

Abstracts: ASUM Annual Scientific Congress 2011

Prof Mohammad Elamin Ahmed

Ultrasonography as a tool for monitoring the response to albendazole in patients with hepatic cystic echinococcosis

Ultrasonography has a well-established role in the diagnosis of intra-abdominal hydatid cysts. Albendazole is a first line treatment for selected patients with cystic echinococcosis for whom surgery is not suitable.

In this study, we evaluate the use of ultrasound for the follow-up of the response to albendazole in six patients. Albendazole was given at a dose of 15 mg/kg/day in cycles of four weeks, and the patients were followed clinically and by ultrasound on a monthly basis for a total of 10 months. All of our patients showed clinical improvement. While the changes in the cyst texture and internal structure (detachment of the cyst membrane and increased density of the cyst fluid) have occurred in all patients, only one patient showed a decrease in the cyst size on ultrasonography.

We conclude that ultrasonography is a useful tool for monitoring the response of hydatid cysts to albendazole, with the changes in the cysts internal structure being more indicative than the mere reduction in cyst size on ultrasonography.

Dr Cheryl Bass

The bone detective

You can't judge a book by its cover but you can judge a bone by its cover. High resolution scanning of the periosteum and cortex will reveal secrets about what is happening in the bone. It is the soft tissue changes that usually alert the sonographer to possible bone pathology.

In a sports-orientated clinic, finding radiographically occult/tricky fractures is the most frequent use of bone ultrasound, they may be stress fractures, traumatic fractures or avulsion fractures. The cardinal signs of acute fractures are hyperechoic oedema in the adjacent soft tissues, periosteal hypoechoic thickening, periosteal neovascularity, cortical discontinuity, cortical crazing and focal pain to probe pressure. The typical history clinches the diagnosis.

While not having a great negative predictive value, ultrasound has a good positive predictive value. Nevertheless there is overlap with other common conditions such as enthesopathy (mimicking cortical interruption) and bursa next to bone (mimicking periosteal reaction). This is where talking to the patient and clinical acumen comes in handy.

Other pathology revealed by ultrasound includes osteomyelitis, erosive arthritis and tumour. These can have overlapping appearances with fractures. And if there is concern re other pathology then x-ray/CT/nuclear medicine or MR correlation is necessary.

Finally there are bony clues to pathology in adjacent structures, e.g. synovial osteochondromata may be the first manifestation of osteoarthritis. And there are non-bony clues such as a joint effusion to intra-articular bone pathology.

This presentation will use case histories and images to demonstrate some of the many clues that assist in detecting bone pathology.

Dr Cheryl Bass

The secrets of a successful ultrasound-guided injection

Ensure the patient has the condition that the injection is intended to treat.

Preparation, position, practise

This workshop will demonstrate a standard method of performing the commonly performed MSK injection procedures. Practical aspects of needle selection, syringe size/type, local anesthesia and sterility will be discussed. Techniques to ensure you can always see the needle tip will be demonstrated and there will be tips on how to perform your own quality assurance

Preparation

- 1 Know the anatomy
- 2 Know what you are doing
- 3 Know why you are doing it
- 4 Tell the patient what you are going to do
- 5 Know the anatomy.

Position

- 1 Position the patient with the structure where you want the needle tip to end up pointing at the ceiling
- 2 Position the US screen so that you can see it comfortably
- 3 Position yourself so the needle is a continuation of your hands.

Technique

- 1 Gentle, steady hands
- 2 Watch needle tip
- 3 Only the plunger of the syringe moves when you inject.

Practise

Large ganglia and breast cysts make the best targets for beginners.

Dr Cheryl Bass

Symptoms of trochanteric pain syndrome (formerly known as trochanteric bursitis)

- Pain on lying on side
- Pain in sore hip when lying on contralateral side
- Pain going upstairs (flexion)
- Pain getting out of car (abduction)
- Widespread distribution of pain
- Point tenderness (more than one area).

This workshop will demonstrate how to evaluate patients with trochanteric pain syndrome. The basic requirement is to image the gluteus minimus and medius tendons in orthogonal planes and check the trochanteric bursa for thickening +/- fluid. The ITB and the insertion of gluteus maximus into the ITB should be routinely assessed. Never underestimate the value of comparative imaging of the other side but remember that the condition is often bilateral. After that, patient-led extension of the exam is required and this is where clinical acumen is needed. There is frequently dual pathology so don't stop prematurely.

Is the pain coming from elsewhere?

- 1 Hip joint; check for anterior hip joint fluid and capsular thickening. Look at any previous hip joint imaging
- 2 Tensor fascia lata pain (often younger, sporty people). Check

- TFL origin from the anterior iliac crest. Look for thickening and pain
- 3 Gluteal muscle tear (history of sudden onset of pain during sport or following trauma)
 - 4 Hamstring origin pain (pain when sitting) turn patient prone and check tendons
 - 5 Piriformis syndrome; not an easy one for US
 - 6 Lumbar pain (best not to go there).
- And finally if the lateral hip looks normal on ultrasound, will I still do the bursal injection requested by the GP?

Dr Peter Blombery
Ultrasound in diabetes

Doppler ultrasound plays an important role in assessing and defining the extent of occlusive disease that may be present in diabetics, but this group of patients presents a number of challenges in ultrasound assessment not seen in non-diabetics. These include arterial wall calcification making imaging and measurement of ankle pressure more difficult, and a more distal distribution of occlusive disease. There is increased understanding of the mechanisms resulting in wall calcification and there is now reliable data available about the prognostic significance of high ankle pressures in these patients. Symptoms of peripheral arterial disease correlate poorly with the anatomic extent of disease in diabetics due to alterations in flow mediated dilatation in these patients. Contrast ultrasound can be used to demonstrate these changes in skeletal muscle micro-vascular blood flow. These and other aspects of ultrasound in diabetes will be discussed.

Dr James Bowden
Radiologic intervention in haemodialysis: arteriovenous fistulae

Haemodialysis fistulae are surgically created communications, either native or prosthetic, formed between an extremity artery and vein. Less than 10–15% of all dialysis fistulae will remain patent and continue to function normally during a patient's dependence on dialysis.

The mean problem-free patency period for native fistulae is approximately three years, with issues mostly related to outflow venous stenosis secondary to intimal hyperplasia. Prosthetic grafts generally only last one to two years before problems occur, most often due to anastomotic and graft narrowing/occlusion. Other problems include venous/graft thrombosis and puncture related complications. Duplex ultrasound assessment often represents a useful tool in the assessment of these failing/thrombosed fistulae prior to treatment.

Poorly functioning and thrombosed dialysis fistulae have traditionally been managed surgically, either with revision and/or thrombectomy, or creation of new access. Over the last two to three decades, advances in percutaneous endovascular intervention, such as percutaneous balloon angioplasty (PTA), thrombolysis and mechanical thrombectomy, has permitted the treatment of arterial and/or venous stenosis and fistula thrombosis without the need for surgery. Such treatment prolongs the patency of vascular access, significantly decreasing the morbidity and mortality of patients with chronic renal failure.

Various examples of problematic fistulae and radiologic management will be illustrated in this presentation.

Dr Poonam Charan
The placenta, cervix and kidneys

This presentation reviews the role of cervical assessment and placental localisation by ultrasound.

Placental localisation is essential information for clinicians and part of even the most basic ultrasound examination.

It covers definitions including classification of a low-lying placenta, placenta praevia major and minor as well as the morbidly adherent placenta. We discuss the best approach and typical image findings in the different clinical scenarios.

Measurement of the cervix is mandatory in pregnancies at increased risk for premature delivery or with previous mid trimester pregnancy losses. In these cases, cervical surveillance is clearly beneficial, allowing therapeutic interventions to be directed to the appropriate patients. Its benefits for the general population are less clear. It is increasingly being advocated by ISUOG and is considered part of the routine mid trimester scan in the ASUM guidelines. As less invasive and more effective treatment options for the short cervix become available, the rationale for routine examination of the cervical canal is stronger, potentially leading to a decreased impact of prematurity in our population.

We discuss techniques and pitfalls in ultrasound assessment of the cervix and critically appraise the emerging therapeutic options for the short cervix.

Ms Lisa Clarke
Clarke L, Edwards A
The midline fetal brain

Routine ultrasound imaging of the neonatal brain includes sagittal and coronal views, providing imaging in two orthogonal planes. The fetal brain, however, is often only imaged in one plane during a routine second trimester morphology scan. Additional information is obtained if the fetal brain is examined, not only in the traditional axial planes, but also in the coronal and sagittal planes.

Aim: The aim of this study was to establish how often the midline sagittal fetal brain structures could be visualised during a routine second trimester fetal morphology scan, and the time taken to acquire data.

Method: Transabdominal scanning was performed on either a Philips iU22 or Voluson E8. Fifty consecutive patients who presented for their second trimester routine fetal morphology scan were included. Gestational age ranged from 19 weeks 2 days to 21 weeks 4 days. A single, experienced sonographer acquired all images. The required anatomical detail included either 2D mid sagittal image(s) showing the corpus callosum, cavum septum pellucidum, fourth ventricle, fastigial point, superior and inferior portions of cerebellar vermis, or a 3D acquisition and reconstruction(s) demonstrating the same anatomy.

