Meniscectomy to Repair: Roots, Ramps, Buckets, and Biologics

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Disclosures: None
Orthopaedic Trends:

- Increase in physician education of repair v. removal
- Technical advances make procedures easier
- Evolving developments of the meniscectomized knee
Orthopaedic Trends:

- Meniscectomy v. repair: 16 to 1 rate with 60% repairs in males under age 25 (Abrams AJSM 2013)
- Incidence of meniscectomy after repair is 10% for isolated, and 8% after ACL/repair (Ontario Dept of Health, 2013)
- Recognition of root tears and ramp lesions
- The value of meniscectomy in the arthritic knee is under attack (Katz, NEJM 2013) (Litchfield BMJ 2017)
Risk Factors for Menisectomy After Meniscal Repair

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Investigation performed at the Hospital for Special Surgery, New York, New York

Background: Previous research suggests that a substantial percentage of meniscal repairs fail, resulting in a subsequent meniscectomy. Risk factors for failure have been investigated using small cohorts, providing ambiguous results.

Purpose: To measure the frequency of and elucidate risk factors for subsequent menisectomies after meniscal repair using a large study population from multiple surgical centers.

Study Design: Case-control study; Level of evidence, 3.

Methods: A total of 9529 patients who underwent 9609 outpatient meniscal repairs between 2003 and 2010 were identified from a statewide database of all ambulatory surgery in New York. Patients who subsequently underwent a meniscectomy were then identified. A Cox regression analysis was used to calculate the hazard ratio and 95% confidence intervals. The model included patient age, sex, comorbidities, concomitant arthroscopic procedures, laterality of the meniscus, and surgeon’s yearly meniscal repair volume.

Results: The overall frequency of subsequent menisectomies was 8.9%. Patients were at a decreased risk for subsequent menisectomies if they underwent a concomitant anterior cruciate ligament (ACL) reconstruction (P < .001). Patients undergoing meniscal repair with a medial meniscectomy were at increased risk for subsequent meniscectomies compared to those undergoing repair of the lateral meniscus (P < .001).
Meniscal Repair: Efficacy

- Stein (AJSM 2013) reviewed the % of normal radiographs at 9 years after meniscal surgery
  - 81% of meniscal repair
  - 40% of menissectomized
Meniscectomy: What is the role?

The results were stunning. Those who had the actual procedures did no better than those who had the sham surgery. They all improved the same amount. The results were all in people’s heads.

Many who heard about the results were angry that this study occurred. They thought it was unethical that people received an incision, and most likely a scar, for no benefit. But, of course, the same was actually true for people who had arthroscopy or lavage: They received no benefit either. Moreover, the results did not make the procedure scarce. Years later, more than a half-million Americans still underwent arthroscopic surgery for osteoarthritis of the knee. They or their insurers spent about $3 billion that year on a procedure that was no better than a placebo.

Why ‘Useless’ Surgery Is Still Popular

Before a drug can be marketed, it has to go through rigorous testing to show it is safe and effective. Surgery, though, is different. The Food and Drug Administration does not regulate surgical procedures. So what happens
Knee arthroscopy versus conservative management in patients with degenerative knee disease: a systematic review

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Conclusions: Over the long term, patients who undergo knee arthroscopy versus those who receive conservative management strategies do not have important benefits in pain or function.

Trial registration number: PROSPERO CRD42016046242.
Meniscus: Back to Basics

- Function
  - Load Bearing
  - Stability
  - Lubrication and nutrition
  - Joint homeostasis
Meniscal Anatomy

- 90% Type I collagen, small amount types II, III, V, VI
- Circumferential fibers critical to maintain hoop stresses
- Vascularity outer 25% (2-4 mm),
Data from the Osteoarthritis Initiative (1300 patients) suggest meniscal extrusion due to radial/root tear lead to a greater incidence of OA (Badlani, Harner AJSM 2013)
Meniscal Injuries: History

- Gradual/Insidious
  - Usually degenerative
  - Rarely repairable

- Acute/traumatic onset
  - Twisting/squatting activities
  - Swelling/effusion develops overnight
  - Associated with ligament injuries 20-60%
  - Mechanical symptoms most common
Meniscal Injuries: Diagnosis

- Fowler 1989: 161 patients, ages 13-67
  - Joint line tenderness
  - Pain with forced flexion (meniscal compression)
  - McMurray/Apley
  - Extension block
  - No reliable single physical exam finding
  - Joint effusion
Meniscal Injuries: Radiographs

• Always indicated
  – Avoid the “just get the MRI”
  – Reveals the pre-injury condition of the knee
  – Will prognosticate the treatment
Meniscal Injuries: MRI – Is it necessary?
Meniscal Injuries: MRI

• Accurate anatomic diagnosis
  – Predictable treatment plan

• Associated pathology
  – Chondral defects
  – Subchondral vascularity
Decision Making:

