

**Epidemiology and Outcomes of Firearm-Related Fractures:
An International Perspective Using the SIGN Surgical Database**

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Purpose: Ballistic injuries represent a clinically challenging cause of fracture. There remains little consensus on several aspects of firearm-related fracture management including antibiotic prophylaxis and debridement protocols. Existing literature is also nearly exclusively from high-income nations, leaving the burden and outcomes of these injuries in lower-resource settings relatively unknown. This study aimed to evaluate the burden of firearm-related fractures and several common clinical outcomes in a large, internationally focused database.

Methods: SIGN Fracture Care is a global nonprofit that provides orthopaedic tools and implants free of charge around the world. They maintain a clinical database where they capture a variety of data related to implant usage and patient outcomes. All cases with an injury cause from 2016 through 2022 were extracted from the database and included in our analysis.

Results: We examined 117,729 fracture cases, of which 5256 (4.5%) were caused by firearms. Ethiopia (2375), Afghanistan (1566), and Pakistan (442) represented 83.3% of firearm-related fractures. Most of the reported fractures were in the lower extremity (93.5%). The infection rate was 5.4% among firearm-related fractures compared to 3.4% in fractures with other causes. In a univariate analysis, we found no association between infection and the use of antibiotics prior to surgery ($P = 0.077$). Gustilo Anderson (GA) classification was also not found to be associated with infection ($P = 0.183$). The reported incidence of nonunion in the firearm-related fractures was 29.2% vs 15.7% in fractures with other causes. Patients receiving antibiotics prior to surgery (25.9% vs 55.3%, $P < 0.001$) and patients noting painless weightbearing (64.9% vs 56.8%, $P < 0.001$) were significantly less likely to experience nonunion.

Conclusion: To our knowledge, this is the first evaluation of firearm-related fractures in a large internationally focused database. We identified that firearm-related fractures had a higher infection rate and a higher rate of nonunion when compared to fractures from other causes. While the use of antibiotics prior to surgery did not seem to influence the infection rate, it was associated with lower rates of nonunion. While our data is limited to geographic locations and fracture types treated by surgeons using SIGN implants, it provides an important context for future work evaluating firearm-related fractures in lower resource settings.