Results: Transabdominal midline sagittal image(s) were achievable in 46 out of 50 patients (92%) of cases. In 20 out of 50 (40%) cases the images could be acquired with 2D scanning, in an average of 29 seconds. Of 50 cases, 26 (52%) required 3D acquisition, adding an average of 64 seconds (acquisition and reconstruction) to the scan time. There was one fetus (2%) with the head so low in the maternal pelvis all brain views had to be acquired with transvaginal scanning, including a 3D acquisition for the midsagittal brain anatomy. In two cases (4%) only the corpus callosum and CSP

were visualised but there was inadequate demonstration of the cerebellar vermis and 4th ventricle (BMI > 30). With one fetus (2%) no mid sagittal views were achievable (BMI > 30). With transabdominal scanning, when the fetus is breech (22 fetuses), 2D acquisition is often possible (14/22 = 63.7%), when the fetus is cephalic (14 fetuses) 3D acquisition is generally required (11/14 = 78.6%) and when the fetus is in transverse lie (14 fetuses) 3D acquisition is often required (9/14 = 64%).

Conclusion: Diagnostic images of midline sagittal fetal brain anatomy can be acquired at the time of routine second trimester fetal morphology in 92% of cases with transabdominal scanning. Fetal lie affects whether the acquisition is in 2D or 3D mode and thus adds either 29 or 64 seconds to the scan time respectively. Increased BMI (> 30) appears to severely hinder the ability to see anatomical detail.

Assoc Prof George Condous ***Pregnancies of unknown location***

Pregnancies of unknown location (PUL) are defined as a situation in which there is a positive pregnancy test with no signs of intra- or extra-uterine pregnancy on transvaginal ultrasonography. Expectant management has been prospectively validated in many studies. A wait-and-see approach has been shown to be safe, reduce the need for unnecessary surgical intervention and is not associated with any serious adverse outcomes. The prevalence of PUL is dependent on the quality of scanning for a given early-pregnancy unit. The higher the quality of scanning, the better the detection of ectopic pregnancy using ultrasound as a single diagnostic test, which in turn results in fewer women being classified with a PUL.

The vast majority of women with a PUL are at low risk for ectopic pregnancy. When the location of a pregnancy cannot be confirmed on the basis of a transvaginal ultrasound scan, serum human chorionic gonadotrophin (hCG) and progesterone are measured at presentation and also at 48 hours (h). It is the change in serum hCG over time, the hCG ratio (hCG at 48 h/hCG at 0 h) and the absolute level of progesterone at presentation which can be used to reliably predict the failing PUL and intrauterine pregnancies within a PUL population, but not the ectopic pregnancies. This justifies the recent development and use of mathematical modelling techniques to predict ectopic pregnancies in the PUL population. New mathematical models have been developed to predict the outcome of PULs, however, prospective studies are needed to evaluate the diagnostic performance of such models in different populations.

Assoc Prof George Condous ***Ectopic pregnancy***

Ultrasound technology and in particular the use of transvaginal imaging has taken the guesswork out of ectopic pregnancy diagnosis. The vast majority of ectopic pregnancies can and should be diagnosed with a high degree of certainty before management is commenced. More and more women with ectopic pregnancy are eligible for non-surgical intervention because ultrasound has enabled clinicians to make the diagnosis much earlier in its natural history.

Laparoscopy, traditionally the gold standard in diagnosis of ectopic pregnancy, should not be used in modern management.

There is more and more evidence to support the use of transvaginal ultrasound as the primary diagnostic tool for ectopic pregnancy. In this lecture I hope to demonstrate that transvaginal ultrasound is the new gold standard for the diagnosis of ectopic pregnancy.

Assoc Prof David Connell ***Ultrasound of the groin***

Chronic groin pain is a common problem in professional athletes and is reported to account for 2–5% of all sports injuries. It is responsible for significant morbidity, leading to time away from training and competition and may, on occasion be a career ending injury. Furthermore, if athletes are unable to return to sport, these injuries may have a dramatic economic impact on professional sporting clubs and organisations. The prevalence of groin pain varies among different sports activities but is, essentially, common in those involved in repeated kicking and rapid change of direction such as soccer, tennis, football, ice and field hockey.

High-resolution ultrasound is extremely sensitive for depicting the soft tissues of the groin. Hernias in sportspeople are uncommon, but of course ultrasound will demonstrate these. The inguinal ligament and conjoined tendons are nicely defined, as are tears and subtle disruptions to these supporting structures. Dynamic ultrasound can be used to assess the integrity and stability of the superior and anterior pubic ligaments. Rectus abdominis can be visualised as can the tendinous integration with the anterior capsule. In addition, the arcuate ligament and under surface of the joint can be assessed. The adductor longus origins are well seen and ultrasound is the best modality for identifying enthesopathy, fraying and tearing.

Overall, ultrasound should be considered the front line modality in the assessment of groin dysfunction.

Mr Peter Coombs ***Hi-resolution sonography of the spleen***

The spleen has been described as the “lost and forgotten” organ in abdominal sonography¹. As it is uncommonly a site of primary pathology, it is at risk of being given cursory consideration and just tacked on the end of abdominal ultrasound protocols. Secondary signs of various disease processes present in the spleen thus requiring that sonography of the spleen is performed with care and with optimal imaging.

An underrated technical ultrasound advancement of the last decade is the excellent resolution obtained with mid-frequency linear/curvilinear transducers. Within our tertiary adult and paediatric referral base they are providing additional insight into liver parenchyma, gall bladder and bowel. While integrating this high-resolution ultrasound across the abdominal ultrasound protocol, we have been identifying settings where they may improve splenic imaging.

This paper will consider ultrasound of the normal and abnormal spleen with a focus on this high-resolution technology. Pathology will be grouped into diseases which cause maldevelopment, diffuse changes and focal lesions. Its potential role across various immunologic, haematologic, oncologic and traumatic processes will be reviewed. Reproducible measurement will also be considered.

High resolution ultrasound can considerably augment the examination of the spleen in a number of clinical settings.

Reference

- 1 Gorg C. The forgotten organ: contrast enhanced sonography of the spleen. *Eur J Radiol* 2007; 64 (2): 189–201.

Prof Michel Court-Payen

US-MRI fusion in musculoskeletal pathology

The fusion technique, well established for PET-CT image fusion, has recently been extended to other modalities like US. The possible role of musculoskeletal US, fused with MRI (or CT, US), will be presented, based on our preliminary personal experience and on the few publications found in the literature.

The results of US can be enhanced (overview, penetration, contrast resolution, assessment of bony or air-filled structures), but each fusion examination must often be specially planned (e.g. position of the patient and/or their limb, thinner MRI-slices, non-routine MRI-planes, 3D MRI-sequences). The fusion technique could contribute greatly as a teaching method (reducing the learning curve), might become indispensable for certain specific indications (e.g. US fusion-guided biopsy of certain types of musculoskeletal tumours, steroid injection in difficult-to-access-by-US structures, US-US fusion with previous US examination for follow-up), and may serve as a diagnostic aid in some specific cases (difficult anatomical regions, patients who are difficult to examine by US).

The aim is to combine the qualities of both techniques (e.g. spatial resolution and clinical nature of US and overview provided by MRI), not as an addition but as a synergy. Furthermore, future technological developments will most likely make the technique simpler and faster.

Dr Martha Finn

A new sonographic marker for neural tube defects in the first trimester

A new first trimester sonographic marker for early screening for neural tube defects is described: posterior displacement of the midbrain and Aqueduct of Sylvius.

The distance from the posterior border of the Aqueduct of Sylvius (AOS) to the anterior border of the occiput in the axial plane was measured prospectively in 457 normal fetuses at 11+0 to 13+6 weeks' gestation. The ultrasound images of nine fetuses, with first trimester identified abnormal midbrain position and confirmed neural tube defect were also similarly analysed.

The lower limit of normal AOS to occiput distance (mean minus 2SD) ranged from 1.7 mm at CRL of 45 mm to 3.7 mm at CRL of 84 mm. In the nine cases with abnormal position of the midbrain and confirmed neural tube defect, juxtaposition of the midbrain to the occiput was the clue to diagnosis of the spinal abnormality. In all nine cases, the AOS to occiput distance was below the established normal range.

Sonographic evaluation of the midbrain in an axial plane may prove a reliable marker for the first trimester diagnosis of neural tube defects.

Ms Kate Guskich

Guskich KE, Coombs PR, Ptasznik R

The potential role of the sonographer in training and credentialing FAST

“Point of care ultrasound” (e.g. by emergency department physicians) is being shown to be an accurate, rapid and

repeatable bedside test. It is now becoming a ‘standard of care’¹. While the use of ultrasound is becoming accepted, the scope of practice and the amount of training/ credentialing required is much less clear². This can cause disharmony and tension between diagnostic imaging (DI) and other clinical units. In this environment, there is increasing risk of compromised patient care. Southern Health responded to this proactively and collaboratively. With DI leadership, a model was developed and implemented to ensure the safe, responsible use of ultrasound in non-DI clinical settings by credentialed physicians.

Phase 1: Policies developed in consultation with SH management to provide the boundaries of the practice.

Phase 2: Development of protocols/ credentialing documents in consultation with non-DI clinicians

Phase 3: Training/ credentialing of clinicians, using a reproducible model.

Phase 4: Audit and quality improvement of programs.

Key components of this process have been collaboration between departments to establish a clearly defined scope of practice, appropriate resource allocation, integration to DI PACS and supported training. The model has shown to be successful in other non-diagnostic imaging departments other than ED and is reproducible.

