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The new millennium is now unequivocally underway, even for the purists such as our President Stan Barnett (see President's message). By this time our personal New Year resolutions are likely to be taking a battering as the year's pace picks up. New Year resolutions of a professional nature usually do not rate in the popular press or talk back radio but perhaps this Bulletin is an appropriate place to offer some suggestions:

1. Maintain critical reflection and analysis of what we do
2. Explore possibilities provided by new technologies
3. Push the boundaries of clinical ultrasound applications when justified on the basis of careful appraisal
4. Be careful observers
5. Share our observations
6. Teach

Each of the contributions to this issue embodies one or more aspects of these principles.

Andrew Edwards provides an outstanding discourse on sonographic estimation of fetal weight and suggests future directions. Vanessa Pincham and Andrew McLennan report a large Australian series of fetal malformations detected by first trimester ultrasound. Jackie Brown suggests pushing the boundaries of the role of ultrasound in breast diagnostic services. Francis Miceli describes the use of 3D colour ultrasound to display the fetal circle of Willis and Andrew Rotstein shares his observations about blood flow in struma ovarii.

Read on and make your own appraisal…..and professional resolutions.

Robert N Gibson
Editor

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President's message

The year 2000 was an interesting and productive year for medical ultrasound and for the ASUM. On the international stage, the 9th Congress of the World Federation for Ultrasound in Medicine and Biology was a momentous occasion. Those of us who were fortunate to attend enjoyed the benefit of attending a major international meeting in the glorious and historic city of Florence. For the purists among us, that particular event occurred in the previous millennium!

Whilst the WFUMB Congress was truly a spectacular scenario, I would like to take this opportunity to recognise some recent fine efforts in ultrasound activities in Australia and New Zealand, and to give a brief insight into some future directions for ASUM. As we embark on a new year and prepare for the Annual Scientific meeting in Sydney, I believe that it is appropriate to recognise the efforts and to extend a vote of thanks to our New Zealand colleagues for organising the successful ASUM 2000 conference in Auckland last August. At that time Dr Graham Parry, Convenor, extended a warm "Kiwi" welcome to the "City of Sails". On behalf of the Australian contingent, I would like to say that we truly enjoyed the conference and appreciated the "Kiwi" hospitality. Congratulations to the entire organising committee for a fine effort.

Much of my time was spent in committee meetings of one type or another. Nevertheless, I was able to attend a few scientific sessions and I was impressed by the general standard of presentations. It is pleasing that we are able to recognise some of the efforts through the presentation of ASUM prizes, and I would like to acknowledge the continuing generous support of our corporate members in this regard. For the year 2000, the Acuson Prize for Best Research Presentation was awarded to Jenny Kidd for the paper "*Duplex ultrasound detection of endoleaks: follow-up after endoluminal grafting*". The ATL Best Sonographers Research Presentation Award was given to Winkle Yung for the paper "*Routine or selective carotid duplex screening prior to coronary artery bypass grafting*". The Medical Applications Prize for Best Clinical Presentation was awarded to Lino Piotto for "*The sonographic signs of intestinal malrotation and volvulus*". The Giullia Franco Poster Prize for the two best clinical or technical research posters was awarded to Damien Armstrong (1st prize) for the poster "*Diagnosis of significant patent ductus arteriosus in preterm infants using renal arterial Doppler resistive index*", and Kirsten Black (2nd prize) for "*Prenatal detection of cleft lip and palate: An audit of ultrasound diagnosis at the Royal Women's Hospital in Melbourne*". The Meditron Young Investigator Award in Clinical Sonography was given to Greg Duncombe for his paper "*Fetal thyrotoxicosis: A case report*". Congratulations to the prize winners.

The Annual Scientific Meeting is a major showcase for ASUM professional activities. The New Zealand organising committee deserves our heartfelt thanks for their initiative in encouraging local experts to attend as invited speakers, in addition to the industry-sponsored overseas speakers. ASUM is a mature society and is fortunate to have a wide range of members with considerable experience, many of whom are internationally recognised in their field of expertise. Whilst it is nice to introduce members to high profile speakers from overseas, I do not believe that ASUM has properly appreciated the value of local talent in the past. The quaint old ASUM custom of "inviting" local speakers to present papers at the Annual Conference, whilst insisting that they each pay for their own registration, accommodation and travel costs, is no longer appropriate in the modern world, particularly if we hope to continue to progress as an effective society. The New Zealand scientific organising committee (chaired by David Rogers together with an efficient treasurer in Mike Heath) established a sensible and professional attitude in the selection and encouragement of Australasian speakers. It is the obligation of the Executive Council to ensure that the ASUM develops further improvements in its professional attitudes and modes of operation.

The arrival of a new millennium is as good a reason as any to bring about changes in the operation of some critical areas in ASUM. It is crucial that the Executive Council of any not-for-profit organisation properly represents the interests of the membership. In order to achieve this, the ASUM Executive Council will assume a more proactive role in running the society. The current Executive Council incorporates a range of expertise representing various specialty groups within the society. The current structure includes a scientist (Stan Barnett, President), obstetricians (Andrew Ngu, Past-President and Fergus Scott, Medical Affairs), and sonographers (Mary Young, Hon. Secretary and Pru Pratten, Sonographer Affairs). In addition, we have appointed Kaye Griffiths (who needs no introduction for her untiring efforts on behalf of sonographers) as Assistant Secretary. By virtue of having three members based in Sydney, the Executive Council is able to increase the amount of direct interaction with the ASUM Office. A major objective is the improvement of communications between members and the ASUM Executive and Office. I encourage all members to contact their local representatives or the Council, through the ASUM office. The Bulletin also provides an excellent conduit through which members may publicise ideas or issues of common interest.

It is also important to realise that the role of Councillor in a not-for-profit organisation as large and disparate as ASUM can consume a certain amount of work. I have become quite familiar with these extra-curricular demands on my time! In addition to our councillors, we have a range of committees each with its own Chairperson. An essential objective is to encourage and support the activities of these volunteers to maximise the benefit to ASUM of their contributions. Council has agreed with and fully supports the concept of reducing the large number of councillors, committee chairs, branch chairs and other representatives to a smaller and more effective group of office bearers. The Executive Council is considering options to provide an optimal outcome. One idea that has favour is that our committee Chairs become appointed to Council, thereby reducing the need to find additional councillors and maximising the benefits of active committee chairs. We are fortunate that the Chairs of ASUM committees carry out their obligations in a professional and productive manner and will continue in that vein as members of Council. We will need to ensure that the composition of Council includes proper representation of various groups.

It is critical to maintain an efficient and effective working environment to minimise the additional workload and to ensure productive outcomes. Another way in which we are attempting to improve efficiency is through co-operative efforts between the Executive, the ASUM office, and ultrasound industry corporate members. We are all working together to find ways to co-ordinate educational activities under the umbrella, and imprimatur, of ASUM to the benefit of all concerned in the safe and effective use of ultrasound in medicine.

Dr Stan Barnett PhD
President

In the balance: the accuracy of sonographic estimation of fetal weight

Dr. Andrew Edwards MBBS FRANZCOG DDU, Fellow in Obstetric and Gynaecological Ultrasound, Monash Medical Centre

INTRODUCTION

An important component of obstetric care is fetal growth and well-being monitoring. In the past this was carried out by clinical assessment of the mother and her *in utero* fetus. Since the first attempts at sonographic estimation of fetal weight in the early 1970's (1 , 2), clinicians have increasingly utilised ultrasound in the belief that it offers greater accuracy than clinical estimation of fetal weight, and hence may improve pregnancy outcome. It has become a routine investigation in 'high-risk' pregnancies, such as those complicated by maternal hypertension, insulin-requiring diabetes, antepartum haemorrhage or breech presentation, and is often ordered to confirm the clinician's suspicion when palpation suggests macrosomia or growth retardation. Despite this, it cannot be categorically stated that ultrasound estimation of fetal weight is more accurate than clinical assessment. In fact, in a recent study of 1717 singleton pregnancies, clinical estimation of fetal weight was more accurate than sonographic fetal weight estimation for all babies with birth weight between 2500 and 4000g, and equally accurate for babies born weighing greater than 4000g (3). Overall, 72% of the clinical predictions were within 10% of the actual birth weight, compared to 69% of the sonographic predictions.

In this article I take a step back to look at the entire affair of sonographic estimation of fetal weight. I examine the development of the sonographic methods and the mathematical models, and consider why advances in ultrasound technology have not lead to the type of improvements in this area that we have seen in nearly all other areas of ultrasound over the past two decades. By describing, in detail, the process of sonographic estimation of fetal weight, I hope to allow sonographers to enhance accuracy, and clinicians to be aware of the limitations of the test.

I consider the measurement and reporting of an estimated fetal weight (EFW) to involve two discrete steps. The first is the sonographic estimation of fetal weight, calculated by inserting one or more sonographically measured fetal biometric parameters into a mathematical equation. This result is reported in units of mass such as grams. The second is an assessment of how 'normal' the EFW is when compared to a reference population. This is usually reported as a percentile and is established by comparing the EFW with a reference weight chart. For most of us these processes are carried out instantly by the ultrasound machine, requiring minimal understanding of the procedure involved. Importantly, each of these steps can be a source of error that causes misleading results.

THE SONOGRAPHIC ESTIMATION OF FETAL WEIGHT

The equations

In the early 1970's investigators had some success in predicting birth weight (BW) by sonographically measuring the fetal thorax (1) or abdominal circumference (AC) (2, 4), and developing mathematical equations that calculated the EFW. The size of the study groups used to develop the initial regression equations were often quite small and prospective validation was rare. In the following 20 years over 25 further mathematical equations for the sonographic estimation of fetal weight have been published. The first equation using biparietal diameter (BPD) and AC was published in 1977 (5) and revised in 1982 (6) when it was noted to underestimate fetal weight. Shepard's new equation, despite being developed from a study group of only 73 patients, and not being tested with prospective validation, became one of the best known methods for the estimation of fetal weight. Hadlock et al published 7 equations in 1984 that utilised different combinations of BPD, head circumference (HC), AC, and femur length (FL) based on a study population of 167 live-born fetuses (7). The following year the same group published revised regression models based on an expanded population of 276 fetuses (8). These models remain very popular and are often considered the gold standard by investigators assessing newer models.

In attempts to improve accuracy, several investigators have recently developed equations that are based on the rationale that fetal weight is proportional to fetal volume. Combs et al modelled the fetus as 2 ellipsoids, one representing the trunk and the other representing the head (9). They developed their regression equation in an initial study group of 380 fetuses, and validated it in a further group of 485 fetuses the following year. The fetuses were scanned within 3 days of delivery. The investigators concluded that their equation was more accurate than the equations of Shepard and Hadlock across a broad range of fetal weights. Dudley's circumference-based formula, developed to be geometrically equivalent to his previously published volume-like formula, was developed from 388 consecutive fetuses scanned within 10 days of delivery (10). In the initial study, the investigators found the levels of systematic and random error to be similar to Hadlock's equation.

How accurate is the sonographic estimation of fetal weight?

The intrinsic difficulty in measuring fetal weight means that an assessment of accuracy can only be carried out on those fetuses that deliver soon after the EFW was performed. Some authors have expressed the error as the proportion of EFWs that fall within a particular error range, such as within 10% above or below the BW. Others have described the error using the statistical measures systematic (mean) error and random error. Systematic error refers to the difference between the mean EFW and the mean BW of the study group, and is reported as a percentage of the EFW or the BW. Random error refers to the distribution of the difference (error) between the BW and the EFW for each fetus. It is expressed as the size of a standard deviation (SD), which is a measure of the amount of spread when each difference is plotted on a graph. In simple terms, 1 SD represents 68% of the fetuses and 2 SD represents 95% (11). Standard deviation is also expressed as a percentage of the EFW or BW.

When Shepard published her equation in 1982, she reported that 50.7% of EFWs performed 2 days prior to delivery fell within a range extending from 10% below to 10% above the actual birth weight (6). Hadlock also assessed the accuracy of Shepard's equation, reporting a systematic (mean) error of 1.3% overall, which means that, on average, the equation over-estimated the fetal weight by 1.3% (8). He reported a SD of 10.1%, which means that 68% of EFWs fell within a range 10.1% below or above the BW, and 95% fell within a range of 20.2% below of above the BW. Hadlock's own equations have been reported to have mean errors between –0.7 and 2.3, and standard deviations between of 7.3-9.8% of birth weight (8,12).

The equations of Shepard and Hadlock are particularly well known and remain popular for the sonographic estimation of fetal weight. Many other equations have been published since but problems with accuracy remain. Chauhan et al compared 26 equations published by 13 investigators in premature fetuses and found that the proportion of sonographic estimated weights within 10% of the actual birth weight ranged from 19% at worst to 60% at best (13). They also reported that the accuracy of a given equation varied significantly between the 3 centres that participated in the study. We reviewed 5 equations in a high-risk population in an effort to establish which fetal, and maternal characteristics have an impact upon the accuracy of sonographic estimation of fetal weight. While we found that the equations by Shepard and Hadlock produced a very small systematic (mean) error of less than 2% in the whole study population, Dudley's volume-based equation produced a mean error of 7.4% which corresponds to a mean BW which is 7.4% above the mean EFW. Factors that generally increased the error included the presence of ruptured membranes, which increased the mean error of the equations by Hadlock and Shepard by up to 9-fold. While the actual birth weight did not affect the accuracy of most equations, Combs' equation produced a highly significant difference in the mean error between BW groups which ranged from a mean overestimation in fetal weight by 8.5% for babies with BW<1000g, to a mean underestimation in fetal weight by 6.2% for babies with BW>3000g.

Sources of error in estimating fetal weight

These can be broadly divided into 2 groups: measurement errors and equation errors. The former will include incorrect caliper placement exacerbated by factors such as an inexperienced sonographer, oligohydramnios, difficult fetal position, and poor image quality due to equipment problems or maternal obesity. The latter relates to the ability of the equation to accurately predict the actual fetal weight under ideal ultrasound conditions with perfect biometric measurements. Factors to consider include the methodology of the original research, such as the number and epidemiological characteristics of the fetuses studied, the interval between scanning and delivery, the method of caliper placement, and the mathematical process used to establish the regression equation. Additionally, the number of biometric parameters and the way in which they are manipulated in the equation may be important.

Obviously, it is essential that biometric measurements be taken using the same technique used when the original data for each equation was collected. Unfortunately many investigators failed to provide much detail on how they performed their biometry. Shepard at al briefly described the BPD measurement technique used in their study as being at "at the level of the thalami" (6). Hadlock et al referred back to previous publications in their discussion on technique of measuring the BPD (14 , 15). They used a level originally described by Campbell and Thoms (16), in which the head was scanned in a transverse horizontal plane. The major landmark was the anechoic midline structure now known to be the cavum septi pellucidi (CSP), although at the time Hadlock et al thought it might be the rostrum of the corpus collosum (14), while Campbell and Thoms had previously called it the third ventricle (16). The other landmark was the choroid in the atrium of the lateral ventricle. More recently Hadlock has added that the falx cerebri should be seen anteriorly, and that, depending on the age of the fetus, the thalamic nuclei and the middle cerebral artery pulsations in the Sylvian fissure may also be seen (17). The calipers were placed on the outer and inner edge of the fetal skull (figure 1). The HC, which can be measured by positioning an ellipse just outside the hyperechoic calvarium, was assessed in the same plane by Hadlock et al (18).

Shepard and Hadlock appear to measure the AC at the same level. Shepard described taking "transverse cuts through the fetus at right angles to its long axis…at the level where the umbilical vein joins the portal sinus" (6), and Hadlock used "the axial plane at the level of the umbilical vein-ductus venosus complex" (19). Recently Hadlock has added that the stomach represents a secondary landmark (17) (figure 2). Lastly, Hadlock described measuring the femur length by visualising its longest axis, and taking care to avoid tangential sections, the ilium, ischium, and distal femoral epiphyses (20).

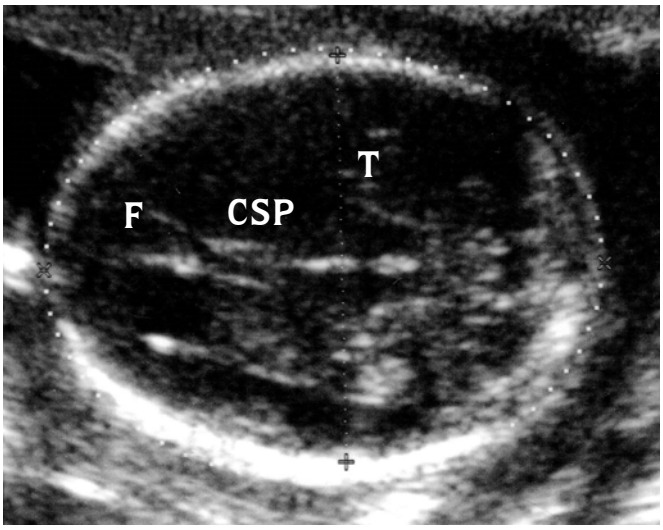

Figure 1 The biparietal diameter and head circumference are typically measured with the fetal head in a transverse horizontal plane. The major landmark is the anechoic midline structure now known to be the cavum septi pellucidi (CSP). The falx cerebri should be seen anteriorly and depending on the age of the fetus, the thalamic nuclei and the middle cerebral artery pulsations in the sylvian fissure may also be seen.
F = falx CSP = cavum septi pellucidum T = thalami

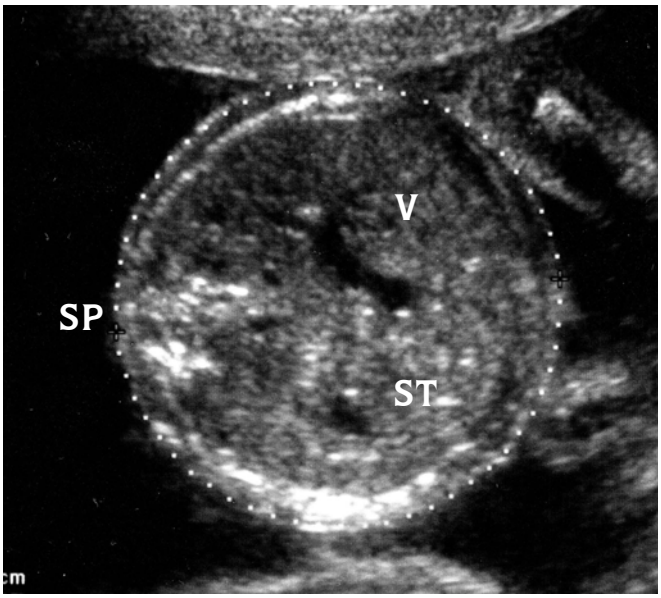

Figure 2 The abdominal circumference is measured in a transverse axial plane at the level where the umbilical vein joins the portal sinus. The stomach and spine are other landmarks.
SP = spine ST = stomach V = umbilical vein/portal sinus

Assessing normality of an EFW

Although the actual EFW will be of value in many circumstances, an indication of whether the EFW is normal when compared to a reference population is often just as important. This can be expressed as a percentile or in equivalent weeks of gestation. Although the latter is still commonly used, the former seems more logical. The clinician interpreting the scan report wants to know whether the estimated weight of the fetus is normal or abnormal for the gestation, and where it lies compared to average. It is usually accepted that EFWs within the 10th to 90th percentile range can be considered normal. Estimated fetal weights outside this range identify a group of fetuses that are at increased risk of perinatal morbidity and mortality (21 , 22). Expressing the assessment of the normality of the EFW in percentiles makes it easy for the clinician to identify the 'at risk' fetus.

