July 2015
Primary Author: Bryan C. Morse MS, MD, Emory Surgery; Faiz Ahmad M.D., M.Ch. Emory Neurosurgery; Ravi R. Rajani MD, Emory Vascular Surgery

Grady Memorial Hospital
Trauma Service Guidelines

Screening and Management of Blunt Cereberovascular Injuries (BCVI)

BACKGROUND

Blunt injury to the carotid or vertebral vessels (blunt cerebrovascular injury [BCVI]) is diagnosed in approximately 0.1% among blunt trauma victims admitted to trauma centers.[1-4] However, the majority of these injuries are diagnosed after the development of symptoms secondary to central nervous system ischemia, with a resultant neurologic reported BCVI-related mortality rates of 23%, with 48% of survivors suffering permanent severe neurologic sequelae.[5-7]When asymptomatic patients are screened for BCVI, the incidence rises to 1% of all blunt trauma patients and as high as 2.7% in patients with an Injury Severity Score ≥16.[1-4] This guideline addresses diagnosis and management of BCVI including screening for asymptomatic injury, screening modality, and management of BCVI (both symptomatic and asymptomatic), and appropriate follow-up for these injuries.

CLINICAL PRACTICE GUIDELINES (see attached algorithm)

I. Evaluation for BCVI[8-11]

a. **SYMPTOMATIC** - Trauma patients with any of the following signs or symptoms should be considered to have BCVI and further evaluation by a CTA is indicated:

i. Arterial hemorrhage from neck, mouth, nose, ears
ii. Large or expanding cervical hematoma
iii. Cervical bruit in a patient younger than 50 years
iv. focal or lateralizing neurologic deficit, including
v. Evidence of cerebral infarction/ischemia on computed tomography (CT) or magnetic resonance imaging (MRI) scan unexplained by other factors like prolonged hypotension, hypoxia or cerebral herniation from mass effect.
vi. Neurologic deficit that is incongruous with CT or MRI findings and unexplained by other injuries.

Any of these findings should prompt emergent diagnostic evaluation and interventions directed at hemorrhage control or stroke management.

b. **ASYMPTOMATIC** – Screening for BCVI is performed for high risk patients with high energy transfer mechanisms:[8-11]

i. Displaced mid-face fracture (LeForte II or III)
ii. Basilar skull fracture with carotid canal involvement
iii. Closed head injury consistent with diffuse axonal injury and GCS ≤ 6
iv. Cervical transverse foramen fracture from C1 to C6 level.
v. Cervical vertebral body fracture.

vi. Near hanging with anoxia (if brain injury is compatible with favorable prognosis for survival)

vii. Clothesline type injury

c. Pediatric trauma patients should be evaluated using the same criteria as the adult population.

II. DIAGNOSIS OF BCVI[10-11]

If BCVI is suspected, CT angiography (CTA) neck (≥ 16 slice multi-detector) at Grady Memorial Hospital is the preferred screening test for BCVI. If diagnosis is unclear, review with neuroradiologist or vascular surgery consult should be obtained for further clarification. For patients undergoing emergent MRI for complete cervical spinal cord injuries or vertebral subluxations/dislocations, MRA with Gadolinium is acceptable.

III. TREATMENT OF BCVI (see algorithm)[8-11]

The primary management of these patients remains under the discretion of the trauma surgery service due to the high likelihood of concomitant injuries. Vascular surgery/Neurosurgery consultation should be obtained as needed by the primary trauma surgeon. No class I or II recommendations exist for the treatment of these injuries.

Injury Grade	Denver Grades BCVI[8]
I	Luminal irregularity or dissection with < 25% luminal narrowing
II	Dissection or intramural hematoma with ≥ 25% luminal narrowing, intraluminal thrombus, or raised intimal flap
III	Pseudoaneurysm
IV	Occlusion
V	Transection with free extravasation

a. Grade I

i. First line therapy is controversial, but these injuries should be treated with antiplatelet or antithrombotic agents.

