THE TREATMENT OF KNEE LIGAMENT INJURIES

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AIMS

• ACL
• PCL
• MCL
• Lateral & Posterolateral Corner
• Multi-Ligament Injuries
• Take Home Messages
Anterior Cruciate Ligament

Natural History

- Does not heal after injury
- Resemble fibrocartilage cells not fibroblasts
Anterior Cruciate Ligament

Natural History

- If untreated
  - Instability
  - Complex Meniscal Tears
    - Not amenable to repair
  - Degenerative changes (Jomha et al 1999)
    - 90% on XR at 5-9 yrs
    - Medial > Lateral
Anterior Cruciate Ligament

Non-Operative Treatment

- Physio
- Closed chain exercises
- Satisfactory results in low demand patients (80% or more patients)
• **Aim**
  – Restore functional stability, without compromising ROM

• **Indications**
  – Symptomatic Instability
  – Unstable repairable meniscal lesion plus ACL insufficiency (Gilquist 1992)
  – Grade III MCL or LCL (Spindler and Walker)
  – ?To prevent OA (Shelbourne, Johnson)
    • No definite evidence
Anterior Cruciate Ligament

Operative Treatment

Patient Selection

• Young active individual

• Malalignment due to medial compartment OA
  • Missed associated patholaxities ie posterolateral corner

• Excellent predictable results in 90% plus


• Sport – 1 year
Anterior Cruciate Ligament

Other Factors

Occupation
People who spend a lot of time on knees eg carpet layers and tilers

Sports
Patellar tendinopathy, common in basketball and tennis players

Open Growth Plate
Several authors confirmed the safety of hamstring grafts across growth plates (Lo et al 1998)

Sex
Increased Risk of ACL injury
Hamstrings used due to ease of harvest, cosmesis, lack of PF problems, easier rehab.
BUT, results significantly worse in women wrt men (Noojin et al AJSM 2000)
Anterior Cruciate Ligament

Operative Treatment

Timing

- Critical in prevention of stiffness
- Need full ROM
- Minimal swelling and inflammation
- In practice around 2-4 weeks (Shelbourne 1991)
- But this could be in the first week (Johnson 2003)
Anterior Cruciate Ligament

Operative Treatment

Type of Surgery

• Direct repair
  • Avulsion Fractures

• Extra-articular Reconstruction

• INTRA-ARTICULAR RECONSTRUCTION
Operative Treatment

Type of Graft

• AUTOGRAFT
  Patellar tendon
  Hamstrings
  Quadriceps (Fulkerson)

• ALLOGRAFT
  Achilles Tendon
  Patellar Tendon

• SYNTHETIC
Operative Treatment

Anterior Cruciate Ligament

Type of Graft – BPTB

ADVANTAGES
• Early bone to bone healing (6/52)
• Consistant size and shape of graft
• Ease of harvest

DISADVANTAGES
• Anterior knee pain (upto 40%)
• Patellar tendonitis
• Fracture
• IBSN
Operative Treatment

Anterior Cruciate Ligament

Type of Graft – Hamstrings

ADVANTAGES
• Stronger and stiffer (3x normal ACL and 2x BPTB (Brown et al 2002))
• Less Donor site morbidity

DISADVANTAGES
• Slower tendon to bone healing (10-12/52)
• ?Fixation (in past) – now no difference in pullout strength or outcome (Pinczewski 1994, Weiler 1999)
• Saphenous nerve injury
• ?Hamstring weakness
Anterior Cruciate Ligament

Operative Treatment

Type of Graft – Quadriceps

ADVANTAGES
- Larger cross-sectional area of graft
- Less donor site morbidity than BPTB

DISADVANTAGES
- Bone block at one end
Anterior Cruciate Ligament

Operative Treatment

Type of Graft – Allograft

• ADVANTAGES
  • No donor site morbidity
  • Available off shelf

• DISADVANTAGES
  • Risk of disease transmission
  • Weak graft
  • Longer time to incorporate
  • Expensive
Operative Treatment

Side of Graft

• Ipsilateral

• **Contralateral** graft harvest of BTPB
  • 662 consecutive reconstructions
  • 3 yr period
  • Superior results up to 2 yrs in group who had graft harvested from contralateral knee
    (Shelbourne AJSM 2000)
Operative Treatment

Anterior Cruciate Ligament

Which Graft?

Metaanalysis Data

• Seems to back the use of BPTB
• Yunes (2001) Arthroscopy
  • 18% increased ability to return to sport at same level with BPTB

• Freedman et al (2003) AAOS
  • BPTB had better patient satisfaction, stability and lower failure rates
  • But increased anterior knee pain and MUA and lysis of adhesions
Anterior Cruciate Ligament

Operative Treatment

Which Graft?

Metaanalysis Data

• Various flaws with metaanalyses in general

• Initial poor fixation methods of Hamstrings perhaps influenced results

• Now superior fixation methods

• “No difference in ability to get back to Australian Rules Football” Bartlett et al 2001
Anterior Cruciate Ligament
Operative Treatment

Which Graft?

