



LATEST ORTHOPAEDIC UPDATES LECTURE 2009

Saturday, 7 November, 2009
University of NSW, Kensington
8:00 am - 12:30pm

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APPROACH TO THE IRRITABLE HIP

Managing our patients with hip joint pathology can be very rewarding but may also be very frustrating.

Hip and groin pain is common in sport comprising 5-10% sports injuries and ranked in the top six for all Olympic sports injuries. The incidence is likely to increase as over 40 year olds in the community are returning to, or continuing, change of direction sports (e.g. over 35's football and masters' level sports). (Bahr 2009; Morelli 2005).

Groin injuries have been associated with the finding of reduced hip range of motion (Verrall et al 2007; O'Connor, D 2004; Fricker et al, 1991; Tyler et al, 2002). It is also observed that patients with chronic groin pain (> 3 months duration) have a 25% chance of a second pathology developing (e.g. hip joint osteoarthritis with adductor dysfunction).

The presentation is not intended to exhaust all causes of antero-medial groin pain, but will focus on hip joint pathology, iliopsoas dysfunction and will briefly comment on the key features of adductor dysfunction, osteitis pubis and two stress fractures (neck of femur and pubic rimus). Embedded in the talk is the author's personal case history of recent hip joint pathology and successful management with a paradigm for managing similar syndromes.

Treatment Pathway for Managing the Irritable Hip with Negligible OA

Non-Invasive

- Medication options
 - For night pain
- Physical treatment
 - In line traction
- Hip flexor, adductor, piriformis, TFL and ITB releases
- Glut strength and core stability
 - Avoid quadrant mobs
 - Lifestyle change
 - Weight loss
- w-b activity / sitting

Minimally Invasive

- As per non-invasive
- Intra-articular corticosteroid (> 2ml Cortisone in 10ml)
- Post-injection unload
- Post injection stretch
Prone IR, extension

Invasive

- Arthroscopy
- Arthroplasty
- Pre-surgery preparation

Review 6-12 weeks

Recommended reading:

- 1 The groin triangle: a patho-anatomical approach to the diagnosis of chronic groin pain in athletes
E C Falvey, A Franklyn-Miller, P R McCrory *British Journal of Sports Medicine* 2009;43:213-220 (full text available online at no cost)
- 2 Clinical examination of athletes with groin pain: an intraobserver and interobserver reliability study
British Journal of Sports Medicine 2004;38:446-451; P Hölmich, L R Hölmich, A M Bjerg

Prof Warwick Bruce

M.B., B.S.(Syd), F.I.C.S., F.R.A.C.S., F.A. Ortho. A.
Hip & Knee Surgeon



THE STATE OF THE ART OF TOTAL HIP REPLACEMENT

We know that osteoarthritis affects half the adult population in people over 60. The knee is more commonly affected than the hip. Osteoarthritis is the most common cause of lost time from work or sport in our community except for influenza.

Risk factors for the development of osteoarthritis of the hip are controversial:

- Long term exposure to sport among men.
- Heavy manual labour as an occupation.
- Secondary to developmental defects (DDH)
- Long term high intensity high mileage running (controversial).
- Chronic renal failure.
- Increasing age.
- Increased BMI, smoking, contraceptive pill – in women.
- Increased BMI of one standard deviation in men.

Obesity is having a significant affect on the incidence of osteoarthritis of the hip. In 2000, 67 percent of men and 53 percent of women were overweight in Australia. Obesity in children from 7 to 15 has tripled from 1.7 percent to 5.1 percent over a 10 year period from 1985 to 1995. More than 21 percent of children and adolescents are overweight.

Liu found that taller women and overweight women are at greater risk of having total hip and total knee replacements in the future. There is a 10.5 percent risk ratio of needing a total knee replacement in obese patients compared to 2.4 percent in total hip arthroplasty. It is estimated now that 27 percent of all total hip replacements are for obesity and 69 percent in the knee.