References

- 1 Markowitz JE, Hwang JQ, Moore, CL. Development and Validation of a Web-Based Assessment Tool for the Extended Focused Assessment With Sonography in Trauma Examination. *J Ultrasound Med* 2011; 30: 371–5.
- 2 Moore CL, Gregg S, Lambert M. Performance, training, quality assurance, and reimbursement of emergency physician-performed ultrasonography at academic medical centres. *J Ultrasound Med* 2004; 23: 459–66.

Dr Manish Jain

Axillary ultrasound in breast cancer

Breast cancer lymphatic spread is classically described to the lymph nodes in the axilla. Ultrasound has an important role in axillary assessment to determine nodal status. A positive FNA from an axillary lymph node will enable axillary dissection to be performed at the time of the initial surgery.

The aim of axillary ultrasound is to preoperatively diagnose 35–50% of node positive patients and reduce the incidence of false negative assessment, which can be up to 5–15% with sentinel node biopsy alone.

It is important to evaluate lymph nodes in the expected sentinel position at the inferior hairline in the axilla, which is Level 1. Level 2 nodes lie deep to the pectoralis minor, Level 3 nodes are adjacent to the axillary vessels and the Rotter's node lies in between the pectoralis major and minor.

Abnormal findings on ultrasound examination include:

- Normal appearing node harbouring micro-metastasis, occult to ultrasound
- Cortex of more than 3 mm
- Focal contour abnormality
- Changes in the hilar echo-texture: distortion, slit, absence
- Peripheral perfusion
- Reduced perfusion
- Simulate a primary mass due to extra-capsular spread
- Calcification due to metastasis from high grade DCIS.

Abnormal nodes should be sampled using a 25 g or 22 g needle through the lymph node cortex and not the hilum, and through focal contour bulges. At least three passes should be made. This is usually done before subjecting breast mass to core biopsy. If there is no obvious primary mass and there is an abnormal lymph node, it can be subject to core biopsy using a Temno type needle.

False positive results from ultrasound may be due to reactive nodes, immunological conditions, lymphoma, and other metastasis particularly from melanoma.

Dr Ryo Kawasaki

Retinal vascular signs and cardiovascular diseases: new insights into old classics

The retina provides a unique window through which we can observe microvasculature directly and noninvasively *in vivo*. There is an article from 1859 which reports relationship between hypertension and retinal signs. Since then, researchers have linked systemic diseases of hypertension, stroke and other cardiovascular diseases to retinal vascular signs. Hence, retinal vasculature is considered as a surrogate marker reflecting microcirculation in the whole body.

Recent advances in retinal imaging techniques have enabled us to measure or quantify subtle abnormalities and variations in the retinal microvasculature. These quantitative assessments have been applied to large-scale population-based epidemiological studies of both adults and children. These studies now convincingly show links between a variety of retinal microvascular signs to both clinical and subclinical systemic diseases including cardiovascular and metabolic diseases.

This presentation will outline how traditional retinal vascular signs have been utilised in systemic cardiovascular disease assessment, and how modern retinal vascular assessments will contribute to improving systemic disease risk assessment.

Ms Penny Koh

Transcranial duplex ultrasound

Transcranial duplex ultrasound (TCD) is an imaging modality that provides information on the haemodynamics of the major intracranial arteries. TCD is usually performed as an adjunct to the carotid duplex examination.

This method of assessment for intracranial circulation has become established in the management of patients with head trauma, transient ischaemic attacks, stroke and syncope. TCD has application in the evaluation of vasospasm following subarachnoid haemorrhage, severe intracranial stenosis, collateral circulation, autoregulatory capacity and haemodynamic insufficiency.

The application of TCD technology now provides a quick and non-invasive method to examine the location, anatomical variations and flow patterns of the intracranial vasculature in various disease states.

Ms Penny Koh

Ultrasound assessment of deep vein thrombosis

Venous duplex ultrasound is a convenient method for a quick non-invasive assessment of the lower limbs for deep venous thrombosis (DVT). Compression ultrasonography has proven to be both a sensitive and specific modality for the recognition of lower limb DVTs. The additional features of colour and Doppler

modalities are also useful as investigative tools. The venous duplex ultrasound scan has the advantages of greater availability and portability over the more costly and invasive CT and MR imaging techniques.

Venous thromboembolism, comprising DVT and pulmonary embolism, is a common cause of mortality and morbidity in Australia. The lower limb DVT, which usually starts in the calf area, is the most prevalent type of DVT diagnosed. Other conditions may mimic symptoms for DVT, such as a ruptured Baker's cyst, cellulitis, hematoma and venous incompetence.

Mr Greg Lammers

Musculoskeletal groin ultrasound workshop

You have done a wonderful examination, comparing with the other side, and there is no inguinal or femoral canal hernia. Unfortunately a lot of scans end there with no cause for the patient's pain found. While up to now a new talk could evolve on the two-minute GP consult and the five-minute ultrasound. This workshop is for the thinking sonographer who wants to help find the cause of the patient's pain.

The groin ultrasound for 'query hernia' can be a complicated scan, more so when there is a hernia and the sonographer is trying to determine what type it is. When normal, there are many other sites sonographers should scan to find the cause of pain or eliminate other causes.

The best starting point is talking to the patient and getting them to point to the pain. In talking to them, find out when the pain occurs, its duration, the activities that may be involved and medical history.

The most common non-hernia finding will be tendonitis of the adductor origins. This scan should extend to examining the contra-lateral side as this tendon insertion does commonly demonstrate a degree of chronic change. As a cause for hip and groin pain, the next most common causes relate to the actual hip joint for which ultrasound has limited use.

The remainder of possible causes fall into the less common categories but are still important to be found. Some of these are:

- Iliopsoas – Bursitis, tear, strain or “snapping hip” (one version of a snapping hip) and frank muscle tears of the iliacus or psoas muscles
- Rectus femoris – Tendonitis, tear, if with an adolescent patient – rolled or fractured apophysis. AIIS.
- Sartorius – Tendonitis or tear
- Rectus abdominus – Tendonitis or tear
- Nerve entrapments – Femoral nerve or lateral Cutaneous nerve of the thigh.
- Lymphadenopathy.

In the rare category but nonetheless important to find:

- Appendicitis
- Colitis/Diverticulitis (usually on left)
- Ovarian cysts
- Scar Endometriosis
- Prostatitis
- Tumour

As much as the patient presents with “groin pain”, they may in fact point over to or near the lateral hip and this will require an examination that includes the gluteal insertions and the Ilio-Tibial band.

Additional material can be downloaded from:
<http://tinyurl.com/ASUM2011GroinWorkshop>

Dr Alain Lavoipierre

Bottoms up: transrectal ultrasound and biopsy of the prostate

Each year, over 3000 men die of prostate cancer in Australia, with around 20,000 new cases diagnosed annually.

Transrectal ultrasound (TRUS) and biopsy constitute the simplest method for definitive cancer diagnosis (or exclusion) of prostate cancer. It is performed in the context of a raised or rising prostate specific antigen (PSA), a positive finding on digital rectal examination or, at times, a very strong family history of prostate malignancy, with additional suspicious features.

TRUS and biopsy requires good equipment, with the ability to scan in longitudinal and axial planes, and the possibility of using colour Doppler to assess the gland.

A satisfactory understanding of McLean's zonal anatomy of the prostate is crucial in the assessment of pathology within the gland. The peripheral zone (PZ) is situated posteriorly and laterally, and becomes compressed by the inner periurethral transition zone (TZ) in benign prostatic hyperplasia. The TZ extends distally to the verumontanum and is in part surrounded by the central zone (CZ).

Prior to biopsy, the patient must receive adequate antibiotic cover (e.g. norfloxacin orally commencing at least the day before the procedure and continuing for a total of five days, and intramuscular Gentamicin just before the biopsy). The procedure is now commonly performed under a light anaesthetic.

After grayscale evaluation of the gland, additional assessment occurs with colour Doppler, which increases the detection rate for carcinoma by 5–15%. Systematic and targeted biopsies are performed and the samples assessed with histopathology.

Potential complications of the procedure include septicaemia, haematuria, haemospermia, rectal bleeding and acute retention.

TRUS and biopsy have a positive predictive value usually reported to be above 50%.

Prof Carlo Martinoli

Ultrasound of shoulder pathology beyond the rotator cuff and the biceps

There are a number of shoulder abnormalities other than rotator cuff pathology that are amenable to ultrasound examination. These conditions can mimic rotator cuff tears clinically and may involve a variety of structures around the shoulder, including the deltoid and pectoralis major muscles, the GH joint and its recesses, the bone and cartilage, the fibrocartilaginous labrum and some nerves e.g. suprascapular, axillary and musculocutaneous.

AC joint lesions, such as osteoarthritis, instability and post traumatic osteolysis of the clavicle, can mimic an underlying rotator cuff disease because of the proximity of this joint to the cuff. Humeral head fractures, such as the greater tuberosity, the lesser tuberosity and the Hill-Sachs type, may be radiographically occult and these patients may be referred to US to look for a rotator cuff tear.

Although US is not used either when the clinical suspicion of fracture is high or for the evaluation of patients with shoulder instability, fractures can be detected with this technique.

