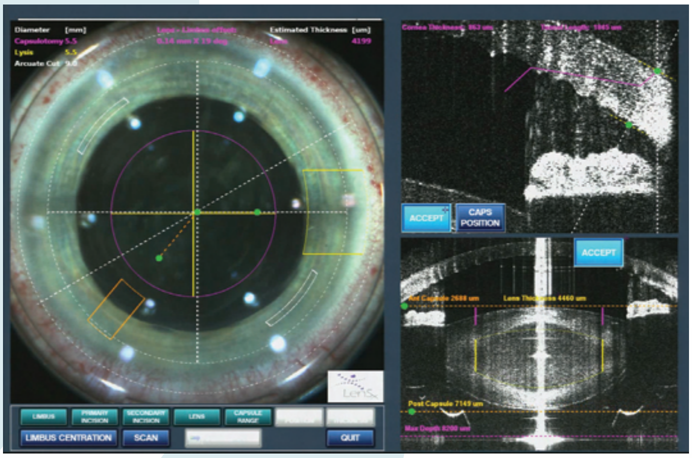
FEMTOSECOND LASER-ASSISTED CATARACT SURGERY

By Associate Professor Geoffrey T Painter

The LenSx Femtosecond Laser.



High-definition Ocular Coherence Tomography (OCT) guides the femtosecond laser to produce precise incisions in the cornea, lens capsule and lens nucleus.

Cataract surgery is one of the most common operations performed worldwide and through extensive development and technological advances has also become one of the safest and most successful operations that exists in modern medicine.

Until the early 1990's cataract surgery was entirely manual with the lens nucleus expressed through a large incision, which was then sutured following intraocular lens (IOL) implantation.

In the 1990s phacoemulsification technology was introduced to Australia, where the cataract was removed mechanically through a small incision using an ultrasound driven probe, with the implantation of a foldable IOL.

Over the last 20 years improvements in phacoemulsification machines along with IOL materials and designs have seen a refinement in the procedure resulting in the high quality surgery that is now commonplace in Australia. However, despite these advances and even in the best of hands, there is still a degree of variability in outcomes that would be desirable to reduce further.

Cataract surgery will take another significant step forward in its evolution this month with the arrival at Dalcross Adventist Hospital (DAH) of the Alcon LenSx Femtosecond Laser for cataract surgery. This new technology uses a computer guided Femtosecond laser to perform the early stages of the cataract operation, cutting the tissues with a degree of precision that manual techniques struggle to match.

Femtosecond laser technology has already been well proven in Refractive Laser Eye Surgery for nearly 10 years with well over 1 million procedures preformed to date.

The LenSx Femtosecond Laser is based on this technology and is now available in Australia with FDA and TGA approval for cataract surgery.

Results from early clinical studies in the USA and Europe indicate the benefits of the technology in a number of areas:

Firstly, experimental studies show the strength of a laser capsulotomy versus a manual one[1]. This will hopefully reduce complications from inadvertent tears of the anterior capsule. The precision of the capsulotomy it is felt will lead to more accurate IOL positioning, giving better unaided visual acuity. This is especially important when toric (astigmatism) and refractive (multifocal) IOLs are used. Early clinical data is giving positive results.

Secondly, the laser creates a tri-planar wound in the cornea, which is more precise in construction than can be created by a blade. It is felt this will create more reproducible results with regard to astigmatism allowing better visual results. The tri-planar architecture is also theoretically more robust, and hence safer, reducing the risk of endophthalmitis. Only large scale, long term studies will determine if this is the case.

Thirdly, the laser produces corneal incisions to augment the effect of implanted toric IOLs, which are far more precise than can be achieved by a blade.

Lastly, and most excitingly, the Femtosecond laser divides the nucleus into segments, which are then removed by phacoemulsification. The reduction in time, energy[2] and fluid used during Laser Assisted Cataract Surgery, will deliver less invasive surgery and less damage to the endothelium (the delicate inner layer of the cornea) leading to quicker visual recovery due to a reduction in post-operative corneal oedema. Early studies have shown a reduction of endothelial cell loss compared to published studies with the femtosecond laser technology.

Large scale clinical trials will be needed to show its effectiveness and superiority over traditional phacoemulsification, however, Laser-assisted Cataract Surgery has the promise to be the next evolution in cataract surgery with improved visual outcomes, quicker recovery, better control of astigmatism and improved safety.

These are goals both surgeons and patients will value and with further clinical research this technology could become the next gold standard for cataract surgery.

REFERENCES:

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2. Initial Clinical Evaluation of an Intraocular Femtosecond Laser in Cataract Surgery. Nagy et. al., Journal of Refractive Surgery, Volume 25, December 2009

A/PROFESSOR GEOFFREY T. PAINTER

MBBS, FRANZCO, FRACS

A/Professor Geoffrey Painter is an ophthalmologist in private practice at Gordon Eye Surgery, Gordon. He is head of Ophthalmology at the Sydney Adventist Hospital Clinical School of The University of Sydney, head of section at Dalcross Adventist Hospital and a VMO at Royal North Shore Hospital.

