

Assessment of the guidelines to screen which pediatric patients should have further evaluation for blunt cerebrovascular injury

While the true incidence of blunt cerebrovascular injury (BCVI) following blunt trauma is not known, it is thought to be approximately 1% in adults [1] and lower in children [2,3]. Well established guidelines are in place for adult care, and their use in children is advocated; however, the use of adult guidelines in children may lead to overutilization of computed tomography angiogram (CTA) as a screening test. Alternatively, guidelines have been created for pediatric care, but none have been widely tested/validated. Ultimately, practitioners must understand that there is an inherent trade-off between widening the criteria for triggering a screening test and the number of unnecessary screening tests performed. Given the lack of evidence, we provide several options that could be used outright, or organizations could use parts of several guidelines to create their own in-house policy.

1) The Eastern Association for the Surgery of Trauma (EAST) Guidelines [4]:

The EAST guidelines are based on an extensive literature review with the committee defining the quality of references available and then making levels of recommendations based on the literature (Level I, “convincingly justifiable;” Level II, “reasonably justifiable;” and Level III, “strongly supported . . . but adequate scientific evidence is lacking”). The EAST guidelines make no level 1 recommendations regarding screening tests for BCVI. Level II recommendations state that patients “should be evaluated for BCVI” if they present “with any neurologic abnormality that is unexplained by a diagnosed injury” or “with epistaxis from a suspected arterial source after trauma.” Level III guidelines note that screening “should be considered” for asymptomatic patients with:

- Glasgow Coma Scale (GCS) score <9
- Petrous Bone Fracture
- Diffuse Axonal Injury
- Cervical spine fracture, particularly involving C1-C3 or through the foramen transversarium
- Cervical spine fracture with subluxation or rotation
- Lefort II or III facial fractures

EAST guidelines do not differentiate between adults and children but make a Level III suggestion that “pediatric trauma patients should be evaluated using the same criteria as the adult population.”

2) The Denver Health Medical Center BCVI Screening Guideline [5]:

This screening tool is based on many years of clinical research performed at a single center. Criteria include either signs/symptoms of BCVI or risk factors that would prompt a screening test. Of note, earlier research to develop these criteria excluded patients under 18 years of age[6], but subsequent research has included children [5]. Also, in reporting their data, the authors do not reveal the total number of screening tests prompted based on their use of the guideline [5].

Signs/symptoms include:

- Arterial Hemorrhage from the neck/nose/mouth
- Cervical bruit
- Expanding cervical hematoma
- Focal neurological deficit (transient ischemic attack, hemiparesis, vertebrobasilar symptoms, or Horner Syndrome)
- Neurological examination incongruous with head CT
- Stroke on imaging

Risk factors include :

- High Energy Transfer Mechanism
- Mandible fracture
- LeFort II or III mid-face fracture
- Complex skull fracture/basilar skull fracture/occipital condyle fracture
- Severe traumatic brain injury (TBI) with GCS < 6
- Cervical spine fracture, subluxation or ligamentous injury at any level
- Near hanging with anoxic brain injury
- Clothesline type injury or seat belt abrasion with significant swelling, pain, or altered mental status
- TBI with thoracic injury
- Scalp degloving
- Thoracic vascular injuries or blunt cardiac rupture
- Upper rib fractures (not specified)

3) The Utah Screening Score [7]:

This screening tool was developed following retrospective review at a single pediatric center that incorporated 10 years of data and included 234 patients who underwent CTA screening. The suggested use for the scoring system is that patients with a score of 2 or less are considered to have a low risk of BCVI (7.9%) while patients with a score of 3 or greater are considered to have a high risk of BCVI (39.3%) [7]. The Utah Score did undergo further validation using multi-center prospective and retrospective cohorts [8]. Limitations to the design of this scoring system include sampling bias (only children who received a CTA were included), and the study did not address Le Fort II/III fractures or spinal pathology.

Variable	Score
GCS score \leq 8	1
Focal neurological Deficit	2
Carotid canal fracture	2
Petrous temporal bone fracture	3
Infarct on head CT	3

4) The McGovern Screening Score [9]

Another pediatric screening tool for BCVI is the “McGovern score,” which modifies the Utah Score. The McGovern score was also designed based on a single-center retrospective analysis to determine risk factors for pediatric BCVI. The database incorporated 10 years of data and included 460 children who underwent cerebrovascular imaging. On examination of the patients who had BCVI but were classified as “low risk” by the Utah score, many had a common mechanism of injury (high-impact injury involving a motor vehicle), so mechanism of injury was incorporated into their scoring system. The McGovern Screening Score has not had external validation, to date. As the study design for McGovern was similar to the Utah Scoring System, the two scoring systems share similar limitations.

Variable	Score
GCS score \leq 8	1
Focal neurological Deficit	2
Carotid canal fracture	2
Mechanism of Injury*	2
Petrous temporal bone fracture	3
Infarct on head CT	3

* Defined as a high-impact mechanism involving a motor vehicle (a motor vehicle collision or a pedestrian struck by a motor vehicle)

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