Whether we decide to report our comparison with 'normal' in terms of percentiles or equivalent weeks of gestation, how do we decide what is 'normal' for a given gestation? If we wanted to assess the normality of a baby's birth weight, we would compare it with a birth weight chart for babies of the same gestation and population. Fetal weights are another issue. Logic suggests that to assess the normality of an estimated fetal weight, we would compare it with a chart of fetal weights for the same population and gestation. Here a problem arises. While birth weight charts are produced by collecting actual birth weight data from a population, we can never know the actual weight of a fetus. In the absence of actual fetal weight charts we are left with several options that allow us to provide an assessment of the normality of an EFW.

Probably the most popular option is to compare the EFW with BW charts. The advantage here is that very robust data gathered from large numbers of births, such as the Australian national birth weight percentiles based on nearly 770, 000 births (23), are often available. At first it seems reasonable to assume that the birth weights of babies born at a particular gestation would be representative of the weights of babies that remain in utero at the same gestation. However, premature babies are, by definition, not normal, and therefore cannot be assumed to be representative of the 'normal' babies that remain *in utero*. In fact, there is evidence that babies who are born prematurely have a lower EFW at 32 weeks than babies delivered at term (24).

An alternative is to use fetal weight charts developed from sonographic estimations of fetal weight such as that published by Hadlock et al. These charts are based on the sonographic EFWs of 392 fetuses, at a range of gestation from 10 to 40 weeks (25). This avoids the problem of comparing birth weights with fetal weights, but introduces new issues. Firstly, the charts tend to be produced from much smaller numbers, and are less robust. Secondly, we have already demonstrated that the different equations for the estimation of fetal weight each have different error profiles. Comparing an EFW produced with one equation with an EFW chart produced with another equation may result in errors.

CONCLUSION

As we have discussed, there are serious problems with calculating and reporting an EFW. The main problems relate to the calculation of an accurate EFW from the biometric information gathered during the ultrasound scan, and the lack of actual fetal weight charts with which to compare the EFW. Both of these issues could be avoided by using the actual measurements of fetal size, as our assessment of fetal well being, rather than the EFW. In other words, we could measure BPD, HC, AC, FL and any other biometric parameter that we think may help assess the well being of a fetus, and compare

them with charts of those measurements. Altman and Chitty have published suitable robust charts of the major biometric parameters, developed from a prospective study of 663 unselected fetuses, each scanned once at a randomly allocated time during the pregnancy (26 , 27 , 28 , 29). The scan report could contain actual fetal biometric measurements, along with accurate comparisons with reference charts expressed as percentiles. This decreases the importance of the EFW because the clinician gets useful, and more accurate, information from the biometry. It depends on what the clinician really wants to know. An EFW may be important for making a decision regarding mode of delivery, but individual biometry measurements plotted on a percentile chart may be more useful in assessing the growth of an 'at risk' fetus. Probably a combination of EFW and biometry is an appropriate compromise, provided that sonographers, sonologists, and clinicians acknowledge the limitations of sonographic estimation of fetal weight.

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Commentary on "In the balance: The accuracy of sonographic estimation of fetal weight"

By Dr Andrew Edwards

Commentary by
David A Ellwood
Professor of Obstetrics & Gynaecology,
Canberra Clinical School,
The Canberra Hospital

This scholarly article traces the history of fetal weight estimation from the early 1970's, and correctly describes the two discrete steps of measurement and reporting an estimated fetal weight (EFW). Both of these involve potential sources of significant error. The assumptions on which the various equations are based may not be valid, and there are arguments for and against the various described methods. However, the most accurate method of estimating fetal weight will not be clinically useful unless there is an accepted reporting method which clearly gives the clinician the information needed to make a judgement of the normality or otherwise of fetal growth. Fortunately the practice of reporting fetal growth parameters in equivalent weeks of gestation is becoming less common and most ultrasound systems will automatically calculate an EFW. However, the biological variation of actual fetal weight is so great (particularly in the third trimester) that a single report of EFW may be quite unhelpful. Even reporting against birth weight centiles may not be useful, unless there is information from serial scans that show a pattern of fetal growth that is diagnostic of either growth restriction, or fetal macrosomia. The author's recommendation that a range of fetal measurements should be made, and reported against validated charts of those measurements, is surely the most sensible way to deal with this problem. Patterns of fetal growth aberrations should be more easily recognised if the relative growth of a number of biometric parameters is compared.

As with any ultrasound examination the reliability of the result is a factor of many things but the most important must be the experience and skill of the operator. Other factors such as amniotic fluid volume and fetal presentation may also significantly affect the accuracy and reports of EFW should alert the referring clinician to these problems. One word of caution is that obstetricians need to be aware of the limitations of fetal growth estimation, as well as the possible benefits of various clinical interventions based on these measurements. Many common practices have not been subject to rigorous clinical trials, such as the decision to perform an elective primary caesarean section based on EFW. Also, it is likely that there are obstetric interventions for presumed cases of fetal growth restriction that may cause harm (including iatrogenic prematurity) rather than decrease morbidity. As always in clinical medicine, it is important to question whether common clinical practices cause more good than harm or vice versa.

Commentary by
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To begin with I must confess to a bias regarding fetal weight estimation. Weighing babies after birth has been undertaken for a considerable time and attempting to "weigh" them before birth probably seemed like a good idea. In this context estimating fetal weight is similar to the prenatal application of an Agpar score, namely the biophysical profile and, in both instances, something has been lost in translation.

If one accepts that weight and mass are not the same thing because weight is affected by gravity, what is really being measured is fetal mass. Mass is the product of volume and density and, as Dr Edwards has demonstrated, it is impossible to accurately measure fetal volume and there is no way that its density can be measured.

It has even been difficult to arrive at reliable measurements of fetal biometry, however with an appropriate statistically based approach (1) this has probably been overcome. In my experience the errors in estimation are greatest at the lowest and highest fetal weights and these are of course the very ones to which the greatest importance is attached. Having been used to composing and reading reports based on biometrical measurements for many years, I am of the opinion that individual measurements plotted on a percentile chart are more useful in assessing fetal growth than weight estimations.

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The clinical use of fetal weight estimates using 2-dimensional biometry is of less value as a clinical test than many clinicians would believe. Dr Edwards has described in detail the inadequacies of this technique and confirmed the need for reconsideration of the manner in which we apply the concept to our practice.

When Warsof first described his novel equation for estimated fetal weight (EFW) in 1977, there was a realistic expectation that the technique would be of immense clinical value. It has been unfortunate that the twenty or more refinements to the equation that have followed have failed to add meaningful precision. With a standard deviation of approximately 10%, a clinician can expect as a rough guide an error of the order of 15%. Thus, for a prediction of fetal weight of 1000g, the true weight will range from 850 to 1150 g and this degree of precision may indeed be of some use in guiding perinatal care. In higher weight ranges however the technique may be misleading and potentially lead to flawed clinical decisions. A predicted fetal weight of 4000g will represent a true weight somewhere between 3400 and 4600g. Many clinicians fail to appreciate the extraordinary inaccuracy of such an estimate. It is not to our credit that the imaging profession often adds to the illusion by reporting the estimate with excessive and misguided precision in the form of statements such as "the fetal weight is 3945g". It is intriguing to contemplate if a diagnostic test with such imprecision would gain accreditation in a pathology laboratory.

The reasons why the technique of EFW has an inherent inaccuracy are well understood and have been reviewed elsewhere(1). The relationship between size and mass is not linear. Even if we had ready access to reliable and reproducible measures of fetal volume, the estimate of mass would be compromised by the fact that different fetuses have different densities. The error is further compounded by macrosomia and growth restriction in which the relative proportions of tissue types will differ. Reliance on 2-dimensional measures adds additional error because the estimate falls short of the true volume and our traditional and humble use of only 3 parameters fails to account for differing body proportions.

In the third trimester, calculation of receiver operating characteristic curves has confirmed that abdominal circumference and EFW are of similar efficacy for the prediction of birthweight <2500gm (2,3). Either can be used to describe a percentile rank of the adequacy of fetal growth. From a scientific perspective, however, it is more precise to use the more accurate and direct measure of abdominal circumference than to add the errors which accompany calculation of EFW.

The widespread popularity of EFW, despite longstanding evidence of its imprecision, is most likely a manifestation of our societies overwhelming interest in the weight of newborns. Estimated weight is a concept which is understood by all in our community while percentiles are a description appreciated by few. It nevertheless behoves us to ensure that our reports and clinical management are based on the most accurate measure and that any use of EFW must be accompanied by a full appreciation of the inaccuracy of this estimate.

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First trimester sonographic detection of fetal malformations

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ABSTRACT

Nuchal translucency (NT) screening for chromosomal abnormality has been accompanied by a greater emphasis on screening for structural abnormalities in the first trimester. First trimester ultrasound examination can identify approximately 80% of aneuploidy and 60% of major structural abnormalities. Neck, cranial and abdominal wall defects are well demonstrated in the first trimester. However, it is difficult to define cardiac, spinal and diaphragmatic defects until the second trimester. The finding of an increased NT measurement and a normal karyotype defines a group of patients who require careful second trimester morphological assessment and fetal echocardiography. The 18-20 week ultrasound remains important for cardiac, diaphragmatic, spinal and facial assessment.

INTRODUCTION

One in sixty-three live born babies in Australia has a major congenital malformation. Termination of pregnancy due to structural malformation or aneuploidy occurs in at least 0.2% of pregnancies (1). Of these, approximately 56% are for structural malformation and 44% for chromosomal abnormality. The most common structural malformations at termination of pregnancy are neural tube defects and cardiac defects. Approximately 80% of these terminations are performed between 16-22 weeks (2).

The current approach to screening for fetal structural abnormality involves ultrasound assessment at 18-20 weeks. Approximately 60% of abnormalities are detected at this assessment, but there is wide variation in detection rates reported in the literature (3,4). The ability to detect anomalies also varies with the organ system involved, ranging from 80% for central nervous system abnormalities to 25-50% for cardiac defects (5).

Screening for congenital malformation at 18-20 weeks gestation has several potential problems:

1. The anomaly detection rates and cost benefit dramatically decrease if there has been inadequate sonographer / sonologist training or if the patient population is small (3).
2. Transient changes such as cystic hygroma and nuchal translucency may be missed. This has implications for the detection of chromosomal abnormality.
3. There is uncertainty over the significance of 'soft' markers of aneuploidy discovered at this time, in particular choroid plexus cysts, renal pelvic dilatation and cardiac echogenic foci.
4. Second trimester termination for fetal structural abnormality, usually via prostaglandin induction of labour, potentially has higher physical and psychological morbidity (6).

As a result of these concerns, there has been a shift towards ultrasound assessment of the fetus in the first trimester. First trimester screening has many advantages, including accurate dating, detection of early pregnancy failure (3% of first trimester examinations), and identification and characterisation of twin pregnancies (2% of first trimester examinations). First trimester NT screening can detect approximately 80% of fetuses with chromosome abnormalities (7). Furthermore, Whitlow has shown detection of 68% of fetal structural abnormalities in the first trimester (8). In women where the NT measurement is increased but the karyotype is normal, a variety of structural abnormalities, notably major cardiac defects, diaphragmatic hernia and skeletal dysplasias, has been reported (9,10). Therefore, those fetuses constitute a high-risk group that requires careful second trimester morphologic and echocardiographic assessment.

This study reports the types of anomalies that may be detected in the first trimester and those that remain second trimester diagnoses.

METHODS

All patients who were referred to Sydney Obstetric and Gynaecological Ultrasound at 11-14 weeks for chromosome abnormality risk assessment and fetal structural evaluation between April 1997 and December 1999 were reviewed. The lower gestational age limit was initially 10 weeks 4 days gestation (crown-rump length (CRL) 38mm) but became 11 weeks (CRL 45mm) in October 1999, following revision of the Fetal Medicine Foundation (FMF) NT protocol. The protocol for the 11-14 weeks scan encompassed fetal gestational age assessment, NT measurement and structural assessment (Table 1). This group of women also underwent ultrasound assessment of fetal morphology at 18-20 weeks.

Sonographers and sonologists who undertook training in the FMF 11-14 week scan protocol performed all examinations. Toshiba SSA-270 and GE Logiq 500 ultrasound machines were utilised. Transabdominal assessment was performed using curvilinear 5MHz transducers. Transvaginal ultrasound was performed using 6-7.5MHz end-fire endocavity transducers if trans-abdominal assessment was suboptimal due to obesity, fetal or uterine position. Suspected fetal abnormality on transabdominal assessment was further evaluated transvaginally. Audit of ultrasound image quality was performed bi-annually through the FMF, London.

TABLE 1:

Fetal structural features that may be visible on ultrasound in the first trimester

	CRANIUM	HEART	ABDOMEN	SKELETAL
9 weeks	Head	Heartbeat		Limbs Facial bones
10 weeks	Falx Choroid plexus 3rd / 4th ventricles	Atrio-ventricular valves	Stomach Physiological mid-gut herniation	Hands Feet
11 weeks	Cranium	4 chambers	Diaphragm Bladder	Spine
12 weeks	Lateral Ventricles Cavum septum pellucidum Cerebellum	LVOT RVOT Aortic arch	Liver / Gall bladder	Toes Fingers

Women whose fetuses had an increased risk for Down syndrome on NT assessment were offered karyotyping by chorionic villus sampling or amniocentesis depending on the gestational age and individual preference. Those fetuses with an NT of 3.5mm or greater and normal chromosomes were reviewed at 15 weeks for viability and morphology assessment at 18-20 weeks was performed in accordance with ASUM guidelines. Referral for targeted fetal echocardiography was also offered.

Only structural abnormalities diagnosed at one of these assessments were analysed. Abnormalities detected in the third trimester and post-natal period were not included. Patients with early pregnancy failure at the initial examination or with a gestation exceeding 14 weeks(CRL > 84 mm) were excluded from the study.

RESULTS

Eleven thousand, five hundred patients were reviewed in this study. The women ranged in age from 17 to 48 years, with 28% being 35 years or older.

Ninety-three fetuses were identified with one or more structural abnormalities. Sixteen of these fetuses had chromosome abnormalities. A total of 103 abnormalities were detected, of which 59% were identified in the first trimester (Table 2).

In the first trimester, 34 of the 38 neck, cranial and abdominal wall defects were identified. Twelve of the 13 cystic hygromata were first trimester diagnoses. The fetus with cystic hygroma identified in the second trimester showed no abnormality at 12 weeks. The 8 abdominal wall defects were all identified in the first trimester, and were comprised of exomphalos (n=7) and Pentalogy of Cantrell (n=1). The majority of cranial defects were identified in the first trimester with anencephaly (n=10) and holoprosencephaly (n=2) being the most common (Figure 1). Those cranial abnormalities that were not identified until the second trimester were anencephaly (n=1), ventriculomegaly (n=1) and agenesis of the corpus callosum (n=1).

Just over half (23 out of 41) of urinary, skeletal, umbilical cord and spinal abnormalities were identified in the first trimester. Megacystis (n=5) was the most common first trimester urinary tract anomaly detected. Ten of the 18 urinary tract anomalies were identified in the second trimester. Hydronephrosis (n=3) was the most common second trimester urinary tract anomaly detected.

Limb deficiencies represented the most common first trimester skeletal anomaly (n=4). Skeletal dysplasias (n=3) were more commonly second trimester diagnoses. Spina bifida was identified in the first trimester in three out of the five cases. All cardiac (n=11) and diaphragmatic (n=4) defects were second trimester diagnoses. The most common cardiac defects were atrio-ventricular septal defects (n=5) and hypoplastic left heart syndrome (n=4). All congenital diaphragmatic hernias were left-sided.

An NT measurement of 3.5mm or greater was noted in 142 fetuses. Forty-five of these had a chromosome abnormality. Of the remaining 97 fetuses with increased NT and normal karyotype, 10 (approx 1 in 10) had a major structural abnormality and 5 (approx 1 in 19) fetuses had a major cardiac malformation. Of the 37 second trimester abnormalities identified, 12 (32.4%) initially had a NT measurement above 3.0mm and normal karyotype (Table 3). This group included 58% of the cardiac, urinary tract and skeletal abnormalities.

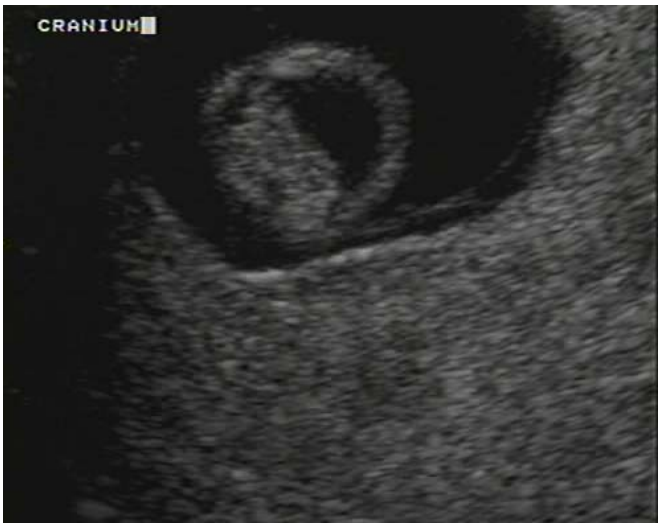

Figure 1 Holoprosencephaly at 12 weeks gestation

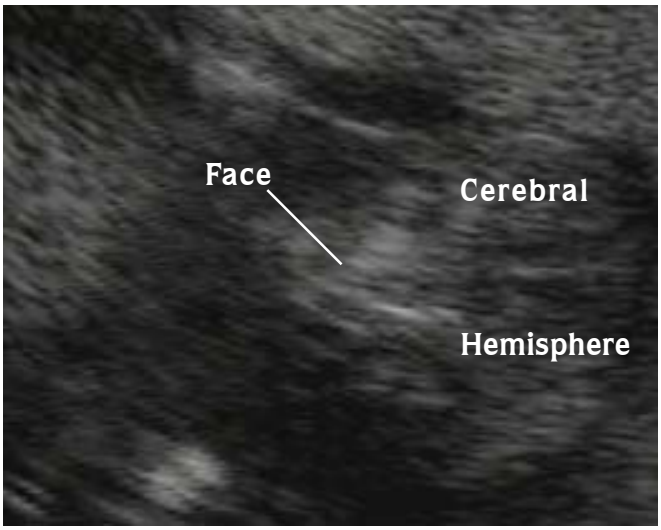

Figure 2 Anencephaly - 'Mickey Mouse' sign (protruberant cerebral hemispheres

DISCUSSION

This study demonstrates that many fetal structural malformations can be detected in the first trimester. Fifty-nine percent of all abnormalities diagnosed prior to 20 weeks were found at the 11–14 week examination. This compares favourably with recent studies (8).

There is a clear distinction between the types of structural abnormalities that are detected in the first and second trimesters. The first trimester provided excellent assessment of the fetal cranium, neck and abdominal wall. Eighty-nine percent of the anomalies detected in these regions were identified in the first trimester.

