

Practical Arthroscopy Newsletter No 4 2006

Editorial - AAOS Chicago March 2006



The site of the Academy had to be moved to Chicago due to hurricane Katrina which devastated New Orleans. The city was a great choice, and everyone wondered why the meeting had not been back here since 1970. This is a great city, fine restaurants, exceptional shopping, and lots of museums. I would rather come here than go to New Orleans. The convention center was about 3 miles away from the hotels, but the taxi and bus service was good. The Marriott Renaissance hotel was central with a large room. The workout room was marginal, but I was able to run 3 miles on the treadmill each morning. I had lots of work during this meeting, including moderating on the first day for the sports and arthroscopy session. I then had the instructional course on meniscal repair with Laurie Hiemstra, and Peter Kurzweil on the Thursday afternoon. On Friday afternoon I participated in the ACL symposium, which was well attended, approximately 800? I was honored to part of such an illustrious group, Steve Howell, Lonnie Paulos, Freddie Fu, and moderated by Chad Prodromos. We had good initial feedback on this symposium and I will be interested to see if this will be accepted as an instructional course.



Fig 1. Chicago, my kind of town.

Overview of Allograft use in ACL Reconstruction

At this year's academy again there was considerable discussion about the use of allograft for ACL reconstruction. It is generally agreed that the use of allograft tissue reduces the patient morbidity due to graft harvest of autogenous tissue, reduces the operative time, and its use is generally safe. The potential for disease transmission is fairly low, 1.6 million chance for AIDS. There has been a recent report of hepatitis C transmission. The freeze dried graft has not been associated with any viral transmission, that we are aware of. That could be a problem in the future. When I started orthopaedics we did not know about hep C, so what about hep D, E, and F? I also had a patient who was a victim of the funeral home harvesting of tissue. I had to call the patient back and have him undergo blood tests for HIV, hepatitis C, and syphilis! Not a very pleasant situation. This just emphasizes the introduction of one more factor that the surgeon can't control.

A paper was also presented on what to do about the positive culture from the graft that may be obtained at the time of implantation. The authors had 3 cases with no signs of infection in the knee. They concluded that careful observation was the best management of this situation. I know a couple of situations where this has happened, and caused concern for both the patient and the surgeon.

The other issue that is gaining some attention is the increased failure rates. There have been several comparison studies to autograft tissue, such as Shelton's, to show that the outcome is the same with both grafts. However, as reported below, the group from University of Kentucky showed a 20% failure rate with the tibialis graft. This increased when the under 25 group was studied. This was an unacceptable failure rate, and the authors recommended that the tibialis allograft NOT be used for routine ACL reconstruction. The failure may have been due to several factors, fixation of the graft in the tibial tunnel with a single screw, early return to sports at 4 months, and not just due to the allograft tissue. This does make one think that perhaps this young athletically aggressive patient should have an autogenous patellar tendon graft. Don Shelbourne has reported that due to the rapid bone to bone healing, accelerated rehab is possible, allowing return to sports between 3 and 4 months, with no increased failure rate. Another paper reviewed the failure rate of grafts from different tissue banks. One tissue bank, unnamed, had a 20% failure rate compared to 3 other tissue banks. It highlights that you must know how the bank procures, processes, sterilizes, and delivers the tissue.



Fig 2. This allograft is obviously up to the task of replacing the ACL



Fig 3 Ruptured BTB allograft.

This allograft BTB broke in the middle while applying manual tension to the leader sutures! Fig 3. This must have been one of the grafts from tissue bank D – unnamed.

On the other hand, we know that ripping out the hamstring tendons often leaves significant weakness in full flexion. The choice of graft is always a balance of one advantage over another disadvantage.

This patient did not have active flexion beyond 100*, but did not perceive any significant weakness in recreational activities. Fig 4.



Fig 4 Weakness in full flexion after autogenous hamstring harvesting for ACL reconstruction.

Report from the American Academy of Orthopaedic Surgeons Chicago ACL Symposium.

Chad Prodromos put together a good panel to discuss the current controversies in ACL hamstring reconstruction.

The first session dealt with graft choice comparing autograft to allograft. Even though there have been comparison studies to show that the long-term outcome (Shelton's 5 year follow-up), there are still issues that haven't been resolved, such as risk of disease transmission, and later increased failure rate.

