Ballistic Distal Radius Fractures: Differences in Management and Outcomes

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INTRODUCTION:
Firearm-related injuries have a significant impact on morbidity and mortality in the United States, with over 48,000 deaths and numerous non-fatal injuries in 2022. Gunshot wounds (GSWs) to the upper extremities, in contrast to more conventional mechanisms such as falls, are profoundly different injuries with unique characteristics including the typical energy imparted to the tissues, they more commonly involve younger patients, and have extensive skeletal comminution with associated injury. Little has been documented comparing gunshot related distal radius fractures to injuries from other causes. The current study sought to compared injuries, management and treatment differences as well as complications and rates of healing.
METHODS:
In this retrospective IRB-approved study, medical records from a Level 1 urban trauma center were reviewed from May 2018 to December 2023. Patients aged over 16 years with radiographically confirmed DRFs were included in the study. Injury mechanism was then reviewed and 2 cohorts were created; a control group, consisted of patients who had non-ballistic DRFs and a group of patients with GSW related DRFs. Data collected included patient demographics, injury characteristics including AO classification and the presence of associated injuries, treatment decisions, surgery time, fixation method, and outcomes. Post-treatment complications were also reported including malunion, delayed union, wound healing, and infection. Healing was defined by clinical and radiographic parameters.
RESULTS:
Over the study period, 265 patients presented with DRFs including due to GSWs, and 244 from other mechanisms. GSW patients were significantly younger (28.62 years ± 11.02 vs. 50.48 years ± 20.20, p<.001) and predominantly male (95.2% vs. 36.1%, p<.001). Radiographs and AO classification demonstrated higher intra- and extra-articular comminution in GSW patients, while non-GSW fractures were more evenly distributed (Table 1, p<0.01). Associated injuries were higher in the GSW cohort with a higher incidences of DRUJ instability (9.5% vs. 0.4%, p<.001) and carpal fractures (19.0% vs. 4.9%, p=.009). Additional injuries outside the upper extremity were also more common in GSW patients (57.1% vs. 28.7%, p=.007).

Neurovascular injury symptoms were more prevalent in GSW patients (38.1% vs. 12.3%, p<.001), though this did not lead to increased nerve exploration surgeries. However, Guyon canal release was more frequent in the GSW group (4.8% vs. 0.4%, p=.027). GSW patients were more likely to be treated surgically for their injuries (66.7% vs. 40.6%, p=.020) with longer times to surgery (10.42 ± 15.51 days vs. 5.52 ± 6.04 days, p=.002). Despite the delayed surgical intervention, no significant differences were observed in fixation methods, time to full weight-bearing, or complications between groups including infection.
DISCUSSION AND CONCLUSION: Gunshot related distal radius fractures appear to present unique diagnostic and management complexities. Ballistic DRFs appear to be distinct from their non-gunshot related DRFs in their frequence of surgical management, and the longer surgical procedures. Despite these difficulties, ballistic DRF healing outcomes were equivalent to non-ballistic DRF healing outcomes, suggesting that similar recovery outcomes can be attained with proper care. The results underline the need for further investigation, including large studies, to better understand the functional results and management of ballistic DRFs.

	GSW (n=21)	Non-GSW (n=244)	p-value
Age (years)	28.62 +/- 11.02	50.48 +/- 20.20	**<.001**
Male, n (%)	20 (95.2)	88 (36.1)	**<.001**
Injury to dominant hand	9 (42.9)	130 (53.3)	.359
PMH, n (%)			
HTN	0 (0)	64 (26.2)	**.007**
Asthma/COPD	0 (0)	15 (6.1)	.242
CVA	0 (0)	4 (1.6)	.554
DM	0 (0)	25 (10.2)	.123
CAD	0 (0)	10 (4.1)	.344
Anticoagulation	0 (0)	8 (3.3)	.399
Smoking	4 (19.0)	48 (19.7)	.945
Mean follow up (days)	87.53 +/- 35.24	80.23 +/- 38.45	.510
Mechanism, n (%)			
MVC		70 (28.7)	
Fall		145 (59.4)	
Peds v Auto		14 (5.7)	
Motorcycle		3 (1.2)	
Assault		4 (1.6)	
Accidental other injury		8 (3.3)	
AO classification, n (%)			**<.001**
A2	3 (14.3)	70 (28.7)	
A3	11 (52.4)	28 (11.5)	
B1	1 (4.8)	23 (9.4)	
B2	0 (0)	16 (6.6)	
B3	4 (19.0)	17 (7.0)	
C1	0 (0)	46 (18.9)	
C2	1 (4.8)	30 (12.2)	
C3	1 (4.8)	14 (5.7)	

Table 1: Demographics