- **Conservative Treatment**
  - What time of the season?
  - What stage of the player’s career?
  - What is the nature of the tear?
  - How much arthritis is present?
  - Is there an effusion or obvious mechanical symptoms?
  - What is the role of steroid injections?
Meniscal Injuries: Repair v. Removal

- Established Indications (Labile JAAOS 2013)
  - Tear 1-4 cm length
  - Acute (< 6 weeks)
  - Red zone tears
  - Vertical
  - Patient age < 40 years
  - No mechanical malalignment
  - Concurrent ligament surgery
Meniscal Injuries: Repair v. Removal

- **Extended Indications: Radial**
  - **Lateral/posterior root**
    - Leave alone with ACL surgery (Shelbourne 2012, Marzo 2014)
    - Fix (Noyes, Arthroscopy 2000, LaPrade AJSM 2016)
  - **Medial/posterior root**
    - Leave alone - Degenerative radiographs, Obesity, >50 years
    - Fix – Traumatic injury, normal BMI, normal articular cartilage
Meniscal Injuries: Repair v. Removal

• Young patients
  – Aggressive repair indications for any patient 18 years and under
  – Lateral meniscal deficiency leads to rapid cartilage loss
Meniscal Repair: Principles

- Full assessment of the entire joint (posterior view)
- Stable anatomic repair
- Optimize biologic environment
- Minimize surgical morbidity
- Cost effective

Methods
- All inside suture
- All inside anchors
- Inside-out sutures
- Combo suture/anchor
- The more unstable, the more you should consider inside-out
Meniscal Repair: All Inside

- Cost consideration
  - Blue Cross $2100 max facility fee knee arthroscopy
  - Meniscal repair suture $15-30 (6-8 per case)
  - Meniscal implants $280-360 per implant (1-3 per case)
  - Time saving of implant over incision
  - Surgical morbidity of implant over incision
Meniscal Repair: **Essential Elements**

- Synovial abrasion, induce capsular response
- Assess the posterior compartment
- Micro-fracture awl to access marrow cells
- Proper reduction of meniscal segments
Meniscal Repair: Repair stimulation

- Vascular access channels – repeated perforation
- Synovial abrasion using rasp
Meniscal Repair: Repair stimulation

- Growth factors (future)
- Fibrin Clot
  - Glass syringe (30 cc blood)
  - Stir with frosted glass rod 3-5 minutes
Meniscal Injuries: Biologic Augmentation

- Hutchinson, Rodeo (AJSM Review 2013)
  - Growth factors mixed results in animal models
  - Mesenchymal stems promising
  - Currently PRP and bone marrow aspirate commonly used without evidence
Meniscal Repair: Inside out with Accessory Incision

- **Pro’s**
  - *Solid repair that allows aggressive rehabilitation*
  - *Predictable results with literature support*
  - *Minimal implant costs*
Meniscal Repair: Inside out

- **Con’s**
  - Labor intense (need 5 experienced hands)
  - Surgical morbidity high
  - Secondary Incision
  - Time consuming
  - Difficulty leads to narrowed indications
Meniscal Repair: Inside out

- Identify repairable tear
- Posterior medial exposure
- Meniscal preparation
- Reduction stitch contralateral portal
- Anatomic stabilization femoral and tibia surfaces
Meniscal Repair: Lateral

- Accessory Incision
  - IT band-Biceps interval
  - Incision parallel to lateral collateral
  - Separate capsule from lateral gastrocnemius
  - Tourniquet helpful
Meniscal Root Tears: Can we fix? Should we fix?

• Case Example
  – AK, 46 female attorney tennis player
  – Develops refractory anterior knee pain
  – MRI benign
Case Example: AK

- 1 year later, several medial side knee pain and swelling with tennis
Case Example: Surgical delay 6 months

2 year standing X-ray
Meniscal Injuries: Root Injuries

- Jung AJSM 2010
  - 2nd look arthroscopy on 11/21 patients with suture root repair
  - No cases of complete healing
  - 5 lax, 4 scar, 2 no healing response
  - Advocating different surgical methods
Meniscal Injuries: Root Injuries

- Jung AJSM 2012
  - 13 patients with anchor root repair.
  - F/u MRI: 5 complete healing, 4 partial healing, 1 no healing
  - All clinically improved
  - Meniscal extrusion persisted
Long-term Evaluation of Posterior Lateral Meniscus Root Tears Left In Situ at the Time of Anterior Cruciate Ligament Reconstruction

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Investigation performed at the Shelbourne Knee Center, Indianapolis, Indiana

Background: The long-term radiographic and subjective results of patients with posterior lateral meniscus root tears left in situ at the time of anterior cruciate ligament reconstruction has not been reported.
Hypothesis: The authors hypothesized that patients who had posterior lateral meniscus root tears left in situ would have statistically significantly lower subjective scores and greater joint-space narrowing as compared with a control group.

