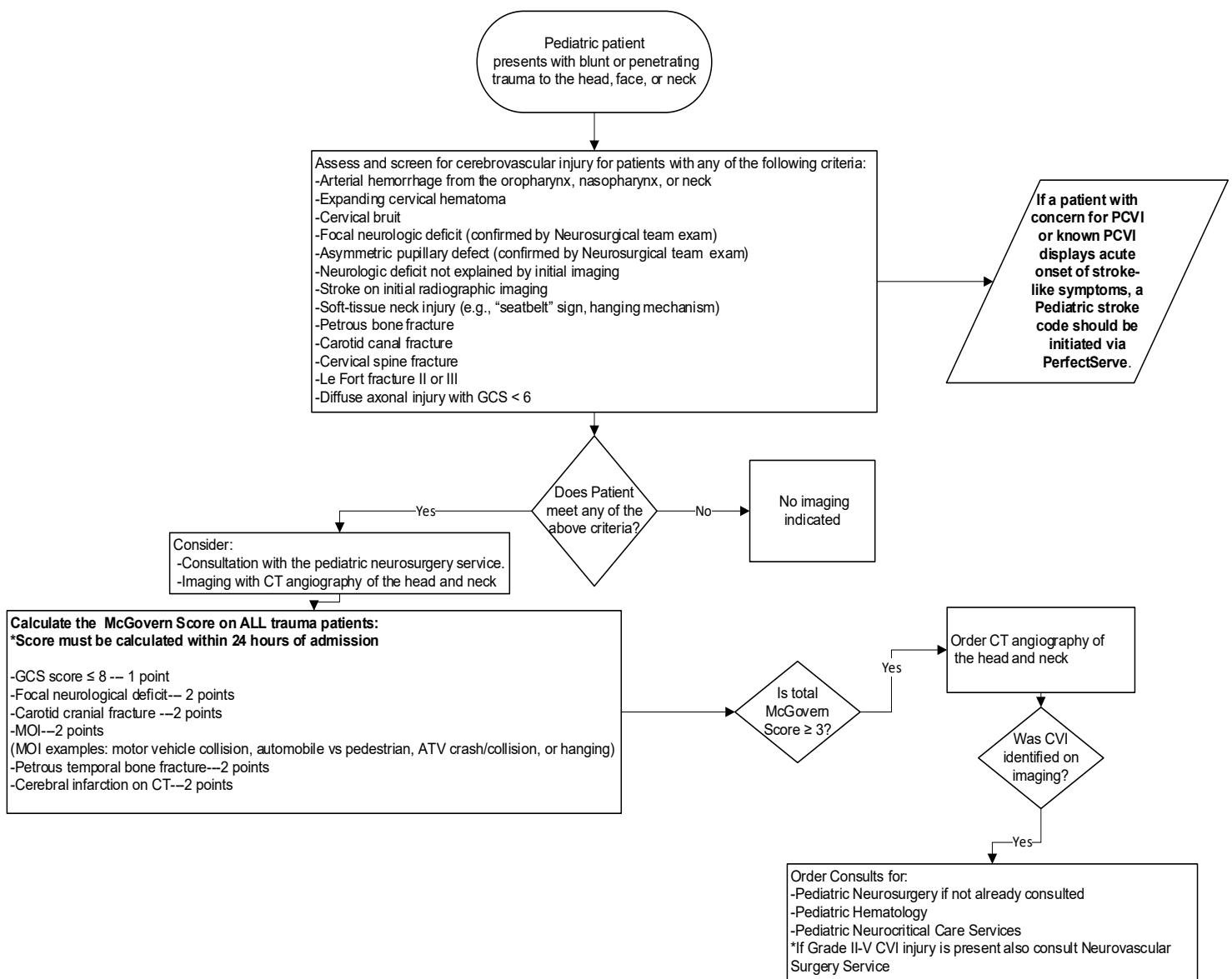


PEDIATRIC CEREBROVASCULAR INJURY (PCVI) MANAGEMENT , EMERGENCY DEPARTMENT & INPATIENT, PATHWAY

Updated: June 28, 2022

Clinical algorithm:



Clinical Pathway Summary

CLINICAL PATHWAY NAME: Pediatric Cerebrovascular Injury Management (PCVI)

PATIENT POPULATION AND DIAGNOSIS: Pediatric Patients presenting with suspected PCVI

APPLICABLE TO: Helen Devos Children's Hospital and Butterworth Emergency

BRIEF DESCRIPTION: This guideline is for use as a tool for all practitioners involved in the care of children with blunt or penetrating cerebrovascular injuries (CVI). PCVI is characterized by trauma to the vertebral and/or internal carotid arteries that may result in vessel disruption, thrombosis, or pseudoaneurysm, as well as vascular stenosis or occlusion.

