Comparative Outcomes of Closed Manipulation Under Anesthesia, Arthroscopic Arthrolysis, and Open Arthrolysis for Post-TKA Stiffness: A National Claims Analysis

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INTRODUCTION: Total knee arthroplasty (TKA) is a highly effective procedure for relieving debilitating pain and restoring function in patients with end-stage knee osteoarthritis. Despite its success, postoperative stiffness remains a common cause of failure, contributing to a significant number of reoperations. This stiffness, often caused by arthrofibrosis, is managed with an escalating therapeutic algorithm, from manipulation under anesthesia (MUA) to arthroscopic or open arthrolysis. Each intervention carries distinct risks, yet large-scale comparative data on their outcomes are limited. This study uses a national claims database to compare the timing and complication profiles of these interventions. The investigators hypothesized that MUA would be associated with fewer major complications and would be performed earlier than surgical arthrolysis.

METHODS: Patient records were extracted from the PearlDiver Mariner database (2016–2021), identifying TKA cases and subsequent interventions for stiffness using ICD-9/10 and CPT codes. Patients undergoing same-day procedures were excluded. Cohorts were defined by treatment type: manipulation under anesthesia (MUA), arthroscopic arthrolysis, and open arthrolysis. Each procedure was further stratified by timing following TKA: 0–3 months, 3–6 months, 6–12 months, and 12–24 months. To control baseline differences, cohorts were exactly matched by age, gender, and Charlson Comorbidity Index (CCI), yielding 225 patients per group. Outcomes included persistent stiffness, peroneal neurapraxia, infection, dislocation/instability, and revision TKA. Categorical variables were compared using Chi-square or Fisher's exact tests where appropriate. Odds ratios (OR) were calculated to quantify the relative risk of complications across treatments. All analyses were performed in R statistical software (Version 4.1.0), with significance defined as $P < 0.05$.

RESULTS: A total of 1,769,004 patients underwent TKA, of whom 354,840 developed postoperative stiffness. Among these, 6,289 underwent closed MUA, 887 underwent arthroscopic arthrolysis, and 639 underwent open arthrolysis. After matching for age, gender, and Charlson Comorbidity Index (CCI), each treatment cohort included 225 patients with a mean age of 63.7 ± 7.7 years and a male-to-female ratio of 142:83. The timing of intervention differed significantly between groups ($P < .001$). Closed MUA was most frequently performed within 0–3 months of TKA (41%), followed by 3–6 months (17%) ($P < .001$). Arthroscopic arthrolysis was most often performed between 12–24 months (16%) and 6–12 months (12%) ($P < .001$), while open arthrolysis was evenly distributed across time intervals ($P = .43$). Overall complication rates were similar across groups ($P = .20$); however, the distribution of complication types varied ($P < .001$). In the closed MUA cohort, stiffness was most common (30%), followed by dislocation (0.4%) and revision TKA (0.4%) ($P < .001$). In the arthroscopic arthrolysis cohort, stiffness remained most frequent (36%), followed by dislocation (3.6%) and revision TKA (1.8%) ($P < .001$). In the open arthrolysis cohort, stiffness (30%) was again most common, with higher rates of revision TKA (8.9%), infection (4.0%), and dislocation (3.1%) ($P < .001$). Odds ratio analysis showed that open arthrolysis was associated with a 19-fold higher risk of revision TKA compared with closed MUA ($P < .001$) and a 5-fold higher risk compared with arthroscopic arthrolysis ($P < .01$). Revision occurred at slightly higher rates in arthroscopic arthrolysis than in closed MUA ($P = .37$). Open arthrolysis also carried a 6.4-fold higher risk of dislocation compared with closed MUA, a finding that approached significance ($P = .07$).

DISCUSSION: This analysis of a large national claims database highlights important differences in timing, utilization, and complication profiles among interventions for post-TKA stiffness. Consistent with prior literature, MUA was most frequently performed in the early postoperative period and was associated with the lowest risk of subsequent revision compared with arthroscopic or open arthrolysis. Early intervention is supported by systematic reviews showing that MUAs performed within 3 months achieve greater flexion gains and carry fewer complications than delayed procedures. In contrast, arthroscopic and open arthrolysis were more commonly performed beyond 6–12 months, when established fibrosis limits the efficacy of nonoperative measures. While these techniques can restore motion, they carry higher complication and reoperation rates, with this study demonstrating that open arthrolysis conferred a nearly 19-fold increased risk of revision compared with MUA. These findings align with prior reviews noting variable and often modest outcomes of surgical arthrolysis. These results also reinforce the importance of patient-specific risk factors. Chandi et al. recently demonstrated that patients who require an MUA after one TKA are nearly 14 times more likely to need the procedure after a contralateral TKA, suggesting a biologic predisposition to arthrofibrosis. These data underscore the value of early, evidence-based escalation of care. Identifying high-risk patients and prioritizing timely MUA may improve functional outcomes while minimizing the costs and morbidity associated with repeat operations.

SIGNIFICANCE/CLINICAL RELEVANCE: Early identification and treatment of post-TKA stiffness can restore function while minimizing complications and costs. This study provides population-level evidence supporting early MUA as first-line therapy and cautions that open arthrolysis may carry substantially higher revision risk.