Compression of the suprascapular nerve by a ganglion cyst can present as nonspecific shoulder pain. US can demonstrate a paralabral cyst centred at the level of the supraspinous and spinoglenoid notch. The axillary neuropathy is usually secondary to fibrous bands or stretching injuries at the quadrilateral space. Injuries of the musculocutaneous nerve are rare and usually associated with brachial plexus lesions. The most typical space-occupying masses about the shoulder include lipomas and the elastofibroma dorsi. This latter mass can be diagnosed with US based on its typical striated echotexture and parascapular location.

Prof Carlo Martinoli

Ultrasound of tendon disorders in children

Especially in the age range between 12 and 16 years, the ossification centres of most apophyses are still immature and the cartilage, under hormonal influence, loses elasticity and is unable to give firm stability to the osteotendinous junction. Hence, the rough application of shear or torsion forces, exercised upon them by tendons and ligaments can overcome the threshold of cartilage and bone resistance causing fragmentation or detachment with variable functional impairment.

The apophyseal damage derives from a traction mechanism that produces traumatic injury to the cartilage and subchondral bone. Then, there is a sequence of overlapping damage-repair events. At the site of insertion into apophyses, two main categories of tendon lesions may occur: chronic and acute. The first is caused by microtrauma from repeated traction, often in relation to functional overload (overuse). These injuries lead to fragmentation of the tendon-to-bone interface e.g. Osgood-Schlatter disease. The degree of avulsion of apophyseal structures is minimal and does not significantly compromise the biomechanics. In these syndromes, US is basically used in phases of re-exacerbation of symptoms to check the status of the tendon insertion.

When detachment involves fragments of cartilage, these can later become ossified, forming small foci of heterotopic ossification: the distance intervening between these ossicles and the apophysis is limited and usually filled with fibrocartilage or with a fibrous bridge. If the degree of displacement of the ossicles is not great, and they are in close contact with the apophyseal cartilage, they go on to be reabsorbed inside the apophysis during bone maturation.

When the fragment is instead dislocated far away from the growing apophysis, it can be transformed into a permanent ossicle (e.g. os subfibulare). Acute apophyseal injuries typically derive from a unique indirect major trauma. In these injuries, the tendon applies an excessive traction force with respect to the resistance posed by an apophysis that has not yet reached full maturation and biomechanical consolidation.

Acute apophyseal injuries can be subdivided into major and minor types based on the degree of dislocation of the apophyseal fragment. Major apophyseal lesions cause dislocation of the avulsed fragment to the extent that it can no longer be reabsorbed. Growth may become compromised or stopped, and, in case of complete avulsion, a significant biomechanical deficit occurs.

When traction is not enough to cause complete avulsion of the apophysis, the fragmentation pattern can differ, involving variable amounts of cartilage and bone. The US pattern of acute

apophyseal lesions may vary based on the amount of detached bone and cartilage. Compared with MR imaging, US has the advantage of being a clinical examination directed towards the patient symptoms and is able to identify even minimal cartilage and bone abnormalities. In minor apophyseal injuries, US used as a complement of plain films can be enough to diagnose and characterise the injury, thus limiting the use of MR imaging to the evaluation of major lesions.

Prof Carlo Martinoli

Ultrasound of difficult-to-scan nerves and unusual neuropathies of the upper and lower extremity

In recent years, ultrasound of the peripheral nervous system has increasingly becoming an imaging tool with an expanding evidence base to support its use. However, the highly operator-dependent nature and level of technical expertise required to perform an adequate US assessment of peripheral neuropathies means that appropriate training and an in-depth knowledge of anatomy and clinical findings are required.

This lecture will make a special focus on the examination of very small and/or difficult-to-scan nerves of the upper and lower extremities, such as the musculocutaneous, the anterior interosseous nerve, the posterior interosseous nerve distal to the supinator tunnel, the palmar cutaneous and motor branches of the median nerve and the divisional branches of the ulnar nerve at the wrist, the lateral femoral cutaneous nerve in the inguinal area, the saphenous nerve throughout the lower extremity, the medial and inferior calcaneal nerves in the hindfoot and the deep peroneal nerve throughout the midfoot. For each nerve, the anatomy, scanning technique and pathological findings related to the most common disorders will be illustrated. A careful US approach, with thorough understanding of soft-tissue planes and extensive familiarity with anatomy being prerequisites for obtaining reliable information regarding the unusual neuropathies affecting these small and difficult-to-scan nerves.

Prof Carlo Martinoli

Ultrasound of ligaments of the ankle and mid foot

Ligament injuries around the ankle and the mid foot are among the most common sporting injuries. In ankle sprains, US is an excellent alternative to MR imaging to diagnose ligament injuries that affect this body area. The examination should be focused on clinical findings in an attempt to save time and increase the efficacy of the study. On the lateral aspect of the ankle, ligament injuries are usually secondary to inversion sprains.

Injured ligaments may appear swollen with focal or diffuse hypoechoic areas. In complete tears, a hypoechoic gap reflecting the hematoma is seen within the ligament substance and the free ends of the torn ligament may appear retracted and wavy. Anterior talofibular ligament ruptures are usually associated with capsular breakage and passage of joint fluid into the anterolateral soft-tissues of the ankle, whereas complete tearing of the calcaneofibular ligament may result in communication between the ankle joint and the peroneal tendon sheath. Because the intact calcaneofibular ligament tightens during dorsiflexion and pushes the peroneal tendons toward lateral, this manoeuvre can help to assess whether the ligament is torn.

During scanning, stress e.g. (anterior drawer) tests can be

helpful to assess ligament injuries and joint instability. US has shown accuracy in the evaluation of anterior tibiofibular ligament tears. Isolated ruptures of the medial ligamentous complex of the ankle are rare. When the deltoid ligament ruptures US can be helpful to differentiate a ligament injury from a lesion of the overlying tibialis posterior, both conditions presenting with similar clinical symptoms over the medial ankle.

In the mid foot, the spring ligament is a complex ligament which has its main function in supporting the head of the talus and stabilising the longitudinal arch of the foot. It consists of a superomedial calcaneonavicular, a medioplantar oblique and an inferoplantar component. From the biomechanical point-of-view, the first one is the most relevant and is amenable to US examination.

Other midtarsal ligaments possibly involved in lateral ankle sprains are the dorsal talonavicular ligament, which joins the dorsal capsule of the talonavicular joint, and the dorsal calcaneocuboid ligament, lying over the lateral aspect of the calcaneocuboid joint. The injury of these ligaments is often associated with avulsion of a small fleck of bone. Finally, the bifurcate (Chopart) ligament is a strong "Y-shaped" band consisting of a calcaneocuboid and a calcaneonavicular component. It may play a causative role in anterosuperior process calcaneal fractures.

Dr Barry McGrath

McGrath B and Asbeutah A

Chronic venous insufficiency and venous reflux following deep venous thrombosis

Patients who suffer a deep venous thrombosis (DVT) have a 25-fold increased risk of chronic venous insufficiency (CVI). In a five-year follow-up study of 51 patients treated for lower limb DVT (49% proximal, 51% distal), CVI was assessed by clinical, etiologic, anatomic and pathophysiologic (CEAP) classification and reflux by Duplex ultrasound of DVT affected and unaffected limbs.

After five years, moderate to severe CVI (CEAP class 4–6) was seen in 54% of proximal and 11% of distal DVT limbs. Reflux was detected in 96% of proximal DVT limbs, 36% of distal DVT limbs and in 52% of apparently unaffected limbs. This raises the question of potential haemodynamic or systemic effects on unaffected limbs. This was further examined in a prospective study of 20 patients with proximal DVT, studied at baseline, 3, 6 and 12 months. By 12 months there were 40% of DVT limbs in CEAP class 4–6 and 80% of these limbs showed reflux. None of the non-DVT limbs were in CEAP class 4–6, but dilatation of the sapheno-femoral junction was seen in 18/20 and four of these showed borderline reflux after six months. Similarly, we observed increases in the mean diameter of femoral and popliteal veins in unaffected limbs, suggesting a potential systemic effect of the contralateral DVT.

Quantitative assessment of CVI in this population using Duplex ultrasound, and at pletysmography, showed that ultrasound indices (reflux duration, flow volume) lacked discrimination for CVI disease severity, whereas the venous filling index (VFI) determined by pletysmography gave very good discrimination. This technique now needs to be applied to further examine the potential systemic influence of a DVT on other veins.

Mrs Glenda McLean
3D of the neonatal head

Neonatal cranial ultrasound is routinely performed to screen preterm infants for complications of prematurity using a standard 2D technique¹. Subependymal haemorrhage, intraventricular haemorrhage, periventricular haemorrhagic infarction, ventriculomegaly and periventricular leucomalacia are commonly identified. 2D ultrasound is considered a reliable method of imaging and enables measurement of the lateral ventricle size in neonates².

Early 3D studies outlined the potential of 3D ultrasound to substantially reduce time at the bedside scanning and in the neonatal setting this could limit stress on the neonate and provide a volume which can be remotely interpreted^{3,4}. Use of a 3D matrix transducer has been investigated in the setting of cranial ultrasound at Monash Medical Centre in Melbourne, Australia.

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Mrs Glenda McLean
Ultrasound in congenital hypothyroidism

Congenital hypothyroidism occurs every 1 in 3600¹ live births and is detected by a heel prick test performed at birth. Early diagnosis and treatment is imperative to avoid complications of severe physical and mental retardation². In Australia thyroid scintigraphy using Tc-99m pertechnetate is the primary imaging investigation³. Sonographic evaluation of the thyroid as an adjunct to scintigraphy has not been routine.

