

The Role of Short-Term Glycemic Markers in Predicting Outcomes After Total Joint Arthroplasty: A Systematic Review of Fructosamine Versus HbA1c

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INTRODUCTION:

Total joint arthroplasty (TJA), including total knee arthroplasty (TKA) and total hip arthroplasty (THA), is one of the most effective surgical interventions for end-stage arthritis. Postoperative complications such as periprosthetic joint infection (PJI), reoperations, and unplanned readmissions pose significant clinical and financial burdens. Poor perioperative glycemic control is a well-established risk factor for adverse outcomes in TJA patients. Hemoglobin A1c (HbA1c) has served as the standard biomarker for assessing glycemic control, reflecting average blood glucose over 2–3 months. However, it may not adequately capture recent glycemic changes before surgery. Fructosamine, reflecting glucose levels over 2–3 weeks, has emerged as a potentially more accurate predictor of immediate postoperative outcomes. This systematic review and meta-analysis compares the predictive utility of preoperative fructosamine and HbA1c for postoperative outcomes following hip and knee arthroplasty, focusing on PJI, reoperation, readmission, and length of hospital stay (LOS).

METHODS:

This study followed a pre-registered protocol and PRISMA guidelines for systematic reviews. Literature searches were conducted in PubMed, EMBASE, Web of Science, and Cochrane databases from January 1990 through May 1st, 2025. The search included studies assessing preoperative fructosamine and HbA1c levels in adults undergoing primary hip or knee arthroplasty that reported PJI, reoperation, readmission, or length of stay outcomes. Eligible studies included randomized controlled trials, cohort studies, case-control studies, and case series with at least 10 patients per group. Studies on pediatric populations, case reports, editorials, or those lacking outcome data were excluded. Two reviewers independently screened titles, abstracts, performed full-text reviews, and extracted data using standardized forms. Disagreements were resolved through consensus or third-reviewer consultation. Extracted data included demographics (age, sex, BMI), arthroplasty type, glycemic marker thresholds, and postoperative outcomes. Risk of bias was assessed using the Cochrane Tool for RCTs and Newcastle-Ottawa Scale for observational studies. Effect sizes were reported as odds ratios with 95% CI for dichotomous outcomes and mean differences for continuous outcomes. Heterogeneity was assessed using I^2 statistic.

RESULTS: A total of five studies comprising 3,530 patients undergoing total joint arthroplasty, 239 had elevated fructosamine levels (≥ 293 $\mu\text{mol/L}$) and 3,291 had normal levels (< 293 $\mu\text{mol/L}$). Patients with elevated fructosamine levels were older (67.43 vs. 64.30 years) and had a higher BMI (30.11 vs. 29.97 kg/m^2). The high fructosamine group included 40.2% males, 53.6% females, and 6.3% unspecified, whereas the normal group comprised 41.2% males, 57.3% females, and 1.5% unspecified. For arthroplasty type, 37.2% of the high fructosamine group underwent TKA, 38.1% underwent THA, and 24.7% underwent unspecified arthroplasty, compared to 45.4% underwent TKA, 47.2% underwent THA, and 7.4% underwent unspecified arthroplasty in the normal group. While the diagnostic odds ratios for complications did not differ significantly when comparing fructosamine > 293 $\mu\text{mol/L}$ to HbA1c $> 7.0\%$, fructosamine showed superior predictive performance across postoperative outcomes. Elevated fructosamine levels are significantly associated with an increased risk of periprosthetic joint infection, hospital readmission, and reoperation. While HbA1c $> 7.0\%$ predicted PJI and readmission, it lacked significance for reoperation risks and showed instability in predictive modelling. Patients with elevated fructosamine levels experienced longer hospitalisations, with an average increase of 0.302 days (95% CI: 0.095–0.509 days). The meta-analysis confirmed this association (mean difference: ~ 0.30 days; $p=0.004$), with Shohat et al. (2021) significantly contributing to the effect ($p=0.011$), while other studies showed broader confidence intervals.

DISCUSSION AND CONCLUSION: This systematic review and meta-analysis demonstrates that fructosamine is a more reliable predictor than HbA1c for complications after total joint arthroplasty (TJA), including infection, readmission, reoperation, and hospital stay. Its short-term glycemic reflection makes it especially useful when HbA1c is inconclusive. Incorporating fructosamine into pre-op assessments may improve risk stratification and outcomes. Further research is needed to define thresholds and guide clinical use.

Figure 1. Mean Difference in Length of Stay Following TJA for Fructosamine ≥ 293 $\mu\text{mol/L}$ versus. < 293 $\mu\text{mol/L}$

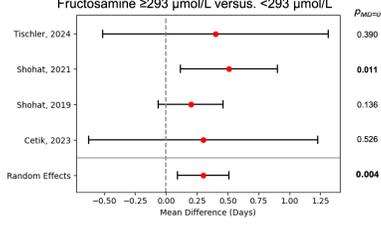


Figure 1. Fructosamine versus HbA1c Diagnostic Odds Ratios for TJA Complications

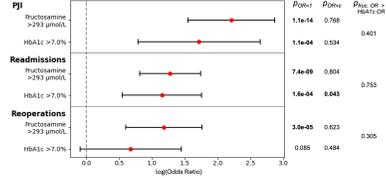


Table 1. Aggregated Patient Demographics

	Fructosamine ≥ 293 $\mu\text{mol/L}$	Fructosamine < 293 $\mu\text{mol/L}$
Sample Size	239	3,291
Age in years (SD)	67.43 (10.11)	64.30 (10.66)
BMI (SD)	30.11 (5.30)	29.97 (5.52)
Sex		
<i>n</i> , Male (%)	96 (40.2%)	1,355 (41.2%)
<i>n</i> , Female (%)	128 (53.6%)	1,885 (57.3%)
<i>n</i> , unspecified (%)	15 (6.3%)	51 (1.5%)
Arthroplasty Type		
<i>n</i> , TKA (%)	89 (37.2%)	1,494 (45.4%)
<i>n</i> , THA (%)	91 (38.1%)	1,552 (47.2%)
<i>n</i> , unspecified (%)	59 (24.7%)	245 (7.4%)