Blunt Cerebrovascular Injury (BCVI) and Denver Criteria

RLH TRAUMA INSIGHTS no.5

March 2025

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Case Overview:

A 25-year-old man was admitted to the RLH following a high-speed road traffic collision as an unrestrained driver. He was intubated at the scene by HEMS due to low GCS. CT revealed a traumatic brain injury (TBI), C2 spinous process fracture, sternal fracture, bilateral 1st-5th rib fractures, and pulmonary contusions, with no abdominal or pelvic injuries. He was admitted to the ACCU after ICP monitor placement.

What Happened Next?

A week later, an interval CT brain showed developing ischaemic changes. A CT angiogram (CTA) of the neck revealed a right internal carotid luminal irregularity, identifying a previously missed blunt cerebrovascular injury (BCVI).

Key Insights:

- BCVI is an often silent but serious injury that can lead to ischaemic stroke in trauma patients.
- Identify patients at risk using the **Expanded Denver Criteria.**
- CTA is the imaging of choice and should be undertaken in the first 24 hours of admission.
- Higher-grade injuries are associated with increasing stroke and mortality risk.
- Antithrombotic therapy should be initiated promptly when safe to reduce stroke risk.
- Routine endovascular stenting as an adjunct to antithrombotic therapy is not recommended for BCVI without active bleeding.

EXPANDED DENVER CRITERIA

CTA if signs/symptoms of BCVI:

- arterial haemorrhage from the neck/nose/mouth
- cervical bruit in patient < 50 years
- expanding cervical haematoma
- focal neurological deficit/neurological exam incongruous with CT head findings/stroke on secondary CT scan

CTA if Risk factors for BCVI:

High-energy transfer mechanism with any one of…

- le Fort II or III # or mandible #
- complex skull # or occipital condyle #
- severe TBI with GCS < 6
- any level cervical spine #/subluxation/ligamentous injury
- near hanging with anoxic brain injury
- seatbelt abrasion + swelling/pain/altered mental status
- TBI with thoracic injury
- scalp degloving
- thoracic vascular injury/blunt cardiac rupture
- upper rib fracture.

BCVI is a non-penetrating injury to the carotid and/or vertebral arteries, which may result in ischaemic stroke. It is associated with high-energy trauma and is frequently underdiagnosed, with an incidence as high as 9% in patients with severe head injuries. Early recognition through targeted screening and treatment with timely stroke prophylaxis is critical to improving outcomes and reducing morbidity and mortality.

Mechanism of Injury:
Direct blunt force to the neck or rapid uncontrolled head and neck movements (flexion, extension, or rotation).

Who should be screened?
Patients meeting the Expanded Denver Criteria.

Grading & Management of BCVI:

The European Society for Vascular Surgery (ESVS) grading scale:

Grading & description		General approach to management
1	Low-grade: partial wall injury with normal external wall contour	Single antiplatelet therapy (SAT) + surveillance
2	High-grade: complete wall injury with contained bleeding	SAT + endovascular repair for a select few
3	Uncontained bleeding	Open surgical or endovascular repair
X	Occlusion	SAT + surveillance if normal neurological examination versus an individualised approach in the presence of neurological symptoms

At RLH, we use the ESVS scale to assess BCVI. While we primarily rely on this system, we also recognise the Biffl scale as an alternative. The Biffl scale, widely validated and commonly used in clinical practice, closely resembles the ESVS scale.

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