Sickle Cell Trait is Associated with Higher Healthcare Utilization and Revision Rates Following Total Knee Arthroplasty

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INTRODUCTION: Sickle cell trait (SCT) is a heterozygous carrier state of the sickle hemoglobin gene. While generally considered relatively benign, SCT has been associated with increased complications and early mortality. While the outcomes of sickle cell disease (SCD) patients undergoing TKA have been studied, the outcomes of those with SCT undergoing this procedure have not.

METHODS: Patients undergoing TKA were identified from the 2010-2022 PearlDiver M170Ortho administrative database. Exclusion criteria included: patient age less than 18 years, trauma, neoplasm, or infection diagnosis within 90 days before surgery, those with less than 90-day follow-up in the database, or a diagnosis of SCD. This population was divided into two cohorts: those with a diagnosis code for SCT and those without a diagnosis code for SCT. The SCT cohort was then matched 1:4 to the non-SCT cohort based on age, sex, and Elixhauser Comorbidity Index (ECI).

The incidence of 90-day perioperative adverse events in both aggregated (any, severe, or minor) and individual forms (cardiac events, venous thromboembolism, sepsis, surgical site infection, pneumonia, urinary tract infection, acute kidney injury, wound complications, or transfusions), as well as 5-year implant-related adverse events (periprosthetic joint infection, periprosthetic fracture, aseptic loosening, or joint stiffness) were tabulated. Further, healthcare utilization within 90 days, including emergency department (ED) visits and readmissions, was similarly collected. Adverse events and healthcare utilization rates were compared using multivariable logistic regression, controlling for patient age, sex, and ECI. Five-year rates of revision TKA were assessed using Kaplan-Meier survival analyses and compared with log-rank tests.

RESULTS: Out of a total of 1,686,606 TKA patients, SCT was identified for 1521 (0.09%) TKA patients. After matching, SCT patients were 1517 (20.0%), and non-SCT patients were 6062 (80.0%).

Considering 90-day perioperative and 5-year implant-related adverse events, no significant differences were identified in the relative odds of individual or aggregated 90-day adverse events or 5-year implant-related adverse events. In terms of healthcare utilization, SCT patients were significantly more likely to visit the ED (OR 1.82; $p<0.001$) or be readmitted (OR 2.08; $p<0.001$) within 90 days. SCT patients also had significantly higher rates of revision TKA (7.2% vs. 4.4%; $p<0.001$) (Figure 1).

DISCUSSION: Patients with sickle cell trait undergoing TKA had no significant differences in the relative odds of perioperative adverse events. While specific longer-term joint-related adverse events were not found to be different, there were higher rates of revision TKA over time. Furthermore, SCT patients had higher odds of healthcare utilization via ED visits and readmissions compared to those without. These findings were significantly less than have previously reported for SCD patients undergoing TKA.

SIGNIFICANCE/CLINICAL RELEVANCE: The present study is the first to investigate outcomes of SCT patients in TKAs using a large database. These findings suggest that SCT carriers may not have elevated surgical risk like that reported with SCD but still suffer from higher healthcare utilization and revisions.

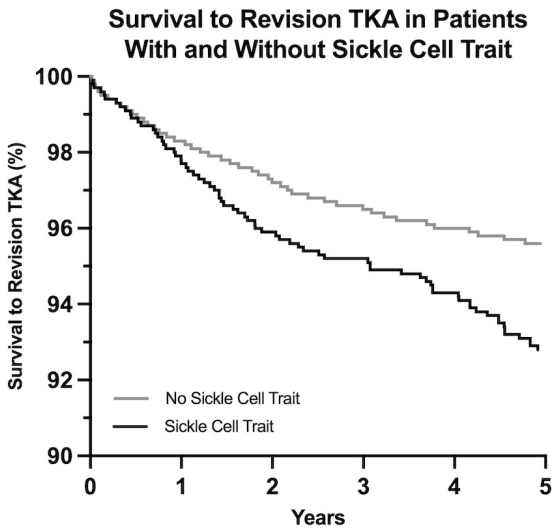

Figure 1: Kaplan-Meier survival curve comparing 5-year survival to revision total knee arthroplasty (TKA) rates in sickle cell trait versus non-sickle cell trait patients. Log-rank test demonstrated a significant difference between cohorts (7.2% vs. 4.4%, $p<0.001$)