Changulani in 2008 has shown that patients with morbid obesity have a mean age of arthroplasty surgery 10 years younger than normal subjects for total hip replacement and 13 years younger than normal for total knee replacement.

Griffin has shown that the effect of obesity on the development of osteoarthritis is more complex than load and biomechanics, it seems that obesity creates an environment of low grade inflammation which may predispose to osteoarthritis.

As our population is living longer and joint replacements are being done in younger people, arthroplasties have to last longer. A person at the age of 30 has a life expectancy of 80 (female) and 74 (male). This means in a female joint replacement has to last 50 years and in a male it has to last 44 years. At the age of 85 a female has a life expectancy of 94 and a male 92, which means life expectancy of 9 and 8 respectively.

The National Joint Replacement Registry shows a much higher rate of failure of joint replacements in patients less than 55 compared to those patients over 75.

The main reason why joint replacements are failing is wear debris. Wear debris is mostly polyethylene. Wear debris particles activate macrophages. Macrophages release tumor necrosis factor and cytokines which destroy bone and cause large osteolytic lesions. If these lesions are allowed to get large enough then loosening may result.

contd/...

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Over the last 10 years there has been an average annual increase of 7 percent each year in knee and hip replacements. 62,000 total hip and total knee replacements were performed in 2004/05 compared to 32,000 from 1993/94. Total knee replacements are increasing at twice the rate of total hip replacements. Revisions of both hips and knees are at approximately 10 percent with knees a little lower.

When does your patient need a total hip replacement?

Total hip replacement is for pain and disability. The patient should never be told they need a total hip replacement. The patient will ask when they cannot cope anymore. This issue is that the patient and doctor's expectations often don't match and this is because of non-peer reviewed education on the internet and in the lay press and surgeons that feel their duty is to advertise their skills on the television or in the press which gives the patient unrealistic expectations. The main factors that influence me when a patient deserves total hip replacement is they are getting pain at rest, their walking distance is less than a kilometre, they have night pain and pain that is unrelieved by medications. I also tend to perform hip replacements sooner in people that have severe stiffness in the hip, as a stiff hip does not get as good a result as a mobile hip.

How do we make total hip replacements last longer?

A lot of effort has been used to improve the longevity of the articulating surfaces. One of the reasons for this is that the polyethylene particles are the particles that activate macrophages and cause osteolysis. It was thought that by using metal on metal or ceramic on ceramic surfaces we would circumvent osteolytic disease. In the latest National Joint Replacement Registry figures despite the advances in metal on metal and ceramic on ceramic technology, total hip replacements that are metal on polyethylene are still lasting the longest. There are many other variables that affect this but if you just look at the articulation metal on polyethylene is doing the best.

One of the properties of ceramic that is beneficial is that ceramics are harder than metals. We thought we had made ceramics tough enough in the 1990's with a significant decrease in fracture rate, however, in 2001, 2002 and 2003 there was a large increase in fractures of Prozyr ball heads and this was due to a change in manufacturing. This speeding up had disastrous effects on the results.

Problems with hard on hard surfaces:

Fracture: We know that ceramics can fracture and the rate now is probably 1 in 35,000. This is because the liner and acetabular cup is put in a suboptimal position and during flexion or extension there is impingement of the neck on the acetabular cup which causes high pressure on the contra-lateral side of the cup as the head grinds on the acetabulum, this cause grain release, third body wear and fracture propagation. When a patient walks, micro-separation occurs during the swing phase and this produces rim contact on heel stripe and strike wear of the head which may lead to early failure.

Squeak: Instance is up to 0.48 percent. It is more common in heavier, taller and younger people. Again it is concluded that squeak is due to edge loading and relates to component orientation. Excessive anteversion causes squeaking extension. Insufficient anteversion causes squeak in flexion.