An audit of the period 2005 to 2009 at Monash Medical Centre revealed that 89 patients were identified to have had nuclear medicine thyroid scans for the clinical indication of congenital hypothyroidism. 22/89 were shown to have had no uptake of Tc-99m pertechnetate, a diagnosis of congenital hypothyroidism was made and thyroxine treatment commenced. 6/18 patients who had no thyroid uptake scintigraphically have since been found to have thyroid tissue present on ultrasound examination. Four patients were lost to follow-up.

Transient hypothyroidism enables a trial off therapy at three years of age to be attempted whereas confirmed agenesis on imaging would indicate mandatory lifelong thyroxine therapy. The implications for treatment, if thyroid tissue is found to be present on ultrasound, warrants children having an ultrasound examination.

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Dr Andrew McLennan
Effect of crown-rump length measurement accuracy on trisomy 21 detection

All components of combined first trimester screening rely on accurate pregnancy dating. The background risk is dependent on gestational age, as the prevalence of Down syndrome (DS) decreases with advancing gestation. Nuchal translucency (NT) increases with gestational age and multiple of the median (MoM) or delta (dNT) values that are used for the development of likelihood ratios are therefore dependent on defining an appropriate gestational age. Maternal serum marker values also alter across the 11–14 week screening window and are adjusted by gestational age.

First trimester dating using crown-rump length (CRL) is more reliable than menstrual dating to predict the date of delivery.

As demonstrated in recent studies, errors in NT and serum marker measurements may greatly impact on the efficiency of screening programs, and many studies have emphasised the need for quality control programs. Yet, scant attention has been paid to the quality of CRL measurements where inaccurate calculation of gestational age will result in erroneous likelihood ratios being developed and inappropriate risks for Down syndrome being presented to the patient.

Recent modelling based on a 12-week assessment using a risk cut-off of one in 100 has shown that a systematic error in CRL measurement of ± 5 mm (± 2.7 days) can alter the DS screening parameters substantially (DR 80% with FPR 1.4% at -5 mm; DR 89% with FPR 5.5% at +5 mm).

Retrospective assessment of CRL measurement by 23 experienced sonographers has been undertaken at Sydney Ultrasound for Women in 1350 pregnancies conceived through assisted reproduction. The variation in measurement between operators was calculated as was the gestation-related variation. We have attempted to develop a “correction” factor that allows for variation in CRL in the calculation of the four screening parameters being examined and to define an “auditable standard” of an acceptable level of CRL variation.

Dr Andrew McLennan and Les Sheffield
Difference in trisomy 21 detection between certified and non-certified operators

Fetal nuchal translucency thickness (NT) is the single most effective marker for trisomy 21. Appropriate operator training and standardisation of first trimester NT image acquisition are crucial to achieve efficient screening. Furthermore, rigorous ongoing audit of operator performance and constructive feedback from assessors has been shown to maintain standards.

Errors in NT measurement may greatly impact on the efficiency of screening programs. Recent modelled data shows that both NT measurement deviation from the median (bias) and variation in NT measurement scatter (spread) have powerful effects on screening accuracy. At 12 weeks, using a fixed cut-off risk of 1 in 100, systematic under-measurement of NT by 0.6 mm reduces the T21 detection rate (84% to 76%) while an increase in the scatter of measurements by 50% increases the FPR (2.7% to 4.3%).

In Australia the number of certified operators has steadily increased since audit commenced in 2001 but they still represent only 58% of all the operators who are audited. The number of certified operators reaching an appropriate standard of NT measurement has also increased since 2001 but has stagnated at approximately 55%.

Victorian data have recently confirmed the influence of certification on screening accuracy. Non-certified operators perform approximately half of all NT measurements and the mean NT measurement across all gestations is approximately 0.1 mm lower than for the certified operators. Even this apparently small difference has a powerful effect on the T21 screening accuracy with a detection rate of 90.7% for certified operators compared to 84.2% for the non-certified (at a 3% FPR).

Efforts are being made to improve the conversion of registered operators into certified operators and also to review the methods of audit and feedback to improve the numbers of certified operators reaching the standard.

Dr Andrew McLennan and Les Sheffield
First trimester echocardiography and abnormal findings in the trisomy 21 fetus

First trimester aneuploidy screening provides an opportunity to assess fetal structures allowing diagnosis of up to 67% of all structural anomalies and approximately 50% of major cardiac anomalies.

This presentation will focus on the approach to first trimester cardiac assessment. The development and visualisation of important cardiac structures will be addressed. First trimester ultrasound screening for major cardiac abnormalities has been attempted for over 15 years. Initially this was based on increased NT measurement alone (rate 3/1000 when the NT is within the normal range, up to 125/1000 when the NT exceeds 5.5 mm) but the sensitivity does not exceed 40% in most studies. The addition of ductus venosus and tricuspid valve Doppler assessment has improved the screening sensitivity substantially.

Examples of major abnormalities that can be diagnosed readily in the first trimester will be presented (such as AVSD, hypoplastic left heart syndrome, tricuspid atresia, Ebstein's anomaly) along with pitfalls associated with their diagnosis.

Most fetuses with trisomy 21 have a structurally normal heart on echocardiography. A recent large study performed by specialist fetal cardiologists (75% before 14 weeks) found structural CHD in 164/487 T21 fetuses (34%). The most common diagnosis was atrioventricular septal defect (AVSD) (115/487, 24%). The ratio of female to male fetuses with AVSD was 29%:18%. Relatively few cases of isolated VSD are noted compared with postnatal series and the importance of aberrant right subclavian artery will be discussed.

Ms Delwyn Nicholls
Nicholls D, MacKinlay K, McLennan A
Ultrasound assessment of the posterior fossa at 11–14 weeks gestation utilising the aqueduct of Sylvius

Background: Recent studies have evaluated the fetal posterior fossa in an attempt to improve first trimester screening for open neural tube defects (NTD). Problems with fetal position and replicating imaging planes have hampered widespread application of these methods.

Objective: To assess the posterior fossa using a novel imaging plane that demonstrates the aqueduct of Sylvius (AOS) and to measure the posterior fossa distance (PFD).

Methods: Prospective 2D study of PFD in 57 normal fetuses. A posterior tilted transchoroidal axial image of the fetal cranium demonstrates the echogenic walls of the AOS. The PFD was measured from the posterior AOS canal to the inner occipital rim. *Results:* The PFD was measured in 54 of 57 fetuses (95%). PFD is positively correlated with CRL, BPD and HC. The reproducibility of the AOS to occipital measurement is dependent on the imaging plane. Further research is required to assess the usefulness of this measurement in the detection of open NTD. Intra and inter observer reliability studies are ongoing.

Conclusion: Identification of the AOS appears to be a simpler method of posterior fossa assessment than previously described methods. Further research is required to assess the utility of this measurement in early screening for NTD.

Assoc Prof Ricardo Palma Dias
Mild/borderline ventriculomegaly: work-up and counselling

Assessment of the lateral cerebral ventricles is part of the midtrimester anomaly scan. The mean measurement of ventricular width is 6-7 mm. Measurements ≥ 15 mm are classified as severe ventriculomegaly and are associated with a poor prognosis. Approximately 0.7% of all fetuses will have at least one of the ventricles measuring between 10 and 15 mm and are said to have mild ventriculomegaly.

While most of these fetuses will have a normal outcome, mild ventriculomegaly carries an increased risk of underlying chromosomal anomalies, congenital infections and developmental brain anomalies. Counselling parents in this scenario poses a significant challenge to the sonologist, and to the clinician, as some of these diagnoses will not be evident at the time of the initial scan.

In this lecture we discuss definitions/terminology in this area, frequency of associated pathology and perinatal outcomes of mild ventriculomegaly. We will discuss a rational management plan for these pregnancies including the use of fetal MRI.

Dr Allison Rose
MRI directed ultrasound (second look ultrasound)

1 *Know where to look for a lesion on an MRI directed ultrasound*
 MRI is performed in the prone position, which adds another level of complexity to correlation of lesions from one modality to the other. It is important to understand the positional variations from MRI to US. Lesion movement can be unpredictable and there are as yet no standardised descriptors (measurements to a lesion from nipple, skin edge or chest wall for MRI localisation). The dependant breast (MRI) has much more depth than the flattened supine breast (US) and the nipple (the main point of reference) is quite mobile on the supine breast. We have adopted a simple approach using quadrants or a clock face (obtained from a coronal MPR) and a depth descriptor from the axial scans, e.g. "upper outer quadrant in the middle third of the breast". If there is doubt that the lesion on MRI has been identified on US it is important to have a low threshold for intervention and follow up. This may mean another MRI scan and MR guided biopsy.

2 *Know what to look for on an MR directed US (second look ultrasound)*

An understanding of the likely pathology from the MRI scan will greatly improve the sensitivity of the ultrasound examination. Significant lesions on MRI enhance with contrast. In addition to this basic morphology, lesions on MRI have signal intensity characteristics on T1 and T2 weighted images, contrast enhancement patterns and enhancement kinetics. Diffusion imaging and spectroscopy are currently research tools but show promise for improving specificity. These features in concert help to narrow the likely diagnosis.