Soft Tissue Allografts for ACL Reconstruction

Pro

- Reduced morbidity from graft harvest

- Shorter operative time

Con

- Risk of disease transmission
- Longer time to incorporate
- Weaker tissue due to processing
- Cost
- Availability

Fixation and Tensioning of Soft Tissue Grafts

Prodromos has recently published a meta-analysis of the most recent papers to show that with the new generation of soft tissue fixation devices, there were 4 quadrupled bundle hamstring graft studies that were more stable than the comparable BTB studies. The most common femoral fixation was cross pin or closed loop endobutton, and on the tibial side was cortical fixation with either staples, screws with spiked washers, or cancellous screws. We have reported that the corticocancellous screw, the XtraLok, has the same KT-1000 values as the Intrafix. Paulos also uses a tensioner to tension all 4 bundles, but neither of us could come to a consensus about how much to tension, and whether tensioning on the back table is necessary. We certainly can make a stiff graft with lots of tensioning, but how stiff and tight do we need to be? The only number in the literature is the 80N of tension reported by Yasuda. We now apply approximately 50N to the double loop semitendinosis, and 30N to the double looped gracilis tendon. The cycling of the knee after the tension is applied takes all the play out of the construct, and the knee leaves the OR tight. The KT at the end of the procedure is usually equal to the other normal knee.

Double Versus Single Tunnel

We all gave credit to Freddie Fu for bringing to our attention the concept of the double bundle anterior cruciate ligament, and the necessity to reconstruct the bundle or bundles that are torn. I don't think that he swayed many to start drilling 4 tunnels, but certainly we all have become more critical in our analysis of the

injury pattern of the ACL. Several of us have done an augmentation reconstruction, when only one of the bundles has been torn. That most commonly means that the PL bundle is preserved and an AM bundle only is reconstructed. The judgment call comes when evaluating this patient. They will usually have a significant Lachman test with a 5+ mm side to side difference on the KT-1000 measurement, but only a pivot glide test. When assessing the remnant of the ACL, all the synovium and fat must be removed and the ligament must be probed with the knee in flexion and close to extension. If the PL bundle is loose when probing in extension, then a standard ACL reconstruction must be done. When reviewing one of the intra-operative thermal shrinkages that I did, I realized the mistake, and reason for the failure. The patient had an isolated AM bundle tear, with an intact PL bundle. We shrank the remnant, and restored a little of the a-p translation, but set the patient up for long term failure. The PL bundle is not strong by itself to allow return to vigorous sports.

The other issue is that maybe not everyone needs to have a 2 bundle reconstruction. There must be an indication for the more complex operation.

Single Bundle Reconstruction

Pro

- There are good published series using only a single tunnel with 90% good and excellent functional outcomes.
- Most surgeons only do 10 ACL reconstructions and placing the tunnels in the correct position is a challenge.
- If the femoral tunnels are placed at the 10 and 2 o'clock position a reconstruction is more anatomic. The mistake that has been made with the trans-tibial drilling of the femoral tunnel, is to place the tunnel too high resulting in a vertical graft.

Con

- The lab study by Yagi and Woo showed improvement in the kinematics of the knee with the double bundle reconstruction compared to the single bundle.
- Most studies show that only 75% of the cases have a KT value of 0-2 mm

side to side difference.

- The double bundle reconstruction may control rotation better by adding the PL component, but we only have a clinical way to measure this the very subjective pivot shift test.

Double Bundle

Pro

- This has been shown by several researchers to be a more anatomical reproduction of the ACL, and to restore the normal kinematics of the knee.
- There is more tendon to bone surface for healing with multiple tunnels.

Con

- The double bundle procedure is technically more difficult to perform, with twice the potential to place the tunnels incorrectly.
- There are limited femoral fixation options, the endobutton and interference screw are the main methods to fix the graft on the femoral side.
- There is more potential for notch impingement with the larger tibial footprint created by drilling 2 tibial tunnels.
- There is no consensus on tensioning of the grafts by the principal proponents of the double bundle.
- The revision of multiple tunnels placed in the wrong position may be extremely difficult.
- There are no evidence based studies to demonstrate that the double bundle procedure is superior.
- There are no guides available for drilling the tunnels.
- There is no standard technique to drill the femoral tunnels, from inside out or outside in.
- If one is using autogenous hamstring grafts, occasionally the gracilis may be very small, and would not be adequate to use as a posterolateral bundle.