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Although metal on metal joint replacements have been lauded as a significant advancement in joint replacement, in particular, surface replacement - this has not been shown to be the case. Surface replacement on the National Joint Replacement Registry has a 3.8 percent failure rate compared to 2.8 percent with conventional total hip replacement at 5 years. The main reason for revision of resurfacing is loosening/lysis/pain and fracture. Fracture is due to poor surgical technique, poor patient selection and small size patients. It has been shown that if the head size of the surface replacement is less than 50 mm the failure rate doubles or triples.

Because surface replacement has to be put in with perfect alignment, they are unforgiving. In fact surface replacement metals on metal hips compared to large metal heads in total hip replacement have a much higher failure rate. Birmingham surface replacement has a 2.5 percent cumulative failure rate at 3 years compared to the same head and cup on a femoral stem of 1.6 percent in the same time period. This demonstrates that poor surgical technique may lead to early failure.

We know that because in a surface replacement the femoral neck is retained, the range of motion of hip replacement is much greater than the range of motion of surface replacement. This is why surface replacement may not be ideal in a very stiff hip.

Metal on metal surfaces also release chromium and cobalt in the urine which may be carcinogenic. Visuri has looked at the observed and expected cancer rate of people with metal on metal hips and it is exactly the same.

Another attempt at long term survival of joint replacement has been looking at bioactive surfaces like hydroxyapatite. Certainly hydroxyapatite outperforms other surfaces in relation to bony ingrowth.

What can the patient do?

The patient can get back to non-manual work at 6-8 weeks, manual work at 8-12 weeks and sexual intercourse at 3-6 weeks. Sport should include walking, bowls, golf, bike-riding, swimming and doubles tennis. Jogging and contact sport will cause early failure rate.

Common Questions from the Patient

Am I too young or old? No.

Should I wait for technology to change? No

How long will it last? Approximately 1 percent failure rate per year.

Will I go off at the airport? Yes.

When can I drive? About 4 weeks.

What sort of joint should I have?— the surgeon is more important.

Will it feel normal? Probably not but maybe.

Do I need to be followed up? Yes.

Can I kneel? Yes but it may feel uncomfortable.

Do I have limitations? Yes.

Conclusion

A lot of the advances in total hip replacement have not been shown to fulfill their role in improving longevity. This is why the National Joint Replacement Registry is so important to assess early failure and to react to early failure by either design changes, advice on which patients are suitable or withdrawing a product completely.

END.

Dr Andreas Loeffler

B.S.C., M.B., B.S., F.R.A.C.S. (Ortho.)

Joint Replacement, Arthroscopy, Spinal Surgery



DEVICES IN THE LUMBAR SPINE

Back pain is very common, but the exact cause is often obscure. Therapists have tried all sorts of treatments in the past and an ever-increasing variety seems to be available now. Physical treatments range from rest, braces and traction to exercise and strengthening of various muscle groups. Injections include local anaesthetic, steroids, Botox and the sugar solutions of prolotherapy. Many of these treatments are driven more by the desperation of patients and their well-intentioned therapists than by sound science. Surgical treatments are no different. There is now a plethora of devices to be implanted in the lumbar spine. Some of the more common devices will be discussed.

Fusion Devices

Spinal fusion continues to be a good treatment for certain conditions, such as painful instability and painful disc disease when such pathology is limited to one or two levels. A fusion can be achieved through an anterior or a posterior approach and occasionally requires both.

Pedicle screws have become standard implants to aid a fusion, to fix instability, to correct deformity and allow early mobilization. There are many different models on the market. Most are made of titanium and thus MRI compatible.

Fusion Cages

Fusion cages may be used to achieve additional stability and insert bone graft into the disc space. Small cages can be inserted from posterior, in a procedure called Posterior Lumbar Interbody Fusion or PLIF. Larger cages can be inserted when performing an Anterior Lumbar Interbody Fusion or ALIF. Cages give mechanical stability to the spinal column when a disc has collapsed or been removed. Cages allow bone graft to fill the disc space and fuse the adjacent vertebrae. Most cages are now made of PEEK, a biocompatible plastic, or of titanium. Coral and tantalum have also been used.