Contact 9418 1488

BREAST RECONSTRUCTION

By Dr Thomas Lam

1. R implant reconstruction, R nipple reconstruction and L br lift

A mastectomy may be required by women because of breast cancer or wide-spread ductal-ca-in-situ (DCIS) or may be a matter of personal choice for patients who for example may be high risk patients or BRCA gene carriers who request contralateral or bilateral risk-reducing mastectomies.

Many women find post-mastectomy deformity difficult both physically and emotionally.

Breast reconstruction (BR) offers these women restoration of their breast form. An increasing number of women are taking up BR. From the historical low of 5% in NSW in 1995, an estimated 30-40% of patients now undergo BR if they are offered the opportunity at the time of their mastectomy.

Breast reconstruction procedures are generally classified by techniques that involve prostheses or autologous tissues only, or a combination of these. They can be performed as immediate or delayed reconstruction. The current surgical options for post-mastectomy reconstruction are:

2. Bilateral implant reconstruction

(1) temporary skin expander with subsequent replacement by an implant

(2) transverse rectus abdominis myocutaneous (TRAM) or other flaps

(3) latissimus dorsi myocutaneous (LD) flap and implant insertion

PROSTHETIC BREAST RECONSTRUCTION

The modern era of BR surgery commenced in 1963 when Cronin and Gerow introduced the silicone breast implant.

BR surgery was constrained at that time however because after mastectomy the chest wall skin is tight and allows only the insertion of a small implant.

In 1982, Radovan added tissue expansion to BR. A tissue expander is an empty implant with an injection port where saline can be instilled regularly until the appropriate size when it was then removed and replaced with a permanent implant.

The ability to create a larger implant pocket has resulted in better results and the increased popularity of tissue expansion.

The main disadvantage of implant reconstruction is that it is difficult to match a mature contralateral breast but for the same reason, it is ideal for bilateral BR as they match each other perfectly. However, even in unilateral BR, patients are generally satisfied with the symmetry in clothing.

The modern implant may still require replacement eventually but this would not be expected within 15-20 years. Other drawbacks include the 4-6 visits required for expansion and the 2-staged nature of the procedure.

For suitable patients, there is a recent trend away from this 2-staged approach with skin or nipple-sparing mastectomies where an implant can be inserted directly. If the chest wall skin has been irradiated, implant reconstruction can still be achieved with addition of a latissimus dorsi myocutaneous flap to provide added soft tissue cover.

AUTOLOGOUS TISSUE RECONSTRUCTION

In 1982, Hartrampf published the Transverse Rectus Abdominis Myocutaneous (TRAM) flap and this has become the gold standard in BR. It provides a soft-tissue reconstruction which is similar to a natural breast with the added benefit of an abdominoplasty.

The operation takes 6-8 hours to perform and the post-operative recovery is significant. There is also a small risk of partial or total flap loss as well as a potential weakness in the abdomen as a result of the loss of a rectus muscle. In bilateral reconstructions there is a risk of loosing both rectus muscles.

A recent modification of the TRAM flap is the Deep Inferior Epigastric Perforator (DIEP) flap where the tiny perforator blood vessels traversing the rectus muscle are dissected free and the muscle is left behind.

If the abdomen is not available due to previous surgery, other donor sites can be used for free flap transfer, eg the buttock, 'love-handles' or inner thigh. These flaps tend to be smaller and are not as frequently used.

PROCEDURE SELECTION AND TIMING

For the average breast cancer patient all BR options are available to them with guidance

