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Alcohol intoxication may be associated with reduced truncal injuries after blunt trauma

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Abstract

BACKGROUND: Prior studies suggest that positive blood alcohol concentration (BAC) is associated with lower mortality after motor vehicle collisions (MVCs). We investigated the relationship between increasing BAC and mortality after MVC.

METHODS: A retrospective review of the Los Angeles County trauma database from January 2003 to December 2008 was performed. MVC patients greater than or equal to 16 years of age with admission BAC were considered. Patients were stratified by BAC as follows: BAC0 (<.01), BAC1 (.01 to .08), BAC2 (.09 to .16), BAC3 (.17 to .24), BAC4 (.25 to .32), and BAC5 (>.32). Logistic regression was used to determine predictors of mortality.

RESULTS: A total of 12,540 patients were included. Overall mortality rate was 2.2%. Mortality was lowest in BAC3 (1.6%) and BAC4 (1.3%), although the difference among all groups was not statistically significant ($P = .07$). Decreased rates of Injury Severity Score greater than or equal to 16 were noted with increasing BAC, which was largely because of reduced chest and abdomen/pelvis Abbreviated Injury Scale. Adjusted mortality was lower in BAC3 and BAC4 (both adjusted odds ratio .4, $P < .001$).

CONCLUSION: A protective effect of alcohol after MVC may be related to decreased truncal injury burden rather than protection after head injury.

Alcohol-related motor vehicle collisions (MVCs) are a major source of serious injury and death in the United States. In 2010, 10,228 people were killed in MVCs involving alcohol-impaired drivers, averaging one fatality every 51 minutes. This accounted for 31% of all vehicle-related deaths during that year.[1] The financial impact of alcohol-related crashes is significant, as the annual estimated cost of these crashes total more than $51 billion.[2] Although alcohol-related traffic fatalities decreased over the past several years, alcohol-impaired driving remains a major health and economic burden in our society.

In recent years, elevated serum alcohol levels and outcomes after trauma have received increased attention. Conclusions from clinical studies are discrepant, as some

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report increased injury severity and complications in patients with positive blood alcohol concentration (BAC),[3,4] while others found no difference or even reduced mortality.[5,6] Acute alcohol intoxication in the setting of traumatic brain injury (TBI) has been a major focus. Much of the literature supports a neuroprotective role of alcohol,[7,8] particularly after severe TBI[9–12] although the mechanism by which this occurs is unclear and a topic of ongoing study. The degree of intoxication may be an important factor, as higher BAC after TBI has been correlated with increasing survival benefit.[13]

Few studies explored the impact of alcohol intoxication on injury severity and mortality specifically after blunt trauma from MVCs. In the available literature, reduced injury severity[14] and improved survival[15] in MVC patients with high BAC was reported, although the reasons for this apparent protective effect are not entirely understood. Furthermore, there are little data on the specific injury patterns of intoxicated MVC patients in relation to varying BAC levels. The aim of this study was to compare injury severity and mortality after MVC stratified by increasing BAC. Our focus was to determine if a protective benefit was because of alterations in head injury or other regions of the body. We hypothesize that injury patterns in intoxicated drivers vary according to BAC, and the associated survival benefit is attributed to lower injury burden to specific body regions.

Patients and Methods

A retrospective review of Los Angeles County Trauma and Emergency Medicine Information System data from January 1, 2003 to December 31, 2008 was performed. The database was queried for all patients of driving age (16 years and older) with an injury mechanism of MVC and BAC drawn on arrival to the emergency department. Patients with complete data and admission BAC between 0 and .70 g/dL were included. Patients with BAC greater than .70 g/dL were excluded to minimize erroneous data in the analysis. The cohort was stratified into 6 groups according to admission BAC: BAC0 less than .01 g/dL, BAC1 .01 to .08 g/dL, BAC2 .09 to .16 g/dL, BAC3 .17 to .24 g/dL, BAC4 .25 to .32 g/dL, and BAC5 greater than .32 g/dL. An interval of .08 g/dL was selected, as this is the legal alcohol limit to operate a motor vehicle in the United States.

Demographic and clinical data were compared among groups, including age, sex, admission Glasgow Coma Scale (GCS), admission systolic blood pressure (SBP), Injury Severity Score (ISS), regional Abbreviated Injury Scale (AIS), hospital length of stay (LOS), and mortality. Numerical variables were summarized by mean and standard deviation or median and interquartile range. Binary variables were summarized by frequency and percentage. Numerical variables were compared across the 6 BAC groups by analysis of variance and results were confirmed by Welch's analysis of variance on the ranks. Binary variables were compared across the 6 BAC groups by chi-square test. A P value of less than .05 was considered statistically significant.

Multivariable logistic regression was used to assess variables associated with in-hospital mortality. The most frequently used covariates in trauma research for risk adjustment were included in the regression model,[16] in particular age, sex, GCS (≤ 8 vs >8), SBP (<90 vs ≥ 90 mm Hg), and ISS (≥ 16 vs <16). BAC levels were also included in the model, using BAC1 as the reference for comparison because of the highest mortality rate in that group. Adjusted odds ratios (AORs) and 95% confidence intervals were determined for each variable. All statistical analyses were conducted using SAS version 9.2 (SAS Institute, Cary, NC). This study was approved by the Institutional Review Board of Cedars-Sinai Medical Center.

Results

A total of 12,540 patients met inclusion criteria and were analyzed. Mean age was 35.8 years and 71.8% of the patients were male. Overall morality was 2.2%. Mean admission GCS and SBP were 13.9 and 135 mm Hg, respectively. Mean ISS was 9.7% and 20.2% had ISS greater than or equal to 16. Mean injury severity by body region was low, with AIS less than 1 for each region. The regions with the highest frequency of serious injuries were chest (10.4%, AIS ≥ 3), extremities (9.6%, AIS ≥ 3), and head (8.6%, AIS ≥ 3). Mean hospital LOS was 5 days. Additional demographic and clinical data for the cohort are presented in Table 1.

Comparison of patients stratified by admission BAC demonstrated differences in age, admission GCS, injury severity, and hospital LOS (Table 2). BAC2 had the youngest patients (31.8 years) and longest LOS (6.3 days), while BAC5 had the oldest patients (40.6 years) and shortest LOS (3.8 days) (both $P < .001$). A greater percentage of male sex was seen in the higher BAC groups (BAC0 63.6% vs BAC1 75.0% vs BAC2 77.8% vs BAC3 82.1% vs BAC4 84.7% vs BAC5 88.0%, $P < .001$) (Table 3). Admission GCS decreased with increasing BAC (BAC0 14.3 vs BAC1 14.1 vs BAC2 13.7 vs BAC3 13.5 vs BAC4 13.5 vs BAC5 12.9, $P < .001$); however, there were no differences in mean head AIS among the groups ($P = .14$). Admission SBP was relatively similar despite the noted statistical differences. Lowest mortality was seen in BAC3 (1.6%) and BAC4 (1.3%), although the mortality difference among groups was not significant ($P = .07$) (Table 3).

There was an overall decrease in ISS with increasing admission BAC, with the lowest mean ISS observed in the highest BAC group (BAC0 9.8 vs BAC1 10.5 vs BAC2 11.1 vs BAC3 9.8 vs BAC4 8.1 vs BAC5 6.2, $P < .001$). The percentage of patients with serious injuries (ISS ≥ 16) in each group followed a similar decreasing trend (BAC0