Most cages are not stable enough on their own and require additional anterior or posterior fixation. Pedicle screws are used posterior. Plates or specially incorporated screws are used anterior.

Bone Graft Substitutes

A spinal fusion is achieved by getting two or more vertebrae to grow together. This requires auto-graft, allograft, or artificial graft material. Auto-graft is still the gold standard, but the patients bone can be mixed with allograft obtained from one of our bone banks. It can also be extended with calcium sulphate or calcium phosphates, which are similar to the mineral content of bone. There are now two artificial bone-stimulating hormones on the market. These may help to achieve a fusion when the host bone is poor or when there is not enough bone to perform a fusion.

contd/...

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Total Disc Replacement

The wish to relieve pain and preserve motion has attracted patients and surgeons for many years. Many motion-sparing devices have been invented. There are well over 100 patents registered for soft and hard implants, which try to emulate the functions of the natural disc. Five lumbar disc replacements are currently available on the Australian market. All are implanted through an anterior approach. Two are metal on metal and three have a polyethylene core.

Total disc replacement is an attractive alternative to spinal fusion. It may reduce adjacent segment degeneration, which is seen in many patients who have a spinal fusion. The long-term benefits of lumbar disc replacement have yet to be established. The Australian Joint Replacement Registry, an initiative of the AOA, now collects data on all disc replacements performed in this country.

Interspinous Spacers

Lumbar disc degeneration often leads to collapse and narrowing of the inter-vertebral foramina. This may result in radicular symptoms as the exiting nerve roots are compressed. Distraction of the posterior structures may open this foramen sufficiently to relieve nerve pain. A number of interspinous distracting devices have been invented. Whilst several are available on the Australian Market there is presently insufficient evidence to support the concept. There is no rebate for these devices and at least one has been withdrawn.

There are some theoretical reservations about this concept. Posterior distraction will place a disc in more kyphosis. In order to maintain posture a patient will have to compensate at other levels and may cause narrowing of adjacent inter-vertebral foramina.

Facet Joint Replacement

Facet joints are subjected to considerable forces and frequently become arthritic. Whilst the exact mechanisms, which lead to degeneration, are not known, facet joint arthritis accounts for much back pain. Inventive surgeons and engineers are working on Facet joint replacements. This might become an attractive and motion sparing procedure. Experimental models have been developed, but as yet none have become available. Whether these artificial joints will withstand the motion and forces of the moving spine will have to be seen.

Future Devices

As disc disease is very common, many methods and devices are currently being evaluated. These include growing disc material in the laboratory and then reinjecting it to recreate a functioning disc. One group is looking at injecting a type of polyurethane that would become a new nucleus pulposus. One company has presented an interesting study in which disc degeneration in sheep was reversed using mesenchymal stem cells.

Critical research is needed to study current and future devices.

END.

Dr Todd Gothelf

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Foot, Ankle & Shoulder Surgeon



TOTAL ANKLE REPLACEMENT

Historically Total Ankle Replacements have been plagued with difficulties. They possess a high complication rate, poor longevity and far inferior outcomes compared with total hips or knees. Comparatively, an ankle fusion was a more viable option for treatment of ankle arthritis, with its relatively low complication rate. A successful fusion is able to withstand heavy loads and demands during a patient's activities, with little risk of failure.

Although an ankle fusion can function well during strenuous activities, it poses several problems in the long term. Long term problems most commonly relate to the more inefficient walking due to loss of motion at the ankle joint. In addition, stress is absorbed by surrounding joints, leading to an increased incidence of arthritis in these joints over time. Studies have shown that within seven years, 50% of individuals with an ankle fusion will develop arthritis in these surrounding joints. To understand this more fully, we will review the mechanics of walking as well as the manner in which efficiency is reduced with an ankle fusion.

