

## Luck of the Draw: Comparing Outcomes of Ballistic and Blunt Elbow Fractures

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**INTRODUCTION:** This study aims to compare outcomes of elbow fractures due to ballistic trauma to those from blunt trauma.

**METHODS:** This retrospective case-control study was conducted at a single Level 1 Trauma Center from 2014 to 2024. After receiving IRB approval, patients were identified using Current Procedural Terminology (CPT) codes for operatively treated elbow fractures. Patients whose mechanism of injury was a result of ballistic trauma were identified. A 1:1 matched cohort was then created from patients who had fractures as a result from blunt injury. The control group was matched for age and Orthopedic Trauma Association/AO (OTA/AO) fracture classification. Patients that had inadequate documentation in the electronic medical record (EMR), patients under the age of 18, and patients with less than 6 months of follow up were excluded from the study. Humeral shaft fractures without extension into distal humerus were also excluded. The primary outcomes assessed were nonunion, infection, heterotrophic ossification, hardware removal and hardware failure. Nonunion was defined as lack of radiologic union at 3 or more cortices at 6 months after index surgery. Hardware failure was classified as implant fracture or loosening. Secondary outcomes included reoperation rates, range of motion and injury characteristics. Patient demographics, injury, operative and postoperative data were collected from review of the electronic medical record (EMR).

**RESULTS SECTION:** A total of 76 patients were included, 38 in each cohort. The mean patient age for both cohorts was of 35.79 years. There was a significant difference in gender with the ballistic group having a higher percent of males (76.3% vs 52.6%; p<0.001), alcohol (52.6% vs 23.7%; p=0.009) and drug use (42.1% vs 18.4%; p=0.025). The most common mode of injury for the patients in the blunt injury cohort was multiple vehicle accident (55.3%), followed by fall from height (23.7%). The ballistic cohort had a higher rate of nerve injury when compared to the blunt injury cohort (42.1% vs 15.8%; p=0.011) and lower rates of hardware removal (15.8% vs 39.5%; p=0.021) and lower functional ROM (43.5% vs 71.9%; p=0.034). There was no difference in rates of nonunion, infection, range of motion, compartment syndrome or vascular injury.

**DISCUSSION:** Despite higher rate of nerve injury in ballistic elbow fractures, clinical outcomes are comparable to those with blunt elbow fractures except in hardware removal rates but patients with ballistic elbow fractures do have lower rates of functional elbow range of motion.

**SIGNIFICANCE/CLINICAL RELEVANCE:** This study will help increase clinical awareness of elbow fracture outcomes, where mechanism of injury is not often described in the current literature.

**IMAGES AND TABLES:**

Table 1: Patient Characteristics

	Ballistic (n=38)	Blunt (n=38)	P value
Age	35.79 (11.7)	35.79 (11.4)	1.000
<b>Gender</b>			<b>0.031</b>
<b>M</b>	<b>29 (76.3%)</b>	<b>20 (52.6%)</b>	
<b>F</b>	<b>9 (23.7%)</b>	<b>18 (47.4%)</b>	
<b>Race</b>			<b>&lt;0.001</b>
<b>White</b>	<b>8 (21.1%)</b>	<b>33 (86.8%)</b>	
<b>Black</b>	<b>29 (76.3%)</b>	<b>3 (7.9%)</b>	
<b>Other</b>	<b>1 (2.6%)</b>	<b>2 (5.3%)</b>	
BMI	27.8 (7.0)	28.6 (8.3)	0.664
<b>Drug Use</b>	<b>16 (42.1%)</b>	<b>7 (18.4%)</b>	<b>0.025</b>
<b>Alcohol Use</b>	<b>20 (52.6%)</b>	<b>9 (23.7%)</b>	<b>0.009</b>
Tobacco Use	23 (60.5%)	16 (42.1%)	0.108
Diabetes	1 (2.6%)	3 (7.9%)	0.304
HTN	4 (10.5%)	8 (21.1%)	0.208
CVD	5 (13.2%)	0	0.054

Table 2: Outcomes

	Ballistic (n=38)	Blunt (n=38)	P value
Nonunion	7 (18.4%)	4 (10.5%)	0.328
Infection	6 (15.8%)	5 (13.2%)	0.744
Hardware failure	7 (18.4%)	3 (7.9%)	0.175
<b>Hardware removal</b>	<b>6 (15.8%)</b>	<b>15 (39.5%)</b>	<b>0.021</b>
Manipulation under anesthesia	3 (7.9%)	8 (21.1%)	0.103
Postop Neuropathy	17 (44.7%)	10 (26.3%)	0.093
Heterotrophic Ossification	0	5 (13.2%)	0.054
Reoperation number	0.5 (0.9)	1.0 (1.6)	0.084
Follow up length (days)	387 (296)	410 (252)	0.716
Flexion at last visit	106 (28)	113 (26)	0.397
Extension at last visit	15 (11)	12 (23)	0.919
<b>Functional ROM</b>	<b>10 (43.5%)</b>	<b>23 (71.9%)</b>	<b>0.034</b>

