Blunt Cerebrovascular Injury and Facial Fractures: A Systematic Review of the Literature

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ABSTRACT

Objectives: Blunt Cerebrovascular Injury (BCVI) is a rare but lethal sequela of high-velocity trauma often resulting in stroke or death. The objective of this systematic review is to (1) identify craniofacial (CFM) trauma patients who may benefit from BCVI screening and (2) describe the optimal diagnostic and therapeutic modalities to treat these patients.

Study Design: Medline, PubMed, and Cochrane Systematic Review 01JAN1946-14FEB2013

Methods: Using the Preferred Reporting Items for Systematic Reviews and Meta-Analysis model, a comprehensive review of the literature was conducted for BCVI studies involving CFM injuries. Duplicated data extraction was conducted for article meeting inclusion criteria.

Results: 682 abstracts were reviewed; 21 met inclusion criteria. BCVI incidence was 0.45%. 86.6% of patients had high velocity mechanism of injury. Facial fractures incidence in the setting of BCVI were highest for mandible (12.5%) and maxilla (11.8%). Computed tomographic angiography (CTA) has emerged as the screening modality of choice. 63.1% of patients with BCVI were treated non-surgically with anticoagulant or antplatelet medications. The mortality among BCVI patients was 23.9% and the morbidity was 47.1%.

Conclusions: BCVI is a rare yet devastating complication of blunt trauma, with morbidity approaching 50%. 1/3 of all BCVI patients present with facial fractures. Patients sustaining CFM fractures in the setting of high velocity trauma may benefit from CTA screening to avoid the risk of stroke and death.

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INTRODUCTION

Blunt Cerebrovascular Injury (BCVI) to the carotid and vertebral arteries can occur in the setting of head and neck trauma when high-speed deceleration results in neck hypertension and/or hyperflexion. Approximately 1 in 1000 blunt trauma cases result in BCVI. Although BCVI incidence is low, the sequela are devastating with some authors reporting 80% associated morbidity and mortality up to 40%.[2-4] While several BCVI screening protocols (Table 1) include midface fractures as a screening protocol, there is a paucity of data examining the correlation of craniofacial (CFM) fractures with BCVI. The objective of this systematic review is to identify high risk CMF trauma and patients who may benefit BCVI screening and intervention.

METHODS AND MATERIALS

FIGURE 1. Incidence of Facial Fracture Patterns within the BCVI Population

RESULTS

860 abstracts reviewed 21 studies met inclusion criteria[2-24]

14 retrospective studies 7 studies prospective

Incidence of BCVI 0.45% among included studies[2-24]

Most common screening criteria utilized were Memphis, Denver and EAST (Table 1)

Screening yield of each criteria 22.8% with Memphis Criteria, 26.5% with the Denver Screening criteria, 21.2% with the EAST criteria

CTA and Angiography were the most commonly utilized screening modalities

89.2% of patients had high velocity mechanism of injury

Incidence of facial fractures 32.8% among patients with BCVI

Most common facial fractures types were mandible and midface fractures (Figure 1)

Conclusions: BCVI is a rare and devastating complication of blunt trauma. 4.1% of patients suffering BCVI have neurologic deficits and mortality is 5.1%. Within this population 32.1% of patients present with facial fractures with the most common fractures being mandible and midface fractures. Patients sustaining facial fractures in the setting of high velocity should be screened with computed tomographic angiogram to facilitate early identification of BCVI and early treatment. Due to the heterogeneity of studies included in the analysis it is difficult to determine and quantify the increased risk associated with facial fractures in the blunt trauma population. Future directions for research would include prospective studies focused on determining the incidence of BCVI among patients with facial fractures and the morbidity and mortality associated with BCVI and facial fractures.

REFERENCES

The historical incidence of BCVI ranges between 0.33% and 1.07% and within our review it was 0.45%.[2-26] The collective morbidity and mortality of this condition is over 60% with a stroke rate of 16.7%. Mandible and LeFort pattern fractures were the most common fracture patterns in this review. Within our subgroup analysis we found incidence of facial fractures to be 32.8%. Several authors have suggested and increased relative risk for BCVI in patients in patients suffering mandible and midface fractures in the setting of high velocity blunt trauma.[27-28] Although no prospective studies have been done to address true incidence of BCVI within the setting of high velocity facial fractures, this clinical scenario should raise suspicions for BCVI.

Once a clinician identifies a patient at risk for BCVI, that patient should be screened with CTA. This diagnostic modality was the most frequently used within the included studies and sensitivity for BCVI has been noted to be as high as 97.7% with specificities ranging from 84-100%.[5,19,29,30] Eastman and colleagues demonstrated a significantly significant reduction in stroke rate from 15.2% to 3.8% utilizing CTA for screening.

Most patients can be treated with medical management once diagnosed with BCVI. 63.1% of patients within the included studies were managed medically. This is consistent with the published guidelines form the Western Trauma Association and the Eastern Association for Surgery of Trauma.[31,32] Surgical management was reserved for high grade lesions only, which is consistent with these guidelines as well.[31,33]