Denver Grading Scale for BCVI			
Grade	Description	Rate of Stroke (carotid artery, vertebral artery)[1]	Preferred treatment modality[2,3]
I	Luminal irregularity or dissection with < 25% luminal narrowing	8%, 6%	Antithrombotic*
II	Dissection or intramural hematoma with > 25% luminal narrowing, intraluminal thrombus, or raised intimal flap	14%, 38%	Antithrombotic and/or surgical repair
III	Pseudoaneurysm	26%, 27%	Antithrombotic and/or surgical repair
IV	Occlusion	50%, 28%	Antithrombotic and/or surgical repair
V	Transection with free extravasation	100%, n/a	Surgical repair

Table 5. Denver Grading Scale for BCVI, stroke risk, and treatment modality[4,25]

*Antithrombotic therapy = either anticoagulation or antiplatelet agents

Mary Washington Hospital

MWHC

Blunt Cerebrovascular Injury (BCVI) in Trauma Patients

Mary Washington Hospital

Level: Hospital Specific

Purpose:

This is a clinical practice guideline for the management of patients with BCVI. This is a guideline only and does not constitute a standard of care or hospital policy. Deviation from this guideline, when clinically appropriate, will be accompanied by justifying documentation.

Scope:

This guideline applies to all patients that present to Mary Washington Hospital Emergency Department.

Mechanisms of Injury with Risk of BCVI:

- **Internal Carotid Artery:**
  - Cervical hyperextension or hyperflexion with rotation, stretching of the ICA over the lateral articular processes of cervical vertebral bodies C1-C3
  - Direct cervical trauma
  - Intraoral trauma
  - Basilar skull fracture involving the carotid canal
- **Vertebral Artery:**
  - Cervical spine injuries especially subluxations and fractures of the foramen transversarium, severe cervical hyperextension with rotation or hyperflexion
  - Lefort II or III midface fractures
  - Basilar skull fracture involving the carotid canal
  - Closed head injury consistent with DAI or GCS <6
  - Near hanging resulting in cerebral anoxia
  - Cervical vertebral body or transverse foramen fracture, subluxation, or ligamentous injury at any level or any fracture at the level of C1-C3
  - Seat belt or other clothesline type injury with significant cervical pain, swelling, or AMS

Indications for Screening:

- Any trauma patient with a neurologic abnormality unexplained by known injuries.
- Blunt trauma patients with epistaxis thought to be from an arterial source.
- Asymptomatic patients with significant blunt head trauma are at risk of BCVI and should be screened. Risk factors include:
  - GCS < 8
  - Petrous temporal bone fracture
  - Diffuse axonal injury

- Lefort II or III fracture
- Cervical spine fracture patterns: subluxation, fractures extending into the transverse foramen, fractures of C1-C3, severe cervical hyperextension/rotation or hyperflexion
- Near hanging resulting in anoxic brain injury
- Seat belt abrasion or other soft tissue injury of the anterior neck resulting in significant swelling or altered mental status
- Fracture in proximity to internal carotid or vertebral artery
- Basilar skull fracture involving the carotid canal
- Cervical vertebral body fracture

Signs/Symptoms of BCVI:

- Arterial hemorrhage from neck, nose, or mouth
- Cervical bruit in age <50
- Expanding cervical hematoma
- Focal neurological deficit
- Neurologic examination incongruous with CT scan findings
- Ischemic stroke on secondary CT scan

Screening Modality:

- Diagnostic four-vessel cerebral angiography (FVCA) remains the gold standard for diagnosis of BCVI.
- Multislice (8 or greater, ideally 16 slice) multidetector CTA has similar rates of detection compared to FVCA and may be considered as a screening modality.
- Duplex US should not be utilized for BCVI screening due to poor SN and SP
- In the setting of a symptomatic patient with negative CTA screening, FVCA is recommended to exclude injury.

