RECENT ADVANCES IN 3D AND 4D IMAGING OF THE FETUS

by Dr Philippa Ramsay

A 3d image of a fetus at 7 weeks gestation

Ultrasound enthusiasts the world over greatly anticipated the arrival of 3d and 4d ultrasound as computer power and speed has increased. Real-time 3d ultrasound first became available in 2003 and the technology has become better and better.

Of course, the skills of sonographers and sonologists has also had to improve, to really optimize the use of these expensive machines.

These days, we can get a fantastic view of the fetus’s life in utero. We can see fetal development from as early as 6 or 7 weeks gestation. We learnt about embryology from textbooks at university but now we can see normal embryology unfold before our very eyes.

Two-dimensional imaging is still the mainstay of the examination. All of the protocols which have been developed over the past few decades, are based on experience and research of fetal abnormalities seen in the two-dimensional planes. But the 3d image can add lots of extra information to the scan. Many patients and doctors find fetal abnormality to be much more recognisable on the 3d picture. Some mothers have reported that the 3d picture is much less scary. They feel that it gives a softer picture of the problem, with recognisable parts of their baby’s body around the abnormality. They find this reassuring.

This new technology however poses new challenges. We have had to re-learn what a normal fetus looks like, with 3d imaging compared to the old 2d. In the beginning lots of babies looked abnormal to us, with inexperienced eyes! We constantly have to refer back to the 2d image, and our embryology text-books as that is what we know well.

3d Ultrasound uses the same ultrasound technology that has been used in clinical practice since the late 1970s. It is completely safe for babies.

We have been on the learning curve with 3d ultrasound for 5 years and San Ultrasound for Women has four state-of-the-art machines, all equipped with four-dimensional ultrasound facilities as well. Four dimensional ultrasound is three dimensional ultrasound in real-time. The fourth dimension is actually time. So we can now provide most of our mothers-to-be with lovely images of their baby’s face, which they love. But real-time 3d shows more than just pretty faces.

Unfortunately fetal abnormalities occur in approximately three babies in one hundred. Usually they occur out of the blue, with no significant family history or risk factors in the mother. Not all of these abnormalities can be detected prenatally but those which affect the surface of the fetus can be demonstrated well with 3d imaging. Abnormalities such as spina bifida, cystic kidney, abdominal wall hernias and limb reduction defects all show up well with 3d and 4d ultrasound. Knowing about these problems in advance allows parents to prepare for the birth of their baby. Some parents choose to see the Paediatric surgeon before their baby’s birth so that they will fully understand the problems that their baby will face, and the surgical options available to them. Knowing the full extent of the abnormalities allows the obstetricians, midwives and paediatricians to provide optimal perinatal care for these babies. And the more we can do to promote that, the better.

A 3d image of a fetus at 12 weeks gestation

A 3d image of a fetal foot at 19 weeks gestation

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Dr Ramsay specialises in Ultrasound and Prenatal Diagnosis, is a Senior Clinical Lecturer at the University of Sydney and is an Examiner in Ultrasound for the College of Obstetrics and Gynaecology. Dr Ramsay is the Director of San Ultrasound for Women and the Ultrasound Care practices in St Leonards, Newtown and Randwick.
EXTENDED ENDOSCOPIC TECHNIQUES IN MODERN DAY SINONASAL SURGERY

by Professor Ray Sacks

INTRODUCTION

Endoscopic resections of neoplastic disease of the anterior skull base and parasinus are now widely practiced. However, the approach should never dictate the surgery performed. Anatomic location and areas involved by pathologic conditions should always be the determining factor. Similarly, pathology such as inverted papilloma should never imply a particular surgery (endoscopic medial maxillectomy or lateral rhinotomy). It is therefore imperative that the modern day endoscopic sinus surgeon should be equally comfortable performing endoscopic and open procedures. Endoscopic surgery should never imply conservative surgery. There are a variety of open approaches that can be used and they have been well described in the past. However with the advent of endoscopic techniques, many of these procedures are becoming redundant.

THE FRONTAL SINUS

Multiple pathologies of the frontal sinus such as osteomas were always previously treated with open osteoplasty approaches, as seen in Figure 1. Now with modern day image guidance surgery and changing instrumentation, we can clearly access the frontal sinus and remove even very advanced pathology endoscopically thus saving patients cosmetic deformity, neural failure and prolonged hospitalisation. The recovery is far superior and the eventual results equitable.