Randomised Controlled Trials
• “No difference at 2 years between BPTB and Hamstrings”
  • Janssen et al AAOS 2003

• “No difference in Lysholm, single hop, Tegner, IKDC, ROM or subjective knee pain or ability to knee walk at 2 years” “Significant difference with respect to objective knee pain and ability to knee walk”
  • Ejerhed et al AAOS 2003
  • O’Neill et al JBJS (Am) 2001
  • Aglietti et al 2000, Marder et al, 1999
Anterior Cruciate Ligament

Operative Treatment

Which Graft?

Hamstrings have less complications with similar functional results and better rehabilitation
In terms of functional success graft choice is not critical.

The most important factor is correct placement of tunnels and adequate fixation of the soft tissues.
Femoral Tunnel
• 11 O’Clock in right knee,
• 1 O’Clock in left knee,
• At back of the intercondylar notch.

If too **anterior**
• Restriction of flexion,
• Permanent loss of motion,
• Graft failure due to stretching.
Anterior Cruciate Ligament

Operative Treatment

The Operation

Tibial Tunnel
• Posterior 1/3 of the ACL tibial footprint

If too anterior
• Block to extension,
• Impingement,
• Graft Rupture.

• After fixation of one end of the graft, need to cycle knee thru full ROM to ensure no XS graft movement or impingement
Operative Treatment

Anterior Cruciate Ligament

Technical points

Commonest problems with BPTB is related to harvesting graft

Best results by harvesting via 2 transverse incisions

(Sivardeen et al 2004)

Boat shaped bone graft prevents # patella (Johnson 2003)
Anterior Cruciate Ligament
Operative Treatment
Technical points

Care with Hamstrings
Cut bands to gastrocnemius

The Dropped Graft
Anterior Cruciate Ligament
Operative Treatment

Other Factors

• Age and Degenerative changes should not be contraindication (Shelbourne AJSM 1993)

• No real difference between arthroscopic and mini-arthrotomy technique (Shelbourne Arthroscopy 1993)

• No need for routine thromboprophylaxis

• Important for short time on waiting list (Shelbourne AJSM 2000)

(Best Practice BOA 2001)
Critical to optimise results of surgery and prevent complications.

Pre-op

- Optimise ROM, proprioception and strength

6/52

- Pre-Gym: Swelling and ROM

6/52-3/12

- Gym: Strength and Proprioception

3/12-6/12

- Functional Phase

6/12-12/12

- Return to Sport
• Does have the intrinsic ability to heal

• MRI study looking at PCL injuries acutely and at ave of 3.2 years, showed all partial and most complete (86%) regained continuity
  – (Shelbourne AJKS 1999)
The time to healing unknown, but the development of a firm endpoint and painless posterior drawer ~ 2/52 (Shelbourne AJSM 1999)

68% returned to pre-injury level of sport at ave of 6/52 post injury and 80% satisfied with function (Parolie 1986)
Thus the PCL shows good clinical and radiological evidence of healing.
• 80-90% of PCL injuries associated with Postero-Lateral Corner injuries (Cosgarea JAAOS 2001)

• Important
  P/L Corner injuries will stretch PCL repair
  P/L corner injuries do significantly better with early operative treatment
Posterior Cruciate Ligament

Non-Operative Treatment

Isolated Partial Tear (Gd I or II)

- Splint Briefly
- Protected WB followed by early ROM and quads strengthening rehabilitation program
- Expect return to sport by ~4/52
Non-Operative Treatment

Isolated Complete Tear (Gd III)

- Splint in full extension 2-4/52
  - Decreases tension in A/L bundle
  - Minimises antagonistic effect of the hamstrings

- Early rehab – ROM and Quads
- Later - Hamstrings
Posterior Cruciate Ligament

Operative Treatment

Indications

• Displaced Bony Avulsion

• Functionally Unstable Knee

• Multi-Ligament Injury
Operative Treatment

**Posterior Cruciate Ligament**

- Most authors would repair (Cosgarea JAAOS 2001)
- Usually involve tibial insertion and can be seen on lateral XR
- Posterior approach, pt prone and screw it in (?washer)
- Once healed (6-8/52) – aggressive rehabilitation
Operative Treatment

Posterior Cruciate Ligament

- Suture Repair
- Single Bundle Reconstruction
- Double Bundle Reconstruction
- Tibial Inlay

Functionally Unstable
Operative Treatment

Posterior Cruciate Ligament

Functionally Unstable

- For insertion site avulsions
- Acute period (less than 3/52)
- Avulsion from femoral site
- Non-absorbable sutures and drill holes
- Not for Mid-substance

Suture Repair
Operative Treatment

Posterior Cruciate Ligament

Functionally Unstable

- 1 Femoral Tunnel
- At site of A/L bundle
- Most patients have functional improvement, but there is often some clinical laxity (Cosgarea JAAOS 2001)

Single Bundle Reconstruction
Posterior Cruciate Ligament

Operative Treatment

Functionally Unstable

- Replaces both A/L and P/M bundles
  - Biomechanically superior
  - But difficult operation