Lesion types include mass enhancement, non-mass enhancement and foci (enhancements less than 5 mm). Common mass enhancing lesions include cancers, fibroadenomata, cysts, lymph nodes and fat necrosis. Non-mass enhancement and foci are most often normal breast parenchyma but lesions such as DCIS, ILC and radial scar may exhibit non-mass enhancement. Low signal intensity on T2, rim enhancement in masses, clumped enhancement for non-masses, and washout kinetics are all suspicious features.

3 Implications for service planning – where does US fit in the diagnostic pathway now on offer in breast imaging?

Current indications for breast MRI include:

- a High risk screening (NBOCC defines high risk <http://nbocc.org.au/health-professionals/clinical-best-practice/mri-for-high-risk-women>. Only Medicare Item Number)
- b Staging – newly diagnosed breast cancer
- c Assessment of adequacy of excision of breast cancer – margin assessment
- d Monitoring effectiveness of neoadjuvant chemotherapy in advanced breast cancer
- e Primary occult breast cancer (metastatic axillary adenocarcinoma)
- f Solving mammographic/US problems
- g Assessing implants for rupture.

Currently the majority of MRI breast scanning is performed for high-risk screening. These women need a streamlined approach and are probably best served in a high-risk clinic from where all investigations and management can be coordinated. In this setting, to avoid delays and duplication of tests, bilateral mammography and breast MRI should be the first investigations, then US to target any lesions identified on both/either to facilitate biopsy. MRI is more sensitive than US in a screening setting and mammography detects small calcified lesions (DCIS), which may not be found on MRI or US.

It is likely that the role for bilateral “screening” ultrasound will diminish as the demand and funding for MRI expands.

4 Outcomes of MR directed ultrasound

There is relatively little in the literature documenting the outcomes of MR directed US. In recent series, US detected about one half of the MR detected lesions. Masses were more likely to be detected than non-mass enhancement. Increasing lesion size, BI-RADS category 5 versus BI-RADS category 4, rim enhancement in masses, and clumped enhancement in non-mass lesions were significantly more likely to have an ultrasound correlate. Sonographically depicted findings had a significantly higher positive biopsy rate than sonographically occult lesions. However, sonographically occult lesions had a probability of malignancy ranging from 14–22%, which warrants biopsy despite lack of sonographic detection. In one study, on follow-up imaging in 80 benign, concordant ultrasound-guided biopsies, the sonographic

lesion did not correspond to the MRI finding in 10. Nine of these 10 lesions underwent subsequent MRI-guided biopsy and five cancers were diagnosed. This underlines the importance of careful correlation and the need to have the full armamentarium of biopsy procedures including MR guided biopsy available to avoid undue reliance on US detection and biopsy.

Further reading

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Mr Bowen Salvat

The significance of the pulvinar when assessing for developmental dysplasia of the hip

Developmental dysplasia of the hip (DDH) occurs as commonly as one case per 60 newborns with only 0.2% remaining unstable by two months of age¹. Ultrasound is the preferred screening modality when assessing infants for DDH^{2,3}. A combination of angles and coverage are usually used to quantitatively assess the acetabulum for evidence of dysplasia. The two commonly used planes are coronal for quantitative measurements and transverse for dynamic assessment, in which the Barlow stress manoeuvre is applied to demonstrate laxity, subluxation or dislocation.

The pulvinar is a deep structure that lines the acetabulum and appears hypertrophied in cases of DDH. It is widely accepted that the pulvinar along with other structures prevents the relocation of a dislocated hip. The pulvinar is best demonstrated on ultrasound in the transverse plane and is shown to thicken during the Barlow stress manoeuvre. Measuring the pulvinar during dynamic assessment could be used as an important secondary sign for DDH.

Despite the knowledge that the pulvinar is hypertrophied in cases of DDH the use of the pulvinar as a measurement, or its significance, is not reported. The addition of a measurement to quantify the dynamic movement of a hip could aid in reassuring sonographers and clinicians when presented with a borderline hip on coverage and angles.

This paper will show that in cases of borderline coverage and angles, a pulvinar measurement of > 4 mm can be used to add further information and reassurance for screening of DDH.

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Dr Fergus Scott

Screening for structural anomalies in the first trimester

There are many reasons for a scan in the late first trimester, including establishing viability, characterising multiple pregnancies, accurate dating, determining risk of aneuploidy and more recently assessing fetal structure.

Limitations to structural assessment exist due to maternal size, fetal size, the equipment used and the sonographer's experience and with respect to the anomaly itself. Some anomalies change with gestation becoming more obvious and some can resolve. A thickened NT or unusual serology results can indicate an increased risk of finding a structural anomaly.

Detection rates for major anomalies varies in the literature from around 40–80%, with 50% being a reasonable middle ground. Detection of specific anomalies ranges from 90+% (e.g. acrania) to almost 0% (e.g. cleft lip). The different defects, their appearance and detection rates are discussed.

Dr Paul S Sidhu

Doppler ultrasound of chronic liver disease

Ultrasonography of the liver in advanced chronic disease is a useful tool, whereas in early disease ultrasonography may be less informative. The presence of liver fibrosis may be more usefully assessed with the newer techniques of elastography of the parenchyma. Grey scale appearances of established cirrhosis are well documented with an irregular heterogeneous parenchymal pattern, nodular surface often establishing the status of the liver disease without recourse to other imaging modalities. The presence of nodular regeneration and the development of hepatocellular carcinoma can often be established on grey-scale sonographic imaging, with the addition of microbubble contrast being a useful tool. The application of Doppler ultrasonography to establish the presence of cirrhosis and document the complications associated with chronic liver disease is useful.

Portal vein haemodynamics, velocity flow and direction of flow are useful indicators for the development of portal hypertension, as are the secondary signs of splenic enlargement, ascites and the development of varices. Importantly, changes in the spectral Doppler waveform of the hepatic artery allow assessment of the severity of parenchymal disease in the presence of portal hypertension. Morphological changes of the spectral waveform of the hepatic veins may also give the examiner useful information as to the state of liver disease. The use of microbubbles to measure changes of transit time through the liver in different disease states has also been explored. This presentation will concentrate on the use of color and spectral Doppler, as well as the useful addition of microbubble contrast in the evaluation of liver cirrhosis.

Dr Paul S Sidhu

Contrast ultrasound of renal abnormalities

CT examination in staging for renal malignancies is well established.

Often ultrasound is the first imaging modality that detects the presence of a renal abnormality, and can be useful if assessing the characteristics of the abnormality. In particular the presence of vascularity, fatty tissue and calcification may aid the diagnosis.

Ultrasound is particularly useful for ascertaining the patency of the renal vein, and the extension of any malignant renal tumour into the renal vein and inferior vena cava. Ultrasound is particularly useful for detecting cystic changes, and with the advent of ultrasound microbubble contrast media, detection and classification of cystic renal tumours has improved significantly.

Renal Bosniak cyst classification may well replace the classification currently used on CT. Ultrasound is more sensitive and has a higher resolution capability to detect small areas of nodularity within cysts. Although CT remains the gold standard for the assessment of renal tumours, particularly spread, ultrasound retains an important role, particularly with the advent of microbubble contrast agents. Other renal conditions lend themselves to assessment with ultrasound contrast; renal infarction, trauma and areas of pyelonephritis are some. These aspects will be discussed.

Dr Paul S Sidhu

Ultrasound in male infertility

Infertility is a common problem, with male infertility detectable in approximately 50% of involuntary childless couples. Ultrasound plays an important role in the assessment of the male infertile patient. Transrectal and scrotal ultrasound are the imaging techniques of choice allowing detailed examination of the male reproductive system.

Varicocele are associated with infertility, but the significance of this relationship is uncertain, with surgical or radiological repair of a varicocele not recognised as appropriate treatment for infertility in most cases. Ultrasound remains more sensitive than the clinical examination for the detection of varicocele. Transrectal ultrasound allows assessment of prostate and seminal vesicles, particularly if an obstructive cause for infertility is suspected. However, no cause for sub-fertility is detected in the majority of patients, but when a cause is detected; azoospermia is often present which may be non-obstructive or obstructive.

Functional vasogenic erectile dysfunction can impair conception in couples. Ultrasound with intra-cavernosum PGE1 administration allows assessment of the causation of erectile dysfunction and may distinguish between an arterial and a venous problem. Most importantly, detection of the cause of infertility is vital to allow planning of the most appropriate technique for achieving conception.

Dr Paul S Sidhu

Contrast enhanced ultrasound of biliary disease

Ultrasound examination of the gall bladder is accepted as the primary imaging modality in the assessment of gall bladder disease, with inherent superiority in comparison to other imaging modalities. Contrast enhanced ultrasound is established as a reliable tool in the detection and characterisation of focal liver lesions, it is less well recognised in gall bladder and biliary disease but can be a valuable complement to baseline ultrasound examination.

Contrast-enhanced ultrasound has the advantage of real-time, repeatable, multi-planar imaging without compromise to patient

safety or exposure to radiation. Contrast enhanced ultrasound can provide further specific information as pathology often becomes more conspicuous following contrast administration, allowing detailed assessment of benign and malignant conditions arising in the gall bladder and biliary tree.

This review illustrates the application of contrast-enhanced ultrasound in the evaluation of a variety of gall bladder and biliary duct disease allowing clearer delineation of the disease process and more confident diagnosis. Disease entities that will be discussed include gallbladder polyps, adenomyomatosis, inflammation, sludge and biliary duct dilatation. Gall bladder carcinoma, cholangiocarcinoma, cystadenoma and benign disease of the bile ducts that will be discussed include biliary hamartoma, cholangitis and abscess formation.

