Comparison of Ballistic Tibia Fractures With Open and Closed Tibia Fractures Sustained by Blunt Mechanisms

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Purpose: Ballistic tibia fractures are treated regularly in urban trauma centers but for multiple reasons outcomes in these fractures have been difficult to study. The purpose of this study is to identify a group of ballistic tibia fractures (gunshot wounds [GSWs]), report the outcomes of these fractures, and compare them to both closed and open tibia fractures sustained by blunt mechanisms. We hypothesized that ballistic tibia fractures and blunt open fractures would have similar outcomes.

Methods: A retrospective review was performed of ballistic tibia fractures (OTA42) treated at a single Level-Itrauma center over a 5-year period (2014-2019). Two control groups were created for comparison using consecutive patients over a 2-year period (2016-2018). One group was comprised of open fractures sustained via blunt trauma. The second group was comprised of closed fractures sustained via blunt trauma. Minimum follow-up for inclusion was 90 days. Demographics, fracture characteristics, procedures, and surgical outcomes were evaluated. The primary outcomes assessed include unplanned reoperation rate, soft-tissue reconstruction rate, nonunion rate, compartment syndrome occurrence, and infection rate.

Results: 411 tibia fractures were included for analysis (53 GSWs, 179 blunt closed, and 179 blunt open). Compared with the blunt closed group, the GSW group required more operations (2.42 vs 1.46, $P < 0.01$), had a higher occurrence of soft-tissue reconstruction (22.6% vs 2.2%, $P < 0.01$), and higher incidence of compartment syndrome (17.0% vs 5.0%, $P < 0.01$). GSW and blunt closed groups did not significantly differ in rates of unplanned reoperation (20.8% vs 17.9%, $P = 0.67$), nonunion (9.4% vs 4.5%, $P = 0.17$), and deep infection (11.3% vs 5.6%, $P = 0.21$). In comparison to the blunt open group, the GSW group required a similar number of operations (2.42 vs 2.95, $P = 0.15$), had similar rates of unplanned reoperation (20.8% vs 33.5%, $P = 0.09$), soft-tissue reconstruction (22.6% vs 33.5%, $P = 0.13$), nonunion (9.4% vs 17.9%, $P = 0.20$), and deep infection (11.3% vs 10.1%, $P = 0.78$), but a higher incidence of compartment syndrome (17.0% vs 5.0%, $P = 0.02$).

Conclusion: Ballistic tibia fractures require more surgeries and have higher rates of soft-tissue reconstruction than blunt closed fractures. They behave similarly to blunt open fractures in most outcome measures. We found a significantly higher rate of compartment syndrome in ballistic tibia fractures compared to both open and closed blunt fractures. When treating ballistic tibia fractures, surgeons should maintain a high level of suspicion for the development of compartment syndrome and counsel patients that ballistic tibia fractures seem to behave like an intermediate category between closed and open fractures sustained via blunt mechanisms.