 10th November for a full-day workshop in Alice Springs. The program was mainly didactic. It commenced with a series of obstetric themes: fetal heart, first trimester screening and second trimester soft markers.

The obstetric team at Alice Springs attended and contributed valuable dialogue, supplementing the material provided with local context. Vascular themes followed: upper arm DVT and AV fistulae (with live scanning), portal hypertension and then a diversion into ultrasound of the groin.

As the sun set, we had dinner, followed by a detailed look at ultrasound in chronic venous insufficiency. Such was the enthusiasm of the Alice Springs gathering that we reconvened the following morning for a 90-minute tutorial on Doppler physics and haemodynamics.

I wish to thank Virginia Loy who was wonderfully organised and supportive through this large program.

On Friday I flew to Darwin, for a Saturday workshop. The morning was devoted to a series of MSK themes, interspersed with live scanning (shoulder, groin, and an MSK case review). In the afternoon, we reviewed fetal heart and some obstetric cases. Sharyn Bush convened this leg of the journey. The organisation and hospitality of Sharyn and all the group in Darwin was, as always, second to none.

After a late night at dinner, the 4.00 am wakeup call for a flight to Cairns for another full day workshop was a bit of a shock.

The main focus of the Cairns visit was MSK/ vascular. A didactic presentation and live scanning of the groin, shoulder and chronic venous insufficiency provided much interest and corporate discussion. A paper on portal hypertension and a review of 30 MSK cases supplemented the presentation. Kim Duffy found us an excellent venue with the very latest IT. Thanks Kim for your help though this day.

It is reasonable to suggest that, at this point, the body and soul were looking a bit ragged around the edges. I embarked on another morning flight, this time to Townsville where I spent the afternoon live scanning at the Townsville Hospital. The afternoon was spent with a large group of ultra enthusiastic sonographers and radiologists, watching shoulders and groins being scanned and then developing their own techniques. It was an enjoyable session and many thanks to Sonja Brennan for hosting this time.

The program was to have been finalised with Doppler physics and haemodynamics and fetal heart, however, the evening remains just a blur. An acute and very nasty case of food poisoning, at the moment that the evening session was to begin, meant that the Chris Kohlenberg Scholarship would have to be delayed. The attendees were just wonderful in accepting the inevitable plight of their (now supine) speaker.

All was not lost. A short holiday had been planned to follow this event, which meant I was to be going through Townsville five days later. After 11 days and many kilometres, the 2005 Chris Kohlenberg Teaching Fellowship scholarship found completion.

On the afternoon of Sunday 20th November, a group of around 15 sonographers heard a 75-minute presentation on advanced fetal heart. This was followed by Doppler physics and haemodynamics in a presentation which covered the basics but, then, examined some of the very difficult spectral waveforms that may be encountered in carotid and other arterial work. Sue Boyd facilitated this final leg (twice) and like all the other convenors, was organised and supportive.

Finally, I wish to thank everyone for their assistance over this period, including Helen Cuneo and Keith Henderson at the ASUM office, for facilitating the event. It was an enjoyable experience with the following overriding impression.

In each of the four centres, I encountered highly trained sonographers, motivated about their education and the specific needs of their communities. All were receptive to new information and gracious when the information was revision of themes well understood. I was reminded of how well rural centres equip themselves to perform a tertiary level examination in an environment which requires them to be 'jacks of all trades'. The oddity of education is that the persons who benefit most from the education are usually the educators themselves.

Peter Coombs
Chris Kohlenberg Teaching Fellowship Recipient 2005

AUSTRALASIAN COLLEGE FOR EMERGENCY MEDICINE ACCEPTS CCPU

The Certicifate in Clinical Performed Ultrasound (CCPU) for point of care limited ultrasound examination has been accepted by the Emergency Department Ultrasound Subcommittee of the ACEM as a means for emergency medicine physicians to obtain Emergency Department Ultrasound credentials.