BCVI Grading Scale:

- Grade I– Luminal irregularity or dissection with <25% narrowing
- Grade II– Dissection or intramural hematoma with >25% narrowing, intraluminal thrombus, or raised intimal flap
- Grade III– pseudoaneurysm
- Grade IV– occlusion
- Grade V– transection with free extravasation

Management of BCVI:

- Grade I & II – Antithrombotic therapy with aspirin or heparin
    - Antiplatelet or heparin therapy can be used with seemingly equivalent results
    - Heparin therapy should be started without an initial bolus, there has not been a goal PTT determined. Patients can be transitioned to Warfarin titrated to a PT/INR ratio of 2-3 for 3-6 months.
        - Heparin dosing: no bolus, 10 U/kg/h to target PTT 40-50 seconds
        - Aspirin 81-325 mg daily or Clopidogrel 75 mg daily
- Grade III & IV – consider invasive therapy, as these injuries rarely resolve with observation or heparinization.
    - Surgical or endovascular intervention should be considered in addition to antiplatelet therapy to prevent post-procedure thrombosis

    - More research is needed to determine the efficacy and safety of stenting in the setting of BCVI, caution should be used during stent deployment to prevent dislodgement of thrombus and post-stent antithrombotic therapy is crucial. It is not advisable to deploy stents within the first several days of injury.
- Grade V – associated with high morbidity and mortality, urgent surgical repair is indicated if accessible. However, many injuries are inaccessible and require endovascular techniques.
- In patients with early neurologic deficits and an accessible carotid lesion, surgical or endovascular repair should be considered to restore flow.
- In children with ischemic neurologic events, management of intracranial HTN up to and including resection of ischemic brain tissue has improved outcome as compared with adults and should be considered for supportive management.

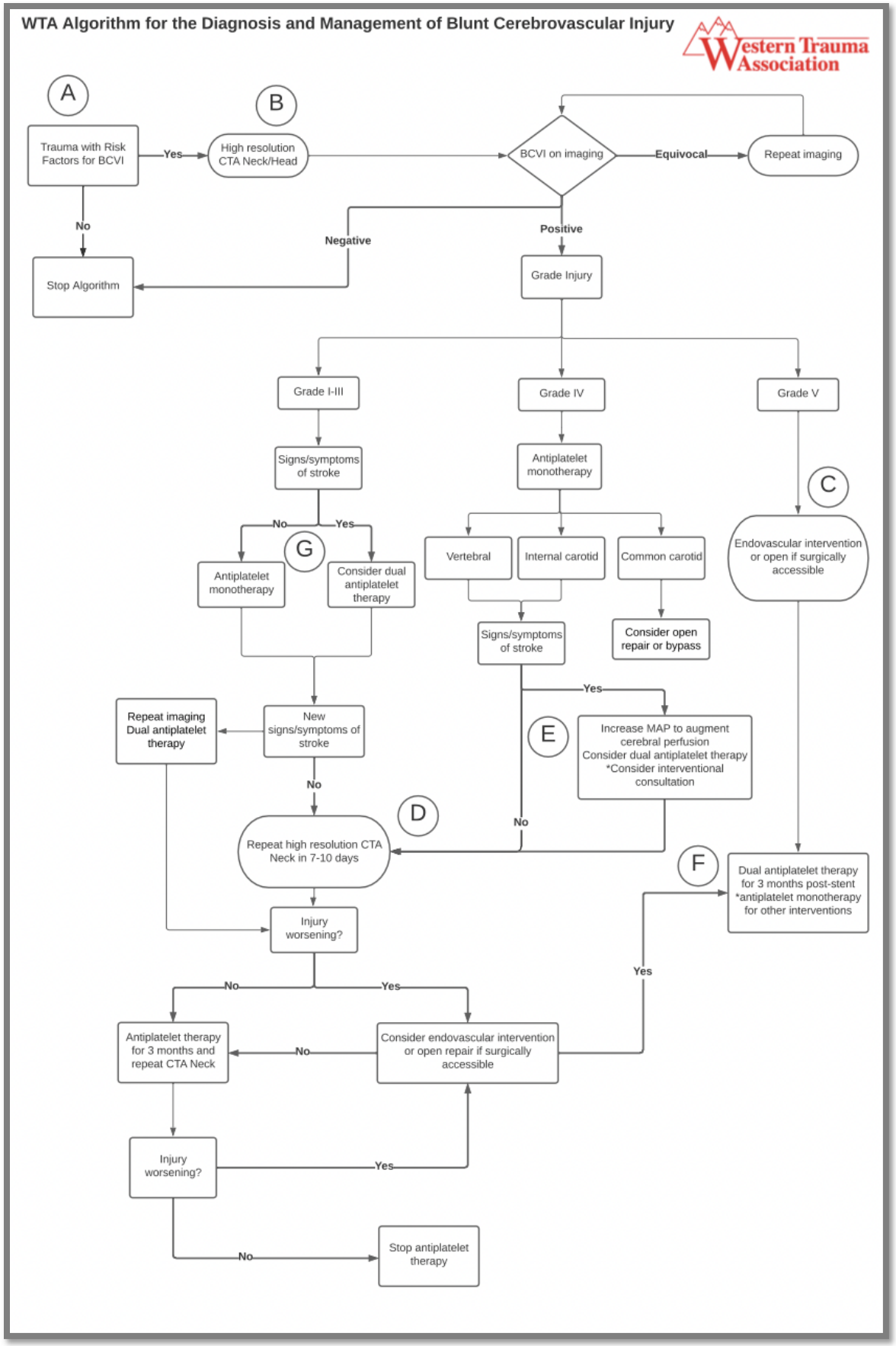
Follow Up:

- Follow up angiography is recommended in Grade I-III injuries 7-10 days post injury or immediately for any change in neurologic status.
- Duration of antithrombotic therapy and the optimal drug have not been determined. Aspirin is currently the agent of choice however newer agents with reversible effects may be the preferable choice in the future.
- Continued ATT for 3 months with a possible need for lifelong antiplatelet therapy is recommended if the lesion persists on repeat CTA imaging

Take Home Points/Recommendations:

- Screening CTA should be performed in patients with high-risk cervical spine injuries to detect BCVI.
- The use of antithrombotic therapy (ATT) is recommended to decrease the incidence of both stroke and mortality in patients with BCVI. This should be done as early, and safely as possible following confirmation of the diagnosis and consideration should be given toward a multidisciplinary discussion of the optimal ATT among patients with concomitant injuries in whom therapy may exacerbate or worsen bleeding.
- Recommend against the use of routine stenting as an adjunct to ATT in adult patients with Grade II or III BCVIs to reduce the risk of stroke.
- Follow up CTA should be performed in 7-10 days to determine longevity of ATT treatment

WTA Algorithm for the Diagnosis and Management of Blunt Cerebrovascular Injury



References:

Bromberg, William J. MD; Collier, Bryan C. DO; Diebel, Larry N. MD; Dwyer, Kevin M. MD; Holevar, Michelle R. MD; Jacobs, David G. MD; Kurek, Stanley J. DO; Schreiber, Martin A. MD; Shapiro, Mark L. MD; Vogel, Todd R. MD. Blunt Cerebrovascular Injury Practice Management Guidelines: The Eastern Association for the Surgery of Trauma. The Journal of Trauma: Injury, Infection, and Critical Care 68(2): p 471-477, February 2010. | DOI: 10.1097/TA.0b013e3181cb43da

Kim DY, Biffl W, Bokhari F, et al. Evaluation and management of blunt cerebrovascular injury: A practice management guideline from the Eastern Association for the Surgery of Trauma [published correction appears in J Trauma Acute Care Surg. 2020 Aug;89(2):420. doi: 10.1097/TA.0000000000002828]. J Trauma Acute Care Surg. 2020;88(6):875-887. doi:10.1097/TA.0000000000002668

Biffl WL, Cothren CC, Moore EE, et al. Western Trauma Association critical decisions in trauma: screening for and treatment of blunt cerebrovascular injuries. J Trauma. 2009;67(6):1150-1153. doi:10.1097/TA.0b013e3181c1c1d6

https://www.westerntrauma.org/western-trauma-association-algorithms/screening-for-and-treatment-of-blunt-cerebrovascular-injuries-algorithm/introduction/

Approved: 9/2024

Reviewed:

Revised:

Signature(s): _____
Medical Director, Trauma Services, MWH

_____
Vice President, Medical Affairs, MWHC