Cranial defects, in particular anencephaly, were well visualised in the first trimester (Figure 2). The views of anencephaly in the first trimester are different to those identified in the second trimester and may help to explain the evolution of this abnormality. In the first trimester, the cranial vault is absent and the protruberant cerebral hemispheres are noted [previously described as acrania and, in the coronal view, called the 'Mickey-Mouse' sign] (11). By 18-20 weeks, exposure to amniotic fluid and mechanical abrasion is believed to cause progressive degeneration of the cerebral hemispheres which leads to the classical 'frog-eye' appearance.

In this study, an abnormal posterior fossa appearance was linked to two abnormalities with differing outcomes. A triploid fetus initially had a cystic lesion in the posterior cranial fossa that was felt to represent an abnormal fourth ventricle, as well as early intra-uterine growth restriction. The second fetus had an enlarged fourth ventricle that was not identified on ultrasound one week later. The 19 weeks ultrasound revealed a lumbo-sacral neural tube defect with associated Arnold-Chiari malformation.

Whilst abdominal wall defects are generally well defined in the first trimester, return of physiological midgut herniation (Figure 3) does occasionally occur beyond twelve weeks and caution should be exercised in diagnosing exomphalos (Figure 4) at this gestational age (12).

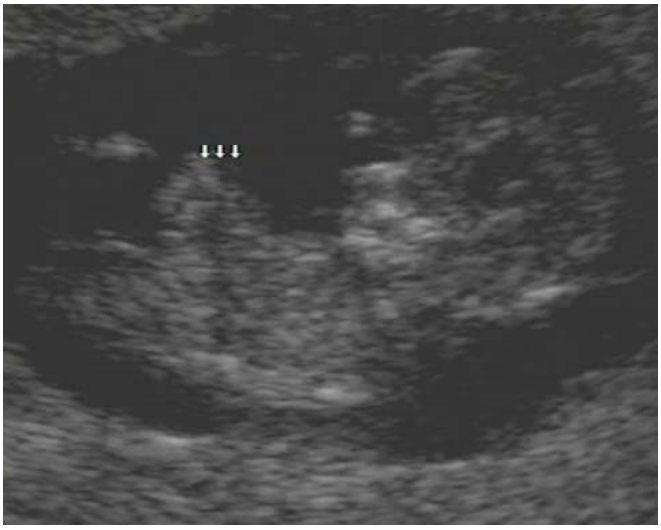

Figure 3 Physiological midgut herniation

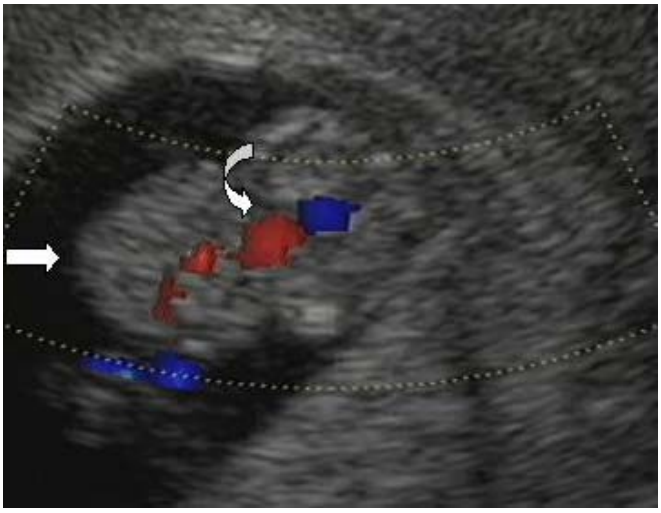

Figure 4 Exomphalos at 12 weeks (straight arrow indicates abdominal contents contained within the peritoneal membrane; curved arrow indicates umbilical vein)

TABLE 2

Structural malformations diagnosed in the first and second trimesters

System	First Trimester Diagnosis		Second Trimester Diagnosis	
	n	Type	n	Type
Neck	12	Cystic hygroma (12)	1	Cystic hygroma (1)
Cranial	14	Anencephaly (10) Holoprosencephaly (2) Abnormal 4th ventricle (2)	3	Anencephaly (1) Agnesis corpus callosum (1) Ventriculomegaly (1)
Skeletal	10	Limb deficiency (4) Radial aplasia (3) Talipes (2) Skeletal dysplasia (1)	6	Radial aplasia (1) Talipes (1) Skeletal dysplasia (3) Polydactyly (1)
Spinal	3	Spina bifida (3)	2	Spina bifida (2)
Cardiac	0		11	Hypoplastic left heart (4) AVSD/VSD (5) Truncus Arteriosus (1) Coarctation aorta (1)
Diaphragm	0		4	(L) Congenital Diaphragmatic Hernia (4)
Abdominal Wall	8	Exomphalos (7) Pentalogy of Cantrell (1)	0	
Urinary tract	8	Megacystis (5) Cystic renal dysplasia (2) Bilateral renal agenesis (1)	10	Cystic renal dysplasia (2) Bilateral renal agenesis (1) Multicystic dysplastic kidney (1) Hydronephrosis (3) Pelvi-ureteric junction obstruction (1) Megaureter (1) Posterior urethral valves (1)
Other	6	Intra-abdominal cyst (2) Allantoic cyst/patent urachus (1) Umbilical cord neoplasm (1) Fetal akinesia deformation sequence (1) Conjoined twins (1)	5	Abdominal cyst (1) Esophageal atresia (1) Duodenal atresia (1) Cleft lip (2) + palate (1)

Diagnosis of skeletal, spinal and urinary tract abnormalities were evenly spread between the trimesters. Limb reduction defects and postural limb anomalies are well visualised in the first trimester. However, only one skeletal dysplasia (diastrophic dysplasia) was identified in the first trimester. In this fetus, all long bones appeared severely micromelic at twelve weeks. The three cases of skeletal dysplasia (thanatophoric dysplasia (n=2) and achondroplasia (n=1) that were identified at the 18 weeks ultrasound appeared to have normal long bones at twelve weeks. Two of the three fetuses with spina bifida that were identified in the first trimester had a spinal defect identified at this gestation. Only one had cranial signs. The two fetuses with spina bifida identified in the second trimester appeared to have normal morphology at twelve weeks.

All fetuses with megacystis were identified in the first trimester (Figure 5). This abnormality may resolve spontaneously by the second trimester, however four of the five fetuses were terminated on the basis of the first trimester findings. The remaining fetus had a normal bladder appearance at 18 weeks. Cystic renal dysplasia and bilateral renal agenesis were equally identified in the first and second trimesters. It was clear that upper urinary tract obstruction was better illustrated in the second trimester. Three fetuses with hydronephrosis and one each with megaureter and pelvi-ureteric junction obstruction were identified at the 18 weeks ultrasound.

TABLE 3

Structural malformations in fetuses with increased nuchal translucency and normal chromosomes

	Number	NT (mm)	Malformation
Cardiac	6 (of 11)	4.3	AVSD
		5.4	AVSD
		3.1	VSD
		5.6	VSD
		4.0	Hypoplastic left heart syndrome
		3.5	Truncus Arteriosus
Urinary Tract	3 (of 6)	4.2	(R) Hydronephrosis
		4.0	(R) Hydronephrosis
		5.1	(R) Pelvi-ureteric junction obstruction
Diaphragm	1 (of 4)	3.7	(L) Congenital Diaphragmatic Hernia
Skeletal	2 (of 4)	3.2	Spondylocostal dysplasia
		3.9	Achondroplasia
Total	12 (of 25)		

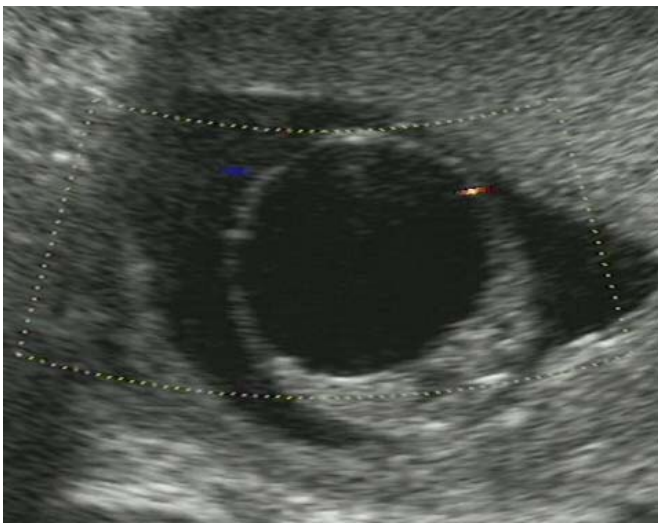

Figure 5 Megacystis identified at 12 weeks

An interesting aspect of our study was the failure to identify any of the cardiac and diaphragmatic defects in the first trimester. Atrio-ventricular and ventricular septal defects were the most common defects identified in the second trimester. In one of the fetuses with hypoplastic left heart syndrome there was concern at twelve weeks that the left ventricle was slightly smaller than the right, however it was felt to be within normal limits. The remaining affected fetuses had normal cardiac views at twelve weeks. In six out of the eleven fetuses with cardiac abnormalities, the NT was elevated and the chromosomes were normal.

The difference in the types of abnormalities detected in the first and second trimesters may be due to a number of factors:

1. These abnormalities may be transient and resolve by the second trimester. Examples include megacystis, cystic hygroma and physiological midgut herniation.
2. Abnormalities, such as anencephaly, may have a different appearance in the first compared with the second trimester.
3. There may be later development of abnormalities with organ growth and increased fluid production such as obstructive uropathy and cerebral ventriculomegaly.
4. Abnormalities may need significant organ growth to be revealed. This is important in the assessment of diaphragmatic defects where increased growth of abdominal organs and bowel may be necessary before they are seen in the thoracic cavity. This may also be true in the identification of some skeletal dysplasias. There may be apparently normal long bone growth until the early second trimester and abnormal skeletal morphology at eighteen weeks. The subtleties of cardiac anatomy are more easily demonstrated in the second trimester, but some lesions clearly have an evolutionary process (such as hypoplastic left heart syndrome) with a normal appearance in the first trimester. Others, such as Tetralogy of Fallot, may require increased blood volume before abnormal flows can be demonstrated (5).

Increased NT acts as a marker for fetuses at risk of structural abnormalities. Our study showed 1 in 10 fetuses had a major structural abnormality and 1 in 19 had a major cardiac abnormality when the NT was increased but the karyotype was normal. Detailed morphological and echocardiographic assessment is clearly indicated in this at-risk group.

CONCLUSION

This study has demonstrated that evaluation for structural abnormalities is possible in the first trimester with a detection rate of approximately 59%. This, combined with a detection rate for aneuploidy of 80%, emphasises the importance of first trimester ultrasound assessment. There is a distinction between the types of abnormalities detected in the first and second trimesters. This study has demonstrated that the majority of cranial, neck and abdominal wall defects and approximately half of the urinary tract, skeletal and spinal abnormalities can be detected in the first trimester. First trimester ultrasound detection of cardiac and diaphragmatic malformations remains difficult. Increased NT in the presence of a normal chromosome complement defines a high-risk group for whom careful second trimester morphology and fetal echocardiography is required.

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Ultrasound practices at a specialist breast centre

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BACKGROUND

St Marks Breast Centre is a multidisciplinary breast centre that offers a number of services that includes a diagnostic breast service, screening and diagnostic mammography, a full range of breast surgical services, breast oncology, physiotherapy and counselling.

Women referred to the diagnostic service are worked-up by the team on the day which includes breast physician, radiologist and breast surgeon with cytohistology being reported within 24 to 48 hours. Cases can be reviewed either at a fortnightly multidisciplinary meeting when malignancy is diagnosed or at a weekly clinical radiological meeting.

Women referred to the diagnostic service have a full work-up that includes clinical breast examination, bilateral breast ultrasound, diagnostic mammography and biopsy (fine needle aspiration (FNA) or core) where appropriate. Women with a strong family history of breast cancer and women diagnosed with breast cancer or ductal carcinoma-in-situ also have bilateral ultrasound as part of in their routine follow up. The ultrasound is performed by a breast physician or radiologist.

GE Logic 400 ultrasound machines are used, utilising a LA 39, 6 to 13 MHz linear probe with multi-frequency capability. Both breasts are scanned at least twice utilising a clockwise, sequential, overlapping radial approach. When a lesion is identified hard copy images, including transverse and longitudinal views, are taken. The average time taken to scan both breasts is approximately ten to fifteen minutes but is dependent on the size of the breasts and the complexity of the ultrasound images.

BREAST PHYSICIAN

The breast physician is a skilled medical practitioner (1) who has specific training in breast disease. There are stringent minimum levels of skill set down by the Australasian Society of Breast Physicians (ASBP) that need to be fulfilled in order for a breast physician to meet competency requirements in clinical breast examination, breast imaging (ultrasound and mammography), interventional techniques (core and FNA), counselling and management.

To achieve membership of the ASBP the breast physician must pass a formal examination in the chosen competency areas after working for three years full time equivalent in a multidisciplinary breast centre. Fellowship is gained after a further 2-year full-time equivalent in a multidisciplinary breast centre. The minimum level of training required by breast physicians performing breast ultrasound surpasses the minimum requirements that are outlined in the American Institute of Ultrasound Medicine (2) and the International Breast Ultrasound School (IBUS) guidelines (3).

BREAST ULTRASOUND

Breast ultrasound has been traditionally used in a targeted manner only to generally elucidate mammographic or clinical abnormalities and to differentiate between solid and cystic masses. Other uses include guidance for interventional procedures and use in young, pregnant or breast-feeding women.

Screening breast ultrasound, by definition is the scanning of asymptomatic women with ultrasound in order to detect breast cancer. The women seen at our diagnostic clinic are either symptomatic and their overriding concern is that they may have breast cancer, or considered to be at high risk of developing breast cancer. Increasingly, however, we are using it routinely in women with mammographically dense breast tissue. Women presenting to our Centre are generally well informed and on some occasions it is at the instigation of the woman or her referring doctor who specifies that an ultrasound be done as well as the mammogram.

It is important to note that for a clinician skilled in both clinical examination and ultrasound it is difficult to differentiate between the two modalities. Ultrasound can be considered to be an extension of the clinician's hand. Like breast self-examination, which is best done in the bath or shower with soap, clinical examination is facilitated by lubrication, namely the ultrasound gel. The correlation of "what you feel" with "what you see" is an invaluable tool that is best appreciated by clinicians performing examination and ultrasound in this manner.

ULTRASOUND ONLY DETECTED BREAST CANCER

In 1999 a retrospective analysis was undertaken of our database of 1200 breast cancers to determine the value of ultrasound in the diagnosis of impalpable, mammographically negative cancers. Ultrasound

detected satellite or multifocal lesions associated with clinically and/or mammographically evident cancers were excluded.

Twenty-two breast cancers were detected by ultrasound only (Table 1). These were diagnosed in twenty-one women. Fifteen were diagnosed in women with breast cancer. Ten were in the ipsilateral breast and considered to be local recurrence with five being diagnosed in the contralateral breast. Of the five cancers diagnosed in the contralateral breast, two were synchronous and three were metachronous. The median time between diagnosis and the detection of the local recurrence or contralateral metachronous cancer was 2 years (range 8 months-7 years).

There were seven women with no previous history of breast cancer, who presented with symptoms unrelated to the ultrasound diagnosed malignancy. One of these women had a strong family history of breast cancer and was undergoing six monthly reviews. The median age of these women was 43 years (range 36–59 yr).

Histologically all cancers detected by ultrasound alone were similar in size to screen detected lesions. Five lesions were categorised as T_1 (2 cm or less), three lesions T_{1a} (under 5mm), eleven lesions T_{1b} (5 to 10 mm) and two lesions were T_{is} (carcinoma in situ) lesions. One lesion was categorised as T_{4a} (any size tumour with chest wall extension) on final histology. The ultrasound dimension of this lesion measured 8 mm and was the only evidence of an occult cancer with extension to the chest wall.

Illustrative examples of ultrasound detected cancers are shown in figures1 to 3.

DISCUSSION

Bilateral, as opposed to targeted ultrasound is utilised with women presenting to the Centre on the basis that no individual diagnostic technique is perfect but together the potential to 'miss' a cancer is minimised. Valid criticisms against the use of ultrasound in this manner are the potential for false positive results, increased use of interventional procedures, patient morbidity and greater cost to the patient.

To minimise some of these concerns, we would encourage the categorisation of ultrasound detected lesions as suggested by Stavros (4). Thus "probably benign" lesions, like their mammographic counterpart, having a less than a 2% chance of malignancy, could be followed rather than biopsied. If such protocols were developed the need for clinicians to biopsy all ultrasound detected solid nodules because of medicolegal concerns would be reduced markedly.

However, many of the breast cancer recurrences detected by ultrasound alone are nonspecific hypoechoic lesions. It is the authors' opinion that any solid lesion seen on ultrasound in women who have been diagnosed with breast cancer requires histological diagnosis.

There is increasing evidence for women who have mammographically dense breast tissue to also have a bilateral breast ultrasound. Cancer detection rates of 3 per 1000 have been noted when women with mammographically dense breast tissue are routinely scanned with bilateral breast ultrasound(5). This figure is similar to incident rounds found in a mammography screening program.

In our opinion, bilateral ultrasound should be used routinely in women diagnosed with breast cancer. This must be done at the time of diagnosis to detect an occult satellite or contralateral cancer, which may affect surgical management, and also as part of routine follow-up. It is well documented that 5-10 % of women diagnosed with breast cancer, over time, may develop a second cancer in the same or contralateral breast. It remains to be determined if early detection of local recurrence by ultrasound alone has an improved survival when compared with women in whom local recurrence is detected clinically or mammographically.

Bilateral breast ultrasound along with mammography and clinical breast examination should also be considered in women at high risk of developing breast cancer and with women who have mammographically dense breast tissue.

It is the author's opinion that the traditional use of breast ultrasound needs to be widened and treated as a flexible tool in the armamentarium available for the majority of women who seek reassurance that there is no evidence of breast cancer while diagnosing early breast cancer in others.