During normal walking the ankle moves through a motion of 10-20 degrees dorsiflexion to about 20 degrees of plantarflexion. When the heel strikes, a rapid movement from dorsiflexion to plantar flexion occurs in order to cushion the impact. The ankle then slowly moves from plantarflexion to dorsiflexion as the body moves over the foot, preparing for toe-off. At toe-off, the gastroc-soleus complex contracts and the ankle rapidly plantar flexes to propel the body forward.

With the ankle fused in a proper neutral position, the efficient movements described above are not possible. The heel strikes more forcefully at heel strike, and the knee rocks forward in order to propel the body, as the ankle is unable to move from plantar flexion to dorsiflexion. Push-off with the use of the gastroc-soleus process is not possible, and thus power at toe-off is lost. The changes in walking associated with an ankle fusion can be appreciated when wearing a camwalker boot. The rocker bottom sole on a camwalker allows for a more efficient, fluid motion with a stiff ankle.

A total ankle replacement, in contrast, will assist with the preservation of ankle joint motion, minimising the likelihood of arthritis and pain in surrounding joints. Newly designed total ankle replacements have shown promise, with fewer complications and longer lifespan than their predecessors. Recent studies have shown comparable complication rates between total ankle replacement and ankle fusion. With the benefits of improved motion and reduced stress in surrounding joints, ankle replacement has become an attractive option for certain patients with ankle arthritis.

MASSIVE ROTATOR CUFF TEARS AND CUFF TEAR ARTHROPATHY

Rotator Cuff Function

The rotator cuff acts as a humeral head depressor and compressor into the glenoid cavity. It works together with the deltoid as a fulcrum to achieve shoulder elevation and abduction.

Balanced Vs UnBalanced Cuff Tears

A Balanced Cuff tear is the term given to a rotator cuff tear which is smaller and has not resulted in a loss of active elevation. E.g. small tear of supraspinatus. An Unbalanced cuff tear is larger and has resulted in a loss of active elevation because of the loss of the humeral head depressor / compressor effect.

e.g. Large tear of Supraspinatus and Infraspinatus. Now the intact subscap cannot function on its own to depress the humeral head, as the cuff is unbalanced. It is easiest to think as the cuff as having a front (subscap), top (supra) and back (infra and Teres Minor) surface, and we need at least 2 out of the 3 sides to be working in order for the cuff to remain balanced. Untreated Massive Cuff Tears lead to proximal migration of the humeral head due to the pull of the deltoid, and eventual cuff tear arthropathy.

What happens to the tendon and muscle after a cuff tear

After a rotator cuff tear, the tendon begins to retract and shorten and the muscle belly undergoes atrophy and fatty infiltration. These changes are irreversible and begin occurring immediately.

Repairing the cuff tear has been proven to halt the progression of these changes but cannot reverse them.

Significance of these Irreversible Cuff Changes

These irreversible changes lower the chance of a successful outcome with surgery. A repair under high tension (because of a retracted, shortened cuff tendon) has a higher chance of failing.

When to refer a cuff tear “Urgently”

Older Patient (>40) with a recent Shoulder dislocation. This patient has a Massive Cuff Tear until proven otherwise. If (s)he has intact Active Forward Elevation above the shoulder level, then a massive rotator cuff tear is extremely unlikely. If they have lost active forward elevation since the dislocation then they must be urgently reviewed for a massive cuff tear (or axillary nerve palsy)

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A shoulder injury that has resulted in loss of the ability to actively raise the arm above the head.
This can be secondary to an acute or chronic cuff tear that has resulted in an unbalancing of the rotator cuff.

The Advantages of Arthroscopic over Open Repair of Large Cuff Tears

The main advantage of arthroscopic shoulder surgery over open surgery is that it does not disrupt the deltoid muscle, which can lead to very poor shoulder function and anterosuperior escape. There is also a higher incidence of infection after conversion from an arthroscopic to open procedure.

