

QUESTION 3: Does current tobacco use increase the risk of surgical site infection/periprosthetic joint infection (SSI/PJI) recurrence?

RECOMMENDATION: Yes. Current tobacco use appears to increase the risk of SSI/PJI in patients undergoing orthopaedic procedures.

LEVEL OF EVIDENCE: Limited

DELEGATE VOTE: Agree: 94%, Disagree: 3%, Abstain: 3% (Super Majority, Strong Consensus)

RATIONALE

PJI is a devastating potential complication after total joint arthroplasty (TJA) procedures. Studies have shown that this complication occurs approximately 1 to 2% of the time following primary TJA, and is even more common following revision surgery [1–3]. Surgical treatments of PJI, with the goal of infection eradication, include irrigation and debridement with implant retention, one-stage revision and two-stage revision procedures. There are no standard definitions for successful treatment but most physicians would agree that the goal of these interventions is to eradicate the infection. Reported success rates of the aforementioned procedures vary and there exists abundant literature focusing on the impact of various patient, surgical and infectious factors on treatment success. Despite the large number of studies on factors contributing to the recurrence of PJI following surgical treatment, relatively little has been published looking at the impact of current tobacco use on PJI recurrence.

An extensive systematic review was performed to identify all studies reporting the success of surgical treatments for hip or knee PJI. This literature review identified 20 published studies that specifically reported or evaluated tobacco use in the study population or in relation to the surgical treatment of SSI/PJI [4–23]. Using the methodology for evaluating evidence as outlined by the American Academy of Orthopaedic Surgeons Clinical Practice Guideline and Systematic Review Methodology Version 2.0 [24], 17 of these studies were graded as being low-quality [4,5,7,8,10–12,14–23], and three studies were graded as being very low-quality [6,9,13].

Of the 20 studies evaluated, 14 studies evaluated two-stage revisions; two studies evaluated irrigation and debridement, and five studies evaluated patients with either of those two procedures for PJI. Univariate statistical analysis evaluating the association between tobacco use and recurrence of PJI was performed in 19 of the studies. Smoking was associated with a significantly increased risk for PJI recurrence in three of these studies [4,8,9]. Further multivariate analysis was performed in two of these studies [4,9]. Hoell et al. retrospectively evaluated 59 patients who underwent two-stage revision for PJI and identified smoking as an independent risk factor for failure to cure infection (odds ratio (OR): 21.5, 95% confidence interval (CI) 2.6 to 178) [9]. Cancienne et al. utilized the Medicare administrative claims dataset to evaluate 18,533 patients who underwent antibiotic spacer placement for infected total knee arthroplasty and found tobacco use to be independently associated with the need for a repeat debridement without reimplantation within one year (OR 1.10, $p = 0.003$) [4].

Given that many of the studies had relatively small cohorts and may have been underpowered to detect an association between smoking and PJI recurrence, pooled analysis on the studies was performed. Of the 20 studies, 12 provided sufficient data to be included in the pooled analysis [5,6,8,10–14,18–21]. The remainder either did not report raw data on the number of patients who used tobacco or did not report on how many tobacco users had a recurrence of PJI. If there were multiple studies from the same institution, only the most recent study with the largest cohort was included. This was done to prevent the unintentional inclusion of the same patient data multiple times. This left ten studies, representing 1,124 patients with PJI, to be included in the pooled analysis [5,6,8,10,12–14,19–21]. Heterogeneity across studies was present as determined using the Q and I^2 statistics or likelihood ratio test. Therefore, inverse-variance weighted random-effects models were used to evaluate the pooled estimates using R software. Forest plots were also generated to display the odds ratios and 95% confidence intervals for each study, as well as the overall random-effects pooled estimate and its confidence interval. Pooled analysis demonstrated that tobacco users were significantly more likely to experience recurrence of PJI after surgical treatment than non-tobacco users, with an OR of 1.53 (1.06 to 2.21) (see Fig. 1). Furthermore, this finding remained significant when only including patients treated with two-stage revision (OR: 1.59, 1.03 to 2.47).

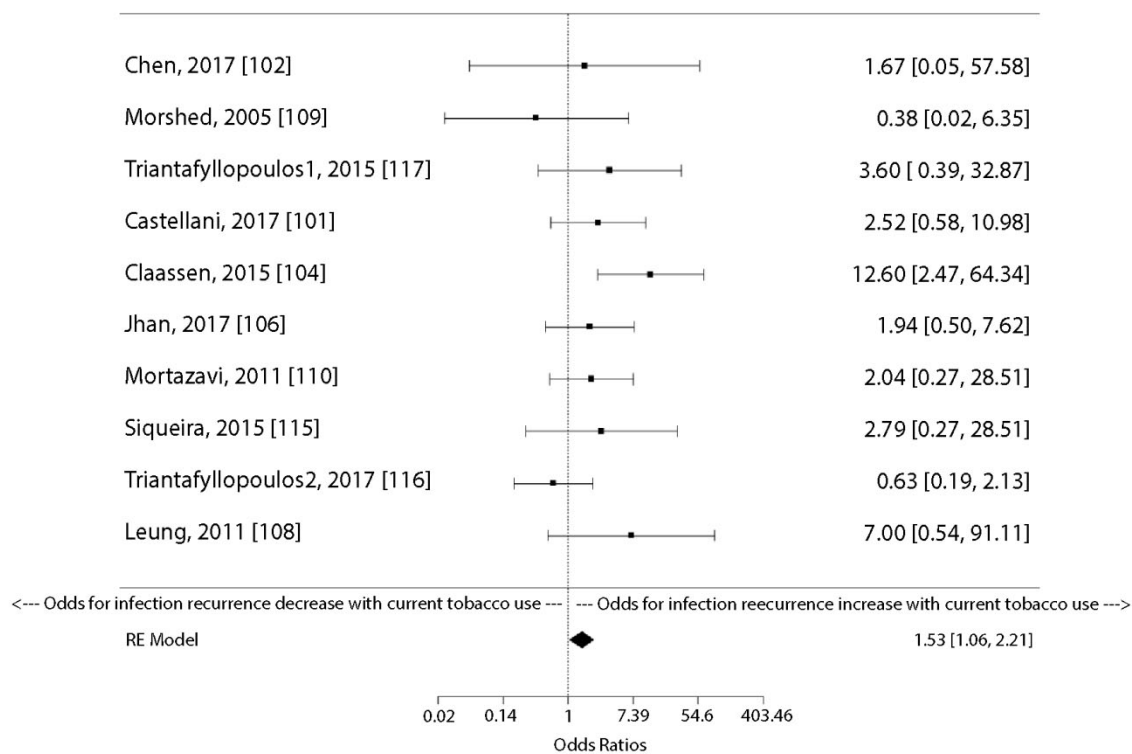


FIGURE 1. Odds ratios for infection recurrence with current tobacco use versus no tobacco use.

The findings from these studies and the results of the pooled analysis suggest that current tobacco use increases the risk of PJI recurrence after surgical treatment of hip and knee PJI. The strength of this conclusion is limited by the available studies being of low or very low quality and primarily including small numbers of patients. However, there is higher quality literature that associates current tobacco use with an increased risk of PJI following primary TJA [25–30]. There are also established adverse effects of tobacco use on wound healing. It is therefore reasonable to conclude that the findings from these studies and the results of the pooled analyses likely represent a true association. There is a need for additional, high-quality research to confirm this association and to assess whether cessation of tobacco use can increase the success of infection remission following surgical treatment for PJI.

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