POSTEROLATERAL CORNER KNEE INJURIES

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OUTLINE

• Case
• Background
• Anatomy
• Biomechanics
• Clinical/Radiographic Evaluation
• Treatment
• Case

CASE PRESENTATION

• 17yo male s/p bicycle crash into tree
• CC: L-knee pain, swelling
• PMH: None
• PSH: None
• Meds: None
• Allergy: NKDA
PHYSICAL EXAM

- Significant swelling L-knee
- Motor: 0/5 TA, 0/5 EHL
- Sensory: Decreased sensation over dorsum of foot
- Pulses: ABI: PT > 1, DP>1
- (+) Lachman’s, (+) anterior/posterior drawer
- (+) unstable to varus stress, (+) posterolateral drawer

X-RAYS

MRI
BACKGROUND

- Multi-ligamentous knee injuries account for less than 1% of all Orthopaedic injuries
- Isolated PLC injuries account for less than 2% of acute knee ligament injuries
- Injuries to the posterolateral corner are infrequent, often missed injuries
- These multi-ligamentous injuries are often the result of knee dislocations, which may present after spontaneous reduction

ANATOMY

- Four primary ligamentous stabilizers of the knee
  - Cruciate ligaments
    - ACL
    - PCL
  - Collateral ligaments
    - MCL
    - LCL
ANATOMY

- Posterolateral corner (arcuate ligamentous complex)
- Lateral collateral ligament
- Popliteus tendon
- Popliteofibular ligament
- Posterolateral capsule

ANATOMY

- **LCL**
  - Primary static restraint to varus opening of the knee
  - Femoral insertion proximal and posterior to epicondyle
  - Popliteofibular ligament
    - Course distally and laterally to insert on fibular styloid process

ANATOMY

- Popliteus tendon complex
  - Tendon and its ligamentous attachments to the fibula, meniscus, and tibia
  - Muscle originates on posteromedial proximal tibia
  - Tendon is intraarticular
  - Inserts on the popliteal saddle on the LFC
  - Anterior and distal to LCL by a mean distance of 18.5 mm
ANATOMY
- Additional structures providing stability
  - ITB
    - Blends into SHB to form anterolateral sling
  - LHB and SHB
  - Fabellofibular ligament
  - Lateral capsule
  - Lateral meniscus

BIOMECHANICS
- Structures of the PLC function to resist
  - Varus
  - External tibial rotation
  - Posterior tibial translation

ANATOMY
- Common peroneal nerve injury reported in up to 40% of knee dislocations
- Vascular injury in up to 40% of knee dislocations
- Ultra-low velocity knee dislocations in obese – higher incidence
- Approximately 10-15% amputation rate in patients with knee dislocations
**CLINICAL EVALUATION**

- **History/MOI**
  - Mechanism: Knee dislocation, impact to anteromedial knee
  - Posterolateral directed blow to the anteromedial tibia with resultant hyperextension
  - Direct blow to flexed knee
  - High-energy trauma
  - Varus-aligned limb
  - "Dislocated knee"

**BACKGROUND**

- Knee dislocation must always be considered
  - NV exam
  - Attention to popliteal vessels and peroneal n.
  - ABI and vascular states considered
  - Lateral dislocation or injury-peroneal nerve injury
  - LCL or PLC injury
  - Associated injuries
  - Evaluate limb alignment and gait

**CLINICAL EXAM**

- Thorough neurovascular exam
  - Ankle-brachial index (ABI)
  - Sensory/Motor exam
  - Ligamentous exam
    - Dial test
    - Posterolateral drawer test
    - Reverse pivot-shift
CLINICAL EVALUATION- POSTEROLATERAL CORNER

- Injuries are often combined
  - PCL most common
- Knee dislocation must always be considered
  - NV exam
  - Attention to popliteal vessels and peroneal n.
  - ABI and vascular studies considered
- Evaluate limb alignment and gait
  - Varus alignment
  - Varus or hyperextension thrust