So, there you have it. You can make the choice to switch to the double bundle ACL reconstruction, or continue to perform a fairly successful single bundle ACL

reconstruction.

Paper N 16 Autograft versus allograft ACL Reconstruction: A Prospective, Randomized Clinical Study. Husain, Bottoni, Ipsen, Smith, Afra.

This was a randomized prospective clinical trial of the fresh frozen tibialis allograft versus the autograft hamstring tendon in a military population. The femoral fixation was cross pin, and the tibia, an interveference screw. The patients were evaluated with IKDC, Lysholm, SANE scores, and Tegner scale. The objective measurement was with the KT-1000, with 94% recall of the patients at an average of 25 months post-op. There was no significant difference in the outcomes, except for the failure rate. There were 7 allograft failures compared to 3 autograft failures, but this was not statistically significant. The authors' conclusion was that the allograft was equivalent to the autograft, but I would question the higher failure rate of the allografts.

Paper no 19. Failure of Primary ACL Reconstruction Surgery Using the Tibialis Allograft. Singhal, Gardiner, Wilson, Johnson

This was a retrospective review of 125 patients who underwent primary tibialis allograft ACL reconstruction. 69 patients were reviewed at 55 months post-op. The grafts were fixed with a bioscrew on the femoral and tibial side. The overall graft failure rate in this group was 30%, but when the group who were under 25 years of age were examined, the failure rate was 45%. This young group also returned to sport early, around 4 months.

The authors concluded that the tibialis allograft was not a satisfactory primary graft for ACL reconstruction.

The cause of failure may have been due to fixation, or early return to sports in this young population, and not the choice of allograft. The follow-up was only 50%, which introduces significant bias.

Paper No 27. Failure Rate of Tibialis Allografts in ACL Reconstruction: Influence of Tissue Banks and Demographics. Pifel, Kaeding, Spindler, Backs.

The paper looked at the authors' results using the tibialis allograft obtained from different tissue banks. The overall failure rate was 12%, but most of the failures

were from one tissue bank. The failure rate was 19% from one particular, unnamed tissue bank. The failure rate from the other 3 tissue banks was 4%. Another factor in the failure group was the age; they were 10 years younger. The authors suggest that the tissue bank source may be an important factor, even more than the use of allograft tissue.

Paper No 26 . Multi-ligamentous Injuries of the Knee and Associated Vascular Injuries. McDonough, Wojys.

This was a retrospective review of vascular injuries in 71 multi-ligamentous injured knees. Four knees were diagnosed with a vascular injury by an abnormal clinical exam, and underwent immediate vascular repair. Six patients had a normal exam and an abnormal angiogram, with 5 requiring vascular intervention. Two patients had a normal exam, and a normal angiogram, and developed an ischemic limb after ligament reconstruction. Both cases had an intimal injury not detected on the angiogram, and underwent immediate vascular repair. The consequence of missing a vascular injury is devastating, particularly if not detected early. The authors conclude that routine angiography is indicated with the multi-ligament injured knee.

Paper no 17. Prospective Randomized Comparison of Single AM, Single PL, and Anatomic Double Bundle ACL Reconstruction. Masayoshi, Kuroda, Mizuana, Muratsu, Yoshiya, Kurosaka.

In this clinical study, 60 patients were randomized into one of the 3 groups: isolated AM, isolated PL, or anatomic double bundle ACL reconstruction. The grafts were all fixed on the femoral side with an endobutton, and on the tibial side with a screw post. The follow up was short, 1 year, and outcome measured by the IKDC form. They also used 3-D sensors attached to the skin to measure motion under anaesthesia at one year when the screw on the tibia was removed. Both the pivot shift test and their new method for 3-D measurement showed that the best control of rotation was with the double bundle procedure. It is interesting the authors would do an isolated PL reconstruction considering that this would probably not sufficiently control the a-p motion of the knee. The other outcome measurements did not show significant improvement with the double bundle

procedure.