3. R BR with free TRAM flap and nipple reconstruction

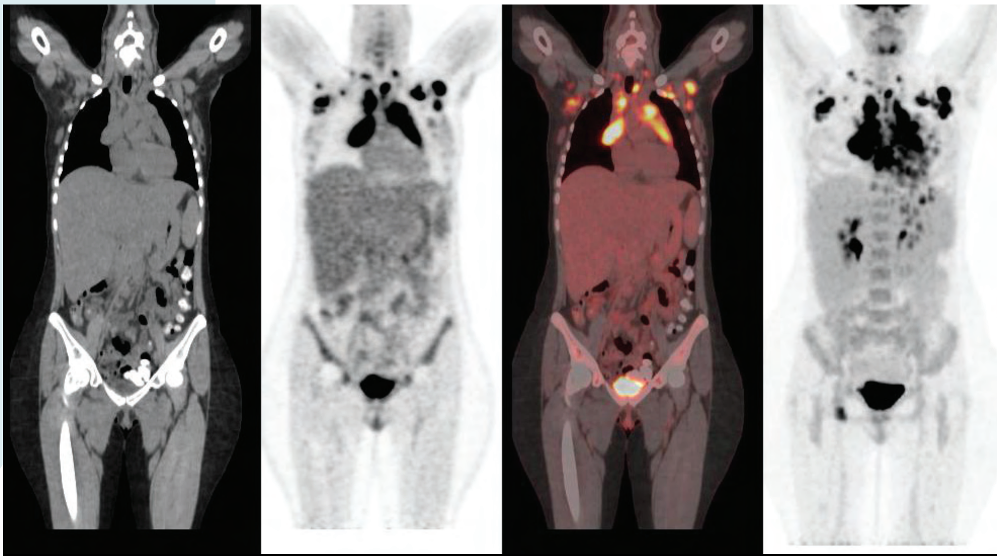
DR THOMAS LAM

MBBS(NSW)
FRCSGlas FRCSEd
FCSHK FHKAM (Surgery)
FRACS FRSM

Dr Lam is a plastic and reconstructive surgeon at Sydney Adventist Hospital and a clinical lecturer at Sydney University where he is also completing his doctorate. His surgical interests include breast surgery - augmentation, reduction and reconstruction; abdominoplasty and other aesthetic surgery as well as skin cancer and hand surgery.
Contact 8028 7349.

THE UTILITY OF POSITRON EMISSION TOMOGRAPHY (PET) IN LYMPHOMA

By Dr David McHarg



Patient with lymphoma in mediastinal and axillary lymphadenopathy, seen as black on PET, and yellow on fused CT and PET images. From left to right: coronal CT, coronal PET, coronal fused CT and PET images, MIP (maximum intensity projection) image.

Positron Emission Tomography (PET) is a nuclear medicine scan that is used primarily in oncological applications. A patient has an intravenous injection of 18F-FDG, which is a short lived radioactive glucose analogue. The PET scanner obtains a 3D image of glucose metabolism in the body, and fuses it with a low dose CT scan to provide anatomical detail. Most malignant solid tumours, including lymphomas, exhibit high glucose metabolic activity (i.e. they are FDG avid) and thus they can be imaged on PET scans.

Lymphomas are classified into two main groups: non-Hodgkins lymphomas (NHL) and Hodgkin lymphoma (HL). NHL is much more common than HL, comprising approximately 85% of all lymphomas. NHL is a heterogeneous set of lymphomas which can be sub-divided into 2 prognostic groups: the aggressive and the indolent lymphomas.

Aggressive NHL includes: diffuse large B cell lymphoma (DLBCL) 30%, mantle cell lymphoma (MCL) 6-8%, and peripheral T cell lymphoma (PTCL) 6-8%

Indolent NHL includes: follicular lymphoma (FL) 22%, marginal zone B cell lymphoma (including MALT lymphoma – mucosa associated lymphoid tissue) 6-8%, and small cell lymphoma 6-8%. Indolent NHL has a relatively good prognosis with median survival of 10 years.

There is an overlap in the degree of FDG uptake (also measured as the SUV – standardised uptake value) between aggressive and indolent forms of NHL. In general, however, the degree of FDG uptake in aggressive NHL and HL is significantly greater than in indolent NHL. Nevertheless the majority of indolent NHL are easily identified on PET.

PET is thus an extremely useful tool in the assessment of these patients, and is now considered the most accurate single test to evaluate lymphoma. As of July 2011, Medicare funding is available for PET scans for lymphoma at Sydney Adventist Hospital.

USES OF PET IN LYMPHOMA INCLUDE:

1. Staging and restaging

- PET is more accurate than CT for staging and restaging lymphoma, including extranodal and bone marrow involvement. Approximately one third of patients will have a change in the stage and management of their lymphoma following a PET scan.

2. Identify site for biopsy

- PET can identify a biopsy site in those patients who don't have an obvious accessible lymph node for biopsy.

3. Assess treatment response

- PET performed during or at the end of treatment provides powerful prognostic information. Negative PET studies are associated with a much better prognosis than positive studies. Positive interim PET studies (i.e. after a few cycles of chemotherapy) are associated with a high likelihood of relapse at the end of treatment. Studies are ongoing to assess whether a positive interim PET study should be used to guide a change in chemotherapy treatment.
- PET scans should be performed at least 3 weeks after chemotherapy (preferably 6-8 weeks) and 2-3 months post radiotherapy.

4. Differentiation between residual lymphoma and necrosis/fibrosis in post-therapy mass

- PET is more accurate than CT in assessing whether a post therapy mass consists of necrotic and fibrotic tissue or residual active lymphoma.

5. Identify transformation from indolent to aggressive forms of NHL

- PET can also identify high grade transformation (greater than a 3 fold increase in SUV on serial studies).

For the patient the procedure involves:

- 6hr fast (but may drink water)
- Cannulation and injection of FDG
- 1hr rest (uptake period) in a lead-lined room
- Scan – rapid low dose CT followed by PET imaging (20 minutes)

As of 1 July 2011 there are now 5 new Medicare item numbers for a range of indications for lymphoma. Specialist referral is required.

DR DAVID MCHARG

BSc MBBS FRACP

Dr McHarg is a Nuclear Medicine physician in full-time private practice at the Sydney Adventist Hospital where he has been since 1996. He is the practice principal of Northern Nuclear Medicine. He has undertaken training in PET at St Thomas' Hospital, London, Peter MacCallum Cancer Centre, Melbourne and Liverpool Hospital, Sydney. He introduced the PET service at the San in July 2010. Contact 9473 8750.