2005 ASUM Giulia Franco Teaching Fellowship

Sponsored by Toshiba Medical

Martin Necas and seminar attendees

Travelling fellowships are a valued part of ASUM's education programs. Unlike conferences and formal meetings where delegates need to travel considerable distances to participate in the event, travelling fellowships are designed to bring the experts into the field, to present lectures, visit clinics, and network with sonographers right in their own place of practice.

The 2005 ASUM Giulia Franco Teaching Fellowship took me to Port Macquarie, Dubbo, Bathurst, Orange, and Newcastle in New South Wales. The range of topics discussed included: general, obstetric, and vascular ultrasound. Local lectures were widely attended and the feedback was very positive.

Sonographers, especially, appreciated being able to attend an ASUM educational activity in their locality, at convenient times and to get on-site practical feedback. In one centre, they decided to extend a mini-conference by over half an hour until 9:30 pm.

Many sonographers took the opportunity to discuss applications of new technologies in clinical practice, current diagnostic trends, and novel ways of looking at common challenges. Others were interested in receiving feedback about hands-on scanning and local department protocols, or simply to seek affirmation that their current practice is up to par with accepted Australasian standards.

Student sonographers did not shy away from asking a variety of insightful questions related to their academic and clinical work.

The aim of the teaching fellowships is to offer something for everyone, promote networking, and make sure all parts of Australasia are striving for the same cutting-edge standards.

I have tremendously enjoyed doing this travelling fellowship and meeting local Australian sonographers in the field. I was very much moved by the warm receptions I received and I was also very impressed at the great turnouts, even in the most remote centres.

I would like, especially, to thank ASUM and Toshiba for their generous support, the local organising committees, and all the sonographers and sonologists who attended for their part in this memorable project

Martin Necas
Giulia Franco Teaching Fellowship
Recipient 2005

2005 ASUM SA Special Recognition Award

Dr Barry Chatterton received the ASUM SA Branch Special Recognition Award on Tuesday 29th November 2005. This award is presented each year to individuals who have made a sustained and significant contribution to medical ultrasound in South Australia.

Barry Chatterton was honoured by receiving the 2005 Award by the ASUM SA Branch at its Annual General Meeting. The 2005 ASUM SA Branch Special Recognition Award citation reads: 'To Barry Chatterton for his outstanding contribution to diagnostic ultrasound in South Australia.'

Barry Chatterton is Director of Nuclear Medicine at the Royal Adelaide Hospital and conducts ultrasound at the hospital and, privately, with Dr Jones and Partners.

Previous recipients of the Award include Pru Pratten and Brian Pridmore (2002), Roger Gent (2003) and Garry LeQuesne (2004).

After receiving his award Dr Chatterton said: "I am very thrilled to receive the award, especially in such esteemed company. We have all grown up together in ultrasound. Being involved in the education, committee work and convening conferences for the ultrasound community is both rewarding and enjoyable. It is exciting to be recognised for something that I truly enjoy."

Dr Chatterton has been an active member of ASUM since 1977.

WFUMB 2006 SEOUL
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Visit www.wfumb2006.com

Early bird registrations close 28th February 2006.

The 11th Congress of the WFUMB, organised by the Korean Society of Ultrasound in Medicine in cooperation with the Korean Society of Ultrasound in Obstetrics and Gynecology and Korean Society of Echocardiography will be held at the COEX Convention and Exhibition Center.

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The 12th Congress of the WFUMB, organised by the Australasian Society for Ultrasound in Medicine will be held at the Sydney Convention and Exhibition Centre in Darling Harbour, Sydney Australia.