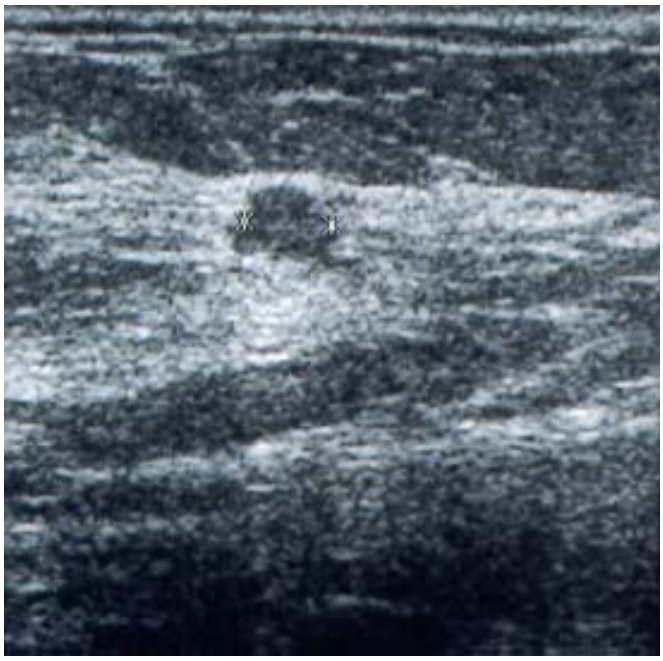
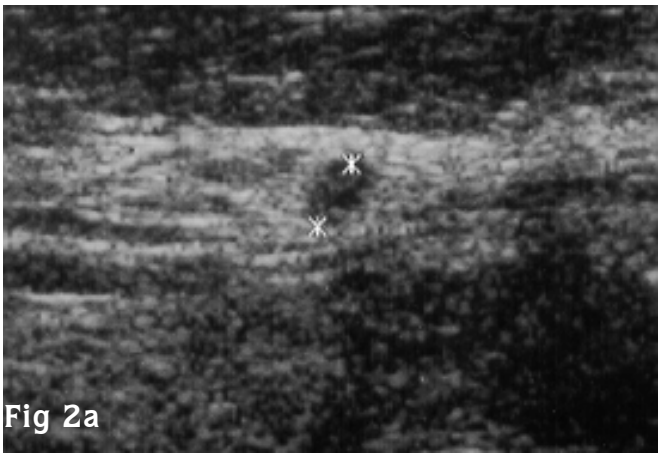
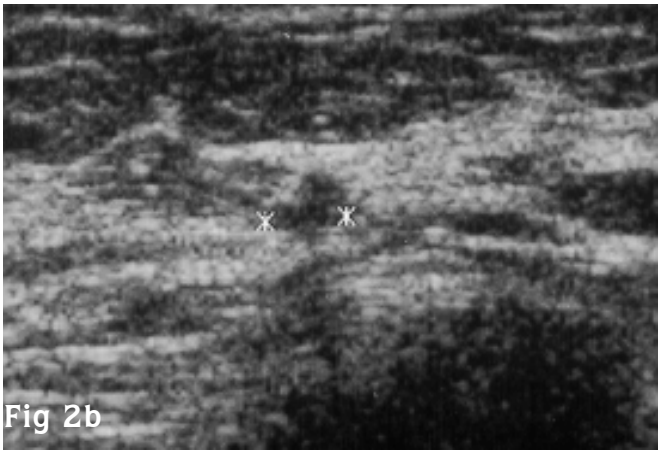


Figure 1 71 yr old had left mastectomy plus axillary dissection for lobular cancer (T2N1M0) followed by Tamoxifen. At 3 years this right ultrasound detected lesion was core biopsy positive (Clinical examination and mammogram negative).
Final histology: (R) Grade 1 infiltrating ductal cancer 6 mm, node negative.





Figures 2a and 2b A 41 yr old had a left partial mastectomy plus axillary dissection (T2N0M0) followed by radiotherapy, chemotherapy and Tamoxifen. Three years later ultrasound demonstrated a nodule in left breast at the biopsy site. Core biopsy positive; clinical examination and mammogram negative. Final histology: Grade 2 infiltrating ductal cancer (5 mm)

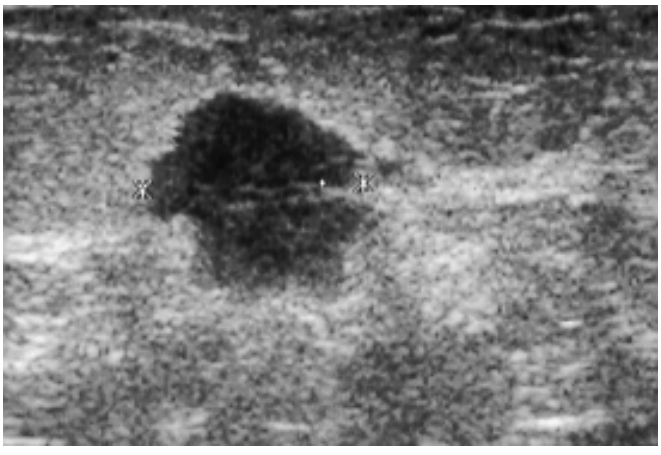


Figure 3 Presented at age 48 yrs for pain in the right breast. Mammogram and clinical examination were negative. Ultrasound demonstrated this lesion in the left breast. Core biopsy was positive. Final histology: Grade 3 infiltrating ductal cancer (12 mm) node negative.

TABLE 1

ULTRASOUND ONLY DETECTED BREAST CANCER

- Total 22 cancers detected in 21 women
- Women with a diagnosis of breast cancer, median age 49 yrs (40-74 yrs)
  - 10 ipsilateral (local recurrence)
  - 3 contralateral, metachronous
    median time from diagnosis , 2 yrs (8 months – 7 yrs)
  - 2 contralateral, synchronous
  - 7 incidental findings
    median age 43 yrs (36-59 yrs)
- Size of ultrasound only detected malignancies

  T_{is} = 2 (in situ)

  T_{1a} = 3 (under 5 mm)

  T_{1b} = 11 (5–10 mm)

  T_1 = 5 (2 cm or under)

  T_{4a} = 1 (any size, extension to chest wall)

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Assessment of the normal fetal Circle of Willis by 3D ultrasound in the 2nd and 3rd trimester

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Christopher Kohlenberg Department of Perinatal Ultrasound, Nepean Hospital, Penrith, NSW

ABSTRACT

Located on the floor of the cranial cavity the Circle of Willis surrounds the pituitary fossa and the optic chiasma. Its branches supply the developing fetal brain. These vessels and the associated cerebral tissue have been studied extensively by two-dimensional (2D) ultrasound and conventional colour and spectral Doppler flows.

Three-dimensional (3D) ultrasound is a new modality that is able to define clearly the relative anatomy of all the major cerebral vessels and surrounding cerebrum. This is made possible by the ability of 3D ultrasound to capture, store, render and rotate an image. By power Doppler assessment of the cerebral vasculature this study examined the potential use of 3D ultrasound to assess the vessels of the normal fetal Circle of Willis and the surrounding cerebrum. The exam was successful in 90% of fetuses between 18-30 weeks gestation. In approximately 6.6% of cases the Circle of Willis was not able to be visualized due to maternal body habitus and in the remaining 3.3% of cases fetal head position prevented an adequate image after several attempts had been made.

The clinical use of 3D ultrasound is a new field. It is likely that its application will greatly add to the earlier detection and diagnosis of many congenital abnormalities such as congenital aneurysms, intracranial tumours and haemorrhages, lobar holoprosencephaly, lissencephaly, AV malformations and other fetal cranial abnormalities.

INTRODUCTION

The Circle of Willis is an important ring of arteries located on the floor of the cranial cavity surrounding the pituitary fossa and optic chiasma. It sits in the subarachnoid space and is thus bathed by CSF. Arising from the trifurcation of the internal carotid arteries where they enter the cranial cavity it consists of the paired anterior, middle and posterior cerebral arteries and the single anterior and paired posterior communicating arteries. It is also associated with the paired vertebral arteries and the single basilar artery (1). There may commonly be variation in the size and number of these vessels with any of them being hypoplastic, absent, doubled or tripled. However in 90% of cases there is a complete circular formation (2). These vessels and their branches form the blood supply to the developing fetal brain primarily in the following arrangement (2):

- the anterior cerebral arteries supply the medial and anterosuperior regions and these are connected anteriorly by the anterior communicating artery in the longitudinal fissure
- the middle cerebral arteries which are the largest vessels in the brain supply the lateral and anterior regions
- the posterior communicating arteries supply the medial part of the thalamus and third ventricle
- the posterior cerebral arteries supply the cerebral peduncles, occipital lobe and parts of the temporal lobes
- the basilar artery lies in a midline groove of the pons and supplies the pons, fourth ventricle and parts of the cerebellum and midbrain
- the vertebral arteries supply the cord, brain stem and parts of the cerebellum

This unique arrangement allows mixing of the anterior and posterior and the right and left cerebral circulations. This is important as collateral circulations can develop in the event of a slowly progressing impairment of another vessel, for example from a tumour or atherosclerosis (3). However as variations in the size and presence of these vessels do exist the development of collateral circulations may be affected (2). Also in cases of acute or developmental/ congenital vascular abnormality (as is likely to be the case in the fetus) the vessels of the Circle of Willis are less able to develop collateral circulation to maintain sufficient blood flow and the affected area will suffer damage.

Previously 2D ultrasound has been used extensively to investigate Doppler flow within the fetal cerebral circulation. While 3D capabilities are more commonly known to be used for the "pretty pictures of the baby's face" its diagnostic uses are potentially of far greater importance. The ability of 3D to rotate the rendered image makes it able to define clearly the relative anatomy of all the major cerebral vessels from all angles. To date this has not been possible with 2D ultrasound. The aim of this study was to examine the Circle of Willis with 3D ultrasound to determine if the cerebral vasculature could be readily viewed in routine scanning.

MATERIALS AND METHODS

The anatomical relationship of the fetal cerebral vessels with 3D ultrasound was studied. On routine scanning a 3D image of the Circle of Willis was captured using 3D Medison VoluSon 530 D with power Doppler capabilities.

Thirty patients with gestations between 18-30 weeks were examined. Early attempts to scan gestations beyond 30 weeks were unsuccessful. It was felt that the fetal cranium was too difficult to penetrate making it more difficult to appreciate the cerebral vasculature to be examined and

therefore more prone to inaccurate images. Gestations less than 18 weeks also proved difficult owing to the smaller size and extreme mobility of these fetuses. Therefore for the purpose of this study only the gestations between 18-30 weeks were included.

In order to visualise the Circle of Willis the biparietal diameter (BPD) plane, slightly obliqued to include part of the cerebellum, is used as the MCA is seen to come relatively straight towards the transducer with power Doppler 2D imaging (figure 1). Consequently the relevant plane is easy to achieve in most instances. However if the fetus was facing straight up or down it was not possible to attain the necessary plane. In these instances the rest of the examination was completed while waiting for the head to move. In one case several attempts were made and it was still not possible to achieve the proper plane or to visualise the relevant vessels due to head position. In this case the study was abandoned.

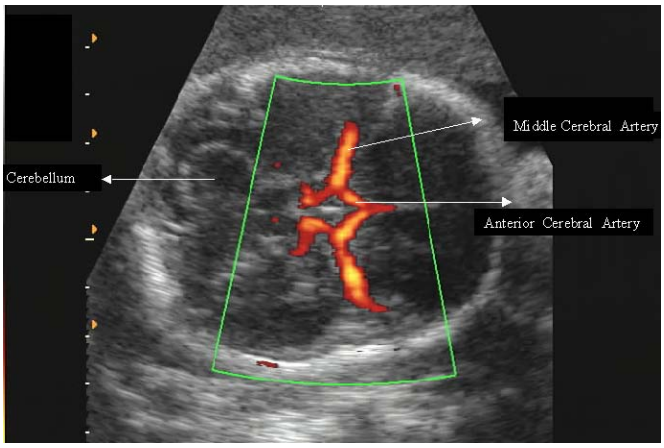

Figure 1

The power and gain settings were kept as low as reasonably possible. Power Doppler was chosen over conventional colour flow Doppler as it is known to be more capable of demonstrating lower flows in the smaller vessels in the fetal brain. However in some cases of gestations approaching 30 weeks or maternal obesity the fetal cranium was difficult to penetrate and it was necessary to have the power Doppler settings at or near the maximum level. The transducer used was an S-VAW 3-5MHz 3D probe capable of scanning in both 2D and 3D modes. The 3D volume scanning was automatically performed by the scan mechanics of the transducer (4).

Using the MCA as a guide the Circle of Willis was visualized in real time 2D imaging. In order to obtain adequate information by colour flow of the vessels a slow sweep speed was necessary. This required the fetus to lie still for four seconds. In most instances, and in particular the fetuses between 18-20 weeks gestation, the fetal head moved during the volume acquisition. This would cause the resultant image to be blurred. On average 3-4 attempts were made on each case. These images were all captured and stored. After the patient had left the department the images were recalled and the process of rendering (or 3D reconstruction) and rotating began. This step required a great deal of patience with each completed image taking 5-7 minutes to obtain.

RESULTS

The normal Circle of Willis and the surrounding cerebral tissue were easily defined and the examination was successful in 90% of the studied cases. In approximately 6.6% of the cases it was not possible to visualize the Circle of Willis due to the maternal body habitus and in the remaining 3.3% fetal head position prevented an adequate image after several attempts had been made. In these cases the study was abandoned.

A great deal of the diagnostic information is obtained as the image is rotated throughout the three dimensions. All the major vessels of the Circle of Willis were clearly identified (figure 2). On rotation of the 3D image the normal course of these vessels and their relationship to each other as well as their relationship to the surrounding cerebrum could be seen from all angles. In addition some of the more peripheral branches such as the basilar artery and the position of the anterior communicating artery in the longitudinal fissure (figure 3) could be appreciated when the 3D image was rotated superiorly. Lateral rotation afforded a view looking straight along the MCA (figure 4).

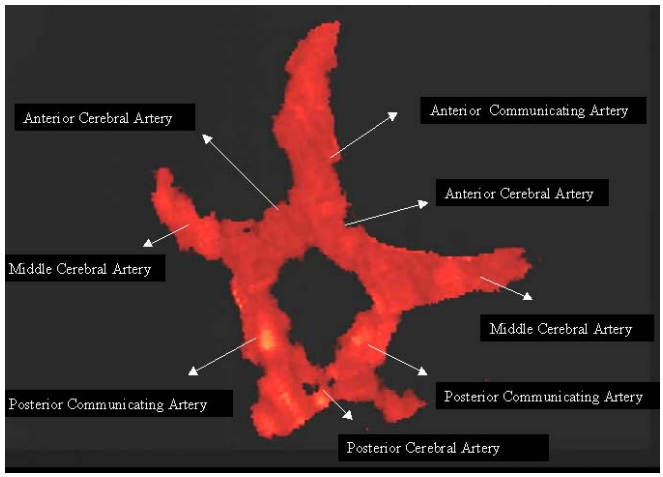

Figure 2

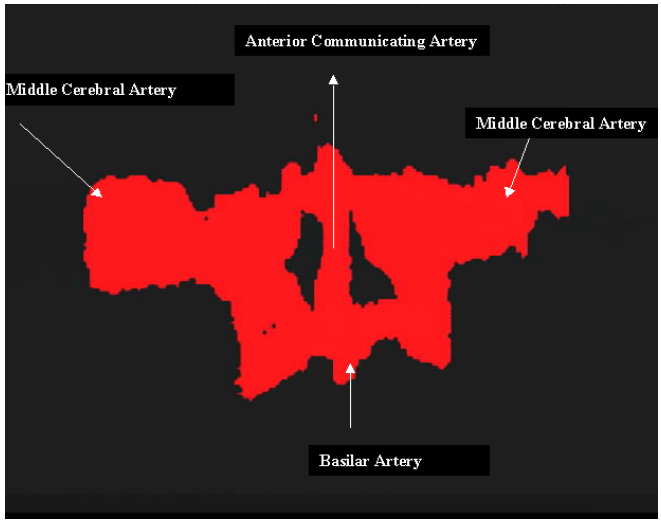

Figure 3

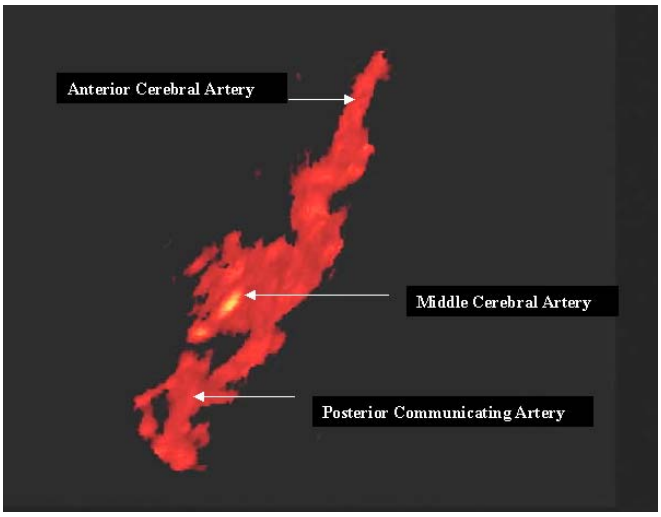

Figure 4

DISCUSSION

It has long been possible to scan and diagnose abnormalities of the fetal intracranial structures by conventional 2D ultrasound. However the aim of this study was to examine the normal vasculature in the three dimensions and to determine if this could be viewed with consistency. This has been shown to be possible in 90% of studied cases. In the event of abnormality it is likely that the 3D picture of these vessels will make the diagnosis of fetal congenital aneurysms, intracranial tumours and haemorrhages, lobar holoprosencephaly, lissencephaly, AV malformations and other fetal cranial abnormalities easier and more accurate. It is also likely that some of the known variations in the size and number of the vessels of the Circle of Willis will be identified.

The clinical application of 3D ultrasound is a relatively new field and much remains to be studied in this area (5). The diagnostic capabilities of this modality shown in the normal fetus in this study would suggest that further research is warranted both in the normal and anomalous fetus.

Acknowledgement

I gratefully acknowledge the kind assistance of Dr Henry Murray, Professor Ron Benzie and Mrs Mani Viswasam of the Christopher Kohlenberg Department of Perinatal Ultrasound, Nepean Hospital and of Mr Ted Dobosz for his computer expertise.

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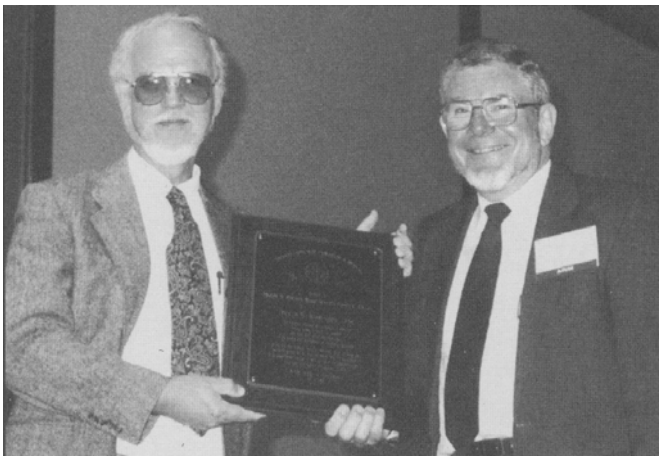
David Robinson Honoured by the AIUM



David Robinson is congratulated by Professor John Ophir, Professor of Radiology, University of Texas, Houston.

David Robinson was honoured last year by the AIUM at their Annual Scientific Meeting held in San Francisco. He was awarded the AIUM's prestigious Basic Sciences Award in recognition of his contribution to the advancement of diagnostic ultrasound and tissue characterisation.

Case report and review - Struma Ovarii

Andrew H. Rotstein MB BS , Department of Radiology, Royal Melbourne Hospital

ABSTRACT

Struma ovarii is a rare tumour representing 0.3% of all ovarian tumours. It is a germ cell tumour composed entirely or predominantly of thyroid cells. A case is presented of struma ovarii in a young woman which demonstrates that the preoperative diagnosis of struma ovarii can be suggested by Doppler ultrasound. The characteristic findings of struma ovarii are a multiloculated solid and cystic ovarian mass with vivid Doppler colour flow from the centre of the mass and capsule due to the hypervascular thyroid tissue.

CASE REPORT

A 24 year old woman presented one hour after the onset of sharp pelvic pain, more severe on the right. There was no vaginal discharge or bleeding. Her last menstrual period was 2 weeks prior. She was sexually active. She had no urinary symptoms and her bowel habit was unchanged. Her only significant past history was a cholecystectomy and she was taking no medications.

On physical examination, the patient was in distress, afebrile, and tender in the right iliac fossa and pelvis. There was no palpable pelvic mass. The urinalysis was normal and the urinary βHCG was negative. Full blood examination, liver function tests, and serum amylase were all normal.

