**Side-Impact Collisions Increase Proximal Upper Extremity Injuries**

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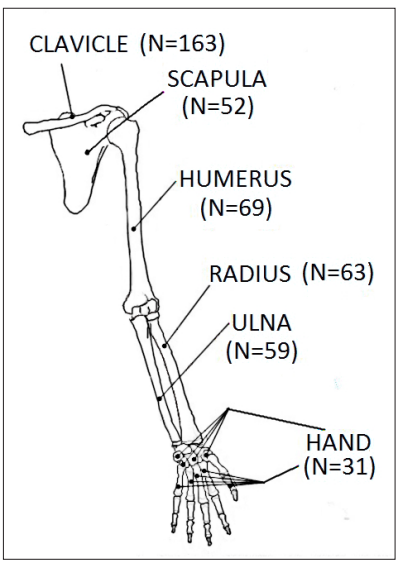
**Purpose:** Motor vehicle collisions (MVCs) remain a major cause of morbidity and mortality in the United States. While much research has focused on injuries in frontal impact MVCs, few studies have examined the injury patterns and severity of upper extremity injuries in side-impact collisions. This study sought to further characterize upper extremity injuries in side-impact MVCs.

**Methods:** We reviewed 3089 total upper extremity injuries involving 756 participants from the National Highway Traffic Safety Administration's Crash Investigation Research and Engineering Network from 1995-2012. Data on the occupant and injury included: age, gender, weight, belt status, injury description, and injury source, defined as the structural component of the car that caused injury. Exclusion criteria were: those not wearing a seatbelt at the time of injury or unknown belt status; those who sustained frontal, rear impact, or rollover collisions; and crashes with undocumented primary direction of force or change in velocity (Δv). All injuries were categorized into distinct anatomic locations. Injuries were initially stratified by type and distribution. Statistical analysis of the data included descriptive statistics. The same analysis was done for gender stratification.

**Results:** Of the 3089 upper extremity injuries, most were soft-tissue injuries (83.4%), including abrasions, lacerations, and contusions. The majority of non-soft-tissue injuries were fractures (86.1%), with the clavicle being the most common fracture (n = 163). The incidence of fractures decreased with location distally down the arm. There was no association between injury location and type with gender, age, height, or weight. The left B-pillar, the interior structural support of the car, was the most common injury source (62.3% of all injuries, 51% of fractures). In addition, pillars caused 100% of nerve, burn, and degloving injuries. Neither airbags nor seatbelts caused injury.




**Conclusion:** Our study sought to characterize the distribution of upper extremity injuries in side-impact collisions and demonstrated that side-impact collisions increase proximal upper extremity injury incidence preferentially over distal upper extremity injuries. This differs from prior studies of frontal impact collisions that demonstrate a greater incidence of distal injuries of the upper extremity. Since we have shown that the majority of these upper extremity injuries are from

the left B-pillar and interior surface, we recommend further research on pillar structure safety and improved vehicle performance. Limiting upper extremity injury will potentially improve functional outcomes and return-to-work in side-impact crash survivors.



See pages 49 - 106 for financial disclosure information.