



Complete Traumatic Occlusion of the Carotid and Vertebral Arteries: Acute stroke rate in the Biffi IV population

Ryan Morton MD; Brian Hanak MD; Michael Robert Levitt MD; Jason Jer Jia Chang MD; Eric C. Peterson MD, MS; Joshua William Osbun MD; Louis J. Kim MD; Randall M. Chesnut MD, FCCM, FACS
Harborview Medical Center at the University of Washington, Seattle, WA



Introduction

The incidence of stroke after blunt cerebrovascular injury (BCVI) varies considerably in the literature. We sought to define the acute stroke rate for the most severe form of BCVI: complete traumatic parent artery occlusion (Biffi IV).

Methods

All CT angiography reports of the head or neck from 2005-2011 at a high-volume level one trauma center were reviewed. An electronic search identified a subpopulation with complete traumatic occlusion (Biffi IV) of the vertebral artery (VA) or internal carotid artery (ICA). Acute strokes were diagnosed by clinical exam (confirmed by MRI) or MRI alone.

Results

Over the 7 year period almost 1100 BCVI were diagnosed. Of these, fifty (4.5%) were complete traumatic occlusion or Biffi IV injuries. The Biffi IV category was subdivided into the following: 8 ICA, 40 unilateral VA, and 2 bilateral VA.

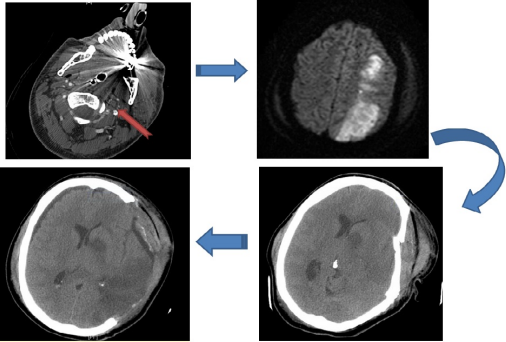
Six patients (75%) with ICA occlusion developed acute stroke despite treatment with aspirin (n=2), clopidogrel and aspirin (n=2), or heparin infusion (n=1). One patient with clinical brain death shortly after presentation received no treatment. Three of these five survivors (60%) required decompressive hemicraniectomy due to malignant swelling (See Figure 1). All five patients had a poor outcome (mRS 3-5) at last follow up. For the two patients who did not suffer a stroke, one was treated with ASA while the other with ASA and Plavix.

Results Continued:

Three of the 40 patients (7.5%) with Biffi IV vertebral injuries developed infarction, two while receiving aspirin and clopidogrel therapy. The third was on no therapy due to systemic injuries. All 3 infarctions were clinically silent. Of the 37 patients who did not stroke (i.e Figure 2) , 33 were on ASA, 1 on coumadin, and 3 received no medical therapy due to systemic injuries.

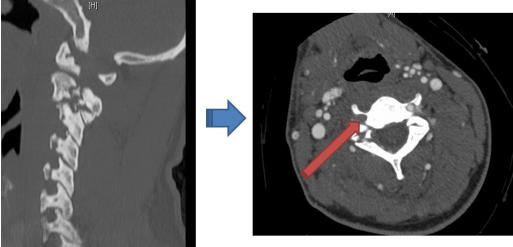
Both patients with bilateral VA Biffi IV injuries were treated with aspirin alone. One suffered infarctions to the cerebellum (Figure 3) and brainstem, but was already quadriplegic from a cervical spine injury. The other patient remained clinically asymptomatic.

Figure 1. Left Biffi IV ICA Injury



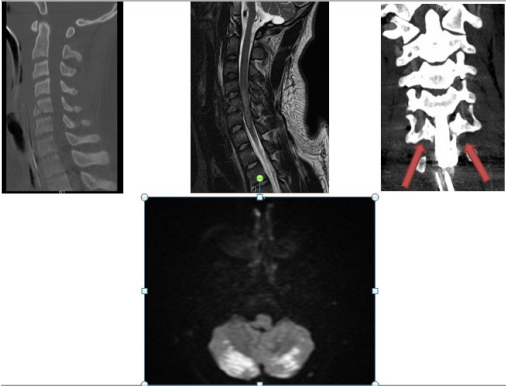
This 43 year old man suffered a traumatic left ICA occlusion after a rollover MVC. He developed a left sided MCA stroke with subsequently malignant progression requiring a decompressive hemicraniectomy.

Figure 2. Right Biffi IV VA Injury



This 40 year old man fell off a 40 foot cliff while snowboarding. He sustained an atypical Hangman's fracture and posterior C1 arch fracture. His R vertebral artery was traumatically occluded. He suffered no clinical strokes from this injury.

Figure 3. Bilateral Biffi IV VA injuries



This 20 year old man who suffered a C5 teardrop fracture after a fialed suicide attempt. He was treated at an outside facility and sent to Harborview where a CTA diagnosed persistetent traumatic occlusions of both vertebral arteries at C5 despite open reduction and fusion. He suffered bilateral cerebellar hemispheric strokes which were clinically silent as he was a C5 ASIA A quadraplegic.

Conclusions

Complete traumatic parent artery occlusion is rare but dangerous, with 20% developing acute stroke. While less common than VA injury, ICA occlusion was associated with a 10 times higher rate of acute stroke (75% vs 7.5%), as well as further intervention (decompressive hemicraniectomy) and worse outcome.

Learning Objectives

By the conclusion of this session, participants should be able to describe the stroke risk of the patients with Biffi IV injuries. Additionally, the topic of stroke prevention with anticoagulation or antiplatlets therapies should be discussed as well as ways to identify the higher risk patients sooner.