An Evidence Based Medicine Understanding of Meniscus Injuries and How to Treat Them

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Disclosures

- None
Anatomy of the Meniscus

- Act as functional extensions of the tibial plateaus to increase depth of tibial articular surface
- The meniscotibial attachment contributes to knee stability
- Triangular in cross-section
Gross Anatomy of the Meniscus

- Ultrastructural Anatomy
  - Primarily Type I collagen (90%)
  - 70% water
  - Fiber orientation is circumferential (hoop stressing)
Meniscal Vascularity

- Relatively avascular
- Vascular penetration
  - 10 - 30% medial
  - 10 - 25% lateral
- Non-vascularized portions gain nutrients from mechanical loading and joint motion
Medial Meniscus

- Semilunar shape
- Thin anterior horn
- Broader posterior horn
- More stable & less motion than the lateral = tears more often
Lateral Meniscus

- Almost circular in shape
- Intimately associated with the ACL tibial insertion
- Posterior horn attachments
  - Ligament of Humphrey
  - Ligament of Wrisberg
- Lateral meniscus is a more dynamic structure with more motion
Main Importance of Menisci

- Load transmission
- Joint stability
Load Bearing / Shock Absorption

• MM 50% and 70% LM of load transmitted through meniscus in extension
• 85% at 90° of flexion
• Menisectomy
  – 50% decrease in contact area
  – 20% less shock absorption
Meniscal effect on joint stability

- Secondary restraints to anterior tibial translation in normal knees
- In an ACL-deficient knee: the posterior horn of the medial meniscus is more important than the lateral meniscus
Interaction of ACL and PHMM

• Lack of MM in ACLD knees significantly ↑ anterior tibial translation at all knee flexion angles
• Think about with high grade pivot!

(Levy, JBJS, 1982)
(Allen, JOR, 2000)
Cristiani, AJSM, 2017)
Meniscus Function

- Now known to be important structure for load distribution and secondary stabilizer to the knee.

- Complete, or total menisectomy leads to progressive joint degeneration

Fairbanks, JBJS, 1948
Meniscus Tears

• Common
  – >9 million people
  – 35% of people >50 years old have a meniscus tear
  – 2/3 are asymptomatic!
  – High prevalence (100%) in grade IV osteoarthritic knee

• Traumatic or degenerative...

Katz, NEJM, 2013
Englund, NEJM, 2008
Types of Meniscal Tears

- Vertical
- Bucket
- Horizontal
- Oblique
- Degenerative
- Root
- Ramp
- Radial
Clinical Evaluation and Diagnosis
Meniscus Injury History

- Known injury or not?
- Mechanical symptoms?
- Locking or pain?
- Deep posterior knee pain?
- Previous Rx (PT, injections, bracing)
- ? Effusions
Physical Exam

- Effusion
- ROM
- Joint line pain/crepitation
- Joint line pseudolaxity
- Deep posterior knee pain (flexion or squatting)
- Positive provocative maneuvers (McMurray’s, Appley’s)
Radiographs

- AP / lateral (weight bearing!)
- 45° axial patella
- Rosenberg views
Alignment Radiographs

- Mechanical axis
- Mal-aligned knees wear out faster
- Varus or valgus
MRI Scans

- Stable vs. unstable tear
- Degenerative tear?
- Articular cartilage surfaces
- Meniscal extrusion
- Joint overload or insufficiency fractures
Root Tears: The Silent Epidemic

Not as rare as once thought
Often missed on MRI and arthroscopy
Can lead to rapid OA
  - Inability to resist hoop stress
  - Meniscal extrusion
Articular cartilage loss
Compartment narrowing
Insufficiency fractures
Up to 28% of overall meniscal tears in some series
  (Bin, Arthroscopy 2004)
Medial Meniscal Radial Root Tears

Radial tear near root attachment can simulate root avulsion both functionally and on imaging
Biomechanics of Meniscal Root Attachment

Harner, JBJS 2008

- PH root tear equivalent to total meniscectomy!