Victoria Branch meetings for 2006

Victoria Branch meetings for 2006
Contact Monica Pahuja email
mpahuja@mercy.com.au
or asum_vic_branch@hotmail.com

Tuesday 7th March 2006
ASUM Victorian Branch meeting
Royal Melbourne Hospital
Charles Latrobe Lecture Theatre
Flemington Road Parkville Melbourne
Topic to be advised
Time 6.30 pm for 7 pm start drinks and snacks prior to lecture

Tuesday 9th May 2006
ASUM Victorian Branch meeting
Royal Melbourne Hospital
Charles Latrobe Lecture Theatre
Flemington Road Parkville Melbourne
Speaker Professor Rob Gibson
Gallstones and the bile duct/diffuse liver disease
6.30 pm for 7 pm start drinks and snacks prior to lecture

Tuesday 27th June 2006
ASUM Victorian Branch meeting
Royal Melbourne Hospital
Charles Latrobe Lecture Theatre
Flemington Road Parkville Melbourne
Speaker Dr Simon Meagher
The first trimester – anomalies
6.30 pm for 7 pm start drinks and snacks prior to lecture

Thursday 20th July 2006
ASUM Victorian Branch combined meeting with Royal College of Radiologists
Royal Childrens' Hospital
Ella Lathan Lecture Theatre
Flemington Road Parkville Melbourne
Topic and speaker to be advised
6.30 pm for 7 pm start

Thursday 19th October 2006
ASUM Victoria Branch combined Meeting with RANZCR
Royal Childrens' Hospital
Flemington Road Parkville Melbourne
Speaker Dr Andrew Baldey
Ultrasound and nuclear medicine correlation – a 'pot pourri' of cases
Time 6.30 pm for 7 pm start

November 2006
Interesting case night –
to be organised by ASA

WA Branch meetings for 2006

WA Branch Meetings 2006
Contact Christina White email
christinawhite@westnet.com.au

Saturday 25th February 2006
WA Branch education meeting
St John of God Hospital Subiaco
Atrium Lecture Room
Presented by Dr Philip Currie and Mr Adrian Macmillan
Cardiac resynchronisation therapy topics benefits of biventricular pacing, case study reviews, pacing and echo technician optimisation
9.30 am – 12 noon
Contact Leanne Hargrave email
leanne.hargrave@echo-services.com.au

April
O & G seminar (to be confirmed)

May
MSK (to be confirmed)

May/June
Physics weekend (to be confirmed)

July
O & G (to be confirmed)

September
Vascular (to be confirmed)

November
End of year function
(to be confirmed)

ATTENTON CANDIDATES

ASUM DMU EXAMINATION

late applications close 31st March

Enquiries to Matthew Byron

tel +61 2 9958 0317

email dmu@asum.com.au

Changing address? New job?
Going overseas?
Make sure you tell ASUM
Contact tel +61 2 9958 7655
email asum@asum.com.au

New members October–December 2005

FULL MEMBERS
Stewart Begg Vic
Janet Benstead NZ
Lucy Berwick NZ
Joanne Bolton NZ
Gail Cahill SA
Carol Christensen NZ
Simon Clarke WA
Chrisie Cox NSW
Peter Davies Tas
Bruce Doust NSW
Sally Dunbar NZ
Kate Duncan NSW
Don Esdale SA
Ann Forrest NSW
Melinda Glasgow NZ
Tina Guy SA
Julian Hanson NSW
Linda Hayward SA
Annette Hausler SA
Brian Hill NSW
Paula Kinnane Qld
Pippa Kyle NZ
Amanda Lansdowne NZ
Victor Lee Vic
Shannon Lock Qld
Greg McGrath NSW
Justin Molloy NZ
Okwun Ojah NSW
Kate Paddick SA
Kathy Pascoe SA
Siva Rajaratnam NSW
Julie Rathbone Vic
Andre Roszkowski Qld
Elizabeth Ryan SA
Hafees Saleem NZ
Avninder Sandhu SA
Michael Saunders Tas
Jennifer Schnell Qld
Carmen Siu NSW
Kurinji Malar Sivaram Kannan WA
Michael Smith Vic
Lesley Southcombe Tas
Shelley Splitek SA
Noreen Tracey NZ
Alison Vance Qld
Carlie Vandenberg SA
Matthew VukasoVic NSW
Mary Walter NSW
Neale Walters Vic
Yan Shuk Yee NT
Colin Weatherill SA

ASSOCIATE MEMBERS
Elena Balagulo NZ
Margot Brissenden NSW
Elliot Bruce NZ
Trisha Conventry SA
Georgina Dunbar SA
James Fordyce Vic
Belinda Lines NT

TRAINEE MEDICAL
Suhas Nerlekar Vic

CORRESPONDING
Ming-tak Chau HK
Rethy Chhem Canada
Rhodri Evans UK
Anna Parsons USA
Hugues Pin Martinique
Richard Pole UK

Registrations Now Open!!