Dr Neha Singh

Use of liver contrast enhanced ultrasound at the Royal Melbourne Hospital from 2008 to 2011

Contrast enhanced ultrasound (CEUS) is relatively new to Australia and New Zealand, having been used widely elsewhere over many years. We present our experience with liver CEUS in a tertiary referral centre to outline how it is being used, clinical indications where it is being used commonly and the impact on imaging and management, in particular with respect of focal liver lesion characterisation.

CEUS with microbubble agent Definity (Lantheus) has been used for dynamic imaging of the liver in over 350 cases between January 2008 to April 2011. Requesting documentation, including prior imaging and findings on CEUS and ancillary imaging have been reviewed retrospectively. Where subsequent imaging or histology was performed, this was reviewed. Of the 363 hepatobiliary CEUS studies, 292 were for focal liver lesion evaluation. Approximately 70% of the studies had accompanying CT and/or ultrasound and approximately 20% had MR imaging for review. Approximately 50% of the studies were concordant with prior imaging and an additional 35% either confirmed the diagnosis or altered it such that there was a change in management. Approximately 10% of the lesions remained equivocal. Just over 20% (57) of the lesions went on to resection or biopsy providing histological correlation.

Mr Mark Smyth

Ultrasound of renal cystic lesions – the good, the bad and the ugly

In 1986 Morton Bosniak first described a classification to categorise renal cystic lesions into surgical and non-surgical cases, based on CT criteria. A pivotal component of this classification involves detecting enhancement within septa or mural nodules.

Up until now, ultrasound has not been able to play a role in this classification, due to its relatively poor sensitivity for low flow vascularity in deep structures. Now with the advent of second generation ultrasound contrast agents, coupled with the use of 3D technology, we can gain extensive information that can help confirm and sometimes change the CT Bosniak characteristics of a complex cystic lesion.

In some cases, contrast enhanced ultrasound may be able to replace CT for ongoing surveillance of Bosniak 2F lesions, and may also become the initial investigation of choice for complex cyst investigation in younger patients.

Ms Presanna Sujenthiran

How to evaluate the pelvis in infertility

The aim is to provide an overview of the role of ultrasound in the investigation of female patients who present with infertility. Infertility can be primary or secondary and may be due to various factors, including anovulation, tubal disease, or idiopathic.

An ultrasound examination is performed on patients presenting with infertility and, in conjunction with biochemical analysis +/- laparoscopic assessment, facilitates diagnoses of specific pathologies causing infertility. Ultrasound assesses the endometrium and ovarian volume, as well as the fallopian tubes, uterus, uterine cavity, cervix and ovaries.

There are a variety of abnormalities of the uterus and uterine cavity that are associated with infertility; common conditions include fibroids, intrauterine polyps and congenital uterine anomalies. Endometriosis, polycystic ovaries and hydrosalpinges are other causes of infertility that can be identified by ultrasound.

Dr Tom Sutherland

Renal transplant ultrasound “what can we see?”

Renal transplants are the most common visceral transplant. Early detection of complications enabling intervention can prolong graft survival and thereby reduce patient morbidity and mortality. Ultrasound is frequently used to assess renal transplants and so it is vital that general radiologists and sonographers are aware of the sonographic features of transplant complications.

Transplant complications can be classified as vascular (vascular stenosis, thrombosis, arteriovenous fistulas and pseudoaneurysm), peritransplant collections (urinoma, haematoma, abscess, lymphocoele) or parenchymal (infarct, rejection, drug toxicity, tumours including post transplantation related lymphoproliferative disorder and renal cell carcinoma).

Dr Ben Thomson

The role of ultrasound in the operating theatre

Ultrasound remains a cheap and effective tool in the investigation of disorders of the liver, gall bladder, biliary tree and pancreas. Intraoperatively it has three main roles. The first is the detection and staging of small volume tumours of the liver and pancreas that are unable to be visualised with conventional pre-operative imaging. The second is the ability to identify the major vascular and biliary structures within the liver and pancreas and their relationship to tumours planned for resection. Third, ultrasound can be used to target and monitor intraoperative ablation of hepatic tumours.

With the improvements in computed tomography, magnetic resonance imaging, endoscopic ultrasound and nuclear medical imaging many of the advantages of intraoperative staging ultrasound have been superseded. A discussion of the current utility of intraoperative ultrasound will be presented and examples of its use. A discussion of the intraoperative use of transoesophageal echocardiography in trauma patients will also be presented.

Ms Sue Walker

Management of fetal anemia in pregnancy

Untreated severe fetal anemia may result in fetal hydrops and *in utero* death. While most commonly due to red blood cell isoimmunisation, other causes include parvovirus infection and fetal haemorrhage. Treatment of severely anemic fetuses with *in utero* transfusion has been one of the earliest and most successful advances in fetal therapy. This talk will address the potential

aetiology and management of fetal anemia, including the role of ultrasound in non-invasive diagnosis of severe fetal anemia. While measurement of the middle cerebral artery peak systolic velocity is now the mainstay of management in the diagnosis of fetal anemia, the limitations of this technique need to be appreciated.

Mr Daniel White and Mr Robert Zeigenbein
Ultrasound techniques for varicose veins

The aim of a venous ultrasound examination for varicose veins is to document the presence of incompetent veins and their superficial and deep venous communications. Despite such a relatively simple purpose, the complexity of veins appearing on a given patient's leg and inconsistent anatomical terminology have caused substantial confusion and anxiety among many who perform this examination. Furthermore there still remains considerable confusion regarding the technical advantages and disadvantages of specific techniques related to augmentation of venous blood flow, patient position and the definition of significant reflux.

Despite the apparent complexity and confusion surrounding this examination there have been significant advances in unifying the anatomical terminology of the veins in the leg. In addition, a careful consideration of the pros and cons of the technical execution of this test, based on the principles of blood flow and venous physiology, will help a sonographer or sonologist make an appropriate choice for a given patient.

This presentation will discuss both the terminology for describing the distribution of veins in the leg and discuss the techniques at our disposal to provoke and record blood flow so that complex networks of incompetent veins can be identified and documented with greater accuracy and consistency.

Dr Hui Zhi

Hui Zhi1, Bao-Ming Luo, Xiao-Yun Xiao, Bing Ou, Wen-Jing Zhong, Zi-Zhuo Zhao, Xin-Bao Zhao, Hai-Yun Yang

Could ultrasonic elastography help the diagnosis of small (≤ 2 cm) breast cancers with the usage of sonographic BI-RADS Classification?

Objectives: To evaluate the additive value of ultrasound elastography (UE) to BI-RADS for the differentiation of benign and malignant breast small lesions.

Methods: Breast masses (≤ 2 cm) with histological diagnosis examined by ultrasonography and UE in our department from April 2004 to December 2009 were reviewed. Conventional B-mode ultrasound findings were classified according to the BI-RADS classification. UE findings were classified according to the five-point scale. Histological diagnosis was used as the reference standard.

Results: 401 (246 benign, 155 malignant) from 370 consecutive patients were included in the study. Sensitivity and specificity were 90.3%, 68.3% for BI-RADS; 72.3%, 91.9% for UE. The sensitivity of BI-RADS was better than that of UE ($P < 0.05$), while the specificity of UE was better than that of BI-RADS ($P < 0.05$). A revised BI-RADS combined with UE results were proposed in this study. Sensitivity and specificity were 83.9% and 87.8% for revised BI-RADS. The diagnostic performance of revised BI-RADS was better than BI-RADS ($P < 0.05$).

Conclusions: UE could give BI-RADS some help in the differentiation of benign and malignant small breast lesions. Revised BI-RADS could improve the diagnostic performance.

E-Poster Presentation Abstracts

Dr Seung A Choi, Choi SA, Kim YJ

Crucial US findings for non-surgical repeated intussusception in an eight-year-old boy

The purpose of this study was to list crucial sonographic findings that will be helpful for clinicians in the management of recurrent intussusception. Recurrent intussusception usually occurs at the same site and recurrent small bowel intussusception carries pathologic leading points such as polyps, tumors, infections, polyps, lymphomas, Meckel's diverticulum, duplication cyst, intraluminal hematoma, and adhesions that often lead the patient to an operation.

We revised every 10 cases of recurrent intussusception that underwent pneumo-reduction at least once in our hospital for the last three years. All except one of the cases recurred at the same site. The eight-year-old patient showed different manifestation while the location of intussusception was changed from ileocecal area to ileoileal area and recurred ileoileal intussusception did not have a certain pathologic leading point.

The sonographic findings of ileoileal intussusception showed the new location and relatively short length of the lesion, which is less than 3.5 cm, no ascites, no proximal small bowel loop distention, and normal peristalsis. These findings could give an idea to doctors that this intussusception was not in surgical condition. We compared this extraordinary case with two others of each type of 10 intussusceptions and discussed sonographic findings of them by showing each case.

Keywords: non-surgical, recurrent, ileoileal, intussusception, sonography

Mr Sean Coveney

Room lighting and its perceived or real effect on ultrasound images

In the digital environment does lighting conditions have an effect on our perceptions of images?