- Contact pressure also seen in lateral compartment

- ER also seen
Meniscal Root Tears
MRI: SONK = root tear

SONK = PH MM Root tear until proven otherwise
Treatment
Nonoperative Treatment of Meniscal Tears

• Stable or small tears – PT, brace, injection
• Concurrent arthritis (+/- corticosteroid injections) – PT
• DJD and malalignment – unloader brace
Young patients with meniscus tears

- Often do NOT recommend non-operative treatment
- Avoid removing large amount of meniscus tissue
- Meniscus REPAIR most often
  -- Definition of young?
NFL – Meniscectomy vs. ACLR
(Brophy, AJSM, 2009)

• Isolated meniscectomy decreased length of career and games played
• Isolated ACLR no effect on mean career length
Menisectomy and Osteoarthritis

- Jorgensen, *JBJS*, 1987
  - 4.5 yr and 14.5 yr clinical and radiographic outcome of athletes after open menisectomy
  - Compared to other knee
    - 89% radiographic changes
    - 67% asymptomatic
    - 34% did not return to sports 2/2 knee pain
Menisectomy and Osteoarthritis

- 14x higher risk of significant knee arthritis following total menisectomy

- Contact forces increase in proportion to the amount of meniscus tissue removed.

Roos, Arthritis and Rheum, 1998
Baratz, AJSM, 2011
Repair vs Menisectomy and OA

- Stein, *AJSM*, 2010
- 4.5 and 9 year blinded radiographic follow up
- Average age 31
- Isolated, “traumatic tears”, both groups, vertical/bucket handle tears
- Results at 9 years
  - Menisectomy: 60% OA changes
  - Meniscus repair: 20% OA changes
- Repair showed higher return to sport (96% vs 50%)
Myth: I have a meniscus tear so I need surgery

• False!
• Many patients will do well with non-operative treatment
  – Age and concurrent DJD important
  – Assess for mechanical symptoms
  – BUT not all meniscus tears DO NOT need surgery!!
• Sihvonen, N Eng J Med, 2013
  – Multicenter RCT, level 2
  – Arthroscopic partial meniscectomy vs sham surgery in patients without OA
  – NO DIFFERENCE at 12 months

• Herrlin, KSSTA, 2013
  – RCT, level 1. No osteoarthritis
  – Middle aged patients
  – PT group did as well as scope/PT at 5 years
    • 33% crossed over from PT to surgery and did better after surgery!

RCT, multicentered, level 1 evidence

Age >45 yo, mild to moderate DJD

Arthroscopy and PT vs PT alone

12 months f/u, age >45 years old

NO DIFFERENCE!

– BUT 33% crossover, with improved results
– Treatment failure: PT alone (49%), arthroscopy (25%)
Beware knee arthritis with arthroscopy!

Knee arthroscopy is common...but should it be. Meniscus tear is often asymptomatic

  - RCT, Level 1
  - Arthroscopy with debridement and meniscectomy, vs lavage vs sham surgery

- NO DIFFERENCE!


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• Monk, AJSM, 2016
• Systematic review of 9 RCTs and 8 SR

• NO Difference between non-op treatment and arthroscopic menisectomy for first line treatment of degenerative meniscal tears.
  – Is evidence to support menisectomy for select subgroup of patients with mechanical symptoms that failed non-op management
Knee arthroscopy and Osteoarthritis

- First line treatment: PT, brace, NSAIDs, injection
- In general, scope for severe knee OA is wrong answer
- Mild OA? No OA in an older patient?
- Arthroscopy and partial menisectomy may be considered for those who fail non-operative measures
Surgical Treatment Options for Meniscal Tears

- Arthroscopic partial meniscectomy
  - smooth, stable, and symmetric rim
  - Lateral meniscus tears (horizontal cleavage tears) majority of the meniscus can be left intact and does not need debridement
Meniscus Repair Options

- All-Inside
- Inside out
- Outside in
- Root Repair
Meniscal Healing

- Dependent on blood supply
- Peripheral injuries vs central injuries
- Conjunction with ACL-R
- Tear pattern matters
- Age?
- Injuries in avascular region
  - Partial meniscectomies
  - Attempt to create vascular supply
  - Attempt to assist wound healing process (Fibrin clots, rasp meniscosynovial junction, PRP)
  - There is a cost to menisectomy for patients!
Meniscus Repair

- Reported healing rates: 50-82%
  - Higher with ACLR: ~90%

Tenuta, AJSM, 1994
Cannon, AJSM, 1992
Westerman, AJSM, 2014
Comparable Outcomes After Bucket-Handle Meniscal Repair and Vertical Meniscal Repair Can Be Achieved at a Minimum 2 Years’ Follow-up

Gilbert Moatshe, MD, Mark E. Cinque, MS, BS, Jonathan A. Godin, MD, MBA, Alexander R. Vap, MD, Jorge Chahla, MD, PhD, Robert F. LaPrade, MD, PhD

Outcomes After Biologically Augmented Isolated Meniscal Repair With Marrow Venting Are Comparable With Those After Meniscal Repair With Concomitant Anterior Cruciate Ligament Reconstruction

Dean, AJSM, 2017
MM Root Repair Outcomes

- LaPrade et al, AJSM, 2016
  - Compared PROs after transtibial pull-out repair for posterior root tears in patients <50 and >50 years of age.
  
