Management of Knee Injuries: An Evidence Based Update

Management and Myths of Ligamentous Injury

Kenneth G. Swan, Jr., M.D.
Clinical Assistant Professor
Rutgers Robert Wood Johnson Medical School
June 1, 2019
# Levels of Evidence

<table>
<thead>
<tr>
<th>Level</th>
<th>Example of Evidence</th>
</tr>
</thead>
</table>
| **Level 1**     | Meta-analysis of Homogenous RCTs  
Randomized Control Trial                                                         |
| **Level 2**     | Meta-analysis of Level 2 or  
Heterogenous Level 1 Evidence  
Prospective Comparative Study                                                      |
| **Level 3**     | Review of Level 3 Evidence  
Case-control Study  
Retrospective Cohort Study                                                          |
| **Level 4**     | Uncontrolled Cohort Studies  
Case Series                                                                           |
| **Level 5**     | Expert Opinion  
Case Report  
Personal Observation                                                                |
| Foundational Evidence | Animal Research  
*In Vitro* Research  
Ideas, Speculation                    |
Knee Ligaments

- MCL
Knee Ligaments

- MCL
  - Posteromedial Corner (PMC)
Knee Ligaments

- MCL
  - Posteromedial Corner (PMC)
- LCL
Knee Ligaments

- **MCL**
  - Posteromedial Corner (PMC)
- **LCL**
  - Posterolateral Corner (PLC)
Knee Ligaments

- MCL
  - Posteromedial Corner (PMC)
- LCL
  - Posterolateral Corner (PLC)
- PCL
Knee Ligaments

- MCL
  - Posteromedial Corner (PMC)
- LCL
  - Posterolateral Corner (PLC)
- PCL
  - 2 bundles, Anterolateral (AL) and Posteromedial (PM)
Knee Ligaments

- MCL
  - Posteromedial Corner (PMC)
- LCL
  - Posterolateral Corner (PLC)
- PCL
  - 2 bundles, AL and PM
- ACL
Knee Ligaments

- MCL – Posteromedial Corner (PMC)
- LCL – Posterolateral Corner (PLC)
- PCL – 2 bundles, AL and PM
- ACL – Anterolateral Ligament (ALL)?
Medial Collateral Ligament (MCL)

- Superficial MCL
- Posterior oblique ligament
- Deep MCL
- Oblique popliteal ligament
- “PMC”
- [Semimembranosis]
MCL

• Injury: valgus force, typically contact injury (~75%)
• Medial based pain
• Difficulty with WB
• If isolated injury, no effusion
• Pain/laxity to valgus stress testing (30*)
MCL

• Injury Severity Grading
  – Grade I
    • MCL focal tenderness, minimal to no laxity; structures strained but intact
  – Grade II
    • Diffuse MCL tenderness, + laxity in 30° flexion, with endpoint; tearing of sMCL
  – Grade III
    • Significant tenderness and swelling, gross laxity, no endpoint at 30°, laxity in full extension, + anteromedial rotatory instability in 90° flexion; tearing of sMCL and PMC
MCL Injury: Management

- R-I-C-E
- Protected WB prn
- Immobilization?
  - Animal studies show increased collagen mass and improved biomechanical properties if early ROM utilized over immobilization***

MRI if severe/add’l injuries suspected
MCL Injury: RTP

- Grade I
  - <1-2 weeks
- Grade II
  - 2-4 weeks
- Grade III
  - ~6 weeks
  - Pending additional injuries
  - ~75% have add’l injury, most commonly ACL
    - Kovachevich, KSSTA, 2009
MCL Reconstruction

Ligaments reattached using suture anchor

POL (graft)

sMCL (graft)
MCL repair vs reconstruction

- Dong, *Arthroscopy*, 2015
  - Level 2 study
  - Better objective results with reconstruction, similar subjective scores

- Wijdicks, *AJSM*, 2013
  - Anatomic, biomechanical study
  - Equivalent results between “anatomic” repair and reconstruction

- Bottom line: No high-level evidence to support reconstruction over repair. However, many surgeons prefer repair for acute avulsions; reconstruction favored over repair in sub-acute and chronic situation
Lateral collateral ligament (LCL)