Factors Affecting Whether a Large Cuff Tear is Arthroscopically Repairable

All acute tears are “repairable” by most experienced shoulder arthroscopists as they should have adequate mobility and a low-tension repair. More chronic tears may need advanced procedures like interval slides. This procedure releases the tissue on either side of the supraspinatus to help achieve adequate lateral excursion for a low-tension repair. This is an advanced procedure not widely practiced. Hence, when considering a rotator cuff tear, the term “repairable” is a subjective term which depends on the skill of the surgeon.

Treatment of Cuff Tear Arthropathy

Anterior Deltoid Re-Education: Reference: The role of anterior deltoid re-education in patients with massive irreparable degenerative rotator cuff tears. Journal of Shoulder and Elbow Surgery, Volume 17, Issue 6, Pages 863-870. Levy, et al

Joint Replacement:

- **Hemiarthroplasty with “CTA” head.** Good for improving pain, less for active motion.
- **Reverse Total Shoulder Replacement** is successful at improving both pain AND active motion. It should however be reserved for the elderly patient with low demands, as it has a high early complication rate (10-15%) and also an increasing late failure rate from 7 years onwards.

END

THE BICEPS TENDON

Biceps tendon pathology is an often overlooked cause of shoulder pain.

The long head of Biceps has origin from the superior glenoid where it is anchored to the superior labrum. This relatively avascular tendon travels through the shoulder joint exiting, while making a 90 degree turn, through a narrow tunnel into the biceps groove and down the arm. The entry to the biceps groove(biceps pulley) is an area where the tendon can be subject to significant forces and damage.

The exact function of the long head of biceps is controversial. It may have some function in stabilising the shoulder and acts as a humeral head depressor.

Biceps pathology can be divided into the following groups:

1. Inflammatory
2. Traumatic
3. Instability

Injury to the biceps can be caused by:

- Longitudinal arm traction
- Repetitive microtrauma – mainly overhead

Clinical examination is not precise. The best test is that of tenderness over the biceps tendon. The Speed's test and O'Brien's test will not differentiate between pathology in the tendon as opposed to a SLAP lesion.

Radiology tests are not particularly helpful. An MRI with contrast will help exclude other pathology involving the labrum and rotator cuff and is useful for instability of the biceps. No test is accurate for traumatic or inflammatory lesions of the tendon.

One should rely on history and point tenderness over the biceps in the biceps groove.

Dr Jerome Goldberg

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Shoulder Surgery



Nonoperative treatment includes:

- Injection of cortisone into BT sheath or GH joint
- NSAIDs
- Rest from precipitating activity
- Physiotherapy – mainly RC program

The results of nonoperative treatment is variable. The results are good in low demand patients but poor in high demand patients – those involved in repetitive and overhead activities e.g. weight training.

Operative management includes:

- Biceps tenotomy - low demand patient
- Biceps tenodesis - high demand patient
- Acromioplasty - where there is associated RC pathology
- Repair subscapularis – where associated significant partial tear

When does one repair a rupture of the long head of biceps? This is a controversial topic as most studies show that the only long term outcome of a chronic rupture is a 10% loss of elbow supination power or no loss of power at all. I would recommend repair only in very active young patients or those who need elbow supination (e.g. carpenter).

END.

WHAT'S NEW IN ACL RECONSTRUCTION?

History – nothing new

- Valgus external rotation injury over planted foot

Or

- Quadriceps active mechanism

Clinical Examination – nothing new

- Positive Lachmann
- Anterior Drawer
- Pivot shift
 - There are more than 8 described methods of doing a pivot shift
- Beware of the varus knee (needs HTO with the ACL to stop the graft stretching out)

Initial Evaluation – nothing new

- History
 - Diagnostic 95% of the time
- Examination
 - Confirms history
 - Easy if very acute or chronic

Investigations – nothing new

- Mainly clinical diagnosis
- Plain Radiographs
 - AP / Lat / Tunnel / Skyline Patella
- Bone Scan rarely useful
- MRI for complex injuries
- Arthroscopy rarely necessary for diagnosis

Measurements – needs something new

- KT-1000 - but this does not measure rotational instability, only in the AP plane
- Trying to find better methods

