

# The Effect of Non-tobacco Nicotine on Ankle Arthrodesis

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**INTRODUCTION:** Non-tobacco nicotine dependence (NTND) is associated with products such as e-cigarettes and vaping and has been increasing in popularity as an alternative to traditional tobacco. NTND has been shown to increase complications in shoulder and knee arthroplasty. However, limited data exist on the effects of NTND in foot and ankle surgery. This study investigates the association between NTND and outcomes following ankle arthrodesis (AA).

**METHODS:** This retrospective study utilized the TriNetX database (2005–2025) to identify patients undergoing AA. Two cohorts were created: patients with NTND (n = 16,591) and controls without NTND (n = 68,048). Propensity score matching (1:1) was performed to control for confounders, resulting in 14,954 patients per cohort. After matching, the NTND cohort (47.6% female) had a mean age of 45.5 years, mean BMI of 30.0 kg/m<sup>2</sup> (range: 25.0–40.0), and mean follow-up time of 677.511 days (range 180-730 days). The control cohort (47.7% female) had a mean age of 46.2 years, mean BMI of 31.1 kg/m<sup>2</sup> (range: 25.0–40.0), and mean follow-up time of 637.701 days (range 180-730 days).

**RESULTS:** At 6 months, the NTND cohort demonstrated significantly increased risks of opioid abuse (Risk Ratio [RR]: 5.700; 95% Confidence Interval [CI]: 2.912–11.157), wound dehiscence (RR: 1.608; 95% CI: 1.215–2.127), implant-related pain (RR: 1.165; 95% CI: 1.059–1.282), and implant-related infection (RR: 1.953; 95% CI: 1.547–2.465). The risk of nonunion or malunion was lower in the NTND cohort compared to the control group (Risk Difference [RD]: -0.001; 95% CI: -0.001 to -0.001; p = 0.002), though this is likely not clinically significant. By 2 years, NTND patients had increased risks of wound dehiscence (RR: 1.720; 95% CI: 1.051–2.814), hardware removal (RR: 1.363; 95% CI: 1.070–1.735), implant-related pain (RR: 1.664; 95% CI: 1.419–1.951), implant-related infection (RR: 2.138; 95% CI: 1.376–3.321), and pulmonary embolism (RR: 1.381; 95% CI: 1.065–1.792).

**DISCUSSION AND CONCLUSION:** Patients with NTND undergoing ankle arthrodesis have elevated risks of wound complications, infection, and other complications but interestingly do not have an increased rate of nonunion. These findings highlight the importance of avoiding NTND in patients undergoing AA. Additional research is needed to better characterize this association and its clinical implications.

(Table 1) Risk Ratios and 95% Confidence Intervals for Postoperative Complications at 6-Months and 2-Years Following Ankle Arthrodesis

OUTCOMES	6 MONTH POSTOP	2 YEAR POSTOP
Opioid Abuse	RR: 5.700 95% CI: (2.912, 11.157)	RR: 5.000 95% CI: (2.691, 9.289)
Wound Dehiscence	RR: 1.608 95% CI: (1.215, 2.127)	RR: 1.720 95% CI: (1.051, 2.814)
Removal of Hardware	RR: 1.064 95% CI: (0.955, 1.185)	RR: 1.363 95% CI: (1.070, 1.735)
Nonunion or Malunion	RD: 0.001 95% CI: (-0.001, -0.000) p = 0.002	**N/A
Implant-Related Pain	RR: 1.165 95% CI: (1.059, 1.282)	RR: 1.664 95% CI: (1.419, 1.951)
Implant-Related Infection	RR: 1.953 95% CI: (1.547, 2.465)	RR: 2.138 95% CI: (1.376, 3.321)
Implant-Related Embolism	RR: 1.112 95% CI: (0.933, 1.326)	RR: 1.381 95% CI: (1.065, 1.792)

Abbreviations: RR, Risk Ratio; RD, Risk Difference; 95% CI, 95% Confidence Interval.  
 \* No instances of this outcome were recorded in cohort 1, thus a RR was calculated.  
 \*\* No instances of the outcome occurred for either cohort.  
 Furthermore, the TriNetX platform calculates p-values only for RDs. All statistically significant RRs are assumed to have p < 0.05 and all non-statistically significant RRs are assumed to have p > 0.05.