The ASA2006 Canberra registration brochure is now available, so to obtain your copy email us on conference@a-s-a.com.au or log on to www.A-S-A.com.au for full program and registration details. Remember to get your registration in early and ensure your workshop selections. As an Early Bird registrant you will go into the draw to win a fantastic hot air balloon ride for 2 – register by Friday 17 March 2006 to be in the draw!

This exciting program features:

- ~ Optional elite sports imaging workshop at the Australian Institute of Sport on Friday morning
- ~ Wide range of plenary presentations
- ~ Live scanning workshops
- ~ Professional issues sessions and workshops
- ~ Cardiac Day on Saturday
- ~ Excellent range of keynote and invited speakers
- ~ Networking at the largest annual gathering of sonographers
- ~ Diverse trade exhibition
- ~ Three fantastic social events.

Opportunities to win cash prizes of up to $750 are on offer for proffered papers and posters, so to be a part of this important event log onto www.A-S-A.com.au to submit your abstract online by no later than 17 March 2006.

www.A-S-A.com.au

Corporate Members 2005

Australian Medical Couches
Couch Manufacturer
Marcus Egli 03 9376 0060
claudia@australianmedicalcouches.com

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sjohnston@bambach.com.au

Bristol-Myers Squibb Medical Imaging
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mobile 0409 985 011
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Focus Medical Technologies
Laurence Heron 02 9209 4530
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GE Healthcare
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tsui_min.lian@med.ge.com
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Meditron Pty Ltd
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Michael Fehrmann 03 9879 6200
michaelf@dornier.meditron.com.au

Peninsular Vascular Diagnostics
Vascular Ultrasound Education
Claire Johnston 03 9781 5001
pvdvic@austarmetro.com.au

Philips Medical Systems Australasia P/L
incorporating formerly ATL, HP, Agilent
Liz Jani 03 9945 2026
liz.jani@philips.com
General Manager: Wayne Spittle

Queensland X-Ray
Radiology
James Abbott 07 3343 9466
James.abbott@qldxray.com.au

Siemens Ultrasound
Acuson
Nick Kapsimallis 02 9491 5863
nick.kapsimallis@siemens.com
General Manager: Kevin Fisher

Sonosite Australasia Pty Ltd
Portable Ultrasound
Greg Brand 1300 663 516
greg.brand@sonosite.com

Sound Medical Equipment
Distribution of ultrasound scanners
Ron Mellenbergh 02 8437 3555
contact@soundmedical.com.au

Toshiba (Aust) P/L Medical Division
Toshiba
David Rigby 02 9887 8063
drigby@toshiba-tap.com
General Manager Rosina Davies

ASUM values the support of our corporate members and invites suppliers of medical equipment, services and consumables to join the Society. Call Dr Caroline Hong CEO tel +61 2 9958 7655 for further information.

2006

Saturday 25 Feb 2006
ASUM WA Branch Education Meeting
Venue St John of God Hospital Subiaco Atrium Lecture Room
Presented by Dr Telilip Currie & Mr Adrian Macmillan
Cardiac Resynchronisation Therapy
Topics Benefits of biventricular pacing
Case study reviews and Echo technician optimisation
Time 9.30 am – 12 noon
Contact Leanne Hargrave
leanne.hargrave@echo-services.com.au

Friday 3 Mar 2006 5 Days
ECR 2006 (European Congress of Radiology)
Venue Vienna Austria
Information www.ecr.org
Email info@ecr.org

Tuesday 7 March 2006
ASUM Victorian Branch Meeting
Venue Royal Melbourne Hospital Charles Latrobe Lecture Theatre Flemington Road Parkville Melbourne
Topic yet to be confirmed
6.30 pm for 7 pm start drinks and snacks prior to lecture
Contact Monica Pahuja
MPahuja@mercy.com.au