- PLC (posterolateral corner)
  - Lateral collateral ligament
  - Popliteus tendon
  - Popliteal fibular ligament (arcuate ligament)
LCL/PLC

- Injury: Direct varus force and/or hyperextension injury
- Usually (~75%) in combination with cruciate injury*
- Biceps, fibular head, ITB, peroneal nerve often injured as well
- Popliteal artery
LCL/PLC Injury

- Exam: lateral swelling and tenderness over LCL
- Laxity to varus stress in 30° flexion, and in extension (Grade III)
- + Dial test
  - Prone, 30 degrees flexion, check ER
LCL/PLC Injuries: Management

• Grade I
  – LCL sprain; non-operative, RICE, early ROM
• Grade II
  – Similar to Grade I, longer recovery, Rare
• Grade III
  – High Energy injury
  – Typically additional [major] injuries
  – Needs surgery to LCL/PLC in addition to other injured structures
LCL/PLC
LCL/PLC Repair vs Reconstruction

• Late: >3-4 weeks; Reconstruction
• Early: <3-4 weeks
  – Avulsions can be repaired
  – Several studies show better results with reconstruction vs repair, even in early stages, even with avulsions
    • 37% failure rate in repair vs 9% in reconstruction group

PLC repair?
LCL/PLC Reconstruction
Posterior Cruciate Ligament (PCL)
PCL Injury

• Mechanism:
  – direct blow to proximal tibia (helmet, dashboard)
  – Hyperextension
  – Hyperflexion

• Can go undiagnosed for years

• Often not as dramatic or symptomatic as an ACL tear
PCL: exam

• ISOLATED PCL INJURY
  – FROM; ABLE TO SLR
  – MAY HAVE PAIN WITH HYPEREXTENSION
  – LOOK FOR POSTERIOR SAG IN THE FLEXED KNEE
  – + POSTERIOR DRAWER
  – DON’T GET FOOLED BY “FALSE LACHMANS” OR “FALSE ANTERIOR DRAWER”
  – SHOULD NOT HAVE VARUS/VALGUS INSTABILITY
  – CHECK ROTATION WITH DRAWER TESTING (ALWAYS!) AND WITH SUPINE AND PRONE DIAL TEST

www.UOANJ.com
PCL Grading

- **PCL Instability Grade**
  - I: <5mm, still anterior to femoral condyles
  - II: 5-10mm, even with femoral condyles
  - III: >10 mm, posterior to femoral condyles
PCL Injury

• Grade I
  – Minimal posterior translation on posterior drawer
  – PT

• Grade II
  – Moderate posterior translation on posterior drawer
  – PT, expectant management, RTP in 3-4 weeks

• Grade III
  – Significant posterior translation on posterior drawer
  – HIGH INCIDENCE OF ADDITIONAL INJURY; RARE TO HAVE ISOLATED GRADE III PCL
PCL Reconstruction

- Autograft vs Allograft
- Technically more demanding and dangerous than ACLR
- More often in combination with multi-ligamentous repair
PCL Controversies

• Operative vs Non-Operative for isolated Grade III injuries

• Single bundle vs Double Bundle

• Transtibial (arthroscopic) vs Open Inlay technique

CONSISTENT LEVEL I/II DATA IS LACKING
Anterior Cruciate Ligament (ACL)

- Relatively common injury
- 70% Non-Contact
- More common in females (~3-6x more common)
- Meniscal injuries common (~50%)
  - Acute: lateral meniscus
  - Chronic: medial meniscus
ACL bundles (AM, PL)
ACL Risk Factors

- Female Gender
- Family Hx
- Notch Width
- Posterior tibial slope
- ACL size
- Ligamentous laxity
- High BMI
- Jump landing mechanics
- Hormonal
- Playing Surface