1. Administer Aspirin 325 mg po or 300 mg pr q day
2. Contra-indication to antithrombotic - For patients with TBI, Neurosurgery should be consulted prior to beginning therapy.

ii. Depending on the risk of bleeding as determined by trauma surgery, patients may be treated with aspirin 81mg or no treatment in select patients.

b. Grades II, III injuries (pseudoaneurysms) and Grade IV

i. **SYMPTOMATIC** -

1. Vascular surgery (extra-cranial injury)/Interventional Neuroradiology (intra-cranial injury) consultation may be obtained to determine need for potential intervention at discretion of trauma surgeon

2. Administer Aspirin 325 mg po or 300 mg pr q day
3. Contra-indication to anticoagulation - For patients with TBI, Neurosurgery should be consulted prior to beginning therapy.
4. For select patients without contra-indication to anticoagulation, dual antiplatelet and antithrombotic therapy may be considered.
5. For patients selected for conversion to warfarin therapy, prothrombin time and international normalized ratio of 2-3 for 3-6 months are recommended.

ii. **ASYMPTOMATIC** –
1. Patients should be managed with medical therapy - Aspirin 325 mg po or 300 mg pr q day
2. Vascular surgery (extra-cranial injury)/Interventional Neuroradiology (intra-cranial injury) consultation should be considered to facilitate follow-up imaging and possible delayed endovascular therapy.

iii. Patients with carotid stents need post-intervention dual antiplatelet therapy due to high rate of thrombosis without it and need follow up with endovascular service.

c. Grade V
i. These injuries require immediate surgical or endovascular intervention for control of bleeding.
ii. Trauma surgery, neurointerventional radiology, and vascular surgery may be consulted to discuss these injuries on a case-by-case basis.

IV. FOLLOW-UP
a. Patients with a confirmed BCVI should undergo a repeat CT Neck angiogram at 7 days post-injury or post-diagnosis to monitor progression of injury. More severe cases may need an earlier CTA.
b. BCVI patients need regular outpatient monitoring with trauma surgery for new neurologic symptoms that need further evaluation and imaging.
c. Patients with persistent CTA findings at 7 days should be continued on medical therapy and Vascular surgery (extra-cranial injury)/Interventional Neuroradiology (intra-cranial injury) may considered to facilitate follow-up imaging and possible delayed endovascular therapy.

REFERENCES

1. Davis JW, Holbrook TL, Hoyt DB, Mackersie RC, Field TO, Jr., Shackford SR. Blunt carotid artery dissection: incidence, associated injuries, screening, and treatment. *J Trauma.* 1990;30:1514 –1517.
2. Martin RF, Eldrup-Jorgensen J, Clark DE, Bredenberg CE. Blunt trauma to the carotid arteries. *J Vasc Surg.* 1991;14:789 –795.
3. Cogbill TH, Moore EE, Meissner M, et al. The spectrum of blunt injury to the carotid artery: a multicenter perspective. *J Trauma.* 1994;37:473–479.