Transabdominal and transvaginal ultrasound revealed a complicated 12 × 8 × 6 cm multiloculated pelvic mass. The mass contained multiple anechoic cysts with hyperechoic septa (Figure 1). Dramatic colour flow was demonstrated from the central solid areas within the mass (Figure 2) as well as from the capsule. There was moderately resistive flow within the mass with a resistive index of 0.48. The right ovary could not be identified and the mass was assumed to arise from the right ovary. The mass was separate from the uterus and left ovary which appeared normal. There was no free fluid within the pelvis.

After transfer to a gynaecological unit of another hospital, blood testing for ovarian tumour markers revealed a normal CEA of 0.3 ug/l and an elevated CA 125 at 72ug/ml (normal 0- 35). Laparoscopy revealed a large right multiloculated ovarian mass.

Right oophorosalpingectomy was performed and post-operative recovery was uneventful. The uterus and left ovary appeared normal. There was no evidence of omental seeding.

Macroscopically the right ovary weighed 424 gm and measured 9.5 × 9 × 7.5 cm. It was multiloculated, with the locules containing clear straw coloured fluid (Figure 3). The solid components were coloured with a green and brown tinge. Microscopically the lesion was composed of colloid filled follicles characteristic of thyroid tissue. No other elements, immature or malignant components were present. Based on the histopathology, the diagnosis of benign struma ovarii was made. The patient's thyroid stimulating hormone level was normal.

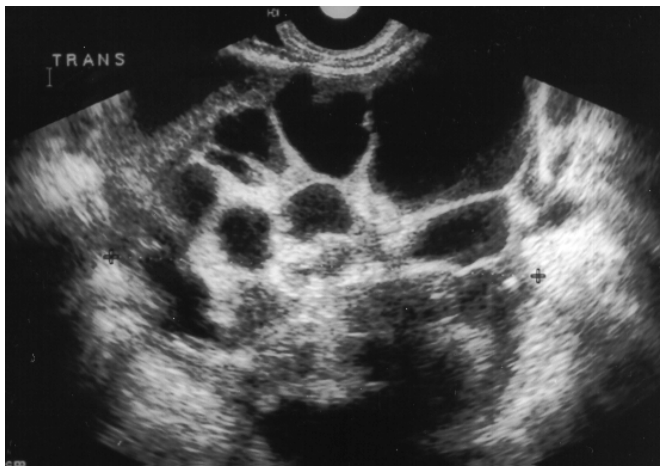


Figure 1 **Transvaginal ultrasound**

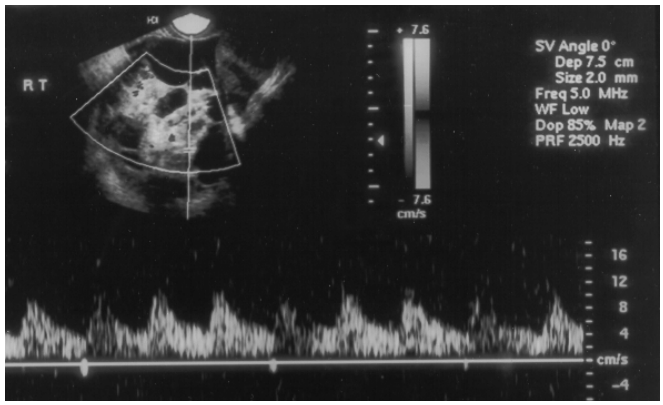


Figure 2 **Doppler ultrasound**

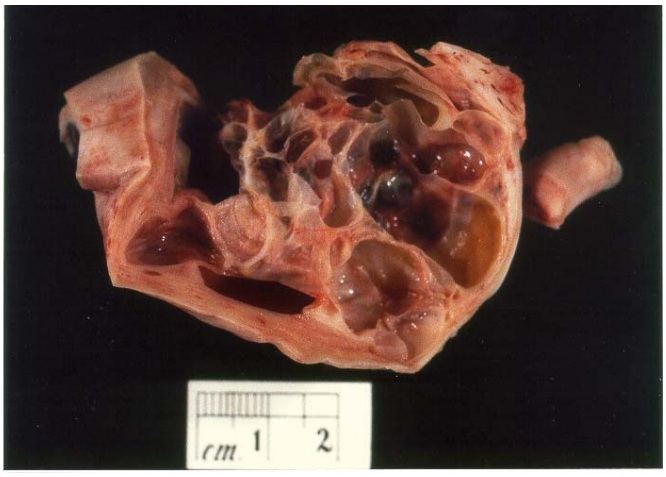


Figure 3 **Macroscopic specimen of right ovary**

DISCUSSION

Ovarian germ cell tumours represent approximately 25 % of ovarian neoplasms.

The majority of germ cell tumours are teratomas. Teratomas are composed of the three embryonic cell layers; ectoderm, endoderm and mesoderm. Ninety five percent of teratomas are benign cystic teratomas (dermoid cysts). Their characteristic ultrasound appearance is a cystic structure with a mural nodule or fat-fluid level. Echogenic bands within a hypoechoic medium may also be present. Struma ovarii is the most common monodermal teratoma (1). Monodermal teratomas are composed of one highly specialised cell type. Struma ovarii accounts for 2-3% of germ cell tumours and 0.3 % of all ovarian tumours (2,3).

Thyroid tissue forms the predominant or sole component of the struma ovarii. The presence of thyroid follicles and staining for thyroglobulin enables histological diagnosis (1). Ovarian thyroid tissue is biologically and microscopically the same as thyroid gland tissue (4). The presence of a green or brown colour to cyst contents is highly suggestive of struma ovarii as it is rarely seen in other cystic ovarian neoplasms (1). Hyperthyroidism occurs in 5% of struma ovarii cases (5). A few reported cases in the literature of thyrotoxic women with pelvic masses that were evaluated with a technetium-99m-pertechnetate and iodine-131 (I^{131}) scan have revealed low uptake in the thyroid gland but significant uptake by the pelvic mass. Following removal of their struma ovarii the women returned to a euthyroid state (4, 6).

The majority (95 %) of struma ovarii are benign while 5% contain malignant elements (7). There are differing criteria for malignant struma ovarii. Most authors use the standard cellularity, cellular atypia and mitotic activity (8). Some authors advocate vascular invasion and capsule invasion as the definitive criteria for malignancy because unless one of these two features is present, metastatic disease is highly unlikely (9). The malignant spread of struma ovarii is to local pelvic structures and distantly to bone, liver, brain and lung. Struma ovarii may accompany benign cystic teratoma (10).

Torsion and haemorrhage may lead to presentation (1), but there was no obvious cause for the pain in this case.

The management of struma ovarii is controversial and depends on the malignant grade of the tumour and the woman's family planning. Benign cases can be managed with unilateral oophorosalpingectomy. Malignant cases can be managed with unilateral oophorosalpingectomy or total abdominal hysterectomy and bilateral salpingo-ophorectomy depending on the woman's future plans (3). Metastatic struma ovarii requires thyroidectomy and then subsequent ablative radioactive I^{131} with thyroid hormone replacement (11).

CA 125 is a tumour-associated antigen which is used as a tumour marker for epithelial ovarian tumours. CA 125 is, however, a nonspecific marker that is elevated not only in ovarian cancer but also in many benign conditions such as pregnancy, endometriosis and inflammation. The CA 125 in our patient was elevated. There have been three other reported cases of elevated CA 125 associated with struma ovarii (12, 13). The cause for the elevation of CA 125 in struma ovarii is thought to be due to peritoneal irritation and inflammation and is a function of ascitic fluid.

The ultrasound B-mode appearance of struma ovarii is that of a complex solid and cystic mass with thick hyperechoic septae and is similar to that of benign cystic teratoma.

The Doppler characteristics of benign cystic teratoma have been well described. These are typically the absence of central colour flow and the occasional presence of capsular flow.

Kurjack et al. analysed 102 cases of benign cystic teratoma, demonstrating that colour flow was present in only 27.5% of cases and when present it was typically peripheral (14). This contrasts to the presented case of struma ovarii that demonstrates dramatic colour flow from the centre of the tumour and its capsule.

Comparison of the Doppler characteristics of histologically proven cases of benign cystic teratoma and struma ovarii has been performed by Zalel et al (15), who assessed 74 cases of benign cystic teratoma and 4 cases of struma ovarii. Of the 74 benign cystic teratomas, colour blood flow from the cyst capsule was present in 18 while colour flow could not be demonstrated centrally in any of the 74. Doppler analysis was also made of the 4 cases of Struma ovarii. In all 4 cases abundant colour flow was displayed from the centre of the mass with a mean resistive index of 0.56 and flow was present in the capsule.

Zalel et al postulate that the abundant flow in the centre of struma ovarii is due to its highly vascularised thyroid tissue, while there is no flow within benign cystic teratoma because it contains relatively avascular fat and hair. This accounts for the differing Doppler ultrasound appearances. Therefore struma ovarii should be suspected when an ovarian neoplasm with the B-mode appearance of benign cystic teratoma demonstrates vivid central colour flow (15).

The use of Doppler ultrasound to differentiate ovarian pathology and determine malignancy in ovarian neoplasms remains difficult (16). Malignant ovarian neoplasms commonly have central colour flow. However, a review of 211 ovarian masses demonstrated central colour flow in 17% of 183 benign lesions and the absence of central flow in 14% of 28 malignant masses (17). The use of central colour flow to distinguish benign from malignant ovarian masses produces unsatisfactory sensitivity and specificity.

When colour flow is present, resistive index (RI) has been proposed as a discriminator due to the lower vascular resistance of the extensive vascular channels within malignant neoplasms. There is, however, considerable overlap between the RI values of malignant and benign neoplasms. Various authors have proposed a RI below 0.4 to be suggestive of malignancy. However a review of 8 malignant neoplasms within 44 ovarian masses using a RI cut-off of 0.4 for malignancy produces a specificity of 96% but unacceptably low sensitivity of 50% (18). Ultimately imaging findings are no substitute for histopathology when it comes to the definitive diagnosis of ovarian neoplasms.

In summary struma ovarii is a monodermal ovarian teratoma that is composed partly or entirely of thyroid cells with an ultrasound appearance of a multiloculated solid and cystic mass with hyperechoic septa and abundant central colour flow. Struma ovarii should be considered when highly vascularised solid tissue is detected in an ovarian neoplasm that has the ultrasonographic appearance of a benign cystic teratoma.

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Web technology and its relevance to PACS and Teleradiology

Wayne T. DeJarnette, PhD Reprinted with kind permission of the publishers of Applied Radiology [Applied Radiology 29(8):30-31, 2000

INTRODUCTION

There has been much talk about the use of Web technology in medical imaging, specifically its application in picture archiving and communication systems (PACS) and teleradiology. This article will define Web technology and its associated terminology, and discuss its relevance to medical imaging.

WHAT IS THE "WEB"?

The term "Web" is used to mean many things. Usually, it is understood to mean a community of computers and users communicating over the Internet, making use of Web browsers, e-mail utilities, and other technologies. At the highest level, where most of us function, there is no distinction made between "the Web" and "the Internet" or the technologies that make it all possible. It is this lack of distinction that causes significant confusion in technical discussions of PACS and teleradiology, as well as confusion among potential purchasers of these systems.

Web technology is not a single technology, it is a multiplicity of technologies. Table 1 provides a (partial) list of the technologies usually considered Web technology.

TABLE 1.
Definitions of Web Technology Terms

Internet	A publicly owned, network-based communication infrastructure that grew out of DARPA (Defense Advanced Research Project Agency) research in the 1970s and 1980s. The Internet relies on the TCP/IP communication protocol for its addressing and routing capabilities.
Web browser	A software program that resides on a computer that allows a user to view pages of information supplied by Web Servers.
Web server	A computer and software program that stores pages of information and presents that information on request of a remote user using a Web browser.
TCP/IP	A low level communication protocol that defines the addressing, routing, and message transfer protocols used by higher-level services. It can be thought of as an electronic envelope with address that is delivered by an electronic postal service. TCP/IP defines the envelope and the rules used by the electronic postal service to deliver the envelope.
HTTP	Hypertext transfer protocol: an application-level communication protocol or service used for communication between Web browsers and Web servers over a TCP/IP network. It can be thought of as a specially formatted form letter, placed in an electronic envelope.
FTP	File transfer protocol: an application-level communication protocol or service used for transferring data files from one computer to another over a TCP/IP network. It can be thought of as a specially formatted form letter, placed in an electronic envelope.
HTML	Hypertext markup language: a language used to define the formatting of Web pages. It is very similar in concept to the "language" used to format an electronic document generated by word processing or desktop publishing software. HTML is non-proprietary and less full-featured than most other page format description languages.
JAVA	A high-level programming language, originally developed by Sun Microsystems. The goal of this language is to provide an object-oriented programming language that is totally hardware independent.
XML	Extensible markup language. This language is similar to HTML, but with more ambitious goals. XML is intended as a document formatting language, capable of defining and managing a broader set of document "objects" than just text, graphics, and images. In the future, XML may have the ability to address the same types of problems (data representation and usage) as the DICOM standard currently does.

WEB TECHNOLOGY IN PACS AND TELERADIOLOGY APPLICATIONS

Although the technologies listed in Table 1 (and others) are frequently thought of as Web technologies or an integral part of the Web, their usefulness in PACS and teleradiology applications must be examined individually, not as a whole. Some of these technologies are highly useful in PACS and teleradiology systems, while others are considerably less so.

Fundamental technologies, like TCP/IP and the Internet, are very useful for PACS and teleradiology deployment. TCP/IP has become the de-facto, low-level standard protocol for implementation of the DICOM standard. The Internet provides a low cost communication infrastructure, which can be useful in teleradiology, remote viewing, and report distribution applications. The Internet does have its drawbacks, however, including unreliable communication bandwidth and significant security problems.

Other than these two technologies, the others mentioned in Table 1 have much more limited utility in PACS and teleradiology. XML shows some promise for the future, but is of limited use today, other than in proprietary applications. The DICOM, HL-7, and other standards bodies are studying ways in which XML could be used in a "standard fashion" to address medical informatics problems. Such standardization is years away, however. This standardization is also of questionable utility, as DICOM today addresses many, if not most, of the issues that could be addressed by XML.

Java is really a programming tool. As such, it should be of no interest to a PACS or teleradiology user or purchaser, other than if the use of this technology results in a more reliable, more maintainable, higher performing, and/or lower cost system. Java usage today, however, does not guarantee any of these.

Web browser/server, hypertext transfer protocol (HTTP), hypertext markup language (HTML), and file transfer protocol (FTP) are technologies that can be used to address PACS and teleradiology problems. These technologies, however, cannot address all problems or any individual problem in an optimal fashion. As an example, FTP is a far less useful protocol for medical imaging application than DICOM. FTP can be used to transfer medical images from one computer to another, but in a far less elegant and useful fashion than allowed for in the DICOM standard. HTTP and HTML technologies are only useful in the context of Web browser and Web server applications. The application most often associated with Web browser/server technology is teleradiology.

WEB SERVER-BASED TELERADIOLOGY

In its simplest form, a Web server-based teleradiology system works as follows:

1. Images are received from imaging systems in the radiology department (generally by means of DICOM).
2. The received images are converted into a standard image format, such as JPEG or TIFF, and stored on the server. The demographic data associated with an image is stripped out and placed in its own text file. The image file and the text file are associated with each other by means of a computer directory structure, or database.
3. A remote user connects to the server, over the Internet, using a general purpose Web browser without any additional software.
4. The user is presented with a list (directory) of viewable images by means of a Web page formatted in HTML and transferred to the remote user over the Internet, using HTTP.
5. Upon selecting an image to view, the user causes the Web server to build a Web page that contains the requested image and the information from the associated demographic text file. This Web page is transferred to the remote user over the Internet, using HTTP.

This simple Web server-based teleradiology model has a number of disadvantages. It is not possible to window or level the retrieved image, as such functionality is not part of a general purpose Web browser. In order to accomplish this function, the Web server would have to constantly send a new Web page with the same image, windowed and leveled differently by the Web server. It may also be that the image was truncated to an 8-bit image when converted to JPEG or TIFF, making window/level meaningless. Specialty viewing functions (like cine, stack, dynamic multi-image format definition, annotation, zoom, etc.) are not easily available inside this simple model, for the same reason that it is not possible to window and level in a useful fashion. The only justification for such a simple model is cost. The required Web browser application is inexpensive and generally available. This model, however, is unsuitable for any application other than the transfer of an image with a text report to referring physicians for record keeping and/or patient consultation purposes.

It is possible to overcome the limitations inherent in this model, by creating a specialty Web browser or tailoring a general purpose Web browser by means of applets and/or plug-ins, which can be thought of as application accessories. Both of these solutions require engineering development on the part of a vendor, however, which means the viewing application is no longer "free" (even if the vendor gives away the applet or plug-in). It also requires significant engineering effort to make these custom browsers perform well.

DICOM-BASED PULL TELERADIOLOGY

A DICOM based "pull" teleradiology system, in its simplest form, works as follows:

1. Images are received from imaging systems in the radiology department (generally by means of DICOM).
2. The received images are stored as DICOM files on the teleradiology server.
3. A remote user connects to the server, over the Internet, using specialty teleradiology application software.
4. Making use of DICOM query/retrieve protocols, images of interest are transferred across the Internet to the remote user.
5. The remote user now makes use of the specialty teleradiology application software to view and manipulate the images in a fashion similar to how these operations would be performed on a dedicated radiology viewing station in the radiology department.

DICOM-BASED PUSH TELERADIOLOGY

Most simply, a DICOM-based push teleradiology system works as follows:

1. Images are received from imaging systems in the radiology department (generally by means of DICOM).
2. The received images are stored as DICOM files on the teleradiology server.
3. A routing agent (software) in the teleradiology server determines to whom the images are to be distributed and attempts to forward the images to that user.
4. A remote user connects to the server, over the Internet, using a static IP address, by means of specialty teleradiology application software.
5. The teleradiology server forwards the images to the remote user.
6. The remote user now makes use of specialty teleradiology application software to view and manipulate the images in a fashion similar to how these operations would be performed on a dedicated radiology viewing station in the radiology department.

The DICOM-based teleradiology systems described have the ability to accomplish the same tasks as a Web server-based teleradiology system. All three types of systems are capable of making use of the Internet. So how does one choose between them?

WEB TECHNOLOGY LOW COST MYTH

It is an article of faith, today, that using the Web results in lower cost distributed applications. This is a myth! It is the Internet, not the Web that allows for the deployment of low cost applications. All of the other so-called Web technologies have very little impact on the cost of developing, deploying, or maintaining a distributed application, with few exceptions. Teleradiology is not an exception.

What drives the cost of any application is customer demand, the cost of engineering development, the cost of maintenance, and recurring operational expenses. This is the same for teleradiology. Only in the case of the simplest Web server-based teleradiology application does the Web result in a lower cost system. This system has price advantage in two areas: 1. the availability of low cost (even free) Web server software, and 2. the lack of programming required on the Web browser side. These advantages are engineering development advantages only. Maintenance costs, operational costs, and customer demand are not affected by these engineering advantages. It must be remembered however, that the simple Web server-based system offers only limited features.

A more full-featured Web server based system requires significant programming effort on the Web browser side if it is to compete in function and performance with DICOM-based teleradiology systems. In this case, the engineering costs are nearly identical. Neither approach has any significant development cost advantage on the image viewing side. DICOM-based viewers generally have a performance advantage however.