PRIOR ACL INJURY

Smith, *SportsHealth*, 2012
ACL Risk Factors
ACL Re-Injury

• Not uncommon to have repeat ipsilateral or contralateral ACL injury

• Rates vary from 5-30%

• Allograft much higher (~4x) risk of re-injury

• Highest risk is in Young, Active, Female, cutting/pivoting sport athletes

  • Shelbourne, AJSM 2009 (LEVEL II)
  • Paterno, AJSM 2014 (LEVEL II)
  • Wiggins, AJSM 2014 (LEVEL II)
  • Andernod, AJSM 2015 (LEVEL II)
ACL Myths/Controversies

• “Double bundle ACLR is better than single bundle”

• “The Anterolateral Ligament is the reason why my ACL keeps failing”

• “ACL Suture Ligament Augmentation is the wave of the future”
ACLR: Double Bundle vs Single Bundle

- Mayr, *Arthroscopy*, 2018
  - Prospective, RCT
  - Level I
  - 53 patients; 5 year f/u
  - Findings:
    - **No difference** in Subjective or Objective scores
    - **No difference** in Osteoarthritis at 5 years

- Most similar studies agree---a few show more objective stability with DB, but no difference in subjective scores
Anterolateral Ligament

- ALL: Capsular expansion that runs from the lateral epicondyle to lateral tibial plateau
- Early descriptions including by Segond, 1879
- May play a role in rotatory instability, pivot shift
- ALL reconstruction in combination with ACLR now advocated by some

www.UOANJ.com
NY Times 2013

*ALL Articles:*
- 2000-2012: Zero
- 2012-2016: One
- 2016: 45 Articles

All Level IV or V
No RCT, No prospective

Moroz, *Clin Sports Med* 2018

- **Anatomic:**
  - The ALL is a distinct ligament
  - ALL in males 2x as thick as females!

- **Biomechanical:**
  - ALL is a Secondary stabilizer to internal tibial rotation and pivot shift

- **Clinical:**
  - ACL+ALL may have increased pivot shift, but confounding factors (meniscus, increased tibial slope) not accounted for in studies

- **Conclusions:** ALL reconstruction or tenodesis during ACLR have NOT been shown to improve clinical outcomes or decrease ACL re-tear rates [but may be considered in some highly unstable, ligamentously lax re-tears]

- **LEVEL V Opinion Paper**
  - “Expert Group”: 13 international surgeons, *8 paid consultants*
ACL repair with “Suture Augmentation”

• aka “Internal Bracing” or “Bridge Enhanced ACL”
• Early results: 53% re-injury rate at 5yrs f/u
  • Feagin, *CORR*, 1996

• More recently:
  – van Eck, *AJSM*, 2017; Systematic Review of poor quality studies
  – Suture or scaffold used to repair ACL; biologics added
  – Data scant, but:
    • Braided suture > Monofilament
    • Early > Late repair
    • Skeletally immature > Mature
    • Proximal avulsions > Mid-substance
ACL REPAIR

• Perrone, *J Orthop* Res 2017
  – “Bridge-enhanced” ACL repair (BEAR) with collagen scaffold and whole blood
  – Porcine model, shows equivalent biomechanical results vs autograft!
  – Human trial has now begun!!

• Gagliardi, *AJSM* 2019
  – Level III retrospective study, comparing ACL suture ligament augmentation (SLA) [of proximal avulsions] vs QTB autograft
  – Adolescents
  – 49% FAILURE RATE FOR SLA vs 4.7% for QTB
Multiligamentous Knee Injury

• Can dislocate with only one cruciate torn, but typically multiple ligaments torn

• Can be High-, Low- or Ultra Low-Velocity

• High incidence of Peroneal Nerve Injury (~25%)

• High incidence of Popliteal Artery injury (10-30%)
Knee Dislocation: Controversies

- Operative vs Non-operative
- Early vs Late repair/reconstruction
- Staged vs All-at-Once
Knee Dislocation: Controversies

- **Operative vs Non-operative**
  - Lysholm scores 85 vs 67

- **Early vs Late repair/reconstruction**
  - <3 weeks
  - Staged with ACL later supported in some studies

- **Repair vs Reconstruction**
  - Reconstruction fewer failures/re-operations

» Vicenti, *Injury* 2019
» Systematic Review, Majority Level IV studies
THANK YOU!!!
References