- Technically 2 tunnels at femur, both grafts routed through 1 tibial tunnel

- Limited Results

Double Bundle Reconstruction
Posterior Cruciate Ligament
Operative Treatment
Functionally Unstable

• Berg et al Arthroscopy 1995

• Avoids problems of long tibial tunnel
  • Graft round sharp angle
  • Neurovascular structures

Tibial Inlay
Medial Collateral Ligament

Natural History

• Cells Characteristic of fibroblasts
• Intrinsic ability to heal
Medial Collateral Ligament

Natural History

- Animal models show MCL can heal with scar tissue structurally similar to the strength and stiffness of the native MCL (Anderson et al 1992)

- Proximal tears
  - Heal very quickly
  - Can lead to joint stiffness and decreased ROM compared with distal tears
  - Related to vascularity (Robins et al AJSM 1993)
Prolonged immobilisation leads to poor results

Due to

- Loss of collagen fibre orientation
- Decrease in strength of the bone-ligament junction (Woo et al 1990)
Medial Collateral Ligament

Treatment

• Minimal immobilisation

• Protected early ROM

• Operative treatment no better than Non-operative treatment (Sandberg et al 1987)

• May need operative reconstruction in the multi-ligament injury and symptomatic instability
Lateral Collateral Ligament

Treatment

• Isolated injuries uncommon

• Treatment generally non-operative

• Operative Treatment controversial
  • Combination injuries
  • Symptomatic instability – often associated P/L
Postero-lateral Corner

Introduction

• Important group of injuries
• Often missed even by the experts
• Significant morbidity
• Lack of static posterolateral structures at foot strike combined with convex opposing surfaces of LFC and LTC leads to lateral compartment opening even in normal gait

• Significant disability

• If not picked up with concurrent ACL or PCL injury leads to failure of these grafts (Harner AJSM 2000)
Postero-lateral Corner

- Lateral Collateral Ligament (varus opening)
- Popliteus Muscle and Tendon Complex (posterolateral rotation)
- Arcuate Ligament
- Popliteofibular Ligament Complex (external rotation)
- Lateral capsular ligament (varus opening)
- Long and short head of biceps
- Iliotibial Band
Grade 1–2 Injuries (Partial Tears)

Non-operative
Knee immobiliser in full extension for 3-4/52
Quads
After 3-4/52 – ROM
Closed chain quads
Active hamstrings only after 6-10/52
Grade 3 Injuries (Full Tears)
Operative (Kannus AJSM 1989)
Early repair <3/52 (Laprade 1997)
Anatomic repair of Individual Structures
Suture to bone, anchors, augmentation
Grade 3 Injuries (Full Tears)

If immobilise post-op do so in 60 degrees of flexion and in IR for 3-6/52
Quads and closed chain exercises
Avoid hamstrings for 4/12 post-op
Postero-lateral Corner

Treatment

Critical to assess alignment
Full length AP XR

If normal alignment
   – Anatomic repair or reconstruction with allograft or autograft

If varus
   - ? HTO
   - Then reassess
Multi-Ligament Injuries

Assessment

? Dislocated

? Dislocated and reduced
  Bruising swelling below knee (capsular injury)

Neuro-Vascular Status
  upto 50% (Miller)
  ?Intimal Tear
  ?Need for angiogram
Assessment

Multi-Ligament Injuries

MRI

Wait 1-2/52

Vascular monitoring
Post-operative stiffness
Capsular healing (arthroscopically assisted)

Limited use of the pump
Fluid extravasation
Controversial with injuries affecting involving medial side

More consensus when affecting lateral side, and both medial and lateral sides
Multi-Ligament Injuries

Shelbourne (2001)

PCL and MCL can heal
Risk of arthrofibrosis in knee
(do not do both ACL and PCL acutely)

Let MCL heal, Tx in hinged brace
Rehab - ROM and quads
Reassess
?ACL reconstruction later if required
Shelbourne (2001)
If MCL does not heal
Tx at time of ACL Reconstruction

Do not reconstruct PCL acutely unless at least 2+ laxity
Multi-Ligament Injuries

Harner (2001), Fanelli (2001)
Wait 1-2 weeks

Repair all structures
ACL/PCL/MCL

Early ROM
Multi-Ligament Injuries

Treatment

Posterolateral corner injuries do poorly unless addressed acutely
Need to reconstruct all other ligaments acutely

Richmond (2001)
Reconstruct posterolateral corner early
Address cruciates later
Multi-Ligament Injuries

Treatment

Fanelli (2001)
Repair and reconstruct all ligaments and go for early ROM

Richmond (2001)
Reconstruct posterolateral corner early
Let MCL to heal by bracing
Address cruciates later
Take Home Messages

Treatment of ACL - physio then ?op if still symptomatic

In future – Operation for almost anyone with an ACL rupture
Take Home Messages

Critical to assess alignment and other evidence of ligament laxity
Take Home Messages

Type of Graft is not crucial, but position is ...
Take Home Messages

Most PCL and MCL injuries treat non-operatively
Postero-lateral corner needs to be identified and treated early

If chronic think osteotomy
Multi-ligament Injury Think Vascular

Can Go for Aggressive or Relatively Conservative Approach
Thank You