Pediatric ACL Reconstruction

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Typical day in the office...

- 11-year-old male ‘elite’ soccer player
- Collided with another player and twists his knee 1 week prior.
- Immediate knee swelling and pain.
- Reports feelings of knee instability
- On exam:
  - Moderate effusion
  - Positive Lachman’s and Pivot Shift
  - Negative Dial test
  - Negative McMurray test
- Next steps:
  - Radiographs
  - MRI
Radiology
- Plain films: rule out osseous injury
- MRI: evaluate ACL and possible additional injuries
- Bone Age film

Operative Treatment:
- High level athlete
- Participates in sports that require pivoting and cutting
- Reports feelings of instability
- Decreases risk of additional knee injuries

Decision making driven by age...

Skeletal age (Bone Age Film)
- Immature
  - Open physes with significant growth remaining
    - Girls <12
    - Boys <14
- Transitional
  - Girls 12-14
  - Boys 14-16
- Mature
  - Girls >14
  - Boys >16

And associated Injuries.
- Meniscal tears
- Osteochondral injury
ACL Immature- Physeal Sparing Approach

Iliotibial band technique

A. Harvest iliotibial band proximally leave attached distally
B. Redirect graft around lateral femoral condyle
C. Pull graft posterior to anteriorly through the femoral notch
D. Sow graft under intermeniscal ligament

No Tunnels!

Soft Tissue Graft Technique

Tibial tunnel

- Steeper anteriorly
- Shallower angle on lateral to avoid physs
- More vertical on AP

Femoral tunnels

- Horizontal tunnel in femur
- Avoid physs on AP and lateral views
- Exit in notch
  - Left 2-3 o'clock
  - Right 9-10 o'clock

ACL Immature- Physeal Sparing Approach

Bone Age

- Girls (11)12-14
- Boys (13)14-16

Soft tissue graft

- Most common hamstrings
- ≤ 8 mm tunnels
- Centralized tunnels
- Minimize risk of angular deformity
**ACL Transitional-Technique**

**Tibial Tunnel Placement**
- 7mm in front of the PCL in ACL footprint
- Tibial guide set @ 50-55 degrees (Sag)
- More vertical than standard technique

**Femoral Tunnel Placement**
- Femoral tunnel 2mm off back wall
- More vertical
  - Right 11 o’clock position
  - Left 1 o’clock position

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**ACL Mature- Technique**

- Allograft
  - Bone patellar tendon bone
  - Hamstrings
  - Anterior tibialis tendon
  - Achilles tendon
  - Quadriceps Tendon
- Autograft
  - Bone patellar tendon bone
  - Hamstring
  - Quadriceps

**ACL Mature- Technique**

- Tibial tunnel
  - Posteriomedial aspect of the ACL footprint
  - Adjacent to the slope of the medial eminence
  - Along a line extended from the posterior border of the anterior horn of the lateral meniscus
  - 7mm in front of the PCL
  - Tibial guide set @ 50-55 degrees (Sag) ACL foot print
ACL Mature - Technique

• Femoral tunnel
  • Notchplasty +/-
    • Visualization
    • Minimize graft impingement
  • 2mm off back wall
  • Right 10-11 o'clock position
  • Left 1-2 o'clock position

ACL Complications - Skeletally Immature

1. Growth Arrest
   1. Longitudinal
   2. Angular deformity
2. Technical errors
3. Failure of graft fixation
   1. Failure of incorporation
   2. Tunnel widening
   3. Failure of hardware
   4. Graft instability
   5. Cystic degeneration
4. Traumatic Failure
   1. Return to activity before complete graft incorporation
5. Associated Ligament Deficiencies
6. Arthrofibrosis

• Growth Arrest
  • Longitudinal
  • Angular deformity
• Centralizing tunnels
  • Minimizes risk of angular deformities
  • Less anatomic positioning increases risk of re-rupture

Loss of Fixation
• Loss of endobutton fixation
• Clinically stable
ACL - Technical Complications

Technical errors in tunnel placement

- Tibial tunnel
  - Too anterior
  - Too posterior
  - Instability with flexion
  - Too vertical
    - Rotational instability

- Femoral tunnel
  - Too anterior
  - Restrictions flexion
  - Elongates graft
  - Too vertical
    - Impingement on PCL
    - Rotational instability
  - Too lateral
    - Impingement on lateral condyle

ACL - Other Complications

Patellar Fracture

- Traumatic fracture of patella after bone-patellar-bone
- Required ORIF to repair

Outcomes

- Low rate of complications
  - Kocher et al 2002
    - Survey of the Herodicus Society and the ACL study group reported 15 cases of growth arrest or angular deformity.
  - Vavken and Murray 2011
    - Systematic review of pediatric ACL complications where at least one tunnel crossed the physeal, found 5 of 479 patients or 0.1% with a growth arrest, angular deformity or limb-length discrepancy.
  - Baldwin et al 2013
    - Meta-analysis of non-operative vs operative treatment of pediatric ACL injuries
      - 86% of operative patients returned to sport
      - 13% of operatively treated patients reported residual instability

ACL Reconstruction does guarantee no re-tears!

- 16+7 mth old male 13mths l/p left ACL reconstruction with autograft hamstrings
- Tackled in football
- Re-presents with effusion and instability
Conclusion

- Surgical reconstruction has low risks and good outcomes.
- Families and patients must be aware of the possibility of physeal injury.
- Return to play more likely with surgical reconstruction

References


THANK YOU