Paper no 25. A Comparison of Posterolateral Corner Sling Methods: Fibular Head Versus Tibial Tunnel. Young-Bok Jung

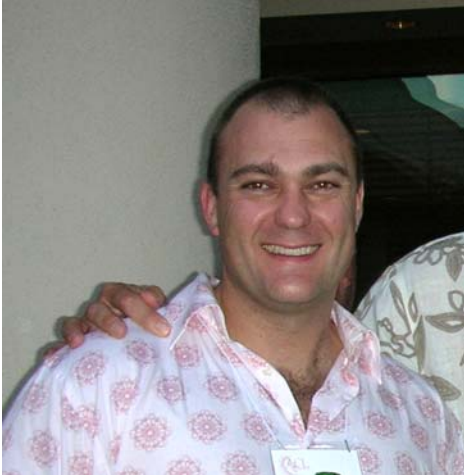
This clinical study compared 20 patients who had a sling through the fibular head versus 19 patients with the graft through the tibial (Meuller by-pass) to control posterolateral corner deficiency. These patients had grade 2 laxity, with no varus. The mean operating time in the fibular head group was about half of the trans-tibial route. The objective IKDC score was higher in the fibular head group. The subjective scores were the same in both groups. The authors conclude that in grade 2 rotatory instability a reconstruction through the fibular head (Larson technique) has a better outcome compared to the reconstruction through the tibia.

Graft Choice for ACL Reconstruction: A Meta-analysis of Level 1 Evidence.

Whelan and co-authors did a meta-analysis on all published or presented papers that compared the choice of grafts for ACL reconstruction and were at level 1 of evidence. They concluded that there was insufficient data to conclude differences in patient function or graft re-rupture rates. All the trials were insufficiently powered with inconsistent data reporting of validated outcome measurements. It seems that we are still functioning at the lower level of evidence based medicine.

ACL Study Group – Hawaii, 2006 A summary of my impressions.

Tim Whitehead – MD FRCS – Arthroscopy and Sports Medicine Fellow.



Tim Whitehead – Arthroscopy and Sports Fellow

The ACL Study Group conducted its biannual meeting at the Hapuna Beach Prince Hotel on the Big Island of Hawaii from the 26th to 31st March. The participants and their families were initially greeted with thunderstorms that soon cleared in favour of blue skies and beautiful warm days. The meeting was excellent, both professionally, and socially, and gave many an opportunity to reacquaint themselves, and others, the chance to meet for the first time. Lively discussion and a wonderfully relaxed atmosphere were highlights. The following is not an exhaustive summary but rather an attempt to select and discuss some interesting highlights.

Monday 27th March.

John Campbell presented a survey from the ACL Study Group with some interesting emerging trends. Fifty percent of members still nominate the patellar tendon as their primary graft choice, with 40% using hamstrings. Only 34% use the IKDC form and 48% regularly utilize the KT-1000 arthrometer, while 45% perform an ACLR as an outpatient procedure. Eighty two percent of the world's leading ACL experts would have their own ACL reconstructed.

There was an emphasis on ACL injury mechanisms and risk factors. David Parker from Sydney, presented his work correlating MRI findings and ACL mechanisms of rupture. Unlike other studies, he has demonstrated a greater

percentage of medial sided bone bruising on both the tibial and femoral sides. Both “active” and “passive” mechanisms were defined, and the differences in MRI appearances noted for both.

Thomas Branch introduced the novel concept of “joint play volume”, which combines both AP laxity and rotational measurements to enable more accurate correlations to be made with patient satisfaction following ACL reconstruction. He has devised an instrument that measures both rotation and AP laxity which highlights the move towards assessing both of these parameters in an objective fashion.

Several presenters discussed the ongoing issue of osteoarthritis and ACL injury and reconstruction. Scott Dye discussed the concept of the “osteoarthritis matrix”, while others presented different techniques for the early detection of articular cartilage injury.

Prof Fu’s fellows presented several papers on topics related to double bundle ACLR, including an anatomical study of the fetal ACL, a risk factor assessment of femoral fracture following the drilling of 2 femoral tunnels, and a paper on the minimum femoral tunnel length required to provide adequate AP stability (15mm).

