NYU Langone Orthopedics

NYU Langone Health

Contralateral Synovial Fluid Biomarkers Predict 10-Year Patient-Reported Outcomes of Arthroscopic Partial Meniscectomy

Vishal Sundaram BA, Emily Berzolla BS, Michael Moore BA, Nathaniel Mercer MD, Bradley Lezak MD MPH, Heath Gould MD, Daniel Kaplan MD, Eric Strauss MD

ISAKOS 2025 Congress
11 June 2025

Faculty Disclosures

Eric Strauss:

- AAOS (Board or committee member)
- American Orthopaedic Association: Board or committee member
- Arthrex, Inc: Paid consultant; Paid presenter or speaker
- Arthroscopy Association of North America: Board or committee member
- Better PT: Stock or stock Options
- Cartiheal: Research support
- Cartilage, Bulletin of the Hospital For Joint Diseases: Editorial or governing board
- Fidia: Research support
- Jaypee Publishing: Publishing royalties, financial or material support
- Joint Restoration Foundation: Paid consultant
- Organogenesis: Paid consultant; Paid presenter or speaker; Research support
- Overture Orthopaedics: Stock or stock Options
- Smith & Nephew: Paid consultant; Paid presenter or speaker
- Springer: Publishing royalties, financial or material support
- Subchondral Solutions: Paid consultant
- Vericel: Paid consultant; Paid presenter or speaker

Background

- It has been proposed that the knee's inflammatory state after injury may be a driver of post-traumatic joint disease
- Pre-operative synovial fluid inflammatory markers in the operative knee have been shown to predict both intermediate and long-term outcomes after knee surgery
- However, the possible effect of an underlying systemic inflammatory response observable in the contralateral knee has not been explored

Purpose: to determine the ability of synovial fluid biomarkers in the contralateral uninjured knee to predict 10-year patient-reported outcomes (PROs) for the operative knee in those undergoing arthroscopic partial meniscectomy

Methods

- Patients undergoing arthroscopic partial meniscectomy for isolated meniscal injury were prospectively enrolled
- Synovial fluid was aspirated from both the operative and uninjured contralateral knee prior to surgical incision
- The concentrations of 10 biomarkers of interest (RANTES, IL-6, MCP-1, MIP-B, VEGF, TIMP-1, TIMP-2,IL-1RA, MMP-3, and bFGF) were measured by immunoassay
- Patients completed VAS Pain, Lysholm, Tegner, and KOOS-PS patient-reported outcome (PRO) surveys at a mean follow-up of 10 years
- To prevent model overfitting, stepwise linear regression was performed to identify the most significant predictor(s) of each PRO score
  - Possible covariates: log-normalized contralateral biomarker concentration, age, sex, BMI

Results: Cohort Demographics

Demographics	N = 17
Age (years)	51.7 ± 9.6
Sex (% male)	7 (41.2%)
Body mass index (kg/m^2)	31.6 ± 5.4
Follow-up time (years)	10.0 ± 1.2

Results: 10Y PROs vs. Contralateral Biomarkers

Biomarker	10Y VAS	10Y Lysholm	10Y KOOS-PS	10Y Tegner
RANTES	N/A	**P = 0.018* B = (-) 0.510**	**P = 0.016* B = (-) 0.518**	**P = 0.040** B = (-) 0.410**
IL-6	N/A	N/A	N/A	N/A
MCP-1	N/A	N/A	N/A	N/A
MIP-B	N/A	N/A	N/A	N/A
VEGF	N/A	N/A	N/A	N/A
TIMP-1	**P = 0.047* B = (-) 0.438**	N/A	N/A	N/A
TIMP-2	N/A	N/A	N/A	N/A
IL-1RA	N/A	N/A	N/A	**P = 0.045* B = (-) 0.410**
MMP-3	N/A	N/A	N/A	**P = 0.049* B = (-) 0.393**
bFGF	N/A	N/A	**P = 0.049* B = (-) 0.485**	N/A

Conclusions

- Synovial fluid biomarker levels in the contralateral uninjured knee at the time of arthroscopic partial meniscectomy were predictive of long-term PROs for the operative knee
- Increased levels of pro-inflammatory biomarkers RANTES and MMP-3 were predictive of worse PROs
- Increased levels of TIMP-1, an anti-inflammatory and chondroprotective cytokine, were predictive of improved VAS pain

Implication: there may be an underlying systemic inflammatory component to unilateral joint injury that influences patient recovery and the outcomes of surgical intervention.

References

1. Kingery MT, Adams AC, Manjunath AK, et al. Synovial Fluid Cytokine Profile at the Time of Arthroscopy Explains Intermediate-Term Functional Outcomes. *The American Journal of Sports Medicine*. 2022-04-14;50(5)doi:10.1177/03635465221075370
2. Avila A, Petrera M, Duenes M, et al. RANTES Concentration at the Time of Surgery Is Associated With Postoperative Stiffness in Patients Undergoing ACL Reconstruction. *The American Journal of Sports Medicine*. 2022-11-09;50(14)doi:10.1177/03635465221131805
3. Moore MR, DeClouette B, Wolfe I, et al. Levels of Synovial Fluid Inflammatory Biomarkers on Day of Arthroscopic Partial Meniscectomy Predict Long-Term Outcomes and Conversion to TKA: A 10-Year Mean Follow-up Study. *JBJS*. February 26, 2021;undefined(undefined)doi:10.2106/JBJS.23.01392