Injury Characteristics Associated with Combined Fractures of the Forequarter

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Introduction

Forequarter injuries are a major cause of morbidity and mortality among trauma patients. This region is structurally composed of the humerus, clavicle, scapula, and ribs. There is little research linking forequarter injuries with concomitant skeletal fractures. The purpose of this study was to investigate other injuries that commonly occur in patients who undergo traumatic forequarter injury in an attempt to improve surgical assessment of trauma patients and to delineate possible patterns of injury.

METHOD

A single center retrospective study was performed on patients with rib fractures following traumatic injuries. Patients who met this criterion and presented between July 2014 and October 2021 were included in the cohort. Once selected, participants were placed into one of four groups: rib fractures only (n=1999), rib fractures with scapular fractures (n=173), rib fractures with clavicular fractures (n=196), and rib fractures with both scapular and clavicular fractures (n=49). Differences in mechanism of injury as well as injury characteristics were further evaluated. Statistics were performed with SPSS v27.

RESULTS

A total of 2,417 forequarter injury patients were selected for inclusion in this study. Among this cohort, 39% of participants were involved in motor vehicle crashes, 27% experienced traumatic falls, 9% were involved in moped accidents, and 25% of the mechanisms of injury were categorized as other (bicycle accidents, ATV accidents, assault). Of the injuries studied, significance was observed between combined fractures of the forequarter and parietal skull fractures ($p<0.001$), temporal skull fractures ($p<0.001$), nasal bone fractures ($p=0.007$), cervical spine fractures ($p<0.001$), thoracic spine fractures ($p<0.001$), pneumothoraces ($p<0.002$), and pulmonary contusions ($p=0.002$). Other injuries that were studied but did not exhibit a significant relationship with forequarter injuries included fractures of the lumbar spine, humerus, radius, ulna, pelvis, femur, tibia, and fibula, as well as traumatic brain injuries.

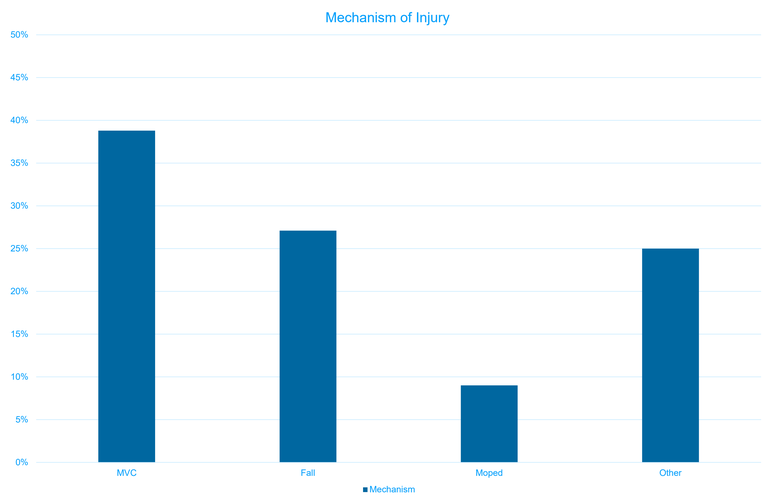
Table 1. Statistically Significant Concomitant Injuries.

Injury	Rib Fx Only (n=1999)	Rib + Scapula Fx (n=173)	Rib + Clavicle Fx (n=196)	Rib + Scapula + Clavicle Fx (n=49)	P-value
TBI	4.0%	7.5%	6.6%	8.2%	0.040
Parietal Skull Fx	6.8%	9.2%	13.8%	16.3%	<0.001
Temporal Skull Fx	5.8%	14.5%	17.9%	26.5%	<0.001
Nasal Bone Fx	8.6%	7.5%	14.8%	16.3%	0.007
C-spine Fx	10.6%	13.3%	21.9%	22.4%	<0.001
T-spine Fx	0.2%	0.6%	0.5%	4.1%	<0.001
Pneumothorax	23.3%	25.4%	36.7%	40.8%	<0.002
Pulmonary Contusion	13.9%	7.3%	20.9%	28.6%	0.002

Table 2. Concomitant Injuries with No Statistical Significance.

Injury	Rib Fx Only (n=1999)	Rib + Scapula Fx (n=173)	Rib + Clavicle Fx (n=196)	Rib + Scapula + Clavicle Fx (n=49)	P-value
L-spine Fx	0.6%	0.6%	0.0%	0.0%	0.688
Humerus Fx	5.0%	5.8%	9.2%	8.2%	0.071
Radius Fx	3.7%	3.5%	6.1%	6.1%	0.322
Ulna Fx	4.6%	5.2%	7.7%	4.1%	0.298
Pelvis Fx	14.0%	7.9%	18.4%	12.2%	0.209
Femur Fx	5.8%	5.8%	6.1%	4.1%	0.960
Tibia Fx	7.8%	8.1%	9.7%	6.1%	0.766
Fibula Fx	6.6%	4.0%	9.7%	10.2%	0.127

Figure 1. Most Common Mechanisms of Injury



CONCLUSIONS

Combined fractures of the forequarter are associated with injuries to the head, face, cervical/thoracic spine, and the lungs. They are not correlated with other orthopedic injuries evaluated in this study. Based on the findings of this study, it can be concluded that combined injuries have a higher prevalence in traumatic mechanisms of injury where patients are less protected, such as motorcycle, moped, bicycle, and ATV accidents. Areas for further investigation include a more extensive evaluation of additional soft tissue injuries and consideration of other geographic and regional associations with injury mechanisms.

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