The apparent cost advantage that Web server systems have, when compared with DICOM servers, is non-existent. Any medical imaging company must have DICOM technology suitable for the development of such a server. The ready availability of low-cost Web server software is meaningless to such a vendor. Their DICOM development costs have already been amortized over many other products, making the DICOM server technology no more expensive than Web server technology.

In the end, there is no difference in cost based on engineering development costs for a meaningful teleradiology application. Maintenance costs, recurring operating costs, and customer application demand are all the same.

CHOOSING BETWEEN WEB-AND NONWEB-BASED SYSTEMS

In order to decide whether or not to choose a Web-based system it is important to understand the details of the application. In the end, the choice should come down to: which system addresses identified needs, as well as anticipated future needs, at the lowest cost. Table 2 provides a generic competitive analysis of Web server-based and DICOM-based teleradiology systems. For the purposes of this comparison, the Web server-based and DICOM-based systems are assumed to have nearly identical functionality at the viewing end.

TABLE 2.

Generic comparison of Web server-based and DICOM-based teleradiology systems

	Web server-based	DICOM-based
Cost	Low	Low
Pull model operation	Yes	Yes
Push model operation	No	Yes
Internet interfaceable	Yes	Yes
Point-to-point POTS interfaceable	Possible, but not generally implemented	Yes
Standards based	Yes (HTTP/HTML)	Yes (DICOM)
Compression	Generally JPEG only	JPEG and Wavelet

CONCLUSION

Although interesting and well hyped, the use of Web technology should not be the sole basis for deciding on the purchase of PACS and teleradiology systems. The technology employed in a medical imaging product should be one of many factors considered as part of the purchasing decisions in PACS and teleradiology applications; Web technology has no de-facto advantage. As with any system purchase, no decision should be made without thoughtful consideration regarding the application itself and how well it meets the needs of the radiology department.

Book Reviews

Title: Ultrasonography in Obstetrics and Gynecology 4th Edition
Editor: Peter Callen
Publisher: WB Saunders , Philadelphia
Year: 2000
Pages: 1078
Illustrations: 1278
Approx Price: $A203.00

The 4th Edition of this classic text, though built on the framework of the three previous editions, has been entirely revamped with considerable changes in the contents and contributors (all of whom are leading authorities) to reflect current thinking and priorities.

The increasing interest in the first trimester of pregnancy is reflected in an expanded section covering this area together with new chapters on fetal syndromes, three-dimensional ultrasound and evaluation of the cervix. The book has expanded up to 1078 pages (from 755 pages in the 3rd Edition). Compared to the 3rd Edition there are 26% more illustrations, 63% more chapter references and the number of contributors has gone up by 44%. This is not just middle age spread as the material is comprehensive, useful, up-to-date and authoritative.

The book is well laid out, easy to read and the illustrations, in the main, are close to the relevant text. Obviously, with 59 different contributors the writing style varies with some being easier to read than others. The illustrations are of high quality and the references are comprehensive up to 1999.

Although Rumack's "Diagnostic Ultrasound" (1998 Mosby-Year Book ISBN 0-81251-8683-5) probably has a better layout for a primer text with grouping of material easier to follow, Callen's book is no disappointment. With Nyberg's "Diagnostic Ultrasound of Fetal Anomalies: Text and Atlas" now out of print, Callen's book is likely to be the standard reference text in the subject for several years at least.

This book represents excellent value for money. When recent movements in the Australian dollar are taken into account, this book is actually cheaper than the 3rd Edition. Using Australian Bureau of Statistics indices the 4th Edition is only 42% more expensive than the 1st Edition from 1983 yet it is three times the size, has six times as many illustrations and has nearly twice the number of contributors.

This book will have broad-spectrum appeal from the trainee sonographer/radiologist to those with many years of experience. It can be used both as a book for studying and as a reliable reference text. Those practicing in the area will find it a very worthwhile purchase either as individuals or as bench books for private practices or hospital departments. Highly recommended.

Dr Peter Warren

Title: Breast Ultrasound 2nd Edition
Author: ME Lanfranchi
Publisher Thieme ISBN 3-13 125731-8
Year 2000
Approx Price: $A209

Breast ultrasound has become more sophisticated so that we now carefully analyze breast lesions to narrow the differential diagnosis so that fewer benign lesions need biopsy.

Mirta Lanfranchi is the major author of this book with a chapter each provided by Norman Koremblit and Roman Rostagno. They provide an excellent, well-illustrated description of breast anatomy, breast ultrasound and breast pathologies. The book commences with chapters on anatomy, equipment and technique. There follows chapters devoted to cysts, solid benign nodules, solid malignant nodules, diffuse pathology, lactiferous ducts, trauma and infection, breast prostheses, post-op changes and recurrent breast cancer. The last few chapters examine ultrasound-guided intervention, artifacts, post-menopausal breast ultrasound, colour Doppler and 3-D ultrasound.

In each chapter, the concise text is well laid out amongst the numerous images with their accompanying illustrations. High quality images are provided for most of the pathologies discussed. Topics can be found easily amongst the concise in paragraphs with clear headings. Some lists of signs and differentials are in bold. Source references are supplied at the end of each chapter. There is no index but topics are listed under chapter headings at the beginning of the book.

Although the author refers briefly to mammography as an important part of breast assessment there is very little attempt to correlate ultrasound with mammography.

I would have found a separate chapter specifically focusing on differentiating benign from malignant lesions helpful because this is the most useful thing we can do every day. However most of this information is in the text if one looks for it.

Breast Ultrasound should be a useful resource during breast ultrasound training. It is probably better read and studied rather than being used as a resource book because features of many lesions overlap.

Patsy Robertson

DMU examination results 2000 and Board of Examiners report

Jill Clarke Chairman, Board of Examiners, Diploma of Medical Ultrasonography

The 2000 Diploma of Medical Ultrasonography examinations commenced on 2 September 2000 with the written papers for both Part I and Part II. Written papers were held at 31 venues across Australia and New Zealand in 7 capital cities, 5 major towns and 19 remote venues.

Part I:

201 candidates presented for the Part I examination.

The overall pass rate was 70.8%.

The pass rate for each region was:

New South Wales	59%
Victoria	64.5%
South Australia	88%
Queensland	61%
Tasmania	100% (4 candidates)
Western Australia	78.9%
ACT	(0 candidates)
New Zealand	78%.

The pass rate by Speciality was:

Speciality	No of Candidates	Pass Rate
General	128	71%
Cardiac	48	72.9%
Vascular	22	72.7%
Obstetric	3	66.6%

The Mean Score (%) for the Physical Principles of Ultrasound and Instrumentation Paper was 69%.

The Mean Score (%) for the Anatomy, Physiology and Pathology Paper was:

General:	71%	Cardiac:	70%
Vascular:	72%	Obstetric:	61%

Part II – Written Paper:

124 candidates presented for the Part II written examination.

The overall pass rate was 84.4%. Successful candidates were admitted to the Practical and OSCE examinations.

The pass rate for each region was:

New South Wales	74%
Victoria	87%
South Australia	100% (2 candidates)
Queensland	25%(4 candidates)
Tasmania	0% (2 candidates)
Western Australia	81%
ACT	0% (3 candidates)
New Zealand	91%.

The pass rate by Speciality was:

Speciality	No of Candidates	Pass Rate
General	97	76.3%
Cardiac	13	84.6%
Vascular	13	84.6%
Obstetric	1	100%

Part II – OSCE:

102 candidates presented for the OSCE examination.

The overall pass rate was 88%.

The overall pass rate for each region was:

New South Wales	94%
Victoria	74%
South Australia	100% (2 candidates)
Queensland	100% (2 candidates)
Tasmania	100% (2 candidates)
Western Australia	100%
NT	100% (1 candidate)
New Zealand	87%.

The pass rate by Speciality was:

Speciality	No of Candidates	Pass Rate
General	78	88%
Cardiac	12	91%
Vascular	11	64%
Obstetric	1	100%

Part II – Practical:

89 candidates presented for the Practical examination.

The overall pass rate was 78%.

The overall pass rate for each region was:

New South Wales	81%
Victoria	59%
South Australia	0 candidates
Queensland	66% (3 candidates)
Tasmania	0% (3 candidates)
Western Australia	90%
Northern Territory	100% (2 candidates)
New Zealand	100%

The pass rate by Speciality was:

Speciality	No of Candidates	Pass Rate
General	64	83%
Cardiac	12	92%
Vascular	12	42%
Obstetric	1	0%

Part II – Overall Results:

127 candidates presented for the Part II examination

The pass rate by Speciality was:

Speciality	No of Candidates	Pass Rate
General	97	65%
Cardiac	15	73%
Vascular	14	36%
Obstetric	1	0%

Part II Examinations - Overall performance:

General

The overall standard of candidate preparation was good. Areas in which the majority of candidates were well prepared included:

- knowledge, understanding and performance of abdominal sonography examinations
- application of physical principles of ultrasound to common artefacts
- OSCE examination technique

Areas in which the overall standard of candidate preparation was below expected included:

- knowledge and understanding of breast ultrasound technique and pathology encountered
- scanning techniques and placental anatomy in the third trimester of pregnancy
- ultrasound markers for detection of Downs syndrome

Cardiac

Areas in which the majority of candidates were well prepared included:

- comprehensive explanations, accurate diagrams and correct formulae in the written paper
- demonstration of good scanning techniques with appropriate calculations and measurements in the practical examination
- understanding of Doppler principles and their application to quantitative assessment of cardiac lesions

Areas in which the overall standard of candidate preparation was below expected included:

- understanding of the bioeffects of ultrasound and safety factors
- use of phantoms in the assessment of system and transducer performance including calibration and resolution
- explanation of how aortic regurgitation can be differentiated from mitral stenosis

Vascular

Overall the candidates demonstrated an adequate knowledge of questions relating to:

- hand ischaemia
- AAA endoluminal grafting
- non-atherosclerotic lesions of the cerebral vasculature

Areas in which the overall standard of candidate preparation was below expected included:

- understanding of the basic principles of colour Doppler imaging
- over- reliance on equipment presets
- optimisation of colour Doppler and pulsed Doppler waveforms
- understanding of principles of colour box size and steering

For the practical exams, examiners were invited from Melbourne, Sydney, Brisbane, Newcastle and Auckland. The pass rate for the practical exams was 42%. Unsuccessful candidates represented both vascular or cardiovascular ultrasound units and general radiology practices. It is speculative to guess why so many candidates failed their practical exam. Possible accreditation in the near future may have lead to candidates presenting too early, clearly without the practical experience required.

The Board of Examiners would like to thank the extensive team of volunteer sonographer and sonologist examiners and supervisors, and the participating hospitals and practices, without whose contributions the examinations could not be held.

The Board of Examiners extends congratulations and best wishes to the successful candidates for their future careers as sonographers.

PART I EXAMINATION

The following candidates passed the Part I examination:

Abdelmalek, Rebekah	NSW	General
Alderton, Hayley	SA	General
Al-Odeh, Rima	NZ	General
Andretzke, Sue	SA	General
Artis, Johanna	Vic	General
Ayres, Robert	NZ	Cardiac
Bacon, Brendon	TAS	General
Barrettt, Wendy	NZ	General
Bateman, Dianne	NSW	General
Batt, Paul	Vic	Vascular
Baum, Stuart	Vic	General
Behn, Marie	NSW	General
Bell, Melissa	SA	General
Bevan, Christopher	WA	General
Blefari, Christina	SA	General
Bloomfield, Sue	Qld	Vascular
Bonnici, Emma	SA	General
Brazzale, Catherine	Vic	Cardiac
Brent, Jessica	NSW	General
Brettig, Eileen	Vic	Vascular
Bruce, Anthony	NSW	Cardiac
Bryant, Marcus	WA	Cardiac
Buck, Debra	Qld	Cardiac
Burkett, Joanne	NZ	Cardiac
Carryer, Paula	NZ	General
Catchpole, Ian	Qld	Vascular
Caton, Rachael	Qld	Vascular

Clissold, William	NSW	General
Cramp, Brendan	Qld	Vascular
Crawford, Gail	TAS	General
Crockart, Rebecca	SA	Cardiac
Daghavarian, Ann	Vic	General
Daley, Theresa	NSW	Cardiac
De Booy, Claire	Vic	General
de Smidt, Andrea	Qld	Cardiac
Dubowsky, Lisa	SA	Cardiac
Dunn, Fiona	NZ	General
Edwards, Trischa	WA	Cardiac
Eller, Timothy	Qld	Cardiac
Elmore, Kylie	Qld	General
Fikak, Esam	Vic	General
Fitzgerald, Katherine	NZ	General
Foder, Kellie	Qld	Cardiac
Fong, Denise	NZ	Cardiac
Foster, Grant	Vic	General
Franklin, Rosemary	SA	Vascular
Ghobar, Khaled	NSW	General
Girdler, Rona	NSW	General
Gray, Carlie	SA	General
Green, Jenene	NSW	General
Hansen, Erica	NZ	General
Harper, Jacqueline	Vic	Cardiac
Harrison, Tania	NZ	General
Haupt, Rebecca	SA	Cardiac
Hawke, Catherine	WA	General
Hill, Brigid	NZ	Vascular
Holmes-Walker, Emma	NSW	Cardiac
Horton, Laura	NZ	General
Huang, Zhi-Jian	NSW	Cardiac
Huynh, Tim	Vic	General
Inglis, Alison	NSW	General
Jeffkins, Sonia	NSW	General
Joyce, Katrina	WA	Cardiac
Keay, Alison	NZ	General
Kelly, Elizabeth	Vic	Vascular
Kemble, Jane	NSW	General
Kent, Rhonda	WA	Cardiac
Kilmurray, Holly	NSW	General
Kumar, Reshmi	NSW	General
Liu, Lisa	NSW	General
Lloyd, Sheree	NZ	General
Lodding, Kirsty	NSW	General
Loosemore, Craig	TAS	General
Low, Charisse	NSW	General
Luckhurst, Emma	SA	Cardiac
Lunghi, Adam	WA	General
Lynch, Jennifer	NSW	General
Maclean, Kimberley	NZ	General
Maruszczak, Ewa	NSW	General
McCahon, Tanya	TAS	General
McCallum, Lindsay	Vic	General
McConnell, Michelle	NSW	General
Mewburn, Jason	Vic	General
Michels, Gail	WA	General
Minch, Sharon	NSW	General
Molloy, Justin	NZ	General
Mullens, Adam	Qld	Cardiac
Muscat, Sarah	NSW	Cardiac
Muthaih, Santha	WA	Vascular
Napier, Donna	NSW	General
Nguyen, Van	NSW	General
Nicholas, Danielle	SA	Cardiac
Nydam, Carolyn	Qld	General
O'Connell, Tania	NZ	General
O'Leary, Justin	NSW	Cardiac
Ouwerkerk, Kristy	Qld	Vascular
Packer, Andrea	VIC	General
Park, Bronwyn	Qld	Vascular
Perkins, Katherine	SA	General
Pham, Trinh	WA	General
Phillips, Daniel	Vic	Vascular
Pry, Rodney	NSW	Vascular
Qin, Ying	NZ	General
Quinn, Katrine	Qld	Cardiac
Quinn, Margot	Qld	General
Range, David	NSW	General
Reid, Karen	WA	Obstetric
Richmond, Angus	Vic	General
Robb, Haylie	NZ	General
Robb, Gareth	NZ	General
Roberts, Janet	NSW	General
Roberts, Dayna	SA	Cardiac
Robinson, Catherine	NSW	General
Russell, John	Vic	General
Russell, Shona	WA	General
Salotti, Leanne	WA	General
Schmitzer, Nicole	NSW	Cardiac
Schrader, Kai-Wee	WA	Vascular
Scott, Catherine M	NSW	General
Semaan, Rebekah	Qld	Cardiac
Smith, Carla	NZ	General
Smith, Sharon	NSW	General
Sreeskantapathy, Karthika	NSW	General
Stanton, Katherine	SA	General
Straznicky, Gillian	SA	Cardiac
Sullivan, Scott	NSW	General
Surdy, Jennifer	Vic	General
Taha, Fatima	NZ	General
Tedman, Hayley	Qld	Cardiac
Teh, Khoon	NSW	Obstetric
Thomas, Christopher	Qld	Cardiac
Thorpe, Kim	NZ	General
To, Benita	NSW	General
Tolfree, Adam	NSW	Vascular
Trewin, Joanne	Vic	Cardiac
Tucker, Deborah	NSW	General
Van Sparrentak, Niels	Vic	General
Vance, Alison	Qld	Cardiac
Wan, Rebecca	Vic	General
Wei, Yue	NSW	Cardiac
Wells, Michelle	NZ	General
Weymouth, Stephen	SA	General
Wild, Sarah	NZ	General
Williams, Kylie	WA	General
Wright, Kate	SA	General
Yeoman, David	NZ	Cardiac
Yulina, Marina	NSW	General
Zhao, Jiazena	NZ	General

PART II EXMINATION RESULTS

The following candidates passed the Part II examination

Bain, Simon	WA	Cardiac
Baker, Rachael	Qld	General
B-Cliffe, Rayya	WA	General
Bickell, Andrew	Vic	General
Bond, Deborah	NSW	General
Boston, Somone	Qld	Cardiac
Buick, Megan	NZ	General
Buman, Sarah	NSW	General
Castrey, Lisa	NSW	General
Clark, Teresa	NSW	General
Collins, Noni	NSW	General
Currie, Sarah	NSW	General
Dabinett, Linda	NSW	General
Dawson, Susan	NT	General
De Luca, Jason	Vic	General
Dowling, Fiona	NSW	Cardiac
Duggin, Patricia	WA	General
Edwards, Ray	Vic	General
Engelbrecht, Venessa	NZ	General
Fawcett, Alison	NSW	General
Fincham, Barbara	NZ	General
Gallagher, Michelle	Vic	General
Galloway, Vanessa	NZ	General
Gullan, Tracy	WA	General
Harrison, Stacey	WA	General
Howell, Lisa	Vic	General
Humphries, Anita	NZ	General
Hunter, Chelsea	WA	General
Javen, Debbie	NSW	Vascular
Jenkins, Petrina	NSW	General
Jennings, Carl	Vic	General
Jones, Matthew	WA	General
Kennedy, Kim	Qld	General
King, Cushla	NZ	General
King, Kathryn	NSW	Cardiac
Kitulagodge, Piyadasa	NSW	General
Lane, Marion	NZ	General
Langston, Richard	WA	Cardiac
Leber, Marguerite	WA	General
Lind, Sally	SA	Cardiac
Lipman, Kim	NT	General
Little, Sara	NSW	Cardiac
Long, Rebecca	Vic	Vascular
Lynn, Katherine	NSW	Vascular
Mackintosh, Stephen	Vic	General
Martin, Stephanie	NSW	General
Mc Donald, Nicole	Vic	General
McCall, Karen	NZ	General
McNicol, Heather	NSW	General
Miu, Vincent	NSW	General
Morrall, Matthew	SA	Cardiac
Mushan, Kristen	NSW	General
Ng, Angela	NSW	General
O'Hearn, Margaret	NSW	General
Otis, Simon	NSW	General
Rinaldi, Leonie	WA	General
Rohrig, Kelly	NSW	General
Saunder, Jan	Vic	General
Scott, Catherine	NSW	General
Shanks, Patricia	NZ	General
Singhal, Alka Ashmita	NSW	General
Smith, Christine	Vic	General
Smith, Katherine	WA	General
Surian, Darren	NSW	General
Ting, Iris	NSW	Cardiac
Treacey, Brian	NSW	General
Varidel, Susan	NSW	Vascular
Vujacic, Irena	Vic	Cardiac
Waixel, Tania	Vic	General
Wallis, Karen	NZ	General
Ward, Samantha	WA	General
White, Alison	Qld	Cardiac
Wilkinson, Penelope	NZ	General
Williams, Eric	WA	General
Williams, Jodi	NZ	General
Wilson, Shayne	Vic	General

DDU Part I examination results

The following were successful in the examination held in November 2000.

