BRIEF REPORT

A Prospective Observational Analysis of Ambulation After Motor Vehicle Collisions

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Abbreviations:
ALS: advanced life support
BLS: basic life support
EMR: emergency medical record
EMS: Emergency Medical Services
HPI: history of present illness
MVC: motor vehicle crash
PCR: patient care report

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Abstract

Objectives: Predicting injury patterns of patients based only on mechanism of injury is difficult and is well described in the literature. Characteristics of patients on-scene immediately following injury(ies) may lead to predicting injury patterns. Although reported frequently, the significance of victim ambulation after a motor vehicle crash is poorly understood. It was hypothesized that ambulation at the scene is not predictive of injury severity following a motor vehicle crash (MVC).

Methods: A prospective, cohort study of 117 consecutive injured patients who were ambulatory after MVCs were enrolled. Paramedics in a large urban Emergency Medical Services (EMS) system were mandated to document "ambulatory" or "nonambulatory" for motor vehicle collisions in order to complete their prehospital electronic medical records. This assured accuracy and completeness in the data collection. All charts were abstracted for trauma-induced injury and imaging results.

Results: A total of 608 (10.9%) persons were ambulatory at the scene, of which 284 had an injury pattern documented in the prehospital or emergency department record. The average age was 35.9 (SD = 16.8) years, and 158 (55.6%) were male. A total of 707 injuries were identified in the 284 patients who had sustained injuries.

Conclusions: Ambulation after motor vehicle collisions appears to be only infrequently associated with major injuries, although this population still may present with significant injuries. A larger, prospective study is warranted.

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Introduction

Estimating the severity of injuries at the scene of motor vehicle crashes (MVCs) is vital for accurate patient triage. Rapid assessments dictate transport to appropriate treatment facilities. The US Centers for Disease Control and Prevention provides a field triage decision scheme developed in concert with the American College of Surgeons.[1] The recommendations include algorithms that serve as the basis for state and national triage guidelines. Based on anatomical, physiological, or mechanism of injury criteria, the field triage decisions scheme assists Emergency Medical Services (EMS) providers in ascertaining whether to transport an injured patient to a trauma center. This decision is important both for the patient and for the allocation of limited health care services. MacKenzie et al reported that severely injured patients treated at a trauma center have a 25% lower risk of death than those treated at a hospital without trauma services.[2]

A patient's ability to ambulate after an MVC is not part of the current criteria for triage decisions. To date, no research has evaluated the value of this factor as a component of the triage decision. Resources could be saved and triage decisions improved if outcomes measures are known for patients who are ambulatory at the scene of an MVC.

Methods

This Institutional Review Board-approved study was a prospective evaluation of persons who were documented to have been ambulatory at the scene of motor vehicle collisions during the study period of April 30, 2010 to January 1, 2011. Individuals who were operators of motorcycles were excluded since injury patterns are different. The primary

end point was the type(s) of injury(ies) sustained by patients who were ambulatory at the scene of the MVC prior to the arrival of the EMS unit.

A decision rule was created in the prehospital electronic medical record (EMR) (www.emscharts.com, West Mifflin, Pennsylvania USA) to determine which of the patients were ambulatory. In order to complete the Patient Care Report (PCR), the EMS providers were required to include the word "ambulatory" or "non-ambulatory." This database was cross-referenced with the Emergency Department database (Sunrise Clinical Manager, Eclipsys Corporation, Atlanta, Georgia USA). Emergency Department diagnoses were evaluated on a case-by-case basis in order to determine injury prevalence and patterns.

The data abstracted from the PCRs included: (1) responding service; (2) receiving hospital; (3) date of birth; (4) sex; (5) date dispatched; (6) history of present illness, or HPI; (7) scene description; (8) ambulation status; (9) impact risk factors; (10) number of vehicles involved; (11) position of patient; and (12) vehicle impact site. By individually comparing data cells with the HPI, the abstractor was able to verify that the words "ambulatory" or "non-ambulatory" were documented correctly.

This study was conducted at an American College of Surgeons-verified Level I trauma center. The trauma volume in this center is approximately 1,500 patients/year with 18% having experienced penetrating injuries. The county population of approximately 800,000 is made up of 68.4% Caucasian, 13.9% Asian, 13.6% Hispanic, and 9.1% African-American residents. The county occupies 323 miles^2 (530 km^2) that contain a combination of urban cities and suburban communities. The EMS system covers 85% of the county. There are five acute care hospitals and three agencies that provide advanced life support (ALS). All trauma patients in the region who meet state criteria are brought to the Level I trauma center.

The EMS system is two-tiered, comprised of a combination of paid and volunteer basic life support (BLS) units, and paid, hospital-based, ALS units that are staffed with two paramedics each. There are eight BLS units and six ALS units that respond to approximately 30,000 dispatches/year, 6,500 of these being patients treated by ALS personnel.

Statistical processing included calculations of mean values, standard deviations, and the percent of overall patient sample size. The SAS software (SAS system for Windows, version 9.1.3; SAS Institute Inc, Cary, North Carolina USA) was used for all analyses.

