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Acute medical impairment among elderly patients involved in motor vehicle collisions

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ABSTRACT

Background: The association between acute medical illness and motor vehicle collisions (MVCs) among elderly emergency department patients is unclear. We sought to determine the prevalence of acute medical conditions that might impair driving ability among the elderly involved in MVCs and determine if there was an increased risk of the driver having an acute medical condition compared to similarly aged passengers.
Methods: We reviewed charts of patients aged 65 years or older whose emergency department visit was prompted by a motor vehicle collision between 1 July 2000 and 30 June 2010 at two Level 1 trauma centres. The exposure of interest was occupancy status (driver vs. passenger), and the outcome measure was the presence of any predefined acute medical illness that might impair driving ability.
Results: Final analysis included 871 drivers (cases) and 307 passengers (controls). An acute medical illness was recorded in 107 patients (9%): 97 drivers (11%) and 10 passengers (3%). Compared to passengers, drivers had significantly higher odds of presenting with acute medical illness (OR 3.7, 95% CI 1.9–7.2). After controlling for potential confounders, the adjusted odds ratio was 5.5 (95% CI 2.3–13.0).
Conclusion: Acute medical conditions are a moderately common diagnosis among elderly drivers, presenting in about one in ten patients. A difference in the risk of finding an acute medical illness when comparing elderly drivers and passengers evaluated in the emergency department after a collision suggests the need for considering additional diagnostic investigation and post-discharge surveillance in this population.

Introduction

The initial evaluation of elderly patients involved in motor vehicle collisions (MVCs) focuses primarily on the rapid identification and stabilisation of injuries. Secondarily, however, such encounters elicit concern over the potential for an acute medical illness acting as a causal factor in the collision. While an extensive body of literature exists regarding functional impairments in driving ability associated with chronic medical illness [1], the risk of individual disease categories on collision risk [2], as well as the influence of age-related physiologic changes alone [3], little is known regarding the contribution of acute medical illness to the epidemiology of MVCs among this patient population from the immediate post-incident perspective in the emergency department.

We considered a focus on the elderly driving population, frequently defined in the medical literature as individuals aged 65 or older, as important and relevant since this population represents one of the fastest growing segments of American and OECD societies. There were 40.3 million seniors living in the United States in 2010, representing 13% of the population [4]. There were 33 million licensed elderly drivers in 2009, a 23% increase from the prior decade [5]. That number is expected to grow with advancement of the baby boomer generation [6]. Since elderly drivers are at an increased risk of injury and death per vehicle-mile of travel compared to younger drivers [7], determining the

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prevalence of acute medical conditions in MVCs involving the elderly would be useful for injury prevention and trauma response planning.

The goals of this investigation were two-fold: (1) to estimate the prevalence of acute medical conditions that might impair driving in elderly victims of MVCs evaluated in the emergency department (ED) and (2) to estimate through cross-sectional methods the relative odds associating occupancy status (driver vs. passenger) and an acute medical condition. The rationale for this approach is based upon the fact that if acute medical conditions had no effect on the risk of being involved in an MVC, then the likelihood of the driver having an acute medical condition should be similar to that of passengers with comparable baseline characteristics.

Methods

Study design and setting

We performed a structured chart review of all patients seen at the University of Utah Medical Center (UUMC) in Salt Lake City, Utah and the Denver Health Medical Center (DHMC) in Denver, Colorado from 1 July 2000 through 30 June 2010. Both facilities are Level 1 academic trauma centres staffed by board-certified emergency physicians. The Institutional Review Board at each institution approved this study.

Selection of participants

Potential cases and controls were identified through electronic search of electronic ED patient tracking system, which holds initial complaint and final diagnosis and professional claims databases using ICD-9 external causes of injury codes E810-E819.

Inclusion criteria

Eligible charts were reviewed and included in the analysis if the patient was 65 years of age or older and the ED visit was prompted by an MVC. After first identifying elderly patients involved in an MVC, occupancy status, among other variables, was abstracted from the chart. Results were then excluded if the visit to the ED did not occur within 24 h of presentation, the patient was transferred from an outside facility, or the patient died in the emergency department, precluding or significantly complicating a diagnostic investigation for acute medical illness. Because of variability in institutional trauma response criteria both between and within institutions over time, we elected not to restrict our search to institutional trauma databases.

Methods and measurements

Data abstractors were trained and proctored by principle investigators at each site (ML, STY) and were blinded to the hypothesis of interest. Closed response data collection instruments were utilised with a standardised data dictionary for both sites. We collected data on age, past medical history, circumstances surrounding the MVC, and acute medical diagnoses of interest discovered during the ED evaluation or inpatient admission (defined below). All variables were assumed negative if not listed in the chart, except when the patient's condition precluded the ability to obtain a history, often indicated as "unknown" in the chart; in these cases, the variables were set to missing. Data were entered and managed using REDCap (Research Electronic Data Capture) an electronic data capture tool [8]. All variables, with the exception of age, were entered as binary or categorical responses.

Outcomes

For purposes of this cross-sectional analysis, the exposure of interest was occupancy status in the motor vehicle at the time of collision (driver vs. passenger). The outcome of interest was defined as the presence of an acute medical condition that might impair driving ability. Principal investigators selected acute medical conditions of interest a priori based on review of published literature [9–17] and investigators' clinical experience.

We counted the outcome as positive whenever at least one of the following were newly diagnosed or actively treated during the episode of care:

1. Transient ischaemic attack or cerebrovascular accident
2. Seizure
3. Syncope
4. Hypoglycaemia (<80 mg/dL)
5. Hyperglycaemia (>800 mg/dL)
6. Acute coronary syndrome
7. Cardiac arrhythmia (atrial or ventricular in origin)
8. High-grade cardiac conduction abnormalities (Mobitz II or higher, bifascicular block, or alternating AV block)
9. Pacemaker malfunction
10. Aortic dissection
11. Deep vein thrombosis or pulmonary embolism
12. Acute exacerbation of COPD

Due to the potential for delayed diagnosis and the episodic nature of some acute medical conditions, we did not attempt to distinguish between those conditions that were clinically apparent in the emergency department and those diagnosed after admission.

While an acute medical condition among passengers is unlikely to substantially contribute to a collision, we chose similarly aged passengers as controls because the direction of causation cannot be ascertained in many individual cases, i.e. the physiological stress of an MVC may provoke underlying coronary artery disease, causing myocardial ischaemia; or acute myocardial ischaemia may precede a collision. Thus, the ratio of odds for the prevalence of acute medical illness among drivers vs. passengers may serve as an estimate of the association between occupancy status and risk of an acute medical illness. Given the observational nature of this data, however, this is a hypothesis screening study and is not able to establish causation.

Analysis

Data were exported from REDCap as a spreadsheet (Excel for Mac 14.2.5, Microsoft Corp, Redmond, WA), inspected for coding errors and imported into STATA statistical software for analysis (STATA/IC 12.1, StataCorp, College Station, TX). Descriptive variables are reported as frequencies with associated percentages or medians and interquartile ranges.

We performed logistic regression to estimate the association between the diagnosis of an acute medical condition and automobile occupancy status in univariate and multivariable analysis. Because select comorbidities, age, and gender differences were expected to be associated with both driving status and outcomes, we controlled for these potential confounders (age $\geq$ 85 years, male gender, history of diabetes, history of valvular heart disease, and history of cerebrovascular disease) based on assumptions of plausibility and whether their inclusion in the model produced a change in the effect size of the occupancy status/outcome odds ratio of at least 10% [18]. Age was dichotomised at 85 years based on a logit transformed LOWESS regression showing a significant rise in the trajectory of predicted outcomes after