Wednesday 22 Mar 2006 2 Days
ASUM DDU Technical Seminars
A theoretical course in applied telysics bioeffects and safety
Venue Conrad Jupiters Gold Coast Queensland
Contact ASUM 2/181 High Street Willoughby NSW 2068
Tel +61 2 9958 7655
Fax +61 2 9958 8002
www.asum.com.au

Wednesday 22 Mar 2006 5 days
ASUM DMU Preparation Course
Venue Conrad Jupiters Gold Coast Queensland
Contact ASUM 2/181 High Street Willoughby NSW 2068
Tel +61 2 9958 7655
Fax +61 2 9958 8002
www.asum.com.au

Thursday 23 Mar 2006
ASUM Nuchal Translucency Course
Venue Conrad Jupiters Gold Coast Queensland
Contact ASUM 2/181 High Street Willoughby NSW 2068
Tel +61 2 9958 7655
Fax +61 2 9958 8002
www.asum.com.au

Friday 24 Mar 2006 2 Days
ASUM Multidisciplinary Workshop
Venue Conrad Jupiters Gold Coast Queensland
– General Ultrasound Workshop
24–25 March
– O & G Ultrasound Symposium
24–25 March
– Vascular Ultrasound Workshop
24–25 March
– Musculoskeletal Ultrasound Workshop
24–25 March
Pelvic Floor Scanning Workshop
26 March
– Nuchal Translucency Course
23 March
Contact ASUM 2/181 High Street Willoughby NSW 2068
Tel +61 2 9958 7655
Fax +61 2 9958 8002
www.asum.com.au

Friday 24 Mar 2006 2 Days
ASUM O & G Ultrasound Symposium
Venue Conrad Jupiters Gold Coast Queensland
Contact ASUM 2/181 High Street Willoughby NSW 2068
Tel +61 2 9958 7655
Fax +61 2 9958 8002
www.asum.com.au

Friday 24 Mar 2006 2 Days
ASUM Vascular Ultrasound Workshop
Venue Conrad Jupiters Gold Coast Queensland
Contact ASUM 2/181 High Street Willoughby NSW 2068
Tel +61 2 9958 7655
Fax +61 2 9958 8002
www.asum.com.au

Friday 24 Mar 2006 2 Days
ASUM Musculoskeletal Ultrasound Workshop
Venue Conrad Jupiters Gold Coast Queensland
Contact ASUM 2/181 High Street Willoughby NSW 2068
Tel +61 2 9958 7655
Fax +61 2 9958 8002
www.asum.com.au

Sunday 26 Mar 2006
ASUM Pelvic Floor Scanning Workshop
Venue Conrad Jupiters Gold Coast Queensland
Contact ASUM 2/181 High Street Willoughby NSW 2068
Tel +61 2 9958 7655
Fax +61 2 9958 8002
www.asum.com.au

Sunday 26 Mar 2006
ASUM DMU Practical Examiner Accreditation & Training Day
Venue AIU Gold Coast Queensland
Contact DMU Coordinator
Tel +61 2 9958 0317
Fax +61 2 9958 8002
dmu@asum.com.au

May–October 2006 ASUM DMU Practical Examination Period
Contact DMU Coordinator
Tel +61 2 9958 0317
Fax +61 2 9958 8002
dmu@asum.com.au

Tuesday 9 May 2006
ASUM Victorian Branch Meeting
Venue Royal Melbourne Hospital Charles Latrobe Lecture Theatre Flemington Road Parkville Melbourne
6.30pm for 7pm start drinks and snacks prior to lecture
Speaker Professor Rob Gibson
Gallstones and Bile Duct/Diffuse Liver Disease
Contact Monica Pahuja
MPahuja@mercy.com.au

Thursday 18 May 2006 3 Days
World Congress of Echocardiograte ly and Vascular Ultrasound
Venue Marrakesh Morocco
Contact Navin C Nanda MD President
ISCU PO Box 323 Gardendale
AL 35071 USA
Tel +1 205 934 8256
Fax +1 205 934 6747 isuc@iscu.org