THE SPHENOID SINUS AND SKULL BASE

The sphenoid sinus is ideally located for the endoscopic approach and in fact the distance achieved by endoscopy and modern day instrumentation allow better access and better vascular control to the areas surrounding the sphenoid sinus than the open approach. It is now the procedure of choice in approaching the pterygoid fossa and trans-sphenoidal endoscopic pituitary tumor resections are commonplace. This is always done with a team approach between an appropriate rhinologist and an appropriate endoscopic neurosurgeon. Skull base surgery has advanced significantly and the entire anterior skull base can now be surgically resected through an endoscopic approach thus giving our neurosurgical colleagues a wide passageway in which to remove intracranial neoplasm. The description of the vascularised septal flap just a few years back has allowed us the ability to seal even very large defects with endoscopic reconstructions. It has been commonplace for many years now to seal CSF leaks with local endoscopic techniques but now even very large defects can be repaired endoscopically.

LACRIMAL APPARATUS

Patients with epiphora secondary to naso-lacrimal duct obstruction have traditionally been treated by an ocu-loplastics surgeon through an external approach. This had significant benefits over the endonasal approach due to the lack of endonasal instrumentation and expertise. Over the past decade, this has changed dramatically and now the endoscopic dacryocystorhinostomy is certainly equal if not superior in terms of the results as compared to the external approach. The major advantage of the endoscopic approach is the lack of an external scar, the lack of trauma to the lacrimal pump and the ability to deal with intranasal anatomical variations and pathologies which previously would have caused failure to the external approach DCR. Most modern day ocu-loplastics surgeons are becoming skilled in the endoscopic dacryocystorhinostomy and it is commonplace to find the ENT surgeon and the ocu-loplastics surgeon working side by side. Even patients with common canicular stenosis, who require the insertion of a glass Jones tube, will have a better outcome due to the superior positioning of the Jones tube when done via an endoscopic approach. Tumours of the lacrimal system can be adequately dealt with endoscopically at the time of surgery as well.

ORBIT AND OPTIC NERVE

The advancement of endoscopic techniques has enabled the entire medial wall of the orbit from the frontoethmoidal suture line superomedially down to the infraorbital nerve inferolaterally to be safely resected and for the ptosis to be removed and fat displaced in patients with severe thyroid eye disease. This should best be combined with an external approach to the lateral orbital wall in order to give patients a “balanced decompression” and to minimise postoperative diplopia. The endoscopic approach allows superior visualisation of the orbit all the way through to the orbital apex. Even the optic nerve can be decompressed in patients with traumatic optic neuropathy and thyroid orbitopathy. Fibro-osseous diseases of the orbital apex compressing the optic nerve can also be safely removed by an experienced endoscopic surgeon.

CONCLUSION

The advancements available in endoscopic sinus surgery have allowed the modern day rhinologist to approach not only the nose and paranasal sinuses but the surrounding lacrimal system, orbit, anterior and middle cranial fossa and even the clivus and posterior cranial fossa regions. With the advent of better imaging, intraoperative CT scanning and MRI scanning and better surgical technique, the extent of endoscopic resection is expanding all the time. Fellowship programs in Advanced Rhinology and multiple endoscopic sinus surgery courses are being run throughout Australia on a regular basis in order to ensure that a high standard of rhinology is available to patients nationally.

Figure 1. Osteoma of frontal sinus removed through external osteoplasty flap approach.

PROFESSOR RAY SACKS

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An Associate Professor at both University of Sydney and Macquarie University, Dr Sacks is an examiner for the Royal Australasian College of Surgeons, has a rhinological practice and has a special interest in endoscopic orbital, lacrimal and skull base surgery.