The concept of ACL augmentation with a single AM or PL bundle was beautifully presented by Dr Ochi, from Japan, who demonstrated a novel method of reconstructing only the PL bundle by incising the intact AM bundle in line with its fibers to allow easy access to the site of the tibial tunnel for the PL bundle. Prof Andrew Amis presented an entertaining summary of his time as the first Breg/ACL Study Group traveling scientist.

Tuesday 28th March.

Dean Taylor started proceedings with an excellent randomized trial comparing patellar tendon and hamstring tendons, with the 2 year results essentially demonstrating no significant difference between the two.

Thomas Carter presented his honest results regarding thermal shrinkage of the ACL with the conclusion being that this procedure probably has very narrow indications in only acute injuries with mild laxity. It is probable that an increased

awareness of ACL injury patterns and the emergence of augmentation procedures will lead to these “partial tears” being managed more appropriately in the future.

Several papers were presented on computer assisted ACL reconstruction, with the consensus being that it is certainly a promising technique that probably helps reduce outliers with the current costs being longer operative time and the extra intraosseous pins required. Jason Koh, from Chicago, has started to utilize CAS as an intra and post operative assessment tool to objectively measure rotation and AP laxity with promising results.

The day was rounded out with an excellent round table discussion on the mechanisms and risk factors for ACL rupture and some preemptive strategies to reduce the risk. Programs that include plyometrics and strength training as well as biomechanical feedback seemed to have the greatest success in reducing the risk of ACL injury. Tim Hewett and Scott McLean both presented fantastic papers focusing on their current work.

Thursday 30th March.

David McGuire presented an excellent paper on revision ACL reconstruction, where as expected, most failures were as a result of technical errors. Consistent use of femoral and tibial guides may prevent a large percentage of these failures and the resultant meniscal and chondral injury that often results.

Karl Eriksson, in his laboratory and clinical study, described PCL impingement from a vertical graft as a cause of flexion loss and graft elongation.

Several papers were presented on tunnel widening. Marc Clatworthy presented a very elegant sheep study which suggested that radiological methods of evaluating tunnel widening may overestimate the actual degree of widening found histologically. In sheep, the tendon tends to integrate well close to the joint line, but atrophies away from the joint. Julian Feller stressed the importance of considering measurement error when analyzing bone tunnel enlargement and suggested there may in fact be a correlation between laxity and tunnel widening when this is taken into consideration.

Robert Arciero discussed the importance of maintaining, or even reducing sagittal tibial slope when performing an opening wedge osteotomy in the ACL deficient varus knee. Anterior plate placement directly leads to an increase in tibial slope with a significant posterior translation of tibio-femoral contact pressures into the region where the clinical “cupula” is located.

Tibial fixation was discussed in some detail. Stephen Howell presented a well designed study comparing joint line interference screw fixation with distal extracortical fixation. Joint line fixation did not restore AP laxity and stiffness as well as distal fixation. Don Johnson presented the preliminary results from his ongoing RCT comparing two types of concentrically placed tibial fixation devices, the Intrafix and Xtralok. Both devices have thus far adequately restored AP laxity and provided excellent patient satisfaction. Interestingly, for females, the Xtralok group demonstrated better AP stability than the Intrafix group, perhaps in part due to the cortical fixation it provides.

Kurt Spindler presented an excellent paper on the use of a collagen-plasma rich scaffold to stimulate healing of a central defect in canine ACL's. It served as a prelude to the round table discussion on primary healing of ACL tears.

Friday 31st March.

The final morning of talks concentrated largely on multiple ligament knee injuries. Chris Wahl presented his work on SAMP or single Achilles allograft MCL/PCL reconstruction, while Andrew Amis acted as a proxy in Andy Williams' absence and presented his paper on the importance of recognizing a fibular head avulsion fracture as a possible indicator of common peroneal nerve injury. This topic was discussed in detail during the final round table discussion on multiple ligament knee injuries.

Upcoming Meetings

- **AANA Spring Annual Meeting** Hollywood Florida May 17-21, 2006
contact www.aana.org

- **Esch Shoulder Course June 21-24, 2006. San Diego CA**
Contact www.shoulder.com
- **AOSSM Annual Meeting 29 June-7 July, 2006. Hershey PA**
contact www.aossm.org