Sunday 28 May 2006 5 Days
11th Triennial Congress World Federation for Ultrasound in Medicine and Biology (WFUMB)
Venue Seoul Korea
Contact Byung Ihn CHOI MD Congress Secretariat
Tel +82 2 760 2515
Fax + 82 2 743 6385
choibi@radcom.snu.ac.kr
Website http://www.wfumb2006.com

Monday 12 June 2006 3 Days
Danish Society
9th International Congress on Interventional Ultrasound
Venue Copenhagen Denmark
Information
www.interventional-ultrasound.org
Email
secretary@interventional-ultrasound.org

Tuesday 27 June 2006
ASUM Victorian Branch Meeting
Venue Royal Melbourne Hospital Charles Latrobe Lecture Theatre Flemington Road Parkville Melbourne
Speaker Dr Simon Meagher – The First Trimester – Anomalies
6.30pm for 7pm start drinks and snacks prior to lecture
Contact Monica Pahuja
MPahuja@mercy.com.au

Thursday 13 July 2006
Student Workshop with Martin Necas
For DMU candidates and other students preparing for other ultrasound qualificaitons

Centre Napier Hawkes Bay New Zealand
Contact rowena.tyman@hawkesbaydhb.govt.nz
or jayne.lloyd@hawkesbaydhb.govt.nz

Friday 14 July 2006 3 Days
ASUM (NZ Branch)
2006 Ultrasound Conference
Venue Napier War Memorial Conference Centre Napier Hawkes Bay New Zealand
Contact rowena.tyman@hawkesbaydhb.govt.nz
or jayne.lloyd@hawkesbaydhb.govt.nz

Thursday 20 July 2006 ASUM Victorian Branch Meeting
Combined Meeting with Royal College of Radiologists
Venue Royal Childrens Hospital Ella Lathan Lecture Theatre Flemington Road Parkville
6.30pm for 7pm start – topic to be advised
Contact Monica Pahuja
MPahuja@mercy.com.au

Saturday 29 July 2006
ASUM DMU Part 1 & Part II Written Examinations – Provisional
Venue As allocated. Candidates receive individual notification.
Contact DMU Coordinator
Tel +61 2 9958 0317
Fax +61 2 9958 8002
dmu@asum.com.au

Sunday 3 Sep 2006 5 days
16th World Congress on Ultrsound in Obstetrics and Gynaecology
Venue Hilton London Metropole London UK
Contact ISUOG, Unit 4 Blythe Mews, Blythe Road, London W14 OHW
Tel +44 (0) 20 7471 9955
Fax +44 (0) 20 7471 9959
congress@isuog.org www.isuog2006.com

Thursday 14 Sep 2006
ASUM DMU Practical Examiner Accreditation Day
Venue Melbourne Convention Centre Melbourne
Contact DMU Coordinator
Tel +61 2 9958 0317
Fax +61 2 9958 8002
dmu@asum.com.au

Friday 15 Sep 2006 3 Days
ASUM 2006 36th Annual Scientific Meeting of the Australasian Society for Ultrasound in Medicine
Venue Melbourne Convention Centre Melbourne
Contact ASUM 2/181 High Street Willoughby NSW 2068
Tel +61 2 9958 7655
Fax +61 2 9958 8002
asum@asum.com.au

Sunday 17 Sep 2006
ASUM 2006 Skills Day
Venue Melbourne Convention Centre Melbourne
Contact ASUM 2/181 High Street Willoughby NSW 2068
Tel +61 2 9958 7655
Fax +61 2 9958 8002
asum@asum.com.au

Thursday 19 Oct 2006
To be confirmed
ASUM Victorian Branch Meeting
Combined Meeting with RANZCR
Venue Royal Childrens Hospital Flemington Road Parkville Melbourne
Speaker Dr Andrew Baldey
Ultrasound and Nuclear Medicine Correlation – "A Pot Pouri of Cases" 6.30 pm for 7 pm start
Contact Monica Pahuja
MPahuja@mercy.com.au