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The editors and Sydney Adventist Hospital do not accept responsibility for any errors or omissions in any article in this publication.
**MORbid OBESITY: AN ANAESTHETIC CHALLENGE?**

Dr Adrian Sultana

Obesity* is variously defined, however the current definition relies on derivation of the Body Mass Index:

**Weight in kilograms ÷ Height in m²**

The National Institutes of Health have promoted the following classification:

<table>
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<th>OBESITY 2003 NIH CLASSIFICATION</th>
<th>BMI</th>
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<td>CLASS I</td>
<td>30-34.9</td>
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<tr>
<td>CLASS II</td>
<td>35-39.9</td>
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<tr>
<td>CLASS III</td>
<td>&gt;40*</td>
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*Obese “fattened by eating”

**PATHOPHYSIOLOGY**

Profound pathophysiological changes and co-morbidities accompany increasing levels of morbid obesity.*

**RESPIRATORY CHANGES**

These include:

- **Mechanical:**
  - Reduced chest wall compliance (truncal fat) and reduced lung compliance further aggravated by lying supine.
- **Chemical:**
  - Increased oxygen consumption, and increased carbon dioxide production.
- **Pulmonary:**
  - Decreased functional residual capacity, progressive reduction in expiratory reserve volume (made worse by supine position and even worse in the head down position). Under general anaesthesia, functional residual capacity will easily fall to within closing volume at moderate levels of obesity leading to absolute shunt and hypoxia; and many obese patients will noticeably hyperventilate at rest.

Cardiovascular Changes:

These include:

- Increased afterload and preload, increased cardiac output and cardiac size and elevated blood pressure (not including the “fat arm syndrome”)

**CO-MORBIDITIES:**

These are widespread and many will need to be addressed pre-operatively and minimized post-operatively.

<table>
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<tr>
<th>A-Z of Disease in the Morbidly Obese</th>
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<td>ANGINA</td>
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<td>ATHEROSCLEROSIS</td>
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<td>THROMBOEMBOLISM</td>
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**WHAT ARE THE RISKS FACING THE SURGICAL TEAM LOOKING AFTER A MORBIDLY OBSESE PATIENT?**

Oolar textbooks, quota a prohibitive perioperative mortality of 6% . The current published risk, of bariatric surgery suggests a 30-day mortality < 0.3% overall and <0.1% for the purely restrictive procedures such as gastric banding. To offset these figures, there are documented positive outcomes (benefit) of bariatric surgery.

**BASIC PREOPERATIVE TECHNIQUES:**

How can the anaesthetist or indeed the primary care physician (GP) prepare the morbidly obese patient for hospital admission and surgery?

**CARDIOVASCULAR CHANGES**

After ACC/AHA Risk Stratification a small proportion of obese patients who have cardiovascular risk factors but whose risk is unclear because of poor or nonexistent exercise tolerance may benefit from non-invasive then invasive coronary assessment and revascularisation.

Re-vascularisation is no longer primarily sought for perioperative risk reduction. Instead, an aggressive medical approach is used focusing on prevention of myocardial ischemia. This may include the introduction of statins and beta blockers, optimal diabetic control and careful optimisation of other medication.

Angiotensin 2 blockers and ACE inhibitors are generally withheld on the day of surgery.

Patients with prior re-vascularisation need careful assessment of their anti-platelet and anti-coagulant drugs - this is best approached in a multidisciplinary manner between anaesthetists, surgeons, cardiologists and vascular physicians.

Some surgeons are happy to operate on aspirin and others believe in a “golden window” for Clopidogrel of about five days.

**Respiratory:**

Smoking cessation, optimisation of bronchodilators and often a sleep study if indicated by symptoms.

Many patients coming to bariatric surgery will resist the idea of preoperative CPAP, feeling that one expensive procedure (surgery) will cure all their ills. If severe OSA is diagnosed these patients would benefit from 2-4 weeks of nocturnal CPAP at home and of course, postoperatively.

**Endocrine & metabolic:**

Preoperative glycaemic, thyroid and lipid control should be as tight as possible.

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Dr Sultana graduated from the University of Malta in 1984, trained in General Medicine in the UK, and graduated FANZCA in 1993.

Dr Sultana has a subspecialty interest in anaesthesia and periparative management of bariatric surgical patients and in 2009, Dr Sultana presented three Scientific Papers on anaesthesia and obesity including one at the 2nd world congress of ICU/TVA in Berlin, Germany.
AIRWAY ASSESSMENT & MANAGEMENT:

The quoted incidence for difficulty in airway management is 13% compared with only 0.03% for abscertics. In practice many morbidly obese patients can be managed with conventional intubation or a non-invasive airway such as the Pro-Seal™ or Supreme™ LMA.