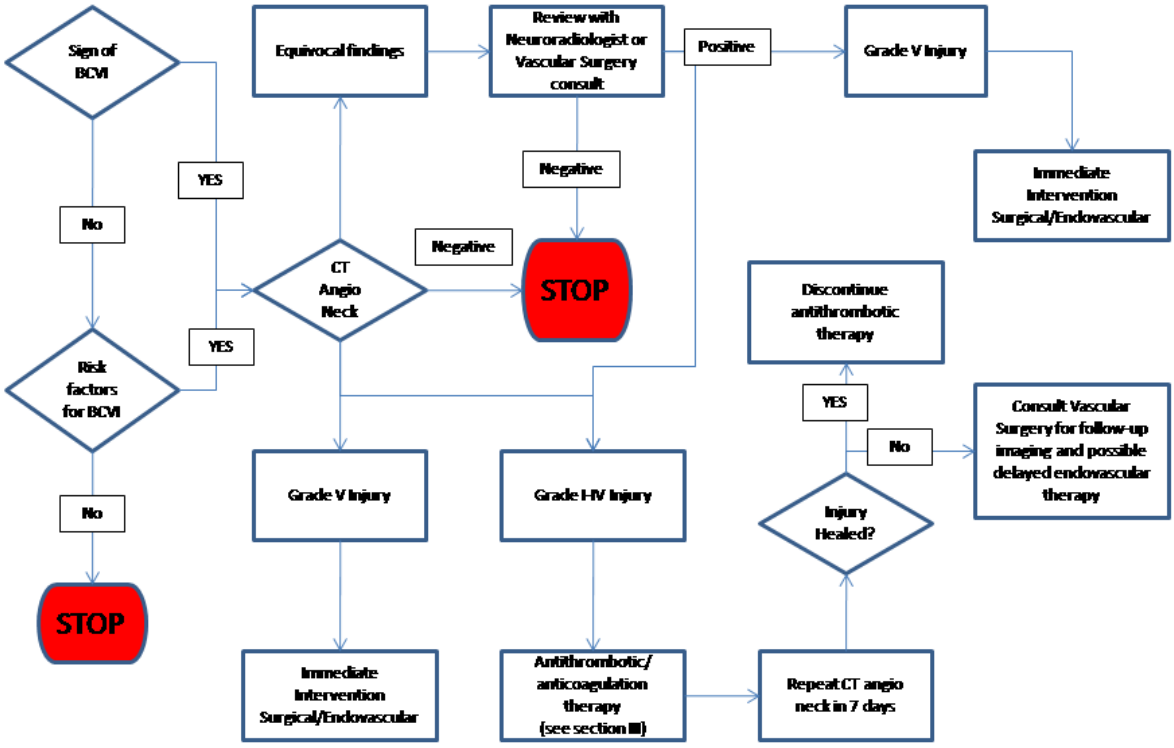
July 2015
Primary Author: Bryan C. Morse MS, MD, Emory Surgery; Faiz Ahmad M.D., M.Ch. Emory Neurosurgery; Ravi R. Rajani MD, Emory Vascular Surgery

4. Ramadan F, Rutledge R, Oller D, Howell P, Baker C, Keagy B. Carotid artery trauma: a review of contemporary trauma center experiences. *J Vasc Surg.* 1995;21:46 –54.
5. Fabian TC, Patton JH, Jr., Croce MA, Minard G, Kudsk KA, Pritchard FE. Blunt carotid injury: importance of early diagnosis and anticoagulant therapy. *Ann Surg.* 1996;223:513–525.
6. Parikh AA, Luchette FA, Valente JF, et al. Blunt carotid artery injuries. *J m Coll Surg.* 1997;185:80–86.
7. Berne JD, Norwood SH, McAuley CE, Vallina VL, Creath RG, McLarty J. The high morbidity of blunt cerebrovascular injury in an unscreened population: more evidence of the need for mandatory screening protocols. *J Am Coll Surg.* 2001;192:314 –321.
8. Cothren CC, Moore EE, Biffl WL, et al. Anticoagulation is the gold standard therapy for blunt carotid injuries to reduce stroke rate. *Arch Surg*. 2004;139:540–545; discussion 545–546.
9. Cothren CC, Moore EE, Ray CE Jr, et al. Carotid artery stents for blunt cerebrovascular injury: risks exceed benefits. *Arch Surg*. 2005;140:480–485; discussion 485–486.
10. http://www.east.org/education/practice-management-guidelines/blunt-cerebrovascular-injury
11. http://westerntrauma.org/algorithms/WTAAlgorithms_files/gif_4.htm
12. Harrigan MR, Hadley MN, Dhall SS, et al. Management of Vertebral Artery Injuries Following Non-Penetrating Cervical Trauma. *Neurosurgery* 72:234–243, 2013

July 2015

Primary Author: Bryan C. Morse MS, MD, Emory Surgery; Faiz Ahmad M.D., M.Ch. Emory Neurosurgery; Ravi R. Rajani MD, Emory Vascular Surgery

EVALUATION AND TREATMENT OF BLUNT CEREBEROVASCULAR INJURIES



http://westerntrauma.org/algorithms/WTAAlgorithms_files/gif_4.htm