3–29 Oct 2006
ASUM DMU Part II Oral Examinations
Venue As allocated. Candidates receive individual notification.
Contact DMU Coordinator
Tel +61 2 9958 0317
Fax +61 2 9958 8002
dmu@asum.com.au

Saturday 4 Nov 2006
ASUM DMU Part 1 Supplementary Written Examination
Venue As allocated. Candidates receive individual notification.
Contact DMU Coordinator
Tel +61 2 9958 0317
Fax +61 2 9958 8002
dmu@asum.com.au

Sunday 5 Nov 2006 5 Days
XVIII FIGO World Congress of Gynaecology and Obstetrics
Venue Kuala Lumpur Malaysia
Information
http://www.figo2006kl.com

2007

March 2007 5 Days
ASUM Multidisciplinary Workshop
Venue Sydney
Contact ASUM 2/181 High Street Willoughby NSW 2068
Tel +61 2 9958 7655
Fax +61 2 9958 8002
www.asum.com.au

Thursday 19 July 2007 4 days
ASUM NZ Branch Meeting in conjunction with RANZCR
Venue Wellington Convention Centre Wellington New Zealand
Contact Rex de Ryke rdr1@xtra.co.nz

Saturday 28 July 2007
ASUM DMU Part I & Part II Written Examinations – Provisional
Venue As allocated. Candidates receive individual notification.
Contact DMU Coordinator
Tel +61 2 9958 0317
Fax +61 2 9958 8002
dmu@asum.com.au

Thursday 13 Sept 2007 5 days
ASUM 2007 37th Annual Scientific Meeting of the Australasian Society for Ultrasound in Medicine
Venue Cairns Convention Centre, Cairns North Queensland Australia
Contact ASUM 2/181 High Street Willoughby NSW 2068
Tel +61 2 9958 7655
Fax +61 2 9958 8002
www.asum.com.au

2008

Saturday 26 July 2008
ASUM DMU Part I & Part II Written Examination - Provisional
Venue As allocated. Candidates receive individual notification.
Contact DMU Coordinator
Tel +61 2 9958 0317
Fax +61 2 9958 8002
dmu@asum.com.au

2009

Sunday 30 Aug–Thursday 3 Sept 2009
ASUM hosts WFUMB 2009
World Congress in Sydney Australia
Venue Sydney Convention and Exhibition Centre
Contact Dr Caroline Hong ASUM CEO
carolinehong@asum.com.au
or asum@asum.com.au
ASUM Head Office 2/181 High Street Willoughby NSW 2068
Australia

2006 DMU EXAMINATION DATES

DMU Prep Course – Gold Coast 22 – 26 March
DMU Part II Practical Examination Period May – October
DMU Part I & Part II Written Examinations 29 July
DMU Part II Oral Examination Period 3–29 October
DMU Part I Supplementary Written Examination 4 November

ASUM relies on information suppplied by organisers for non ASUM events included in the calendar. No responsibility is taken for incorrect information and members are advised to contact event organisers direct

Guidelines for authors

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

Original research

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

Quiz cases

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

Case reports

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

Review articles

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

Forum articles

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

Calendar items

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

Corporate news

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

Format

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

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

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

- Title page should include the:

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

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

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

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

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

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

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

Abstract

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

Images

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

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

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

Copyright

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

ULTRASOUND BULLETIN PUBLICATION DATES

	February	May	August	November	February 2007
Submission Deadline	10 January	3 April	10 July	9 October	15 January 2007
Post Date	13 February	12 May	18 August	17 November	23 February 2007

Australasian Society for Ultrasound in Medicine

36th Annual Scientific Meeting

15 – 17 September 2006

Melbourne Convention Centre
Victoria, Australia

ASUM2006

www.icms.com.au/asum2006

ASUM Head Office

Australasian Society for Ultrasound in Medicine (ASUM)

Promoting Excellence in Ultrasound
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Meeting Secretariat

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