#26: Development of OA Following ACL Reconstruction: Unexpected Findings in Medial vs. Lateral Meniscus Pathology

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Introduction: Osteoarthritis

- Increased Risk of OA Development After Injury\(^1,2\)
  - 23-80% Medial OA
  - 9-32% Lateral OA

- Risk Factors\(^3,4,5\)
  - **Concomitant Meniscal Injury**
  - Chondral Injury
  - Alignment
  - Higher BMI
  - Older Age at Reconstruction
  - Female Gender

Introduction: Treatment of Meniscal Injuries

- **Meniscectomy**
  - Increased Risk of OA Proportional to Amount Removed\(^1,2\)
  - Avoid Total & Subtotal Meniscectomy

- **Meniscal Repair (Med/Lat)**
  - 25-50% Lower Risk of Knee OA After Repair\(^3\)
  - Up to 20% of Patients Still Develop OA\(^4\)
  - But Only 50% of Meniscal Repairs Heal\(^5\)

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Introduction: Meniscus Repair and ACLR

- **Meniscal Repair + ACLR**
  - Improved Meniscal Healing
    - ACLR + Repair - 75-93%
    - Repair Only - 50%
  - Improved Knee Functional Outcomes
    - Higher IKDC & Tegner
  - Unanswered Questions
    - Does Risk of OA Occur and Differ?
      - Medial vs. Lateral Meniscal Pathology
      - ACL + Meniscectomy vs. ACL + Repair

Objective

• **Purpose**
  • To Determine the Influence of Medial &/or Lateral Meniscus Pathology and Treatment on OA Incidence Following ACLR
    • Previous Literature Doesn’t Distinguish Medial vs. Lateral Meniscal Pathology

• **Hypothesis**
  • OA Development
    • Greater in Medial vs. Lateral Meniscal Tears
    • Less OA with Meniscal Repair vs. Partial Meniscectomy
      • No Difference in Medial vs. Lateral Meniscal Repair
Materials and Methods: Inclusion & Exclusion Criteria

- Patients with Acute ACL Reconstruction with Medial or Lateral Meniscus Tear
  - Consecutive Series
    - 1999-2018
    - Single Surgeon (KDP)
  - Autograft or Allograft* BPTB

- Exclusion
  - Less Than 2-Year Follow-Up
  - Revision ACLR
  - Multi-Ligamentous Injuries

*LifeNet (Virginia Beach, VA) <2MRad (20kGy)
Musculoskeletal Transplant Foundation (Edison, NJ) <2.5MRad (25kGy)
Materials and Methods: Data Collected

Alignment

- Standard AP Weightbearing Views
  - Tibio-Femoral Angle Measured\(^1\)
  - \(>180^\circ\) = Valgus Alignment
  - \(<180^\circ\) = Varus Alignment

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Materials and Methods: Data Collected

- **Meniscal Pathology**
  - Operative Report & Arthroscopic Examination
    - Presence of Medial/Lateral Meniscus Tear
  - **Meniscal Treatment – OR Report**
    - Partial Medial/Lateral Meniscectomy
    - Medial/Lateral Repair Technique
      - All Inside vs. Inside Out
Materials and Methods: Data Collected

- **Radiographic Evaluation of Postoperative OA**
  - Standard AP Weightbearing Views

- **Kellgren Lawrence OA Classification System**
  - Grade 0
    - No Presence of OA
  - Grade 1
    - Possible Osteophytes/Doubtful Joint Space Narrowing
  - Grade 2
    - Definite Osteophytes/Possible Joint Space Narrowing
  - Grade 3
    - Multiple Osteophytes/Definite Joint Space Narrowing. Some Sclerosis & Deformity of Bone Ends
  - Grade 4 = Severe OA
    - Large Osteophytes/Marked Joint Space Narrowing, Severe Sclerosis & Deformity of Bone Ends

Materials and Methods: Statistical Analysis

- **Analysis of Variance**
  - Assess Differences in Demographics
    - Age, Alignment, Follow-up Time

- **Chi-Square Tests**
  - Assess Differences in Incidence Rates
    - Medial vs. Lateral Meniscal Tear
    - Partial Menisectomy vs. Meniscal Repair

- **Statistical Significance**
  - p<0.05
Results:

Demographics

- **107 Patients w/ Acute ACLR**
  - 55 Males / 52 Females
  - Avg Age at Surgery: 35.9±11.9 Yrs
    - No Significant Difference
      - Medial vs. Lateral Tear (p=0.2177)
      - Partial Meniscectomy vs. Repair (p=0.1437)
      - OA vs. No OA (p=0.0926)
  - Avg Follow-Up: 8.6±5.0 Yrs (Range 2-20)
    - No Significant Difference
      - Medial vs. Lateral Tear (p=0.7611)
      - Partial Meniscectomy vs. Repair (p=0.7579)
      - OA vs. No OA (p=0.0792)
  - Avg Age at F/U: 44.7±13.2 Yrs
Results: Preoperative Alignment & Meniscal Pathology

• **Preoperative Alignment**
  - Average: $180.9^\circ \pm 2.2^\circ$
  - Neutral
  - $5^\circ$ Varus - $5^\circ$ Valgus

• **Meniscus Pathology**
  - Medial Tear
    - $50.5\%$ Patients ($n=54/107$)
  - Lateral Tear
    - $59.8\%$ Patients ($n=64/107$)
    - $P=0.172$

Results: Postoperative OA & Medial Meniscal Pathology

- **Medial Compartment OA:** 10.3% (n=11/107)
  - w/ Medial Meniscal Tear: 11.1% (n = 6/54)
  - w/o Medial Meniscal Tear: 9.4% (n=5/53)
    - \( p = 0.568 \)

Diagram:
- No Medial Tear, No OA; 48 (44%)
- Medial Tear, No OA; 49 (45%)
- No Medial Tear, Medial OA; 5 (5%)
- Medial Tear, Medial OA; 6 (6%)
Results: Postoperative OA & Lateral Meniscal Pathology

• Lateral Compartment OA: 15% (n=16/107)
  • w/ Lateral Meniscal Tear: 21.9% (n = 14/64)
  • w/o Lateral Meniscal Tear: 4.7% (n=2/43)
    • p=0.015*

• Lateral Meniscus Tear
  • 2x More Likely to Develop OA vs. Medial Meniscus Tear
  • 4.7x More Likely to Develop OA vs. No Lateral Meniscus Tear
Medial Meniscus Repair vs. Partial Meniscectomy

- 29 Patients w/ Medial Repair
  - 6.9% (n=2/29) Developed OA
    - Repair Type
      - 25 All Inside
        - 1 Case of OA
      - 4 Inside Out
        - 1 Case of OA
- 25 Patients w/ Meniscectomy
  - 20% (n=5/25) Developed OA
    - p=0.1567

Incidence of OA

- No Significant Difference
  - Medial Repair vs. Medial Meniscectomy

Results:
Medial Meniscus Treatment & OA
Results: Lateral Meniscus Treatment & OA

- Lateral Meniscus Repair vs. Partial Meniscectomy
  - 13 Patients w/ Lateral Repair
    - 0% (n=0/13) Developed OA
  - Repair Type
    - 11 All Inside
    - 2 Inside Out
  - 51 Patients w/ Meniscectomy
    - 27.5% (n=14/51) Developed OA
    - p=0.0340

- Incidence of OA
  - Significant Decrease
    - Lateral Repair vs. Lateral Meniscectomy
Significance: Altered Knee Biomechanics

• **Biomechanical Analysis**
  • **Medial Meniscus**
    • Load Transmissions Through Medial Joint
      • 50% in Extension
      • 85% at 90° Flexion
  • **Lateral Meniscus**
    • Load Transmissions Through Lateral Joint - Higher
      • 70% in Extension
      • 85% at 90° Flexion
  • **Walking**¹,²
    • ↓ Peak Knee Flexion Angle
      • Significantly Smaller with Meniscectomy vs. Repair
    • ↑ Tibiofemoral Contact Forces in Both Compartment
      • Significantly Higher in Meniscectomy Group vs. Repair

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Conclusion

- ACL Tear with Meniscus Injury
  - Common Concomitant Injury
    - Over 50% of Patients
  - Lateral Meniscus Tear
    - Greater Postoperative Osteoarthritis
      - 2x More Likely Than Medial Meniscus Tear
      - 4.7x More Likely Than No Lateral Meniscus Tear
  - Partial Meniscectomy Increased Incidence of OA vs. Meniscal Repair Especially in Lateral Compartment
    - 0% w/ Meniscal Repair
    - 28% w/ Partial Lateral Meniscectomy

- Abnormal Knee Kinematics
  - May Explain Elevated OA Risk
    - Partial Meniscectomy vs. Repair

- Save & Repair the Meniscus!