Techniques – new

- The single bundle 'Over the top position' worked well but there were a very small number of patients who were not happy with the stability of their knee. Of those that were stable knee many ended up with arthritis anyway (but we aren't sure how much of this is natural history)

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- The emphasis in the last 18 months has changed to using the anatomic footprint which makes sense but..... we aren't sure what will happen. The instructional course lecture at the AAOS in 2008 was not using an anatomical insertion technique. The anatomy has been revisited, understanding the origins and insertions of both bundles of the ACL (Anteromedial and Posterolateral) and people are doing **double bundle reconstruction** surgery. It is not clear how much of this is a marketing exercise and how much is truly patient driven. The studies show conflicting results but in most the rehab is slower (The graft is bulkier so may prevent ROM as easily but this is theoretical only). Allografts are mainly used in the US since autografts do not give a large enough 2nd bundle. In Australia we can't do this because the grafts are irradiated which degrades the collagen and allows it to stretch over time. Another risk is that the Lateral Femoral Condyle can fracture from 2 tunnels which is much more of a concern than ongoing instability in a small number of patients. Having 2 bundles MAY control rotation better but we are not certain what position to tighten either bundle in.

Fixation Methods – a bit new

- Bioabsorbable fixation
- All inside techniques
- New tools to do the same operation though
- Makes revision surgery easier

Graft sources – a bit new

- Autograft
 - HT, PT, Quads, Contralateral leg
- Allograft
 - But irradiated in Australia this is likely to change when supercritical becomes available
- Augmentation Devices
 - LAD, LARS
 - There is a strong marketing push to use the LARS ligament. I performed a Medline search for LARS ligament and found:
- 6 articles
- 1 about ACL Recon from 2002
 - 26 pts, 2 year follow up
 - All pts > 6 months post injury
 - Laxity nearly double the BTB group
 - Nothing published since

I then went to their website www.larsligament.com.au and looked up what articles were available.

- 2 referenced incorrectly
 - 2 presentations, not peer reviewed
 - 1 basic science paper
 - No biomechanical studies
- They did have a nice video though.

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- Their brochure said that surgery needed to be done within 3 weeks of injury but this is not from any of their published papers. **In my opinion this is a completely experimental product and should not be released to the general market.**

Techniques - NEW

- Computer Navigation

Rehabilitation - NEW

- **Vibration Training**
 - Less pain
 - Better muscle bulk
 - BUT not sure about graft stretching out
 - Low intensity vibration improves bone healing
- **Cryotherapy** better than placebo
 - Less Pain
 - No improvement ROM
 - Possibly less drainage
 - Low cost, worth doing
- **CPM**
 - Shorter hospital stay
 - Pain the same (perhaps slightly less drug usage)
 - No increased laxity
 - No increased ROM
 - Swelling the same (conflicting studies)
 - Function the same
 - Same drainage (or less with CPM)
 - Joint position sense better WITHOUT CPM
 - Complication rate same or worse (see above)

Bracing

- 4 studies no difference
- 2 studies quads atrophy at 3 months
- 1 study more swelling with brace
- If you use a brace keep it in extension
- Neoprene better than brace for single leg hop at 3 and 6 months

Cochrane Review Bracing – poor quality studies

There was no evidence to support the routine use of functional or rehabilitative bracing in patients with a reconstructive ACL. None of the studies demonstrated clinically improved ROM, decreasing pain, improved graft stability, or decreased complication and re-injuries.

The use of braces is not supported by currently available evidence (Rehab more important than bracing)

contd/...

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Outcome Studies - NEW

- Patient satisfaction most closely relates to ROM achieved
- Preop ROM relates to post op ROM which is the determining factor for a good result from ACL reconstruction.
- Extension more important than flexion
- Anterior knee pain the same in HT and BTB groups. Decreases with time

Summary

- Common injury
- Current operation works very well
- New operations experimental and need to be monitored very closely
- Rehab improving

END.