Warrick Bishop	TAS
Lawrence Dembo	WA
Michael France	SA
Deepak Haikerwal	VIC
Richard Harris	NSW
David Kaye	VIC
Mark Krawczyszyn	VIC
Elizabeth McCarthy	VIC
Sofie Piessens	VIC
Andrew Taylor	VIC
Susan Walker	VIC

MONASH UNIVERSITY

GRADUATE DIPLOMA IN MEDICAL ULTRASOUND

SEMESTER 2 COMMENCING 16th JULY 2001

by Distance Education

Applications are invited for mid year intake for single subject
SON 4010: Embryology, Anatomy and Pathophysiology.
Applicants would then continue into program in 2002.

For graduates of a Degree program in Radiography &Medical Imaging or equivalent. A degree in related areas will be considered. Applicants with ultrasound qualifications may apply for subject exemptions.

Applicants without a degree but employed full time in ultrasound should apply.

Enquiries and applications:

Administrative Officer
Department of Radiography & Medical Imaging
PO Box 64
Monash University Vic 3800 Australia.

Phone: +61 3 99051212; Fax: +61 3 99058149

ultrasound@med.monash.edu.au www.med.monash.edu.au/BRadMedImag/courses/SON3402/

Applications close 9th April, 2001

SONOGRAPHER - Riverina Medical Imaging Group
LECTURER LEVEL B - Charles Sturt University

A unique position has been created for a suitably qualified medical sonographer who is currently an Academic or who wishes to pursue an Academic career. The position is a full-time position, which requires the performance of timely and accurate medical ultrasound studies for Riverina Medical Imaging Group on an 80% basis, and performance of academic activities for the Charles Sturt University on a 20% basis. The position is based in Wagga Wagga NSW with rotation through Griffith NSW.

Riverina Medical Imaging Group Ultrasound Service provides a wide range of ultrasound services in Wagga Wagga, Griffith and surrounding towns. Generous salary, entitlements and working conditions will be negotiated, depending on your knowledge, skill and level of agreed accountability. Like all sonographers you will be a member of the Ultrasound Team, which is accountable for sonography and some management tasks. Training can be provided for team and management tasks.

Wagga Wagga, is a regional city that lies halfway between Sydney and Melbourne with regular daily flights to and from both cities. It is within easy driving distance of the NSW and Victorian ski fields. Griffith is a smaller town, which has a rich Italian and farming cultural heritage.

Please send a letter of application and curriculum vitae to Mrs Lyn Chapman, Riverina Medical Imaging Group, PO Box 5576, Wagga Wagga, NSW 2650.

For further confidential information please contact Ms Carol Obst or Dr Nick Stephenson on +61 (02) 6925 3733 at Riverina Medical Imaging Group.

For confidential information of an academic nature please contact Dr Scott Bowman at Charles Sturt University, Wagga Wagga, NSW 2650 on +61 (02) 6933 2762.

2001 ~ A SOUND ODYSSEY

Australian Sonographers Association 8th National Conference
4th, 5th & 6th May 2001 ~ Sheraton Perth Hotel

REGISTRATION BROCHURE NOW AVAILABLE

2001 ~ A SOUND ODYSSEY

Australian Sonographers Association 8th National Conference
4th, 5th & 6th May 2001 ~ Sheraton Perth Hotel

Comprehensive scientific and workshop programs on Saturday 5th and Sunday 6th May. Welcome Party on Friday evening following an optional tour. Gala Dinner on Saturday night.

Great prizes will be awarded for:

Best Paper	**$500 Sponsored by Fremantle Radiology**
Best Original Work	**$500 Sponsored by Imaging the South**
Best Proferred Paper	**$500 Sponsored by Perth Radiological Clinic**
Best Poster	**$500 Sponsored by Perth Imaging**
Scientific Quiz	**$500 Sponsored by SKG Radiology**

Please direct all enquiries to:

ASA Conference Secretariat
PO Box 709, Cheltenham, Vic 3192
PH: 03 9585 2996 Fax: 03 9585 2331
Email: enquiries@A-S-A.com.au
ww.A-S-A.com.au

Ultrasound Interpretation Course

Peninsula Vascular Diagnostics (Victoria)
1-A Vera Street
Frankston 3199

"Expressions of interest" for this course – mid 2001

The Course is suitable for:

1) Sonographers, to support the Laboratory by initialising the preliminary report.
2) Radiologists and other medical practitioners, to produce the final report.

Sonographers must be experienced in vascular ultrasound and medical practitioners must be able to demonstrate their knowledge of anatomy, pathology and physics pertaining to vascular sonography.

Participants will be guided through:

- Vascular ultrasound studies and worksheets
- Presentation and interpretation of information
- Report construction by dictation and/or writing
- Finalisation of reports

Participants will receive:

- Detailed diagrams and worksheets
- Report templates on disk

Date/Venue: To be determined **No of Participants:** 16-20 **Duration:** 1 day
Location: Melbourne City **Cost (*incl GST*):** $A250

For more information please ring PVD: John or Rebecca 03 9781 5001

The University of Sydney
School of Medical RadiationSciences

Since 1991 the School of Medical Radiation Sciences has provided a comprehensive program for general sonographers. This year, we are extending our commitment to ultrasound education by providing courses suitable for cardiac and vascular sonographers. As part of this program, we will be offering two subjects in 2001, which may be of interest not only to trainee sonographers, but those interested in updating their knowledge and skills in these specialist areas, while earning continuing education points.

CARDIAC SONOGRAPHY
VASCULAR SONOGRAPHY

Where? University of Sydney, Cumberland Campus, East St. Lidcombe NSW
When? Tuesday Evenings, Feb 27th –May 29th 2001 *(except Easter and Semester Breaks)*
Who? Expert local and interstate faculty

Will suit? Sydney metropolitan based sonographers / trainee sonographers, registrars, and radiologists / sonologists wanting to update their knowledge and skills in one of these two areas. Each subject can be undertaken as a lecture series only, or as a single subject enrolment allowing credit towards a subsequent Graduate Diploma / Masters program in Medical Sonography.

For information contact:
School of Medical Radiation Sciences
University of Sydney
Ph: 02 9351 9501
Fax: 02 9351 0146
Email: mrsinfo@cchs.usyd.edu.au

Continuing Education Sponsored by

Diasonics
Ultra Service Sound Business

RMIT

DEPARTMENT OF MEDICAL RADIATIONS SCIENCE
Since 1981, The RMIT University has offered a **Graduate Diploma in Ultrasonography.**

The course is a two year part-time program designed for people who are already engaged in ultrasound practice, but wish to cultivate their knowledge in sonography and gain an accredited qualification. Distance education (external studies*) provides the flexibility necessary for remote and/or busy people to access university education and earn a living at the same time. All subjects offered in the Graduate Diploma program may be undertaken as
Single Subject Enrolments.
People not wishing to undertake a whole course can choose to just enrol in subjects of particular interest. For example, Vascular Sonography, Ethics and Medico-legal Studies, Ultrasonic Instrumentation and Abdominal Sonography to name a few.

Course applications close November 30 for the start of year and June15 for the mid-year-intake. **Late submissions will be considered.** There is no closing date for single subject enrolments. Admission requirements and further information: Telephone (03) 9925 7700 Fax (03) 9925 7466 or email the Course Co-ordinator at paul.lombardo@rmit.edu.au.

Extra information available at our website: http://www.bh.rmit.edu.au/mrs

***Some block attendance on campus is required.**

South Coast Vascular Laboratory

We are seeking a fully qualified

VASCULAR SONOGRAPHER

for our practice which provides arterial, venous and cardiac duplex scanning.

The position is full time, although part-time or casual hours will be considered.

We provide a generous remuneration package consistent with qualifications and experience.

Enquiries and applications should be directed to

Vicki Grayndler
South Coast Vascular Laboratory,
2/332 Crown Street, Wollongong NSW 2500

Ph (02) 4226 9095 Fax (02) 4226 9743.

ASUM and Acuson present:

Roy A Filly MD

Melbourne Tuesday 31 July
Sydney: Wednesday 1 August

Venues and times will be notified in the next issue of the Bulletin

Roy A Filly MD is Professor of Radiology, Surgery and of Obstetrics, Gynaecology and Reproductive Sciences at the University of California San Francisco. He is co-founder of the UCSF Fetal Treatment Program and also holds the academic positions of Clinical Professor of Radiology and Nuclear Science at Stanford University and Clinical Assistant Professor in the School of Science and Engineering, Seattle University.

Dr Filly has published more than 400 papers including the original description of the utility of ultrasound for the detection of pancreatitis, pancreatic pseudocyst and pancreatic carcinoma in 1970, and landmark papers demonstrating that real-time sonography was the method of choice for the diagnosis of twins and fetal demise. His series of papers on the fetal ventricles and posterior fossa of the fetus have dramatically impacted prenatal diagnosis of fetal central nervous system anomalies. His most recent work is in the arena of fetal therapy and ultrasound.

These meetings are proudly sponsored by Acuson

acuson
The Value of Vision™

ASUM

Vascular Workshop

23-24 June 2001

St Vincents Hospital Melbourne

Convenor: Dr John Vrazas

Featuring plenary sessions and live scanning workshops with prominent intenational and Australian Faculty including:

K Rholl

Director, Section of Cardiovascular and Interventional Radiology, INOVA Alexandria Hospital, Alexandria, Virginia
Director, Noninvasive Vascular Laboratory, INOVA Alexandria Hospital
Director, Section of Cardiovascular and Interventional Radiology, Potomac Hospital
Immediate Past President, Intersocietal Commission for the Accreditation of Vascular Laboratories

Joseph Polack

Associate Professor of Radiology, Harvard Medical School
Director, Noninvasive Vascular Imaging, Brigham and Women's Hospital

Additional information and a registration brochure are included with this issue of the Bulletin and on ASUM's website at www.asum.com.au

ASUM 2001

Welcome to ASUM's 31st Annual Scientific Meeting

7 – 9 September 2001

Skills Development Day – 6 September 2001

On behalf of the ASUM 2001 Organising Committee I would like to extend to you our warmest invitation to attend the 31st Annual Scientific Meeting of the Australasian Society for Ultrasound in Medicine. The planning for the 2001 ASUM scientific meeting is well underway and it is likely to be our best ever. It is being held at Darling Harbour in Sydney, which has great conference facilities and is central to some of the best that Sydney has to offer. There will be high quality international and local speakers covering most of the major areas of ultrasound. The social program includes a cocktail party with some surprising amusements. Our conference dinner is being held across Darling Harbour at Cockle Bay where you will be treated to the "ultrasound" of The Enormous Horns Big Band. Don't forget to check out some fun activities while in Sydney (climb the Sydney Harbour Bridge, tour Fox Studios or experience the amphibious Aussie Duck). We all look forward to seeing you in Sydney.

Fergus Scott,
Convenor

The registration program is enclosed with this issue of the Bulletin. Additional information can be viewed on ASUM's website http://www.asum.com.au

ASUM 2001

31st Annual Scientific Meeting

Prizes

ASUM Corporate Members again generously support the Annual Scientific Meeting prizesto be awarded at the conference dinner during ASUM 2001 in Sydney (7-9 September)

POSTERS

The Giulia Franco Poster Award
(Clinical Research or Technical Research)
sponsored by **Toshiba (Australia) Pty Ltd Medical Division**
1st prize value $3000 *2nd prize value $500*
to be awarded for the best two Clinical or Technical Research poster presentations

PAPERS

Acuson
Best Research Presentation Award
Value$1500
to be awarded for the best proffered research paper

ATL Ultrasound
Best Sonographers Research Presentation Award
Value $1750
to be awarded for the best proffered research paper by a sonographer

Siemens Medical
Best Clinical Presentation Award
Value $1000 plus a shield

ASUM 2001

31st Annual Scientific Meeting
Call for Abstracts

You are invited to submit abstracts for consideration by the oganising committee for presentation at ASUM 2001. **Abstracts must be submitted no later than 31st May 2001** and must follow precisely the instructions for preparation as outlined on the Abstract Instructions Form. A copy of the form is included with the Registration Program in this issue of the Bulletin.

Scientific Papers and Posters

The program will include both scientific papers and posters. The organising committee keenly encourages registrants to submit either or both. Scientific papers will be of 15 minutes duration including 5 minutes for discussion. Poster presentation is an effective way to present information at scientific meetings. It is an ideal way to present research papers and case studies and is proving to be a popular alternative to an oral presentation. The advantages are that posters allow delegates to consider the material in their own time and are free to discuss any point informally with the presenter and graphs and diagrams can be easily displayed. Scientific posters should be no larger than 1.2m high and 1.2m wide, and able to be mounted with velcro strips on fabric display panels. They can either be prepared on sturdy board or laminated. Front lighting only will be provided. The aim is to communicate your information as simply and effectively as possible. Posters should be mounted on Thursday 6th September in the trade display area. Authors of accepted posters may be requested to participate in a brief defence of their work with an expert and small audience.

Chris Kohlenberg Teaching Fellowships 2001
(Sponsored by Diasonics GE)

In 2001 the Education Committee has accepted program proposals from the South Australian and New Zealand branches for the 2001 Teaching Fellows. Details of these programs will be published in the May Bulletin

The Chris Kohlenberg Teaching Fellowship was established by ASUM in association with Diasonics GE to increase the opportunity for members outside the main centres to have access to quality educational opportunities. It has been awarded annually since 1998 to provide educational opportunities for members in New Zealand, Queensland and New South Wales Northern Territory and Western Australia. It is named to commemorate Dr Chris Kohlenberg, who died while travelling to educate sonographers.

The ASUM Diasonics Teaching Fellowship is awarded on the basis of demonstrated knowledge, background and teaching ability. The Fellow is appointed by the Education Committee, which considers nominations form committees, branches and members of ASUM. The Teaching Fellow will conduct workshops and meetings primarily (but not exclusively) in Australian and/or New Zealand centres that would not normally host scientific meetings. In addition the Teaching Fellow will be available to conduct workshops in hospital ultrasound departments during the day.

Members wishing to nominate for the fellowship should provide details of their background and experience which qualifies them for appointment as the Chris Kohlenberg Teaching Fellow.

Branches wishing to propose programs for the 2002 Teaching Fellows should, in the first instance, contact Keith Henderson ph (02) 9958 6200 fax (02) 9958 8002 email khenderson@asum.com.au

Nominations and proposals should be addressed to: The Education Officer ASUM 2/181 High St Willoughby 2068 Australia, and should be received before 22 November 2001.

ASUM Image Database

The first issue of the ASUM Image Database is included on a CD-ROM with this issue of the Bulletin. The purpose of the database is to provide members with a library of good images to assist in their own education, and provide examples to use when teaching others. This issue includes more than 200 images, and 15 video segments. Some of these are organised into 39 teaching cases. Others are provided as good examples of pathology or normal anatomy.

ASUM plans to release further issues to members each membership year. We invite members to assist by submitting cases. A typical teaching case will have a few lines on clinical presentation, a series of images for inspection, perhaps with some comments about technique. The diagnosis should then be provided, perhaps with accompanying literature about the case. Additional supporting images may be appropriate, which may be from other modalities, eg an angiogram for a vascular case. Images can be submitted either as JPEG or TIFF files in PC format, as film. A pro forma for image case contribution is on the CD-ROM, or may be obtained by contacting ASUM.

For further information contact Keith Henderson, Education Officer, ASUM, 2/181 High Street, Willoughby NSW 2068 Australia ph: 02 9958 6200 fax: 03 9958 8002 khenderson@asum.com.au

To Run the Database

The performance of this program will depend upon the specifications of your computer system. It will run more slowly on older systems and those with slower CD-ROM drives.

Windows

Insert the CD into your CD-ROM drive. It should run automatically. If it does not run automatically, run d:\start.bat (where d is the name of the CD-ROM drive). If you do not have a web browser installed on your computer, you can start the database by running d:\aidb folder\aidb.exe.bat (where d is the name of the CD-ROM drive).

System Requirements

To use your database on the Windows platform, you need the following minimum equipment and software:

- an Intel compatible 486/33 PC or higher
- at least 16 MB of RAM
- a hard disk with at least 20 MB of free space
- a CD-ROM drive
- Windows 95 or later, with Internet Explorer 4.0 or later, or Windows NT 4.0 (with Service Pack 3 or later). Note The application requires the shfolder.dll and comctl32.dll files, which are installed by Windows NT 4.0 with Service Pack 3 (or later) or by Internet Explorer 4.0 (or later).

The database contains some video segments. To run these you must have Quicktime4 installed on your computer. Quicktime4 installation files are included on this CD-ROM. To install Qucktime4, select "Install Quick Time 4" from the menu screen, or run d:\qt\quicktimeinstaller.exe (where d is the name of the CD-ROM drive). The sponsor material contains some PowerPoint presentations. To view these you must have PowerPoint installed on your computer.

Mac OS

The CD-ROM distributed with this Bulletin is for PC only. If you require a MAC version, please return the CD with a request for a MAC replacement.

System Requirements

To use the MAC version of the database on the Mac OS platform, you will need the following minimum equipment and software:

- a Power Macintosh or Mac OS computer with a PPC 601 processor or higher
- at least 16 MB of RAM
- a hard disk with at least 24 MB of free space
- a CD-ROM drive
- System 8.1 or later

The production of this CD-ROM has been assisted and sponsored by:

Beresford Buttery Overseas Traineeship (Sponsored by Diasonics GE)

Since its foundation more than a century ago, Diasonics GE has constantly been at the forefront of research and technical innovation, with Diasonics GE Medical Systems today being recognised as a world leader in the supply of diagnostic imaging systems.

It is with great pride that Diasonics GE has the opportunity to offer this annual traineeship in the field of obstetric and gynaecological ultrasound, in memory of Beresford Buttery FRACOG, DDU, COGUS who made an inestimable contribution to his profession.

The award covers attendance at an appropriate educational program at the Thomas Jefferson Research and Education Institute in Philadelphia and will include tuition fees, economy airfare and accommodation for the duration of the course (usually 4 days).

ASUM and Diasonics GE invite applications for the 2001 Diasonics GE Beresford Buttery Traineeship Award

The award is made to applicants:

1. who seek to further develop their skills and experience in obstetric and gynaecological ultrasound
2. have as a minimum qualification Part I of the DDU or DMU (or equivalent) or have been awarded the DDU or DMU (or equivalent) within the last 5 years since 21 December 1996)
3. have been financial members of ASUM for a minimum of 12 months prior to the closing date

Applications should include:

- a curriculum vitae
- details of current employment
- testimonials from two referees in support of the application including contact address and telephone number
- an outline of professional goals and objectives
- an indication of benefit from award of the Traineeship

The successful applicant is asked to provide a written report on return from the course at Thomas Jefferson Research and Education Institute.

Applications addressing the criteria should be forwarded by **Friday 29 June 2001** to:

Diasonics GE Beresford Buttery Overseas Traineeship
c/- ASUM
2/181 High Street
Willoughby NSW 2068 Australia

DDU 2001

EXAMINATION DATES & FEES

Please note that there will be only one DDU Part I examination from 2001 onwards.