Results

A total of 6,604 EMS responses to MVCs occurred during the study period and were included in the study sample. A total of 608 (10.9%) persons were ambulatory at the scene, of which 284 had an injury pattern documented in the prehospital or emergency department record. The average age was 35.9 (SD = 16.8) years, and 158 (55.6%) were male.

A total of 707 injuries were identified in the 284 patients who had sustained injuries (Table 1). By far, the most frequently encountered injuries (658) were to the soft tissues (93.1%). Soft tissue injuries generally were multiple (average of 2.7/patient). Soft tissue injuries to the neck and chest were the most common and comprised 21.9% of all soft tissue injuries.

A total of 31 fractures were identified. The number of fractures/patient could not be determined. The anatomical location of the fracture was widely distributed (nasal and spinal fractures were most frequent, but were few in number).

Injuries by Anatomical Location	Number (%)	Category Total (%)
Solid organ		4 (0.6)
Hepatic	1 (0.14)	
Spleen	3 (0.42)	
Pulmonary contusion	4 (0.57)	4 (0.6)
Pneumothorax	3 (0.42)	3 (0.4)
Intracranial hemorrhage	3 (0.42)	3 (0.4)
Intra-abdominal injury	3 (0.42)	3 (0.4)
Dislocation, shoulder	1 (0.14)	1 (0.1)
Fractures		31 (4.4)
Cervical	2 (0.28)	
Nasal	4 (0.57)	
Facial	3 (0.42)	
Spinal	4 (0.57)	
Sternal	3 (0.42)	
Rib	4 (0.57)	
Knee	1 (0.14)	
Digit	2 (0.28)	
Wrist	2 (0.28)	
Arm	1 (0.14)	
Ankle	2 (0.28)	
Hand	3 (0.42)	
Soft tissue injuries		658 (93.1)
Abdomen	68 (9.62)	
Chest	116 (16.41)	
Neck	144 (20.37)	
Back	72 (10.18)	
Shoulder	35 (4.95)	
Head	72 (10.18)	
Other	151 (21.36)	
Total	**707 (100)**	**707 (100)**
Left against medical advice		**2**

Table 1. Anatomical Location of Injuries Among Patients Who Were Ambulatory at the Scene of Motor Vehicle Crashes (N = 707 total injuries to 284 patients)

Of these ambulatory patients, three sustained an intracranial hemorrhage, four suffered solid organ injuries, and four had pulmonary contusions. Thirty-one (10.9%) of these ambulatory patients required hospitalization. None of these ambulatory

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patients died from their injuries during the study period. Two individuals left the hospital against medical advice at some point during the visit.

Discussion

Myths in the prehospital setting must be dispelled in order for prehospital EMS to develop a more scientific model. Significant data exists on determining injury patterns based upon vehicular damage such as rollover, door intrusion, and roof intrusion. Additionally, similar data exists on likelihood of significant injury association with anticoagulation, advanced age, and time of entrapment.[3,4] However, research on injury patterns' association with ambulation is lacking. Based on the authors' experience, ambulation after a motor vehicle collision is often thought to be automatically classified as a stable patient. To the authors' knowledge, this is the first study to evaluate injury patterns among patients who are ambulatory at the scene of motor vehicle crashes. Multiple injuries were identified in this sample of crash victims who were ambulatory, including hepatic, splenic, cervical, and sternal fractures, pneumothorax, and fractures. The myth that ambulatory victims are less injured than are non-ambulatory patients could not be substantiated in the present study.

Limitations

This was a single institution study at one of three Level 1 trauma centers in one state, and, therefore, extrapolations should be made only to similar settings. The data entered by the prehospital care providers may have had some inaccuracies. Discrepancies identified during data collection included first name/last name switches, misspellings, and/or date errors. Extensive review of the data was completed to identify and minimize the risk of these errors, but the possibility exists that some minor errors escaped detection. Five prehospital EMRs could not be cross-matched in the emergency department and trauma databases. These patients were excluded as injury records and follow-up were unavailable for these individuals.

The information obtained from the prehospital EMR was entered during emergency situations while time was limited, and therefore, potentially could have resulted in reporting errors. It is possible that errors occurred in the data, including dates and injury patterns. Although the data were thoroughly reviewed in efforts to identify these errors, the possibility exists that not all errors were detected. In addition, patients who left the health system against medical advice may have left before identification of their injuries could be completed.

Conclusions

Future research should compare differences in ambulation versus non-ambulation after motor vehicle crashes, but prospective data on non-ambulatory injury patterns was unavailable for comparison. This research validates the important role that an EMS providers' assessment can play in determining trauma outcomes. Based on the current data set, ambulatory status cannot be inferred to indicate injury severity and disposition after motor vehicle crashes. Prehospital EMS providers routinely should be taught the importance of not relying on ambulatory status in conducting patient assessment and making decisions relative to patient disposition.

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