# Minimum 10-Year Clinical Outcomes and Survivorship of Meniscal Allograft Transplantation with Bone Fixation

Kyle R Wagner, Joshua T Kaiser[1], Mario Hevesi, Eric J Cotter, Ron Gilat, Zachary D Meeker, Landon Patterson Frazier, Adam Blair Yanke[2], Brian J Cole[1]
[1]Rush University Medical Center, [2]Rush University Med Ctr

INTRODUCTION: Meniscal allograft transplantation (MAT) can reliably reduce pain and improve function in symptomatic patients with meniscal insufficiency without diffuse chondral wear. Ten-year survival rates following MAT have been estimated to be as high as 74%, though previous studies have been limited to small sample sizes or pooled outcomes including patients who have less than 10-year minimum follow up. The purpose of this study was to report on clinical outcomes and survivorship following primary meniscal allograft transplantation in a large cohort of patients with 10-year minimum follow up.

METHODS: A retrospective review of prospectively collected data was performed to identify patients undergoing primary MAT from 1999-2012. Lysholm, International Knee Documentation Committee (IKDC), and Knee Injury, and Osteoarthritis Outcome Score (KOOS) subscales were collected preoperatively and at 1-, 2-, 5-, and minimum 10-year follow up. Cox proportional hazards modelling was utilized to identify variables associated with reoperation and failure. Failure was defined as revision MAT or conversion to unicompartmental or total knee arthroplasty (UKA and TKA, respectively). Reoperation was defined as a subsequent surgical intervention of the transplanted meniscus, including partial or total meniscectomy, meniscal repair, or failure as defined above.

RESULTS:

A total of 143 patients undergoing primary MAT met inclusion criteria and were followed for a mean of 12.8 ± 2.7 years (range: 10.0 - 21.0). Concomitant procedures were performed in 96 (67%) patients, the most common being osteochondral allograft transplantation (n=50, 35%) (Table 1). Patients demonstrated statistically significant ($p \leq .037$) postoperative improvements in all patient-reported outcome measures at all timepoints, compared to baseline (Figure 1). Fifty-four patients (38%) underwent a meniscal reoperation at a mean time of 6.5 ± 5.4 years (range: 0.3 – 16.7) postoperatively, with the most common reoperation procedure being partial meniscectomy (n=27, 19%). Thirty-five (24%) patients met criteria for failure at a mean time of 7.2 ± 4.9 years following MAT (range: 1.0 - 16.5). Twelve (8%) patients underwent revision MAT, and 23 (16%) underwent conversion to arthroplasty. MAT survival free of meniscal reoperation and failure was 73% and 83% at 10 years and 58% and 69% at 15 years, respectively (Figure 2). At the time of final follow up, 88% of patients reported being satisfied with their overall postoperative condition.

DISCUSSION AND CONCLUSION: Primary MAT demonstrates efficacy and durability with high rates of patient satisfaction at minimum 10-year follow up. Patients should be counseled that while reoperation rates may approach 42% at 15 years, overall revision rates (8%) and conversion to arthroplasty (16%) remain low at long-term follow up.

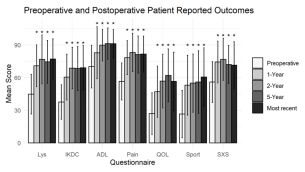


Figure 1: Mean patient reported outcome measure scores following primary meniscal allograft transplantation. Questionnaires included are Lysholm (Lys), International Knee Documentation Committee (IKDC), and Knee Injury and Osteoarthritis Outcome Score (KOOS) subscales at preoperative, 1-year, 2-year, 5-year and most-recent follow-up timepoints. KOOS subscales are abbreviated as: ADL (activities of daily living), QOL (quality of life), and SXS (symptoms). Error bars represent standard deviation and * represent significant improvement, compared to preoperative scores ($p < .05$).

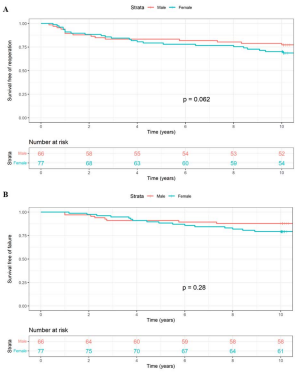


**Figure 2**: Sex-stratified Kaplan-Meier survival analysis for A) reoperation and B) failure (revision MAT or UKA/TKA). Overall survival free from reoperation was 90.2%, 88.1%, 81.1%, 73.4%, and 58.0% at 1, 2, 5, 10, and 15 years, respectively. Overall survival free from failure were 98.6%, 97.2%, 89.5%, 83.2%, and 69.0% at 1, 2, 5, 10, and 15 years, respectively. The log-rank test demonstrated no significant difference in survival distributions between male and female sex for reoperation ($p = .062$) and failure ($p = .280$).

Table 1: Demographics and Intraoperative Variables

| | Post-op | | | p-values | |
|---|---|---|---|---|---|
| **Characteristic** | **None, N=89[1]** | **Reop, N=19[1]** | **Fail, N=35[1]** | **None vs. Reop[2]** | **None vs. Failure[2]** |
| Sex (female) | 44 (49%) | 12 (63%) | 21 (60%) | 0.111 | 0.241 |
| Age (years) | 28 ± 9 | 24 ± 10 | 33 ± 11 | 0.066 | **0.031** |
| BMI | 25.9 ± 4.3 | 22.9 ± 3.6 | 25.9 ± 3.4 | **0.016** | 0.867 |
| Meniscus transplanted | | | | 0.870 | 0.709 |
| Medial | 43 (48%) | 9 (47%) | 17 (49%) | | |
| Lateral | 46 (52%) | 10 (53%) | 18 (51%) | | |
| Concomitant procedure | 66 (74%) | 7 (37%) | 23 (66%) | **0.003** | 0.347 |
| OCA | 34 (38%) | 1 (5%) | 15 (43%) | **0.004** | 0.945 |
| OATS | 1 (1%) | 0 (0%) | 1 (3%) | 0.999 | 0.483 |
| ACI | 13 (15%) | 0 (0%) | 2 (6%) | 0.120 | 0.231 |
| MFX | 8 (9%) | 1 (5%) | 0 (0%) | 0.999 | 0.104 |
| Denovo | 1 (1%) | 0 (0%) | 1 (3%) | 0.999 | 0.483 |
| HTO | 7 (8%) | 0 (0%) | 3 (9%) | 0.598 | 0.999 |
| DFO | 1 (1%) | 1 (5%) | 1 (3%) | 0.307 | 0.483 |
| ACLR | 11 (12%) | 4 (21%) | 5 (14%) | 0.272 | 0.770 |
| Follow-up (years) | 12.8 ± 2.7 | 12.6 ± 2.9 | 7.2 ± 4.9 | | |

[1]categorical variables listed as n (% of respective cohort); continuous variables listed as mean (SD)
[2]Pearson's Chi-squared test; Wilcoxon rank sum test; Fisher's exact test

Reoperations consist of any surgery related to the transplanted meniscus [debridement, meniscectomy, or repair]. Failure defined as knee arthroplasty or revision meniscal allograft transplantation. Those who had a reoperation and later met criteria for failure were only included in the failure column.