Results: The mean objective follow-up time was 10.6 ± 4.5 years. The mean subjective total score was 84.6 ± 14 in the study group versus 90.5 ± 13 in the control group (P = .09). Radiographs showed lateral joint-space narrowing rated as normal in 19, mild in 10, moderate in 3, and severe in 1 versus the control group, which was normal in 28 and mild in 5 patients. The measured amount of lateral joint-space narrowing compared with the other knee was 1.0 ± 1.6 mm in the study group versus 0 ± 1.1 mm in the controls on 45° flexed posteroanterior radiographs (P < .006).

Conclusion: At a mean of 10 years' follow-up of posterior lateral meniscus root tears left in situ, mild lateral joint-space narrowing was measured without significant differences in subjective or objective scores compared with controls. This study provides a baseline that can be used to compare the results of procedures used to treat these tears in other manners.
**Conclusion:** Outcomes after posterior meniscal root repair significantly improved postoperatively and patient satisfaction was high, regardless of age or meniscal laterality. Patients <50 years had outcomes similar to those of patients ≥50 years, as did patients who underwent medial versus lateral root repair. Transtibial double-tunnel pull-out meniscal root repair provided improvement in function, pain, and activity level, which may aid in delayed progression of knee osteoarthritis.
Root Injuries with ligament: Aggressive!

- Suture repair
  - Early treatment
  - Posterior portal
  - Multiple suture configurations
  - Protected weight bearing
  - Can we re-establish the hoop-stress resistance?
Meniscal Injuries: Root Injuries

• 20 year old male football injury
  – PCL/MCL by exam
  – Meniscal extrusion due to MCL/capsular injury?
Meniscal Injuries: Root Injuries

- 20 year collegiate football player
  - Contact valgus injury
  - Grade III PCL injury
  - Distal MCL injury with **meniscal subluxation**

- Root injury
Root Repair: Technique

- Root preparation
- Posterior medial portal
- Suture placement
Meniscal Injuries: Root Injuries
Meniscus Tears: Ramp Lesions

- Hidden peripheral meniscal-capsular separations
- MRI findings subtle
- Ligament injury
Meniscus Tears: Ramp Lesions

- Posterior compartment access critical
- Suture repair as anchors will not hold
Meniscus Tears: Ramp Lesions - CM
Meniscus Tears: Ramp Lesions
Meniscal Repair: Rehabilitation

- Root lesions warrant touch down WB 6 weeks
- When associated with ACL, little change in protocol except no squatting for 12 weeks.
- No evidence to support motion limitation (Lind AJSM 2013 Randomized trial)
- Regain full extension over first four weeks (posterior capsular bunching common)
- Encourage active hamstring activation (suture irritation of semimembranosus or gastrocs)
- Avoid cutting sports before 12 weeks
Meniscal Surgery: *Post-op Problems*

- **Effusions**
  - Resolving post-op swelling
  - Progressive chondral wear
  - Avascular necrosis (resting pain)
- **Motion loss**
  - Manipulation rarely required
- **Persistent pain**
  - Slow rehab progression
  - Visco-supplementation
  - Steroid injection
Meniscal Repair: Failure?

- Decision to re-operate is based on clinical grounds – persistent effusion, mechanical Sx
- MRI – Grade III signal may persist for 2-3 years after successful repair (second look studies) (fluid in repair site, displaced fragment), gadolinium helpful
- Re-repair successful in adolescents and up to age 30. (DeHaven 2003)
Meniscal Transplants:

• Meniscal Transplants
  – No bone remodelling
  – Correctable or normal alignment
  – Technically demanding, bone plugs or blocks
  – Very reliable with proper indications
  – 82% success at 4 years based on clinical, MRI, and 2nd look scope (Kim AJSM 2012)
Meniscus Transplants: Indications

- Failed ACL with meniscal deficiency
Meniscus Transplants: Indications

- Failed ACL with meniscal deficiency
- Normal limb alignment
WASHINGTON — The Food and Drug Administration said Thursday that it would rescind the approval of a patch for injured knees that it granted in error in 2008 after being unduly pressured by four New Jersey congressmen and its own commissioner.

The patch, known as Menaflex and manufactured by ReGen Biologics, was so different from earlier devices that it should have been tested far more thoroughly before approval, officials determined.

“We are concluding that the science does not support a decision to clear the device, and therefore we’ll move forward to rescind” its approval, Dr. Jeffrey E. Shuren, director of the F.D.A.’s device center, said in an interview.
Meniscal Substitutes: Actifit

- **Actifit** (Actifit Orteq, London, UK)
- Polyurethane meniscal scaffold PCL (polycaprolactone) that biodegrades over 5 years.
Meniscal Substitutes: Actifit

18 patients followed for 2 years with IKDC improvement from 61 to 94 with Tegner level improving from 2 to 3

(Kon, Knee Surg Sports Trauma 2012)
Current Recommendations:

- Meniscectomy: If it won’t heal, take it out
- Knotless implants: Repairable tears, may supplement inside-out for inaccessible positions
- Inside-out technique: Complex or grossly unstable tears, requires experienced surgical team
- Always look posterior
- Salvage treatment for patients with pain with ADL. Transplant experience with high level function
Questions?