

“Death in the Same Compartment” as a Predictor for Injury Severity

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ABSTRACT

Objective: To determine if death in same compartment is useful as a predictor for injury severity and mortality.

Methods: A retrospective cross-sectional study was conducted of 525 high-risk automobile accident victims. Data collected from Natividad Medical Center's trauma registry were used to analyze reports of adult patients from July 1 2014 to July 1 2017. 15 patients were victims of high-risk accidents with a death in the same compartment. These patients were compared with the other 510 patients.

Results: Out of 15 patients who had death in same compartment, 2 (13%) were identified to have ISS>15 and 1 (6.7%) expired. Odds of severe injury (ISS>15) were not significantly different between groups [OR 0.73 95% CI 0.16-3.3]. Odds of death between the two groups were not significantly different [OR 2.0 95% CI 0.25-17]. Mean ISS between the two groups was not significant [9.1 ± 6.3 vs 8.3 ± 0.7 P=0.8].

Conclusion: “Death in the same compartment” has a similar prognostic value to other criteria outlined by the CDC.

Keywords: Trauma; Motor vehicle death; Death; Injury severity

Introduction

Triage criteria guide treatment protocols for emergency providers responding to Motor Vehicle Crashes (MVC). The Center for Disease Control (CDC) guidelines for field triage is based on physiologic and anatomic criteria, as well as mechanism of injury and special considerations [1]. They define a MVC as “high-risk” if any of the following are identified:

- Intrusion, including roof: >12 inches occupant site; >18 inches any site
- Ejection (partial or complete) from automobile
- Death in same passenger compartment
- Vehicle telemetry data consistent with a high risk for injury

“Death in the same compartment” is included in the Trauma Activation Criteria at most trauma facilities, however there is limited data to justify this designation. At our Level 2 Trauma Center in Central California, there are often uninjured MVC victims where a death in the same compartment occurred, often because of seatbelt use. Our objective was to validate “death in the same compartment” as an activation criterion by analyzing Injury Severity Score (ISS) and mortality.

Methods

Study design

Natividad Medical Center (NMC) has a Level 2 Trauma center that serves Monterey County in Central California. Our study analyzed demographics and individual trauma criteria collected from patients admitted to NMC's Level 2 Trauma Service following high-risk automobile crash. Injury Severity Score (ISS) was used to stratify patient injury severity on presentation; major trauma was defined as having an ISS>15 [2]. Mortality was analyzed as our secondary endpoint. This study was approved by the Touro University-California Institutional Review Board.

2,210 patients were seen from July 1, 2014 to July 1, 2017. Patients were included if they were 18 years or older and met CDC guidelines for “high-risk” accident. These criteria included intrusion, ejection, or death in same compartment [1]. Out of these 565 patients, 15 had a death in the same compartment. These patients were between the ages of 19 and 75 and made up of 33% women and 67% men. ISS's for these patients were as follows: 1, 1, 1, 1, 2, 2, 5, 5, 6, 9, 10, 12, 14, 24 and 43. Discharge disposition was recorded for these patients as well. Possible discharge dispositions included HOME, REHAB, TRANSFER and EXPIRED-1 patient of these 15 expired.

Data analysis

Data was entered in Microsoft Excel 2011 for Mac. Outcome frequency tables were generated to calculate Odds Ratio for injury severity and mortality (Tables 1 and 2). Student's t-test

was used to compare mean ISS's between patients with a death in the same compartment and those without.

TABLE 1: Outcome frequency table for major trauma. Exposure defined as death in same compartment, control defined as either intrusion or ejection from vehicle, outcome defined as ISS>15.

	ISS>15	ISS<15
Crash Death	2	13
Control	96	454

TABLE 2: Outcome frequency table for mortality. Exposure defined as death in same compartment, control defined as either intrusion or ejection from vehicle, outcome defined as discharge disposition "expired."

	Expired	Survived
Crash Death	1	14
Control	12	340

Results

Out of the 565 high-risk patients included in this study, 98 (17%) had ISS's >15 and 13 (2.3%) died. Of the 15 high-risk patients documented to have had a death in the same compartment, 2 (13%) had ISS's >15 and 1 (6.7%) died. The odds of suffering major trauma as defined by ISS >15 was not significantly different between the two groups. The odds of mortality was also not significantly different between the two groups.

Tables 1 and 2 show outcome frequency tables from which our odds ratios were calculated. **Table 1** outlines the risk of suffering major trauma with a death in the same compartment [OR 0.73; 95% CI 0.16-3.3] and **Table 2** outlines the risk of mortality with a death in the same compartment [OR 2.0; 95% CI 0.25-17].

Mean ISS for death in the same compartment (9.1 ± 6.3) was not significantly different [p -value, 0.8] than ISS for patients in other high-risk automobile crashes without a death in the same compartment (8.3 ± 0.7).

Discussion

We hoped to determine the validity of death in the same compartment as trauma activation criteria. A study by Henry et al suggested that mechanism of injury has significant predictive value for patient outcomes even when concurrent physiologic and anatomic criteria are discounted [3]. Furthermore, the CDC triage guidelines taken as a stepwise approach have been validated in large cohort studies. In a study of over one million subjects, Brown et al found that the CDC's guidelines allowed for the least under-triage when compared with anatomic or physiologic models of triage that utilized body system injury or vital sign parameter (and others) as triage criteria [4]

Some attempt has been made to analyze these criteria independently. An analysis of 880 children in 2009 by Evans, et al demonstrated that intrusion was associated with worse Abbreviated Injury Score (AIS) [5]. Despite many large-scale studies, some of these triage criteria have not been validated individually and pose some risk of over-triage. While under-triage may prove catastrophic for the trauma patient, over-triage may result in inefficient use of trauma staff and should be avoided. Furthermore, as safety features in cars become more advanced, triage criteria should be reviewed to prevent unnecessary trauma activations.

In our Trauma Center, we hoped to determine if using death in the same compartment could be validated as an activation criterion. Out of 565 high-risk automobile crashes, only 15 had a death in the same compartment. Odds of death or major injury (ISS>15) were no different between those with a death in the same compartment and other high-risk accidents and the mean ISS between these groups was not statistically significant. Furthermore, of 565 high-risk automobile crashes, only 15 accompanied a death in the same compartment.

These findings suggest that death in the same compartment is a valid activation criterion when compared with "intrusion" and "ejection from vehicle." In addition, the infrequency of these events suggests that even if "death in the same compartment" were not a valid criterion, the number of false activations would not be a significant burden on our providers.

Several limitations of our study merit discussion. The number of deaths in the same compartment limited the power of our results. Additionally, we used a standardized triage system, but application of these criteria may vary to some degree between EMS personnel. Finally, some selection bias may have been involved since only patients who were transported to and seen at NMC were included in the study.

Conclusion

Mechanistic factors alone have been shown to be useful as predictors for mortality and risk for suffering major trauma. Our study suggests that patients with a death in same compartment are at an equal risk as victims of other high-risk accidents for suffering major trauma and death. Although this study was limited by sample size, these preliminary findings suggest that more studies are needed to examine how each activation criterion relates to injury severity in high-risk automobile accidents.

Conflict of Interest

None of the authors of this manuscript of have conflicts of interests or disclosures.

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