Fees (include GST)

ASUM Members	Non Members
Part I A$385.00	A$660.00
Part II A$660.00	A$935.00

Part II Casebook A$275.00 all participants

Fees quoted above are from 1 July 2000 and may be subject to change.

PLEASE NOTE THE FOLLOWING INFORMATION PERTAINING TO THE NEXT EXAMINATIONS

2001 Part I

Part I written examination will be held on 21 May 2001
*Closing date for applications 26 March 2001

2001 Part II

Casebooks for 2001 Part II DDU Examination must be submitted by 22 January 2001 and accompanied by the prescribed fee of $275.00 for all participants.

Part II written examination will be held on 21 May 2001
*Closing date for applications 26 March 2001

For applicants who pass the Part II written exam the Part II oral examination will be held on 16 June 2001 in Sydney.

Oral Examination for Cardiology candidates will be held in Melbourne on a date to be determined.

***NB** Applications received after the closing date will not be accepted.

For a copy of the latest DDU handbook, DDU application forms and further information regarding DDU contact ASUM on 61 2 9958 7655

For ASUM membership enquiries contact ASUM on 61 2 9958 7655

DMU 2001

EXAMINATION DATES & FEES

Parts I and II Written exam	- 25 August 2001
Closing date for exemption	- 27 April 2001
Closing date for applications	- 1 June 2001

FEES (include GST)

ASUM Members	Non Members
Part I A$385.00	Part I A$660.00
Part II A$660.00	Part II A$ 935.00

The 2001 DMU Handbook will be available 1 February 2001

For further information contact: DMU Coordinator ASUM
2/181 High St Willoughby NSW 2068 Australia
Phone: 61 2 9958 0317, Fax: 61 2 9958 8002
Email: dmu@asum.com.au

The DMU information on the ASUM website is currently being updated and includes information on: examinations Parts I and II, sample questions, case studies, examiners' report and log book.

Ultrasound Events

Wed 28 Feb 2001 - 5 days DMU Preparation Course. Part II General and Obstetric. *Venue*: The Royal Melbourne Hospital, Melbourne. *Contact*: ASUM, 2/181 High Street, Willoughby, NSW, 2068. Ph: 02 9958 6200; Ph: 02 9958 8002; Email: education@asum.com.au

March 2001 ASUM Queensland Education Program. Vascular Meeting. *Venue*: Queensland Vascular Diagostics. *Contact*: Roslyn Savage, Email: markros@powerup.com.au; Fx: 07 3881 2464.

March 2001 Annual Ob/Gyn Ultrasound. *Venue*: Maui, Hawaii. *Contact*: Robyn Walker, Secretary, Memorial/UCI Ctr for Health Ed, 2801 Atlantic Avenue, Long Beach, CA 90806, USA. Ph: 1 562 933 0100; Fx: 1 562 933 0101; Email: rwalker@memorialcare.org

Sun 11 Mar 2001 – 4 days AIUM 2001. *Venue:* Walt Disney World Swan and Dolphin Hotel, Orlando, Florida. *Contact:* AIUM's Prof. Dev. Dept., Suite 100, 14750 Sweitzer Lane, Laurel, MD 20707-5906. Ph: 1 301 498 4100; Fx: 1 301 498 4450; Email: conv_edu@aium.org Web site: www.aium.org

Tue 20 Mar 2001 ASUM Victorian Branch Meeting. Dr Greg Davidson Memorial Lecture. *Venue*: Mercy Hospital Lecture Theatre. *Contact*: Mrs Margaret Condon Ph: 03 9216 8613; Fx: 03 9748 9033.

Wed 21 Mar 2001 - 5 days AIR Brisbane 2001. *Venue*: Brisbane Convention Centre. *Contact*: Brisbane 2001, PO Box 1, Royal Brisbane Hospital, Brisbane, QLD, 4029. Website: http://www.giant.netconnect.com.au/AIR/default.htm

Mon 26 Mar 2001 Applications close DDU Part I and Part II Examination. *Contact*: DDU Co-ordinator. ASUM, 2/181 High Street, Willoughby, NSW, 2068. Ph: 02 9958 7655; Ph: 02 9958 8002; Email: asum@asum.com.au

Wed 18 Apr 2001 - 3 days XVII International Congress "The Fetus as a Patient". *Venue*: The Dusit Resort Pattaya, Pattaya City, Chonburi, Thailand. *Contact*: C/o Suphavit Muttamara, MD., RTCOG, 8th Floor, 2, Soi Soonvijai, New Petchburi Road, Bangkapi, Bangkok 10320, Thailand. Ph: 66 2 716 5721/716 5722; Fx: 66 2 716 5720

Thu 19 Apr 2001 14th Congress of the International Perinatal Doppler Society. *Venue*: Spier Estate, Stellenbosch, South Africa. *Contact*: Sune van Rooyen or Liezel Horn, Congress Department, PO Box 19063, Tygerberg 7505, South Africa. Ph: 27 21 938 9238/9245; Fx: 27 21 933 2649; Email: SDK1@GERGA.SUN.AC.ZA or LH@GERGA.SUN.AC.ZA

Fri 27 Apr 2001 DMU Examinations. Closing date for application for an exemption. *Contact*: DMU Co-ordinator, ASUM, 2/181 High Street, Willoughby, NSW, 2068. Ph: 02 9958 7655; Fx: 02 9958 8002; Email: dmu@asum.com.au

May 2001 ASUM Queensland Education Program. Vascular Meeting. *Venue*: Southern X-ray Clinics. *Contact*: Roslyn Savage, Email: markros@powerup.com.au; Fx: 07 3881 2464.

Fri 4 May 2001 - 3 days ASA 2001 - A Sound Odyssey. 8th Annual National Conference of ASA. *Venue:* Sheraton Perth Hotel. *Contact*: Conference Secretariat, ASA, PO Box 709, Cheltenham, VIC, 3192. Email: enquiries@A-S-A.com.au

Sat 6 May 2001 - 6 days Euroson School on 3D Ultrasound Imaging Eurodop 2001 / 5th Ultrasound Angiography Conference. *Venue:* Princesa Sofia-Intercontinental Hotel, Barcelona, Spain. *Contact:* HITEC, Dept. of Imaging, Hammersmith Hospital, 150 Du Cane Road, London W12 OHS, UK. Fx: 44 20 8383 1610; Email: hitec@hhnt.org

Wed 9 May 2001 - 3 days 3rd International Congress on Vascular Ultrasound and Magnetic Resonance. *Venue:* Amsterdam, The Netherlands. *Contact:* Mediscon, PO Box 113, NL-5660 AC Amsterdam, The Netherlands.

Tue 15 May 2001 ASUM Victorian Branch Meeting. Abdominal Doppler Ultrasound.*Venue*: Mercy Hospital Lecture Theatre. *Contact*: Mrs Margaret Condon Ph: 03 9216 8613; Fx: 03 9748 9033

Sun 20 May 2001 - 3 days 5th World Congress of Echocardiology and Vascular Ultrasound. *Venue*: International Convention Center Seoul, South Korea. *Contact*: Organising Secretariat: International Society of Cardiovascular Ultrasound, PO Box 323, Gardendale, AL 35071 USA, Ph: 205 934 8256; Fx: 205 934 6747; Email: lindyc@uab.edu

Mon 21 May 2001 DDU Part I and II Written Examination. *Contact*: DDU Co-ordinator. ASUM, 2/181 High Street, Willoughby, NSW, 2068. Ph: 02 9958 7655; Ph: 02 9958 8002; Email: asum@asum.com.au

Sat 26 May 2001 – 4 days Euroson School: Small Parts (Thyroid, Testis, Lymph Nodes, Musculo-Skeletal) Ultrasonography / Romanian Annual Conference in Ultrasonography (SRUMB). *Venue*: Adam Muller Guttenbrum Bldg, Timisoara, Romania. *Contact*: Roxana Sirli, MD, County Hospital Timisoara, 145 L Rebreanu Boul., 1900 Timisoara, Romania. Ph: 40 93 537 039; Fx: 40 56 200208; Email: rsirli@aut.uttt.ro

Fri 1 Jun 2001 DMU Examinations. Closing date for Part I and Part II Examinations. *Contact*: DMU Co-ordinator, ASUM, 2/181 High Street, Willoughby, NSW, 2068. Ph: 02 9958 7655; Fx: 02 9958 8002; Email: dmu@asum.com.au

Sat 16 Jun 2001 DDU Part II Examination. Oral Examinations except Cardiology candidates. *Venue*: Sydney except Cardiology candidates. Cardiology candidates will be examined in Melbourne on a date to be determined. *Contact*: DDU Co-ordinator. ASUM, 2/181 High Street, Willoughby, NSW, 2068. Ph: 02 9958 7655; Ph: 02 9958 8002; Email: asum@asum.com.au

Sat 23 Jun 2001 – 2 days ASUM Vascular Ultrasound Workshop 2001. *Venue*: St Vincents Hospital, Melbourne. *Contact*: ASUM, 2/181 High Street, Willoughby, NSW, 2068. Ph: 61 2 9958 7655; Fx: 61 2 9958 8002; Email: asum@asum.com.au

Tue 26 Jun 2001 Sixth Annual Symposium on Contrast Echocardiography. *Venue*: Sheraton Seattle Hotel and

Towers, Seattle, Washington. *Contact*: ATL Learning Centre; Website: www.atl.com or Email: ATL-Bothell.learning-center@Philips.com

July 2001 ASUM Queensland Education Program. Vascular Meeting. *Venue*: Mater Public. *Contact*: Roslyn Savage, Email: markros@powerup.com.au; Fx: 07 3881 2464

Wed 4 Jul 2001 - 4 days 10th International Congress on Twin Studies. *Venue*: Imperial College, London, United Kingdom. *Contact*: Congress Secretariat, 51 Westmoreland Road, London SW13 9RZ, UK. Fx: 44 20 82874427; Email: jwgowing@netcomuk.co.uk

Thu 12 Jul 2001 – 4 days NZASUM 2001. New Zealand Branch Annual Scientific Meeting. *Venue*: Millennium Hotel, Queenstown. *Contact*: Mike Heath; Email: m_lheath@xtra.co.nz

Thu 19 Jul 2001 ASUM Victorian Branch Meeting. ASUM/RANZCR Combined Meeting. *Venue*: Royal Melbourne Hospital. *Contact*: Dr Mark Brooks Ph: 03 9496 5431; Fx: 03 9459 2817

Tue 31 Jul 2001 ASUM Victorian Branch Meeting. Extraordinary Meeting with special guest speaker, Dr Roy Filly. *Venue*: TBA. *Contact*: Mrs Mary Young Ph: (a.h.) 03 9818 8455; Fx: 03 9818 8098; Email: robertmary.young@bigpond.com

Sun 5 Aug 2001 - 4 days CSANZ - 49th Annual Scientific Meeting. *Venue*: Auckland, New Zealand. *Contact*: Organising Secretariat: The Conference Company, PO Box 90-040, Auckland. Ph: 64 9 360 1240; Fx: 64 9 360 1242; Email: infor@tcc.co.nz

Sat 25 Aug 2001 DMU Examinations. Part I and Part II written examinations. *Contact*: DMU Co-ordinator, ASUM, 2/181 High Street, Willoughby, NSW, 2068. Ph: 02 9958 7655; Fx: 02 9958 8002; Email: dmu@asum.com.au

September 2001 ASUM Queensland Education Program. Vascular Meeting. *Venue*: RBH. *Contact*: Roslyn Savage, Email: markros@powerup.com.au; Fx: 07 3881 2464

Fri 7 Sep 2001 – 3 days ASUM 2001-Annual Scientific Meeting. *Venue*: Darling Harbour Convention Centre, Sydney. *Contact*: ASUM. 2/181 High Street, Willoughby NSW 2068. Ph: 61 2 9958 7655; Fx: 61 2 9958 8002; Email: asum@asum.com.au

Sun 21 Oct 2001 - 5 days The 6th Congress of the Asian Federation of Society for Ultrasound in Medicine and Biology. *Venue:* The Shangri-La Hotel, Kuala Lumpur, Malaysia. *Contact:* Mrs Janet Low, Executive Secretary, Department of Radiology, University of Malaya, Medical Centre, 59100 Kuala Lumpur, Malaysia. Ph:60 3 750 2069; Fx: 60 3 758 1973; Email: janetl@medicine.med.um.edu.my

Tue 23 Oct 2001 – 5 days 11th World Congress on Ultrasound in Obstetrics and Gynecology. *Venue*: Convention Centre, Melbourne, Australia. *Contact*: Congress Secretariat: ICMS Pty Ltd, 84 Queensbridge Street, Southbank, Victoria, 3006, Australia. Ph:03 9682 0244; Fx: 03 9682 0288; Email: icms.com.au

Fri 26 Oct 2001 - 3 days Annual Meeting Society of Radiologists in Ultrasound. *Venue:* Inter-Continental Hotel, New Orleans, LA, USA. *Contact*: Susan Roberts, Administrative Director, 44211 Slatestone Court, Leesburg, VA 20176-5109, USA. Ph: 1 703 858 9210; Fx: 1 703 729 4839; Email: info@sru.org

November 2001 ASUM Queensland Education Program. Vascular Meeting. *Venue*: Queensland X-ray. *Contact*: Roslyn Savage, Email: markros@powerup.com.au; Fx: 07 3881 2464.

Tue 27Nov 2001 ASUM Victorian Branch Scientific Meeting. Combined ASUM/ASA case presentation night. *Contact:* Mark Brooks, Ph: 03 9496 5431; Fx: 03 9459 2817.

Tue 11 Dec 2001 - 4 days EUROSON 2001 and 33rd BMUS Annual Scientific Meeting. *Venue*: EICC, Edinburgh, Scotland. *Contact:* BMUS, 36 Portland Place, London WIN 3DG, UK. Ph: 44 20 7636 3714; Fx: 44 20 7323 2175; Email: euroson@bmus.org; Website: www.bmus.org

Council Members

President
Stan Barnett, NSW

Immediate Past President
Andrew Ngu, Vic

Honorary Secretary
Mary Young, Vic

Assistant Honorary Secretary
Kaye Griffiths, NSW

Honorary Treasurer
to be appointed

Medical Councillors
Matthew Andrews, Vic
Roger Davies, SA
George Larcos, NSW
Neil Orr, Qld
David Rogers, NZ
Fergus Scott, NSW

Scientific Councillor
Dave Carpenter, NSW

Sonographer Councillors
Stephen Bird, SA
Janine Horton, WA
Alison Lee-Tannock, Qld
Peter Murfett, SA
Pru Pratten, SA

Co-opted
Gary Sholler, NSW – Cardiac
Charles Fisher, NSW - Vascular

Branches (not represented)
Rob Jones, Tas
Iain Duncan – ACT

Associate Members' Representative
to be appointed

Corporate Members' Representative
David Rigby, NSW

Ex-Officio
Chris Wriedt, Vic – Chairman, DDU
Jill Clarke, NSW – Chairman, DMU

Executive Committee
Stan Barnett, NSW
Andrew Ngu, Vic
Mary Young, Vic
Fergus Scott, NSW
Stephen Bird / Pru Pratten, SA
Kay Griffiths, NSW

Committee and Board Chairmen
DDU Board - Chris Wriedt, Vic
DMU Board - Jill Clarke, NSW
Education Committee - Dave Rogers, NZ
Marketing Committee - Luke Fay, NSW
Medical Affairs Committee - Fergus Scott, NSW
Safety Committee - Stan Barnett, NSW
Scientific Meetings Committee - Rick Dowling, Vic
Sonographer Affairs Committee - Stephen Bird, SA (Acting)
Standards of Practice Committee - Cheryl Bass, Vic

Corporate Members

Acuson P/L ***(Acuson)***
Andrew Hartmann 02 9201 7777

Agfa-Gevaert Ltd *(Scopix, Matrix Images, Digital Memories)*
David Chambers 03 9264 7711

Agilent Technologies *(Hewlett Packard)*
Beverley Jacobson 02 9805 6223

ATL Ultrasound *(ATL, ADR)*
Wayne Spittle 02 9452 6666

Australian Medical Couches *(Couch Manufacturer)*
Ros Russell 03 9589 3242

Central Data Networks *(Teleradiology/Computer Networks)*
Robert Zanier 02 4276 2501

Diasonics GE P/L *(Logia)*
Luke Fay 02 9882 8600

Hanimex Medical Imaging *(Esaote Biomedica)*
Serge Del Vecchio 03 9561 3444

HAL (*Remarketing Medical Equipment)*
Larissa Beavan 03 9417 1244

Harcourt Australia *(Medical Books and Journals)*
Anneke Baeten 02 9517 8999

InSight Oceania *(SonoSite)*
John Walstab 02 9907 4100

Kodak Australasia P/L *(Film and Laser Printers)*
Wendy Williamson 03 9353 2057

Medfin Aust P/L *(Leasing Finance for Medical Practitioners)*
Barry Lanesman 02 9906 2551

Medical Applications *(Siemens and Philips)*
Kevin Fisher 02 9844 2712

Meditron P/L *(Acoustic Imaging, Dornier, Kontron)*
Michael Fehrmann 03 9879 6200

Medtel P/L *(Aloka)*
Wendy Miller 649 376 1088 mobile 6421 947 498

Peninsular Vascular Diagnostics *(Vascular Ultrasound Educ)*
Claire Johnston 03 9781 5001

Rentworks Ltd (*Medical Leasing Equipment*)
Don Hardman 02 9937 1074

Richard Thompson P/L *(Fukuda Denshi)*
Gaye Craigie 02 9310 2166

Schering Pty Ltd *(Ethical Pharmaceuticals)*
Philip Owens 02 9317 8666

Schering (NZ) Pty Ltd *(Ethical Pharmac, Contrast Media)*
Tanya O'Connor 649 415 6342

Shimadzu Medical Systems *(Shimadzu)*
Dennis Tramosljanin 02 9898 2444

Toshiba (Aust) P/L Medical Division *(Toshiba)*
David Rigby 02 9887 8011

Guidelines for authors

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

FEATURE ARTICLES

Feature articles are original papers, or articles reviewing significant areas in ultrasound and will normally be illustrated with relevant images and line drawings. Feature articles are commissioned by the Editor who will indicate the size and scope of the article.

FORUM ARTICLES

Members are invited to contribute short articles expressing their observations, opinions and ideas. Forum articles should not normally exceed 1000 words in length. 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 in the *Bulletin*. Each listing must contain: activity title, dates, venue, organising body and contact details including name, address, phone number, facsimile number (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

Manuscripts should be submitted in triplicate in print and on PC formatted diskette as MS Word documents.

- Font size: maximum 12, minimum 10
- Double spacing for all pages
- Each manuscript should have the following components: Title page, abstract, text, references, tables, legends for illustrations.
- Title Page should include the following:
  - ❖ 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
- Relevant 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.

  Vancouver style format should be used.
  Examples of Vancouver style:

  1. In-text citation: ....as documented in previous studies (1-3). Note: Not superscript
  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

All 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. All images sent must have all personal and hospital or practice identifiers removed. **Images must not be embedded in text. Separate images are required for publication purposes.**

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 (eg Letraset). On the back of the print include the authors name, figure number and a directional arrow indicating the top of the print.

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

Please do not submit images direct from CPD cameras as these may present problems.

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