OPTIMIZED EPIC ENHANCEMENTS:

IMPLEMENTATION DATE: September 2022

LAST REVISED: June 2022

Clinical pathways clinical approach

TREATMENT AND MANAGEMENT:

A. Screening criteria for PCVI:

According to the American College of Surgeons (ACS), PCVI is a diagnosis becoming recognized as awareness increases in pediatric trauma centers. Pediatric-specific guidelines for screening and treatment of PCVI is lacking, thus current screening methods are similar to those used in adults.

- I. Screening criteria is based on clinical signs and symptoms, radiologic findings, and high risk or high-energy mechanism of injury. Pediatric patients with blunt trauma to the head, face, or neck are at high risk for PCVI, and should be considered for further assessment. High risk mechanisms of injury include but are not limited to motor vehicle collision, automobile vs pedestrian, ATV crash/collision, or hanging.

*** If a patient with concern for PCVI or known PCVI displays acute onset of stroke-like symptoms, a Pediatric stroke code should be initiated via PerfectServe.**

- II. Based on the Memphis, modified Denver, and EAST scoring systems: Screening should be considered for patients who meet the following criteria:
 - a. Arterial hemorrhage from the oropharynx, nasopharynx, or neck
 - b. Expanding cervical hematoma
 - c. Cervical bruit
 - d. Focal neurologic deficit (confirmed by Neurosurgical team exam)
 - e. Asymmetric pupillary defect (confirmed by Neurosurgical team exam)
 - f. Neurologic deficit not explained by initial imaging
 - g. Stroke on initial radiographic imaging
 - h. Soft-tissue neck injury (e.g., "seatbelt" sign, hanging mechanism)

- i. Petrous bone fracture
- j. Carotid canal fracture
- k. Cervical spine fracture
- l. Le Fort fracture II or III
- m. Diffuse axonal injury with GCS < 6

*If patients have any of the above findings, imaging with CT angiography of the head and neck should be considered in consultation with the pediatric neurosurgery service.

- III. Calculate the McGovern score (below) on ALL trauma patients. A score ≥ 3 signifies high risk for PCVI and indicates the patient should undergo CT angiography of the head and neck. The trauma team will be responsible for ensuring the completion of the McGovern Score within 24 hours of admission. It can also be completed by other expert services such as Pediatric Intensive Care, Neurocritical Care, or Neurosurgery.

McGovern Score	
GCS score ≤ 8	1
Focal neurological deficit	2
Carotid canal fracture	2
MOI	2
Petrous temporal bone fracture	3
Cerebral infarction on CT	3

*Note: MOI indicates mechanism of injury. Assign 2 points if mechanism of injury is motor vehicle collision, automobile vs pedestrian, ATV crash/collision, or hanging.

- a. Using the above screening tools may decrease unnecessary exposure to radiation. Multi-detector computed tomography angiography (CTA) is the current imaging study of choice according to the ACS. A CTA on a 4-slice scanner is inadequate with unacceptable sensitivity. If the decision is made to obtain CTA imaging, this should be done concurrently with all other initial imaging studies.

B. Treatment for PCVI:

- I. If a CVI has been identified on imaging: Consult Pediatric Neurosurgery, Pediatric Hematology, and Pediatric Neurocritical Care services
- II. Based on imaging, The Denver scale (also known as the Biffi scale) is often used to grade the severity of vascular injuries:
 - a. Grade I: Irregular vessel wall or dissection/intraluminal hematoma with <25% stenosis.
 - b. Grade II: Intraluminal thrombus or raised intimal flap is visualized, or dissection/intraluminal hematoma with $\geq 25\%$ stenosis
 - c. Grade III: Arterial pseudoaneurysm
 - d. Grade IV: Arterial occlusion
 - e. Grade V: Arterial transection

*If Grade II to Grade V injuries are present: Consult Neurovascular Surgery Service due to

possible indications for catheter angiography and/or endovascular treatment.

- III. The goal in treatment of these injuries is to minimize the risk of thromboembolic disease and vessel occlusion, typically using anticoagulation or antiplatelet therapy. Severe cases may require surgical or endovascular treatment. There is an absence of evidence-based literature to help guide treatment decisions in the pediatric population with PCVI. Treatment decisions should therefore be based on multi-disciplinary consultation, after consideration of several clinical parameters, including vessel characteristics, presence/absence of stroke on imaging, and concomitant intracranial hemorrhage.

C. Supplemental Information about PCVI:

Because of the unique responses of children, it is recognized that there may be instances where interventions not identified in this guideline may be indicated. Pediatric CV injuries will require an individualized treatment plan based on hemodynamic stability and bleeding status. The incidence of PCVI varies widely, but is generally thought to be rare, occurring in 0.3 to 0.9% of pediatric patients suffering from blunt trauma. However, if not diagnosed early, CVI could lead to devastating neurological consequences, such as ischemic or hemorrhagic stroke, and possibly death.

Pathway Information

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EXPERT IMPROVEMENT TEAM (EIT): Trauma Performance Committee

CLINICAL PRACTICE COUNCIL (CPC): Children's Health

CPC APPROVAL DATE: September 2022

OTHER TEAM(S) IMPACTED: Physicians, Physician Assistant, Nurse Practitioners, and Registered Nurses

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