Introduction

Nearly 2 million people sustain a TBI annually in the United States, 90% of which are classified as mild or moderate TBI (MMTBI). Tools to assess risk stratification in these patients acutely after injury would aid in their prognosis.1

Capnography is a fast, non-invasive technique that is easily administered and accurately measures exhaled ETCO2 concentration.2 ETCO2 levels respond to changes in ventilation, perfusion, and metabolic state, all of which may be altered following TBI.3

Objectives

We aimed to assess the diagnostic utility of ETCO2 in patients with mild to moderate TBI (GCS 9-15) by examining the association between initial ETCO2 levels and measures of injury severity including initial GCS score, Computerized Tomography (CT) findings, requirement of neurosurgical intervention.

Methods

We enrolled 46 adult patients presenting to Orlando Regional Medical Center's Level 1 trauma center with a MMTBI, defined by blunt head trauma followed by loss of consciousness, amnesia, or disorientation and a GCS score of 9-15.

ETCO2 measurements taken within 4 hours of injury were recorded from prehospital and emergency department records. Additional data were also prospectively collected from patient records to characterize the nature and severity of the injury and any subsequent intervention. These included demographic information, GCS score, vital signs, ISS, head CT results and any clinical interventions.

Data were analyzed using univariate techniques, and comparative analysis was performed using Fisher’s Exact Test. Levels of ETCO2 were measured as a continuous variable and then dichotomized into normal versus abnormal levels. For the analysis, a reference range of 35-37 mmHg +/-10% was considered “normal.” Significance was set at 0.05.

Results

Of the 46 patients enrolled, 21 (46%) had a normal ETCO2 level and 25 (54%) had an abnormal ETCO2 level.

Mechanisms of Injury included MVC in 19 (41%), MA in 9 (20%), fall in 8 (17%), bicycle/pedestrian struck in 8 (17%) and other in 2 (4%).

Eight (17%) patients had a GCS 9-12 and 38 (83%) had a GCS 13-15. Sixteen (35%) patients had intracranial lesions on CT and of those, 15 (94%) had abnormal ETCO2 levels (p=0.006). Five (11%) patients required neurosurgical intervention and of those, 100% had abnormal ETCO2 levels (p=0.05).

Discussion

Rather than a linear relationship, our results showed a significant association between ETCO2 levels that deviated outside of the normal range, both above and below.

Four clinically important measures of injury severity were noted:

- MMTBI patients with intracranial pathology on CT
- Patients who required hospital admission
- Patients who required neurosurgery

Each of these measures closely relates to the severity of traumatic injury.

Future Directions

Limitations of the study include the small sample size, single institution data collection, subjectivity in GCS score and failure to include ventilated patients.

These findings suggest that with further research, ETCO2 may have the potential to become a useful additional diagnostic indicator in the assessment and risk stratification of TBI patients in the Emergency Department.

Selected References