- How much does it affect the quality of our images?
- Do we need to assess this further?
- Should there be a correlation between scanning room and reporting lighting conditions?
- Are we missing pathology?
- Should there be a set standard of light levels for scanning rooms?

These questions were prompted by a perceived difference in images, viewed while scanning, then when reviewed in the collating area and again in the reporting offices. With the use of light meters, ultrasound phantoms and an assessment of the total gain, we defined the difference in image acquisition under differing lighting conditions.

- Do rooms need to be as dim?
- Does this affect our images?
- Should we also consider fatigue and eye strain?

Dr Deepthi Dissanayake

Dissanayake D, Ng A, Metcalf C, Wylie E

Ultrasound characteristics of male breast disease

The purpose of the study was to describe the ultrasound appearances of male breast disease. Forty-four male patients who underwent breast ultrasonography, with or without mammography, between

January 2004 and December 2010 at Royal Perth Hospital were retrospectively evaluated. Results from private imaging reports for these patients were also included. Some patients had more than one diagnosis, resulting in 49 diagnoses.

Thirty-six (73.4%) diagnoses had pathological confirmation via fine-needle aspiration (FNA), core biopsy, or surgical histopathology. The diagnoses in this series included three ductal carcinomas (6.1%), 20 cases of unilateral gynecomastia (40.8%), nine cases of bilateral asymmetric Gynecomastia (18.4%), one bilateral symmetric gynecomastia (2%), two abscesses (4%), three cases of fat necrosis (6%), one epidermal cyst (2%), one lipoma (2%), one chronic inflammation (2%), and eight cases of normal adipose tissue (16.3%).

All malignant masses were detected by ultrasound, in which they appeared hypoechoic and irregular. gynecomastia appeared as retroareolar, hypoechoic, glandular tissue. The abscesses showed mixed echogenicity. Fat necrosis appeared hypoechoic with acoustic shadowing. The epidermal cyst was a well-defined, oval-shaped, hypoechoic lesion. The lipoma was well defined, lobulated, and hyperechoic. We concluded that ultrasonography is an essential and useful tool in the characterization of male breast disease.

Ms Shashini Dissanayake

Shashini D, Gunawardena D, Wylle E

Retrospective analysis of mammographically detected and stereotactic guided core biopsied parenchymal abnormalities which were occult on sonography

Aim: To review cases that underwent stereotactic-guided core biopsy of ultrasonically occult mammographic parenchymal abnormalities in a screening population, in order to evaluate reasons for them to be obscured on sonography.

Method: The database of BreastScreen Western Australia was searched, for the period January 2004 to December 2009. All cases satisfying the following criteria, a mammographic parenchymal abnormality, a negative ultrasound scan result and a biopsy under stereo guidance, were reviewed.

Results: The study consisted of 469 cases accounting for 2.1% of all recalls to assessment. Histopathologically 79% of lesions were benign, 3.5% were borderline and 17.5% were malignant. Carcinomas comprised 68% invasive ductal carcinoma, 1% metaplastic carcinoma, 15% invasive lobular carcinoma and 16% ductal carcinoma in-situ. Among invasive carcinomas there was significantly higher proportion of mucinous carcinoma accounting for 7%. The commonest lesion location was upper outer quadrants. Lesion size measured less than 15 mm in 78% of cases.

Conclusion: Our study confirms that a stereotactic-guided core biopsy needs to be performed on mammographic parenchymal abnormality suspicious of a carcinoma, regardless of a normal ultrasound scan finding. Small lesion size, localising difficulties and tumor characteristics contribute to their non-visualisation on sonography.

Ms Jo Douglas

Lung ultrasound – what can we see?

In my current position in ultrasound training for the Adelaide based ultrasound company Signostics, I was required to present workshops in Milan and Paris on lung ultrasound to European Signostic distributors and pulmonary physicians.

As a clinical sonographer I was used to scanning for pleural effusions but what did I know about A- lines, B- Lines, E-lines, comet tails, sea shore signs, barcode signs, batwing signs, lung pulse and their clinical significance?

I didn't think we could scan lungs due to the reflection of sound by air. I was wrong. Scanning lungs is quick, easy and informative especially to the pulmonologist, intensivist and emergency physician and is often more sensitive than chest x-ray.

An interesting study of ultrasound artifacts and their clinical applications.

Mrs Carla Elliott

CEUS in the traumatic spleen

In blunt abdominal trauma the spleen is the most commonly injured organ. Unrecognised injury can lead to increased morbidity and mortality. Although CT is currently the imaging study of choice for splenic injury, ultrasound is gaining acceptance because it is less expensive, less invasive and relatively portable¹.

In recent years, the development of contrast-enhanced ultrasound (CEUS) has improved the effectiveness of ultrasound in the diagnosis of splenic trauma¹. By using a microbubble contrast agent and contrast-specific imaging software, CEUS is able to detect the micro- and macro-circulation of the targeted organ². This technology has been proven useful in visualising injury size, completeness of injury extension, involvement of organ capsule and active bleeding within the traumatic spleen³. This paper will discuss the current standards of practice in splenic trauma imaging and review several cases performed at Royal Perth Hospital.

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Ms Penny Lam

Lam P, Samson A, Magotti, Benzie RJ

A quantitative method of evaluating image quality at the second trimester fetal morphology ultrasound examination

Objective: The current method used to determine the quality of ultrasound imaging is based on the detection rate of fetal anomalies. This method does not provide a realistic indication of image quality as it is strongly influenced by the frequency of obstetric ultrasounds scanned by the operator. Our aim is to provide a quantitative method of assessing image quality by evaluating images of normal cases in the second trimester of pregnancy.

Methods: Six trained sonographers took images of three biometrical and seven anatomical standardised ultrasound planes at 18–22 weeks gestation. A minimum of 1560 routine second trimester ultrasounds were performed over a period of six months. One hundred normal cases were randomly selected and 10 images from each case were analysed. Four experienced reviewers assessed each image with predefined criteria. The scores acquired by each reviewer were analysed to determine the reproducibility of the quantitative method in assessing image quality.

Results and conclusion: This study is still in progress and statistical analysis will be presented.

Dr Jianui Li

Jianui Li, Bing Chen, Zhang Le

Study on apoptosis of neurons and expression of caspase3 and caspase9 in mouse cerebrum after live three-dimensional ultrasound radiation

Objective: To study the effect of live three-dimensional ultrasound radiation on apoptosis of embryo-cerebral cells and expression of caspase3 and caspase9 in mice with advanced pregnancy.

Methods: Thirty pregnant mice were randomly divided into six groups, unexposed group, pseudo-exposed group, 5 min-exposed group, 10 min-exposed group, 20 min-exposed and 30 min-exposed group, with five mice in each group. Exposed mice were irradiated under the system's probe for 5 to 30 min on pregnant day 16.

On the 10th day after birth, the pups of each group were perfused and fixed with 4% paraformaldehyde; brain slices were made and stained with HE or terminal deoxynucleotidyl transferase-mediated dUTP nick end labeling (TUNEL). Colorimetric method was used to measure caspase3 and 9 activity.

Results: 1) TUNEL method: comparing with the un-exposed group and pseudo-exposed group, positive rate of apoptosis in 5 min-exposed group had no statistically significant difference ($P > 0.05$), but in 10 min-exposed group, apoptosis positive cells were increased and the findings became remarkable in 20 min-exposed and 30 min-exposed groups which showed a statistically significant difference ($P < 0.01$) compared with the other four groups.

2) Caspase3, 9 positive cells were detected in all groups and were remarkably increased in the exposed mice.

Conclusion: Live three-dimensional ultrasound irradiation for longer duration may result in higher Caspase3 and 9 activity that lead to excessive neuron apoptosis in fetal mouse cerebrum.

Mrs Frances Miceli

Magotti R, Miceli F, Benzie RJ

Mosaic trisomy 18 – a case study

Trisomy 18 (Edward's syndrome) is associated with multiple abnormalities of many organ systems including CNS, CVS, GIT and MSK. It is also associated with early IUGR with polyhydramnios. It is generally considered to be a lethal condition either *in utero* or during the first year of life, hence leading to termination of pregnancy in most diagnosed cases.

This is a case of mosaic trisomy 18 with multiple anomalies. Following diagnosis and subsequent counselling the patient decided to continue with the pregnancy. This offered a rare and unique opportunity to image the natural history of the syndrome prenatally and postnatally.

Mrs Narelle Spinner

Spinner N, Clarke L, Piessens S, Edwards A

The 12-week fetal heart

Well established guidelines exist for routine imaging of the fetal heart at the mid trimester fetal anomaly scan. However significant cardiac detail can be obtained at the time of nuchal translucency assessment at the 12-week ultrasound. In nearly all patients it is possible to demonstrate four chambers, outflow tracts and a modified three-vessel view.

This poster will demonstrate the routine views that can be acquired of the fetal heart during the 12-week ultrasound. It will show normal heart anatomy in both 2D and colour Doppler modes.

The 12-week examination is not as extensive as the 20-week assessment; however there is evidence that we can detect many major cardiac abnormalities at this gestation. Early detection of cardiac anomalies facilitates patient management. This includes testing for aneuploidy, including 22q micro deletion, referral to paediatric cardiologist, and earlier counselling. Patients with a past history of major cardiac defects may feel some reassurance if the heart is developing as expected at the 12-week stage. Therefore we believe that the 12-week fetal heart assessment should be viewed as an easily achievable adjunct to early fetal assessment.