  - Improvement in function and activity level at minimum 2-year follow-up not significantly different between age groups, or medial and lateral tear groups.
Sequelae of Excised Meniscus “Partial Menisectomy”

- Removing meniscal tissue increases stress on cartilage
- Inform patient of DJD risk
- Radiographs at 2 - 5 years postop
- Pain / Swelling with activities
Natural History of Post Meniscectomy knee

- **MM** - High risk of DJD
- **LM** - Very high risk of DJD

33 year old male
Meniscal Tears

- If any doubt – repair the meniscus
- Vertical mattress, inside-out technique
Meniscal Repairs

- Meniscal repairs
  - Outer 1/3 of the meniscus
  - Inside-out, vertical mattress suturing technique strongest
  - Provide a stable meniscus until the repair process is complete
Biomechanics of Meniscal Root Repairs

Harner, JBJS 2008
- PH MM root repair restores contact pressure to normal
- ER also restored to normal
Biomechanics of Meniscal Root Repairs

Padalecki, AJSM, 2013

- Complete radial tears of the posterior horn of the medial meniscus = biomechanically equivalent to root avulsions → medial compartment arthrosis

- Repair with an *in situ* pull-out technique → restoration of intact state
Clinical Outcomes

Lee et al. (Arthroscopy 2009): MM root pull-out suture repair

- 2 yr follow-up: almost complete healing in 27 knees at second look arthroscopy
- HSS Score: 61.1 pre-op → 93.8 post-op
- Lysholm Score: 57.0 pre-op → 93.1 post-op

Kim et al. (Arthroscopy 2011): MM root repair

- 48.5 months follow-up: 14 patients better clinical and radiographic results compared to meniscectomy

LaPrade et al. (AJSM, 2016): MM vs LM root repair

- 50 patients (15 lateral, 35 medial), minimum 2 yr follow-up
- Lysholm Score: 53.0 pre-op → 78.0 post-op
- No differences in outcomes between medial versus lateral meniscus root repair
Myth: Radial meniscal tears are irreparable

- False!
- Functions similar to total menisectomy
- Risk of rapid joint deterioration and arthritis progression.

Bedi, JBJS, 2010
Radial Meniscal Tears
Radial Meniscal Tears
Meniscal Ramp Lesions

- "Ramp lesion:" tear of the peripheral attachment of the posterior horn of the medial meniscus at the meniscocapsular junction.
Meniscal Ramp Tears

Quantitative and Qualitative Assessment of the Posterior Medial Meniscus Anatomy: Defining Meniscal Ramp Lesions

Nicholas N. DePhillipo, MS, ATC, OTC, Gilbert Moatshe, MD, PhD, Jorge Chahla, MD, PhD, more...
Meniscus Ramp Lesions

- **Bollen et al, JBJS, 2010**
  - Meniscal ramp lesions present in 9-17% of ACL injuries
  - Injury to medial meniscocapsular complex

- **Stephen et al, AJSM, 2016**
  - Ramp lesions can ↑ ATT and increase ACL graft strain after ACLR
Meniscus Ramp Repair

- DePhillipo et al, AJSM, 2016
  - Repaired via inside-out vertical mattress technique
  - An accessory posteromedial portal *not* required to completely visualize the posterior meniscocapsular attachment.
No difference in outcomes between 2-tunnel radial repair and inside-out vertical mattress repair at mean 3.5 years follow up.
Rehabilitation of Meniscal Repairs

- NWB x 4-6 wks
- “Safe Zone” ROM x 2 wks (0-70° or 0-90°)
- WBAT at 6 wks; ± unloader brace
- Avoid deep leg presses/squats > 70° x 4 months
Summary - Meniscal Injuries

• Important for load transmission

• Secondary knee stabilizer

• Repair if at all possible

• Non-op treatment for meniscal tear and DJD is first line
Questions?

• Thank you!

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