Association Between Peripheral Artery Disease and Prosthetic Joint Infection After Total Knee Arthroplasty: A Systematic Review and Meta-Analysis

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INTRODUCTION: Total knee arthroplasty (TKA) is one of the most frequently performed orthopedic procedures worldwide, offering substantial improvements in pain relief and functional recovery for patients with advanced knee osteoarthritis. Despite its high success rate, periprosthetic joint infection (PJI) remains one of the most severe postoperative complications, leading to significant patient morbidity, prolonged hospitalization, and increased healthcare costs. Peripheral artery disease (PAD), characterized by reduced arterial perfusion secondary to atherosclerotic obstruction, is prevalent among patients undergoing TKA and may predispose them to postoperative infections through mechanisms of tissue hypoxia, delayed wound healing, and immune dysfunction. Although it has been associated with higher surgical complication rates, evidence linking PAD and PJI after TKA remains limited and inconsistent. This study aims to systematically evaluate and quantify the association between peripheral artery disease and the risk of periprosthetic joint infection following primary total knee arthroplasty.

METHODS: A systematic review and meta-analysis were performed according to PRISMA guidelines and registered in PROSPERO. PubMed, EBSCO Host, and Cochrane databases were searched using the following criteria: ("total knee arthroplasty" OR TKA) AND ("peripheral vascular disease" OR "PVD" OR "peripheral arterial disease" OR “PAD”) AND ("complications" OR "infection" OR "readmission" OR "reoperation" OR "periprosthetic joint infection" OR “PJI”). Two reviewers independently screened and extracted data, with discrepancies resolved by a third reviewer. Pooled relative risks (RRs) with 95% confidence intervals were calculated using a random-effects model in RevMan 5.4, and heterogeneity was evaluated using the I^2 statistic.

RESULTS: Four retrospective cohort studies involving over 1.8 million patients were included in the meta-analysis. Patients with PAD had a significantly higher risk of developing PJI after total knee arthroplasty (pooled RR = 1.62; 95% CI 1.42–1.85; $p < 0.00001$), with moderate heterogeneity ($I^2 = 51\%$) (figure 1). All included studies showed a consistent direction of effect. Regarding secondary outcomes, PAD was also associated with a higher risk of postoperative medical complications, including pneumonia (RR 1.77; $p = 0.0005$), acute kidney injury (RR 1.82; $p = 0.002$), myocardial infarction (RR 1.43; $p = 0.0005$) and pulmonary embolism (RR 1.29; $p = 0.003$). The association with implant-related complications such as periprosthetic fracture (RR 1.43; $p < 0.001$) and prosthetic dislocation (RR 1.83; $p < 0.001$) were also significant.

DISCUSSION: The findings of this study demonstrate a robust association between PAD and increased risk of PJI after TKA. By identifying a 62% higher risk of PJI among PAD patients (pooled RR = 1.62; 95% CI 1.44–1.83; $p < 0.00001$), this meta-analysis addresses a critical barrier in arthroplasty outcomes: the lack of robust risk stratification for vascular comorbidity in joint replacement surgery. This relationship is biologically plausible, given that systemic atherosclerosis and compromised microvascular perfusion in PAD may impair wound healing and host immune response, predisposing to bacterial colonization of prosthetic components. The moderate but non-significant heterogeneity ($I^2 = 51\%$, $p = 0.11$) suggests consistency across studies.
Beyond infection, PAD was also linked to higher rates of systemic and implant-related complications, including pneumonia, acute kidney injury, myocardial infarction, pulmonary embolism, periprosthetic fracture, and prosthetic dislocation, highlighting a broader perioperative vulnerability in this population. Considering that 4-5% of TKA candidates may have undiagnosed PAD, preoperative vascular screening and optimization are warranted. These findings enhance current knowledge by quantifying the vascular-infection link and emphasize the importance of multidisciplinary management. Integrating vascular assessment into perioperative care could reduce infection-related complications and improve long-term arthroplasty outcomes.

SIGNIFICANCE/CLINICAL RELEVANCE: This study identifies peripheral artery disease as a significant risk factor for periprosthetic joint infection after total knee arthroplasty. Recognizing and addressing this association may improve preoperative risk assessment and reduce postoperative complications in high-risk patients.

IMAGES AND TABLES:

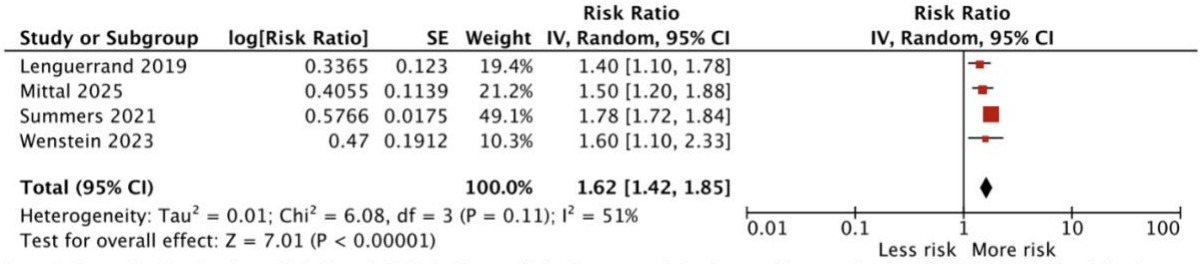

Figure 1. Forest plot showing the pooled risk ratio (RR) for the association between peripheral artery disease and periprosthetic joint infection following total knee arthroplasty.