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Hip dislocations and concurrent injuries in motor vehicle collisions

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ABSTRACT

Introduction: Motor Vehicle Collisions (MVC) can cause high energy hip dislocations associated with serious injury profiles impacting triage. Changes in safety and regulation of restraint devices have likely lowered serious injuries from what was previously reported in the 1990s. This study aims to describe modern-day injury profile of patients with traumatic hip dislocations, with special attention to aortic injury.
Methods: Retrospective review of a prospectively maintained trauma database at an urban level 1 trauma center was conducted. Patients with hip dislocation following MVC between January 2005 and December 2015 were grouped based on seatbelt use and airbag deployment. Patients with unknown restraint use were excluded. Multiple logistic regression was used to identify risk of injury profile between groups.
Results: Of 204 patients with hip dislocation after MVC, nearly 57% were unrestrained. Seatbelt alone was used in 36 (17.7%), airbag deployed in 14 (6.9%), and 38 (18.6%) with both. Gender and number of injuries were similar between groups. The most common concomitant injury was acetabular fracture (53.92%) and the abdominopelvic region was the most injured. Use of a seatbelt with airbag deployment was protective of concomitant pelvic ring injury (OR = 0.22). Airbag deployment was significantly protective of lumbar fracture (OR = 0.15) while increasing the likelihood of radial and ulnar fracture or dislocation (OR = 3.27), acetabular fracture (OR = 5.19), and abdominopelvic injury (OR = 5.07). The no restraint group had one patient (0.80%) with an intimal tear of the thoracic aorta identified on CT chest that was successfully medically managed.
Discussion and conclusion: Hip dislocations are high energy injuries with severe associated injuries despite upgrades in restraint devices. These patients require careful examination and heightened awareness when evaluating for concomitant injuries.

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Introduction

Traumatic hip dislocations are devastating high-energy injuries and are most frequently caused by motor vehicle collisions (MVC) [1]. A significant amount of force is required to dislocate a hip and therefore it is often considered a marker of severe orthopaedic and non-orthopaedic injury [2–5]. Associated injuries are reported to occur as often as 67–95% of the time in patients with hip dislocation [1,3,4,6].

Much of the current literature regarding traumatic hip dislocations and MVCs are from studies done in the 1980s and 1990s. These studies report death rates as high as 6% [4], rate of thoracic injury ranging from 21 to 47% [1,3,5,6], a 15–26% rate of abdominal injuries [1,3,5,6], Injury Severity Scores (ISS) ranging from 17.4-22.3 [3,4], with one well-known study reporting an 8% rate of acute injuries to the thoracic aorta [6]. However, the use of safety devices such as airbags and seatbelts have been shown to greatly reduce the overall injury risk in MVCs [7,8].

The National Highway Traffic Safety Administration (NHTSA) released a report in 2012 concluding that the improvements made in safety devices since the year 2000 have prevented serious injury and contributed to a historically low fatality rate in the United States in 2009 [9]. The fatality rate has remained under 17 fatalities per 100,000 licensed drivers since [10]. Additionally, the increased prevalence of these safety devices in vehicles as well as the increased public awareness of their effectiveness have led to reductions in the MVC-related morbidity and mortality rates for

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several decades [11,12]. An updated evaluation of the effect of these new safety measures on the injury profile and ISSs of patients with traumatic hip dislocations following MVC has not been reported.

The primary purpose of this study is to determine the effect of seatbelts and/or airbag use on the injury profile and injury severity score in patients with a traumatic hip dislocation after a MVC. Additionally, we will specifically evaluate the effect of restraint devices on injuries to the thoracic aorta.

Materials and methods

After Institutional Review Board approval, we performed a retrospective review of adult patients who presented to our urban level I trauma center between January 1st, 2005 and December 31st, 2015 with a hip dislocation after MVC. Patients were identified from our prospectively collected American College of Surgeons trauma database and screened for hip dislocation by International Classification of Disease, 9th edition (ICD-9) code (835.00, 835.01, 835.02, 835.03, 835.10, 835.11, 835.12, and 835.13). Patients under 18 years of age were excluded as well as those with a history of hip arthroplasty on the affected extremity, those transferred from an outside facility without passing through the emergency department, and those without documentation of restraint use.

Charts were reviewed for patient age, gender, use of restraint, ISS, Intensive Care Unit (ICU) admission, length of hospital day stay (LOS), inpatient mortality, direction of dislocation and associated injuries. Traumatic hip dislocation and all associated injuries were determined through the ICD-9 codes assigned to the patient. Patients with injuries to the thoracic aorta were further reviewed to identify the method of diagnosis and details of treatment.

We identified 258 patients that presented to our trauma center with hip dislocations within the assessed time range. Patients under 18 years of age and those with a total hip arthroplasty were excluded at data extraction based on coding of the analysis. Two-hundred thirty-nine Hip dislocations resulted from MVC. Thirty-five patients did not have documentation of restraint use. This left 204 patients for analysis. There were 60 (29.4%) women. The mean age was 38.8 (range 18–83).