IMAGING

- Plain films are often normal but may demonstrate an avulsion injury
  - Standing long-leg films in the setting of a chronic injury to rule out malalignment
  - Arthritic changes not uncommon in the chronic setting
- MRI is the imaging of choice
  - PLC injuries are rarely isolated so be mindful to examine for concomitant pathology
CLASSIFICATION

Isolated Posterior lateral Corner injury
- Grade I: 0-5mm of lateral opening and minimal ligament disruption
- Grade II: 5-10mm of lateral opening and moderate ligament disruption
- Grade III: >10mm of lateral opening and severe ligament disruption and no endpoint

SCHENK’S CLASSIFICATION
- KD 1 - ACL or PCL injury + collateral injury
- KD 2 - ACL/PCL only
- KD 3 - ACL/PCL + Medial or Lateral injury
- KD 4 - ACL/PCL + Medial and Lateral injury
- KD 5 - Multi-ligamentous injury with fracture

NONSURGICAL MANAGEMENT
- Crutches & hinged knee brace in extension for 4-6 weeks
- Progressive ROM, weightbearing, & strengthening
- Full return to activity at 3-4 months
- Grade I & II injuries
  - Good results with early mobilization
  - Minimal radiographic changes at 8 years
- Grade III
  - Poor functional outcomes, poor strength, persistent instability
  - ~50% had radiographic changes in medial & lateral compartments
  - Grade II & III treated surgically had improved varus stability & improved functional outcomes

TREATMENT
TREATMENT

- Acute surgical intervention provides more favorable results to late reconstruction
  - Direct repair with/without augmentation
  - Primary reconstruction
- Late reconstruction
  - Pericapsular scarring makes visualization of structures difficult
  - Chronic injury associated with capsular stretching

TIMING OF SURGERY

- Early (up to 3 weeks after injury)
  - Easier identification of structures if repairable
  - Less risk of arthrofibrosis
  - Less risk of infection
  - In cases with external fixation
- Late
  - Decreased swelling
  - Capsular healing if performing arthroscopy
  - Scarring / adhesions
  - Stretching of intact components

REPAIR VERSUS RECONSTRUCTION

- Common / classic teaching:
  - Repair if there is good tissue & can operate within 3 weeks
  - Repair ligament and tendon bony & soft tissue avulsions
    - Posterior avulsion of bone
    - LCL / PFL / Biceps femoris avulsions of bursal head
    - IT band avulsion off Gerdy's tubercle
    - Mid-1/3 lateral capsular ligament
  - Combination of repair & reconstruction when done within 3 weeks
REPAIR VERSUS RECONSTRUCTION
  - 57 knees (56 patients) with minimum 24-month follow-up
  - 44 (77%) with multiligamentous injury
  - Repair those with adequate tissue quality, done <3 weeks
  - Early motion rehabilitation protocol
  - Failure rate (p=.03)
    - Reconstruction 9% (2/22)
    - Repair 37% (13/35)
      - 11/13 sustained mid-substance tissue stretch / failure
      - Successful reconstruction in 14 pts with failed initial treatment
  - Overall reconstruction failure 5% (1/20)

REPAIR VERSUS RECONSTRUCTION
  - 28 knees included in study
    - 10 with repair then staged cruciate reconstruction
      - Average f/u 34 months
    - 18 simultaneous reconstructions (FCL/PLC & cruciates)
      - Average f/u 28 months
  - Failure rate (p=.04)
    - Repair 40% (4/10)
    - Reconstruction 6% (1/18)
  - Conclusion: reconstruction of PLC is more reliable than repair alone in the setting of MLI

TECHNIQUE – LARSEN
- Non-anatomic, fibular-based approach
  - Larsen MW,Monitor AR, Noorman CT J Knee Surg 2005
- Graft
  - Semi-tendinous autograft
- Fibular tunnel
  - Sagittal tunnel through fibular head
- Femoral fixation
  - Screw and washer between LCL & popliteal attachments
    - No issue with tunnel convergence
  - Graft passed through fibula, around screw in figure of 8, back through fibula, and around screw again
TECHNIQUE - LAPRADE

