Body Mass Index Does Not Predict Mid-Term Outcomes of Meniscal Allograft Transplantation

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INTRODUCTION: Meniscal allograft transplantation (MAT) has been shown to be an effective treatment option for joint preservation in those with meniscal insufficiency. However, proper patient selection is required for the optimization of the post-operative course. Body mass index (BMI), a major modifiable pre-operative risk factor, has been shown to have variable impact on outcomes of MAT, with some studies findings no independent effect of BMI on survivorship and others finding inferior outcomes in overweight or obese patients. Greater clarity on this topic is required for appropriate pre-operative counseling and optimization. Therefore, the purpose of the present study was to assess the effect of BMI on both graft survivorship and patient-reported outcomes after MAT at mid-term follow-up in a large cohort. The hypothesis was that patients with elevated BMI would experience inferior clinical outcomes.

METHODS: Patients who underwent MAT for meniscal deficiency at a single institution between January 2011 and December 2024 were retrospectively reviewed. Post-operative failure of MAT was defined as requiring subsequent ipsilateral ipsicompartmental meniscus surgery or knee arthroplasty. Kaplan-Meier survival analysis was used to assess overall MAT survivorship and then to compare survivorship between (1) obese (BMI ≥ 30 kg/m2) and non-obese, and (2) overweight (BMI ≥ 25 kg/m2) and non-overweight patients using the log-rank test. Cox proportional hazards regression evaluated the continuous effect of BMI on MAT survivorship, adjusting for age and sex as covariates. Patients who had reached a minimum post-operative period of 5 years were contacted for patient-reported outcome (PRO) follow-up and completed the Visual Analog Scale (VAS), Knee Injury and Osteoarthritis Outcome Score (KOOS), Lysholm Score, and International Knee Documentation Committee (IKDC) questionnaires. Multivariable linear regression assessed relationships between BMI and PROs adjusting for covariates of age and sex.

RESULTS: A total of 156 patients (53.8% male) underwent MAT with mean age of 28.6 ± 9.5 years, BMI of 27.8 ± 5.7 kg/m2, and clinical follow-up period of 6.3 ± 3.6 years. The cohort included 56 patients with BMI ≤ 25 kg/m2, 56 patients with BMI 25 to 30 kg/m2, and 44 patients with BMI ≥ 30 kg/m2. During the study period, 31 total failures occurred (19.9%) with a mean time-to-failure of 2.3 ± 2.0 years. Kaplan-Meier analysis yielded 2-, 5-, and 10-year overall graft survivorship estimates of 88.6%, 79.7%, and 74.7% respectively. There were no significant differences in survivorship between obese and non-obese patients (Figure 1; p = 0.575), nor between overweight and non-overweight patients (Figure 2; p = 0.133). Cox regression did not find BMI at surgery to independently predict graft survivorship (p = 0.663). A total of 96 patients had reached minimum 5-year follow-up, of which 41 (42.7%) completed PRO surveys with mean follow-up of 8.2 ± 2.3 years. BMI did not significantly predict VAS (p = 0.579), KOOS (p = 0.640), Lysholm (p = 0.055), or IKDC (p = 0.810) scores at final follow-up when adjusting for age and sex.

DISCUSSION AND CONCLUSION:

Meniscal allograft transplantation demonstrated moderate survivorship at mid-term follow-up with no clear relationship between pre-operative body mass index and clinical or patient-reported outcomes. The current study provides no evidence to support the notion that patients with elevated BMI should expect inferior outcomes after MAT.

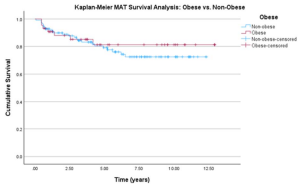

Figure 1. **Kaplan-Meier MAT Survival Curves for Obese and Non-Obese Patients.** Obese and non-obese patients were not found to have significantly different MAT survivorship (p = 0.575).

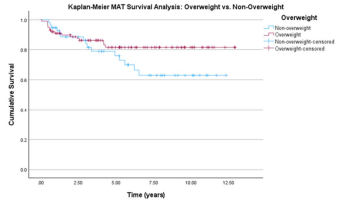

Figure 2. **Kaplan-Meier MAT Survival Curves for Overweight and Non-Overweight Patients.** Overweight and non-overweight patients were not found to have significantly different MAT survivorship (p = 0.133).

Table 1. Cohort Characteristics

Demographics	**N = 156**
Age (years) [mean ± SD]	28.6 ± 9.5
Sex (% male)	53.8%
BMI (kg/m²) [mean ± SD]	27.8 ± 5.7
Follow-up time (years) [mean ± SD]	6.3 ± 3.6
BMI categories	
BMI ≤ 25	56 (35.9%)
25 < BMI < 30	56 (35.9%)
BMI ≥ 30	44 (28.2%)
Failures	31 (19.9%)
Meniscectomy	20
Meniscal repair	8
Total knee arthroplasty	2
Graft removal (septic arthritis)	1