Restraint use and stratification

Restraint use was documented by the pre-hospital care provider and abstracted into the patient record. Patients were classified as no restraint, seatbelt use alone, airbag deployment alone, or both seatbelt use with airbag deployment.

Statistical analysis

Statistical analysis was performed in Stata Multi-Processing edition 13 (StataCorp LLC, College Station, Texas). Risk of injury profiles for each device were identified by multiple logistic regression and reported as odds ratios compared to all other patients. We analyzed no restraint (NR), any seatbelt use regardless of airbag deployment (S), any airbag deployment regardless of seatbelt use (A), and both seatbelt use with airbag deployment (BSA). For example, the odds ratio of a particular injury with airbag deployment would compare A vs S & NR. Additionally, the odds ratio of a particular injury with use of both a seatbelt and airbag deployment would compare BSA vs NR, seatbelt use only, and airbag use only. Significance was defined as $p < 0.05$.

Results

A total of 204 patients met inclusion criteria. Eight (3.9%) dislocations were anterior, the remaining 196 (96.1%) were posterior. Nearly 57% of patients with a hip dislocation were unrestrained; 36 (17.7%) were restrained by seatbelt only, 14 (6.9%) had airbag deployment without seatbelt use, and 38 (18.6%) were restrained by a seatbelt with airbag deployment. Table 1 illustrates the patient distribution used for analysis. Gender, ICU admission, and length of stay distributions were similar between groups; however, patients in the NR group were significantly older, while patients in the S group were significantly younger than the rest of the population. There was no significant difference in ISS between groups (NR 13.7 ± 10.4, S 12.8 ± 7.8, A 13 ± 8.9, BSA 12.1 ± 6.9). One inpatient death was observed in the NR group. This patient was a 38 year-old male with ISS 48 who suffered a right hip dislocation, pelvic ring injury, right acetabular fracture, bilateral femur fractures, left open ankle fracture, liver laceration, splenic laceration, colon laceration, diaphragm rupture, and bladder injury. He developed sepsis with peritoneal infection and died on hospital day hospital day 40 after compassionate withdrawal of care.

Concomitant injury profiles

The number of injuries were not significantly different between groups, with an average of 5.5 ± 4.4 additional injuries. Overall, the most common concomitant injury with hip dislocation was acetabular fracture occurring in 53.9% of all patients with significantly different rates between all groups (NR OR = 0.32, p < 0.001; S OR = 2.43, p = 0.003; A OR = 5.19, p < 0.001; BSA OR = 4.88, p < 0.001). Use of a seatbelt with airbag deployment was significantly protective of concomitant pelvic ring injury (OR = 0.22, p = 0.016) compared to all other groups (NR OR = 0.88, p = 0.735; A OR = 0.66, p = 0.291; A OR 0.84, p = 0.692). The abdominopelvic area was the most common body region injured, and significantly associated with airbag use (A OR = 5.07, p < 0.001; BSA OR = 4.69, p < 0.001; S OR = 2.62, p = 0.002; NR OR = 0.31, p < 0.001) (Tables 2–3).

Upper extremity injuries occurred in 20.1% of patients with fracture of the radius or ulna (7.8%), and hand (6.9%) being most common. While not statistically significant, seatbelt use was associated with decreased risk of upper extremity fracture (NR OR = 1.24, p = 0.5506; A OR 1.09, p = 0.826; S OR = 0.67, p = 0.291; BSA OR 0.88, p = 0.773). Lower extremity fractures occurred in 35.8% of patients with femur (21.6%) and tibia/fibula (11.3%) fractures being most common. Airbag deployment was not associated with an increased risk of lower extremity fracture (NR OR = 1.04, p = 0.885; A OR = 0.96, p = 0.884; A OR = 1.17, p = 0.642 BSA OR = 1.21, p = 0.601). Airbag deployment was

Table 1
Demographics by Restraint Type.

Demographic	Total *n* = 204	No Restraint *n* = 116 (56.86%)	Seatbelt *n* = 36 (17.65%)	Airbag *n* = 14 (6.86%)	Both *n* = 38 (18.63%)	p
Male	144 (70.59%)	82 (**70.69%**)	26 (72.22%)	8 (57.14%)	28 (73.68%)	0.696
Age	38.84 ± 17.32	42.28 ± 18.21	31.00 ± 12.69	36.00 ± 18.88	38.00 ± 15.27	0.477
Number of Injuries	6.52 ± 4.91	6.29 ± 5.54	6.97 ± 3.57	7.86 ± 5.46	6.32 ± 3.67	0.16
Injury Severity Score	13.49 ± 9.72	13.*70* ± *10.41*	13.50 ± 8.78	15.57 ± 12.80	12.05 ± 6.89	0.286

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