Lower BMI Increases Risk of Both Prosthetic Joint Infection and Gutter Impingement Following Total Ankle Arthroplasty

Emily Joan Luo, Kevin Adam Wu, Enrico Pozzessere[1], Albert Thomas Anastasio, Francois Lintz, Wolfram Grün, Pierre-Henri Vermorel, Mark E Easley, Cesar De Cesar Netto
[1]Department of Orthopaedic Surgery

INTRODUCTION: Body mass index (BMI) has long been debated as a potential risk factor for complications following total ankle arthroplasty (TAA), yet its impact remains poorly defined. This study aims to elucidate the relationship between BMI and two common complications of TAA—prosthetic joint infection (PJI) and gutter impingement—using a large, single-institution cohort. We hypothesized that BMI would influence the risk for both complications, though in different ways due to its variable effects on soft tissue coverage, mechanical loading, and implant dynamics.

METHODS: A retrospective review was conducted of 1,322 patients who underwent primary TAA between 2002 and 2022. Demographic and clinical data were collected, including age, gender, race, BMI, ASA classification, diabetes status, smoking history, implant type, and surgical factors such as tourniquet time. Logistic regression analyses were used to assess the relationship between BMI and the occurrence of PJI and gutter impingement, with odds ratios (OR) and 95% confidence intervals (CI) reported. Receiver operating characteristic (ROC) curve analysis evaluated the discriminatory power of each variable.

RESULTS:

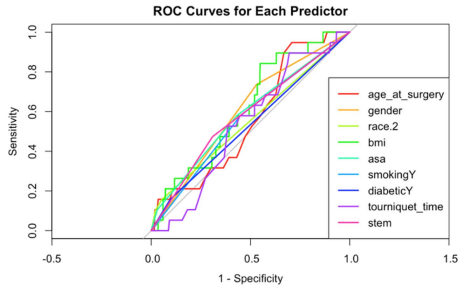
Nineteen patients (1.4%) developed PJI. In this group, multivariate analysis identified higher BMI as the only variable significantly associated with a reduced risk of infection (OR: 0.878, 95% CI: 0.78–0.97). Each 1-unit increase in BMI conferred a 12.2% reduction in infection odds. Although BMI had the highest area under the curve (AUC = 0.618), all variables demonstrated poor overall predictive capacity.

In contrast, the analysis of gutter impingement revealed an inverse association: lower BMI was significantly associated with increased impingement risk (OR: 0.996, 95% CI: 0.992–0.999, p = 0.02). Additional risk factors for impingement included younger age (OR: 0.997, 95% CI: 0.995–0.999, p < 0.01) and post-traumatic primary diagnosis (OR: 1.076, 95% CI: 1.039–1.113, p < 0.01). Gender, diabetes status, and ASA score were not significantly associated with impingement.

DISCUSSION AND CONCLUSION:

These findings suggest that lower BMI is a shared risk factor for both PJI and gutter impingement in TAA, likely due to reduced soft tissue padding that diminishes protection against mechanical irritation and infection. In leaner patients, bony prominences may become more clinically relevant, and assumptions about lower infection risk may lead to under-preparation or suboptimal surgical debridement. Conversely, higher BMI may offer protective soft tissue coverage, albeit with potential mechanical downsides.

This study highlights the nuanced role of BMI in TAA outcomes and underscores the need for individualized surgical planning. Surgeons should not overlook the risks faced by leaner patients and should consider BMI not only in infection prevention but also in soft tissue management and gutter clearance during surgery. Further studies are warranted to define optimal BMI thresholds that balance surgical outcomes and long-term health risks.



Predictive Factors	AUC
Age	0.5608540
Gender	0.5027598
Race (Non-White)	0.5526112
BMI	0.6176985
ASA	0.5879635
Smoking	0.5648024
Diabetes	0.5307933
Tourniquet Time	0.5364717
Stemmed Implant	0.5821631

Figure 1. ROC curve analysis of predictive factors of PJI.

Table 1. Risk factors for gutter impingement

Variable	Odds Ratio	95% CI low	95% CI high	Multivariate Analysis p-value
Current Smoker	1.00	0.92	1.09	0.91
Diabetic	0.98	0.92	1.04	0.45
BMI	0.99	0.99	1.00	**0.02**
Male	0.98	0.94	1.01	0.19
Age	1.00	1.00	1.00	**<0.001**
Post Traumatic Diagnosis	1.08	1.04	1.11	**<0.001**
Rheumatoid Diagnosis	0.96	0.86	1.05	0.35
ASA	0.99	0.96	1.03	0.66

Table 2. Risk factors for PJI

Variable	Odds Ratio	95% CI low	95% CI high	Multivariate Analysis p-value
Age	0.97	0.93	1.01	0.13
Gender	2.85	0.96	10.03	0.08
Race (White)	2.78	0.22	68.47	0.44
Race (Non-White)	0.61	0.10	12.27	0.66
BMI	0.88	0.78	9.74	**0.02**
ASA 2	0.44	0.08	3.51	0.36
ASA 3	0.93	0.17	7.62	0.94
ASA 4	NA	NA	NA	0.99
Smoking	1.91	0.75	5.15	0.18
Diabetes	2.22	0.49	7.47	0.24
Tourniquet Time	0.90	0.50	2.05	0.78
Stemmed Implant	1.92	0.73	4.97	0.17