  - Graft: two-bailed, split Achilles and two 9 mm x 25 mm screws bone plugs
  - Reconstructs FCL, PFL, and popliteus tendon
  - Fibular tunnel
    - ACL drill guide to lateral fibular head at FCL attachment site
    - Exit point posteromedially at PFL attachment site
    - Drill guide pin, ream to 7 mm, and chamfer edges

GRAFT SELECTION

- Autograft
  - Pros
    - No risk of disease transmission
    - No significant additional cost
    - Well-documented healing, vascularization
    - May select ipsilateral or contralateral donor site
  - Cons
    - Donor site morbidity
    - Increased operative time

- Allograft
  - Pros
    - No donor site morbidity
    - Smaller / less incisions
    - Decreased operative time
    - Still available in revision cases
  - Cons
    - Cost
    - Availability
    - Infection risk
      - HIV 1 in 1,667,600 (Buck et al)
      - Bacterial / fungal – CDC recommends antibiotic / antifungal wash, specifically those effective against bacterial species
      - Biomechanical characteristics
APPROACH
• Posterolateral approach to knee
  • Supine, knee flexed to 90 degrees (relaxes peroneal nerve)
  • Longitudinal or slightly curved skin incision
    • May be in line with fibular head or about halfway between fibular head & Gerdy's tubercle
  • Incise deep fascia

APPROACH
• Identify long head of biceps femoris
  • ID peroneal nerve on posterior border and decompress from proximal to distal if performing neurolysis
  • Bluntly dissect anterior to lateral head of gastrocnemius

APPROACH
• Identify FCL (or remnant of FCL) on anterior portion of fibular head
  • Dissect proximally & posteriorly to identify femoral origin
  • Identify popliteus
  • Deep to FCL in hiatus
  • Identify PFL
    • Courses from posterior fibular head to popliteus tendon at approximately 30-degree angle
    • Bluntly dissect between peroneal nerve and biceps femoris to access posterolateral fibia
  • For reconstructions utilizing tibial tunnel
REHABILITATION

- Rehabilitation
  - Hinged knee brace in extension for 2 weeks with TTWB
  - Diminishes pull of gravity & hamstrings
  - Unlock for ROM, closed chain mini squats, quad sets, & SLR
  - PROM at 2 weeks or after ex-fix removal
    - Goal: 90 degrees of flexion by 6 weeks
    - Consider MUA at this point (~20% of their patients)
    - Discuss MUA prior to initial operative management
  - Progress ROM & discontinue brace

COMPLICATIONS

- Peroneal nerve injury
  - Assess preoperatively & document
  - 12-17% of cases
  - Prevent by identifying the course of the nerve in the operative field & protecting
- Persistent laxity
  - Perform thorough physical exam and ID concomitant injuries
  - Understand anatomy & perform anatomic reconstruction
- Tunnel convergence
  - 0 degrees in the coronal plane, max of 40 in the axial plane, and limit lateral tunnel depth to 25mm at the max

COMPLICATIONS

- Compartment syndrome
  - Fluid extravasation during arthroscopy
- Vascular injury
  - More so with concurrent PCL reconstruction
- Persistent knee pain
- Traumatic OJD
- HO
- Arthrosis – particularly if done acutely with ACL/PCL
- Malalignment - varus
CASE
- Planned for staged reconstruction of PLC and cruciates
- First stage
  - Exploration of common, superficial, deep peroneal nerves
  - Lateral-sided reconstruction
    - Primary repair of posterolateral corner capsule
    - LCL reconstruction
    - ORIF fibular head avulsion fracture
FOLLOW-UP

• Most recent follow-up (07/12/18); POD 17
• Incisions well-healed, staples removed
• 4/5 EHL, 4/5 TA
• Sensation improved in dorsum of foot, but still with paresthesia

SUMMARY

• Posterolateral corner knee injuries are uncommon in isolation, but in the setting of a multi-ligamentous knee injury are critical to diagnose and treat
• Pre-op: Thorough neurovascular exam due to possibility of nerve or vascular injury in knee dislocations
• Reconstruction or repair with augmentation preferred

SOURCES


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