Any anaesthetist who routinely provides care for the morbidly obese should also be skilled in awake fibreoptic intubation.

PREMEDICATION IN THE MORBIDLY OBESO

- Benzodiazepine or none
- Oxygen for transfer from/to ward
- Gastric acid control
- Thromboprophylaxis
- Betas blockade if indicated
- Hold ACE 1/A2 blocker
- Give/resume STATN
- Aspirin & clopidogrel “golden window”?
- Anticholinergic if awake fibreoptic
- Salbutamol if indicated

AIMS OF ANAESTHESIA FOR MORBID OBESITY IN 2010

- Optimal surgical conditions
- Prevention of awareness
- Prevention of hyperalgesia
- Haemodynamic stability
- Rapid extubation & fast track
- Acceptable residual analgesia

TECHNIQUES:

Various anaesthetic techniques are successfully used in the morbidly obese:

- Target controlled infusions with Propofol and Remifentanil, Desflurane and Sevoflurane are used interchangeably and muscle relaxants are usually “necessary for surgery”.
- Suxamethonium at a dose of 1mg/kg (TBW) provides excellent intubating conditions and allows a “bail-out” scenario in case of failed intubation.
- Cisatracurium is an ideal drug kinetically however slow onset limits its use for intubation.
- Rocuronium: kinetics are not altered in the obese for a single dose but infusions may accumulate.

References Available on Request.

NEWLY ACCREDITED DOCTORS

- Dr Murthy Chennapragada Radiology
- Dr Allan Forrest ENT Surgery
- Dr John Jagger Cardiology
- Dr Carolyn Orr Neurology
- Dr Kattyn Parratt Neurology
- Dr John Parratt Neurology
- Dr Gavin Sanderson Plastic Surgery
- Dr Muzib Abdul Razak Surgical Assistant
- Dr Daniel Beral Surgical Assistant
- Dr Alison Blatt Surgical Assistant
- Dr Warren Chan Surgical Assistant
- Dr Raymond Chin Surgical Assistant
- Dr Anita Jatan Surgical Assistant
- Dr Emile Kamsel Surgical Assistant
- Dr James Lawrance Surgical Assistant
- Dr Andrew McCormack Surgical Assistant
- Dr Yogesh Nikam Surgical Assistant
- Dr Seamus Phillips Surgical Assistant
- Dr Joseph Rizki Surgical Assistant
- Dr Nicholas Williams Surgical Assistant

NEWS FROM THE SAN

Former SAH Nursing Executive Officer Annette Baldwin is the General Manager of the San’s newly purchased Dalross Hospital at Killara. Dalross Adventist Hospital has over 51 beds offering ophthalmic, vascular, neurosurgical and other services. The additional facility will help cope with the estimated close to 70% increase in demand for San services between now and 2026.

The San Hospital Foundation co-ordinates a wide range of keynote speakers suitable for community groups and presentations. This is a free service. Contact 1300 034 357.

The research arm of the San, the Australasian Research Institute, will be into new facilities on the Hospital campus later in 2010. The ARI coordinates and conducts innovative and developmental health and medical research, and reflects the Hospital’s philosophy of promoting good nutrition, lifestyle, health and aging, and reducing and alleviating disease. The CEO Dr Ross Grant, is a lecturer in Pharmacology at the School of Medical Sciences, UNSW. The new facilities include a purpose built laboratory and administration areas. Queries about the work of the ARI can be directed to 04870602.

Federal Opposition Leader Tony Abbott, State Member for Ku-ring-gai Barry O’Farrell, and former Wallaby international Nick Farr-Jones were amongst 550 guests at the Novus Foundation Gala Dinner in late May. The evening raised close to $150,000. Heavily supported by the San, the Novus Foundation is the partnership between Wahroonga Rotary and McCarroll’s Automotive. The 2010 Appeal fundraising was for StreetWork, Wahroonga Rotary Youth programs, the RCYC Hornsby’s new Centre for Performing Arts and the HealthCare Outreach Program of the San (The Operation Open Heart program finished a two week surgical trip to Fiji in late May after completing 50 closed and open heart surgeries, the majority of them on children and adolescents.)