Table 3. Multivariable predictive model for any amputation among patients with one or more musculoskeletal infection (n=301 surgical amputations, detachments, or disarticulations among 1648 patients, c-statistic 0.81).

Predictor	Adjusted odds ratio (95% CI)	P value
Sex/gender		*0.002*
Male	1.65 (1.20, 2.29)	
Female	1.00 (reference category)	
Race/ethnicity		*0.04*
Black non-Hispanic/African American	2.94 (1.29, 6.71)	
Hispanic	1.65 (1.10, 2.48)	
Other (including two or more races)	1.10 (0.52, 2.34)	
White non-Hispanic	1.35 (0.87, 2.09)	
American Indian/Alaskan Native	1.00 (reference category)	
Infection type		*<0.0001*
Infective/septic arthritis	0.34 (0.24, 0.47)	
Infective/septic myositis	0.22 (0.03, 1.79)	
Osteomyelitis	1.00 (reference category)	
Diabetes mellitus	4.70 (3.29, 6.72)	*<0.0001*
Diabetic neuropathy	2.17 (1.52, 3.10)	*<0.0001*
Peripheral vascular disease	2.08 (1.35, 3.20)	*0.001*
Rheumatoid arthritis	0.42 (0.15, 1.15)	*0.09*[a]

[a]Variables with a $P<0.10$ were eligible for retention in the model. CI: Confidence interval

arthritis were generally less likely to undergo an amputation (Table 3).

Two sociodemographic variables were also significant predictors of amputation, even after adjustment for the other variables as shown in Table 3. Men were more likely to undergo an amputation compared to women (aOR = 1.65, 95% CI: 1.20, 2.29). Meanwhile, Black non-Hispanic/African American (aOR = 2.94, 95% CI: 1.29, 6.71) and Hispanic (aOR = 1.65, 95% CI: 1.10, 2.48) patients were more likely to undergo an amputation compared to AI/AN patients, who had the lowest odds of this outcome in the cohort.

Adjustment of the model shown in Table 3 for HbA1c (model with smaller n = 895) attenuated the ORs for DM (aOR = 1.91, 95% CI: 1.00, 3.62), peripheral neuropathy (aOR = 1.95, 95% CI: 1.34, 2.85), PVD (aOR = 1.89, 95% CI: 1.19, 3.00), and rheumatoid arthritis (aOR = 0.58, 95% CI: 0.20, 1.70). The OR for septic myositis (aOR = 0.16, 95% CI: 0.02, 1.48) decreased further after adjustment, while the OR for septic arthritis (aOR = 0.32, 95% CI: 0.21, 0.47) was similar. A single-unit rise in HbA1c was associated with an aOR of 1.20 (95% CI: 1.13, 1.28) for undergoing an amputation.

Adjustment for HbA1c did not change the patterns observed with the sociodemographic characteristics in the amputation model. Male sex was still associated with more than a 60% increase in the odds of an amputation (aOR = 1.69, 95% CI: 1.17, 2.46). Black non-Hispanic/African American (aOR = 3.83, 95% CI: 1.50, 9.76), Hispanic (aOR = 1.64, 95% CI: 1.05, 2.55), other race/ethnicity (aOR = 1.14, 95% CI: 0.48, 2.71), and White non-Hispanic (aOR = 1.15, 95% CI: 0.70, 1.89) patients still had increased odds of amputation compared to AI/AN patients after adjustment for HbA1c.

4. Discussion

The mainstays of treatment for serious musculoskeletal infections include administration of systemic antimicrobial therapy and, when appropriate, surgical drainage or debridement of the infected anatomic structures. In this cohort of patients with osteomyelitis, septic arthritis, and/or infectious myositis, surgical procedures were common (70.0%) and amputation occurred in nearly one-fifth of cases (18.2%).

Several clinical characteristics of this cohort were notable. DM was a prevalent condition (48.2%). Both DM and DM-associated peripheral neuropathy significantly increased the odds of undergoing either a surgical procedure or an amputation. These findings underscore the risk of musculoskeletal infections in patients with DM (2,5) and may signify a diversity of mechanisms, by which DM increases this risk (e.g., neuropathic and non-neuropathic processes). Furthermore, after adjustment for HbA1c, the impact of both DM and peripheral neuropathy was attenuated in both models, suggesting that the impact of these diagnoses on procedural occurrence may be mediated by (or closely correlated with) the degree of hyperglycemia.

As expected, the type of infection also had a significant impact on the odds of undergoing a procedure or amputation. Septic arthritis was a stronger predictor of procedures than osteomyelitis or infectious myositis, whereas osteomyelitis was a stronger predictor of amputation than septic arthritis or infectious myositis. These patterns likely reflect clinical practice standards, in which septic arthritis often poses an urgent indication for surgical drainage [5], whereas severe or persistent osteomyelitis (e.g., in the bones of the feet) may require surgical resection or amputation [2].

Men had higher odds of both surgical procedures and amputations compared to women. It is unknown whether men in the cohort may have had higher rates of other unmeasured predictors, such as musculoskeletal trauma. Interestingly, adjustment for DM severity using HbA1c largely ameliorated the increased odds of a procedure among male patients. However, this was not observed in the amputation model, in which men had persistently higher odds, regardless of DM severity.

Race/ethnicity was a significant predictor for amputations but not for surgical procedures overall. This is consistent with evidence elsewhere that DM and its complications, including amputation, exert disproportionate impacts across different racial and ethnic groups [6-9]. Our study appears to confirm the presence of significant racial/ethnic disparities in surgical amputation among patients with serious musculoskeletal infections. Importantly, however, adjustments for DM severity using HbA1c did not eliminate this apparent disparity, suggesting that may not be related entirely to preventive DM care.

The disparate odds of amputation by race/ethnicity also cannot be extrapolated to the odds for developing a musculoskeletal

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