Factors Associated with Meniscal Repair versus Partial Meniscectomy in Adults from 2012 to 2022

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INTRODUCTION:

Meniscal tear, with or without concomitant anterior cruciate ligament (ACL) injury, is a common knee injury, and surgical treatment often involves meniscal repair (MR) or partial meniscectomy (PM). Understanding the multitude of factors that may influence the type of surgical management provided is important for surgeons evaluating treatment options. Though some of these factors are related to the characterization of the injury itself, other factors that may influence treatment approach include presence of a concomitant ACL injury, patient demographics, socioeconomic variables, primary payor, and hospital volume. The aim of this study was to examine the association between surgical management options and these previously unexplored variables.

METHODS:

Patients ages 18 years and older who underwent PM (CPT: 29880, 29881), MR (CPT: 29882, 29883), or ACL reconstruction (ACLR) (CPT: 29888) within New York State, between 2012 and 2022 were identified utilizing the Statewide Planning and Research Cooperative System (SPARCS) database. Multivariable mixed-effects logistic regression models, with a random effect at the facility level, were estimated to investigate the association between the surgical management option and patient, socioeconomic, and payor factors. The facility volume was defined by the quartile of the number of operations performed by a facility in a given year. Patient level variables included gender, age, race, ethnicity, Elixhauser comorbidities, and whether or not a concomitant ACL injury was present. ZIP code based socioeconomic variables from the American Community Survey and Rural-Urban Commuting Area Codes included median estimated household income, percent bachelor's degree or higher, urban status, and percent without health insurance coverage.

RESULTS:

From 2012 to 2022, there were a total of 454,873 patients identified. Only 17,559 patients (3.9%) underwent MR, while the majority of those operated on underwent PM (96.1%). The patient population consisted of 45.1% women and 54.7% men. Non-Hispanic white patients comprised 58.7% of the patient population. The average age of adults undergoing PM was 50.9 (SD: 37.2, 64.6) years compared to 33.4 (SD: 20.2, 46.5) years for MR patients.

After adjusting for confounders, men had significantly lower odds of MR relative to women (OR 0.85; CI [0.82, 0.89]; p<0.001). Non-Hispanic Black patients and Hispanic patients had significantly lower odds of MR than non-Hispanic white patients, with odds of 0.78 (CI [0.73, 0.84], p<0.001) and 0.93 (CI [0.87, 0.99], p<0.05) respectively. Relative to patients ages 18 to 45, the odds of patients undergoing MR were significantly lower for patients 45 to 65 (OR 0.19, CI [0.18, 0.20], p<0.001), and over 65 (OR 0.10, CI [0.09, 0.11], p<0.001). The odds of MR decreased as patients had an increasing number of Elixhauser comorbidities, with an odds of 0.90 (CI [0.85, 0.95], p<0.001) for patients with 1 comorbidity and an odds of 0.82 (CI [0.76, 0.88], p<0.001) for patients with 2 or more comorbidities. If the patient underwent a concomitant ACLR, the odds of MR increased significantly (OR 4.78, CI [4.59, 4.97], p<0.001). Patients without private payor insurance had significantly lower odds of MR relative to patients with private payor insurance, with odds of 0.54 (CI [0.47, 0.62], p<0.001) for Medicare, 0.92 (CI [0.86, 0.98]; p=0.012) for Medicaid, and 0.67 (CI [0.63, 0.72], p<0.001) for worker's compensation.

Additionally, when adjusting for facility volume, the odds of MR was lower as facility volume increased, with odds of 0.77 (CI [0.66, 0.91], p<0.01) in quartile 2, 0.78 (CI [0.66, 0.93], p<0.01) in quartile 3, and 0.58 (CI [0.49, 0.70], p<0.001) in quartile 4. At the ZIP code level, percent bachelor's degree or higher was associated with an increased odds of MR (OR: 1.006, CI [1.005, 1.008], p<0.001), while median estimated household income (\$1000s) was associated with lower odds of MR (OR: 0.998, CI [0.997, 0.999], p<0.001). Patient urbanicity and percent without health insurance coverage were not significantly associated with odds of MR.

Over the ten-year period, each year the odds of undergoing MR increased significantly. Relative to 2012, the odds of undergoing MR in 2013 was 1.14 (CI [1.03, 1.26], p<0.05) and further increased to 4.52 (CI [4.10, 4.98], p<0.001) in 2022. Of note, during the peak COVID-19 period (2020-2021), the odds of MR nearly tripled and quadrupled, respectively, relative to 2012, (OR: 3.66, CI [3.32, 4.05], p<0.001 and OR: 4.19, CI [3.82, 4.62], p<0.001). DISCUSSION AND CONCLUSION:

A representative cohort of individuals undergoing surgical meniscus treatment between 2012 and 2022 revealed that each year the odds of undergoing MR increased significantly relative to 2012. The only patient level factor associated with an increased odds of MR was having a concomitant ACL injury. At the ZIP code level, percent bachelor's degree or higher increased the odds of MR. When considering race and ethnicity, non-Hispanic Black and Hispanic patients were less likely to undergo MR. Additionally men, patients with comorbidities, older patients, or non-privately insured patients had lower odds of MR. At the ZIP code level, median estimated household income was associated with lower odds of MR. Also, higher volume facilities had significantly lower odds of MR.

This study found that multiple patient and facility-level factors were associated with undergoing MR rather than PM at the time of surgery, and provides important context on potential surgeon bias and disparities. Notably, while rates of MR seem to be increasing over time, the decision to proceed with MR over PM may be influenced by factors other than injury characteristics. In addition to the more challenging and lengthier recovery following MR, it is known that MR is a longer procedure. This study's findings suggest that a bias might exist amongst higher volume facilities, for example, in order to optimize operating time. Future work should evaluate why these differences between groups may exist.