Cerebral Contusions: Catalysts and Counteractants

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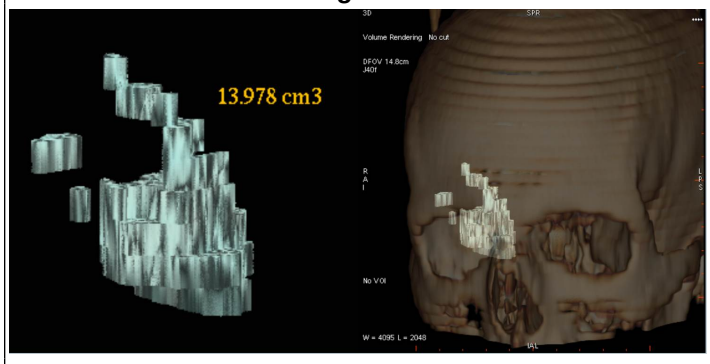
Introduction

Annually in the US, an estimated 1.7 million people experience traumatic brain injury (TBI), resulting in 1.4 million ED visits, 270,000 hospitalizations, and 53,000 deaths. The most common mass lesions associated with TBI are hematomas and contusions.

Currently, there is no proven treatment protocol for contusion management. This retrospective study seeks to provide a more comprehensive assessment of the hemorrhagic progressions of contusions (HPC) by analyzing the rate at which contusions blossom depending on a variety of factors.

Volumetric Rendering of Cerebral Contusion



Contusion volume was measured on axial CT scans using GE Advantage Workstation Software, allowing for calculation ofexpansion rate during the time between scans.

Methods

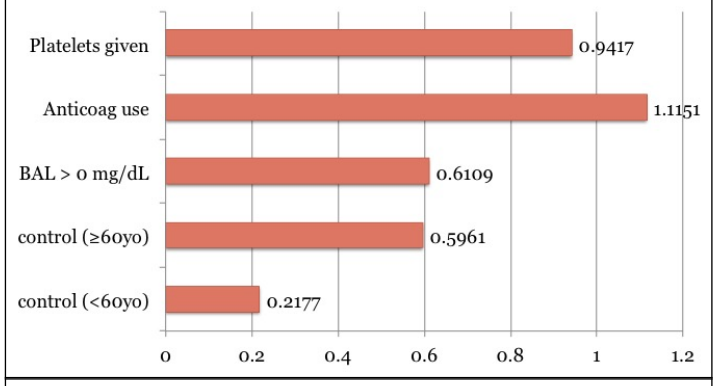
This retrospective study examined 491 patients with cerebral contusions from 2005-2013, who presented to a level 1 trauma center and had follow-up computed tomography (CT) < 72 hours later.

Using volumetric imaging software, contusion volumes were measured and the expansion rate (ER) was recorded and compared based on based on intrinsic and modifiable variables.

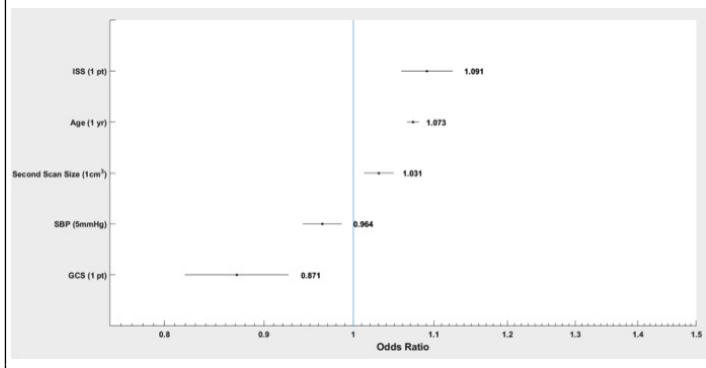
Results

Of the 491 patients, 73.6% experienced HPC. Various subgroups were compared based on age, BAL (30.4%), platelet transfusion (9.4%), and anticoagulation (7.2%).

Expansion Rate in Controlled Subgroups



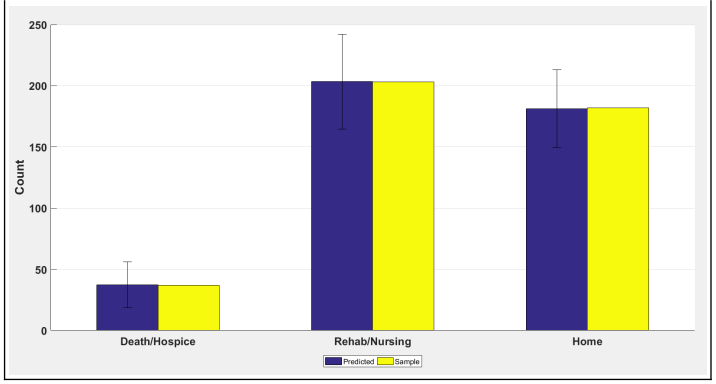
Odds Ratios for Patient Death from HPC



EVD: 14.78 (5.45 – 40.08); Platelet: 1.802 (0.84 – 3.86)

Using Akaike Information Criterion, logistic and linear regressions identified variables capable of predicting patient outcome and contusion expansion, respectively. Logistic regression revealed that age ($p<0.001$), SBP ($p=0.113$), ISS ($p<0.001$), EVD ($p<0.001$), GCS ($p<0.001$), scan 2 size ($p<0.001$), and platelet transfusion ($p=0.13$) predict patient outcome. Linear regression identified age, ISS, scan 1 size, EVD, craniectomy, BAL, and subdural hematoma as significant predictors of 79.63% of the variance in HPC ($p<0.001$).

Predicted vs. Actual Outcomes



Discussion

Data suggests increased rates of contusion expansion based on patient age, BAL, platelet transfusion, and anticoagulation. Systolic blood pressure appears to be negatively correlated with the both the rate of contusion expansion as well as patient outcome. Logistic regression identifies key variables that are associated with patient outcome, most notably the extent by which a contusion grows. Our linear model offers a predictive formula to anticipate how much a contusion will blossom in the acute period.

Conclusions

Various factors contribute to the rate at which cerebral contusions blossom over an acute time course. Understanding the relationship of intrinsic and modifiable aspects of the presenting patient can help predict the rate of expansion and highlight potential therapeutic interventions to improve TBI associated mortality.

Learning Objectives

1) Understand the significance of cerebral contusions on traumatic brain injury;
2) Identify key factors that contribute to the hemorrhagic progression of cerebral contusions; and
3) Discuss the ability to predict the extend to which TBI bleeds expand.