

TRAUMA PROGRAM IMAGING GUIDELINES AT ACH

- Head Imaging
- Head and Neck BCVI
- Spine Imaging
- Chest Imaging
- Abdominal / Pelvic Imaging
- Intubated Trauma Patients
- References

HEAD IMAGING^{1,2,3,4,5,6}

- One or more of the following suggests a CT scan of the head is indicated:
 - Altered level of alertness or abnormal behaviour
 - ◆ GCS ≤ 14 (especially if 2 hours after injury)
 - ◆ Lethargy
 - ◆ Excessive irritability/agitation/inconsolability
 - ◆ Delayed or inappropriate response to stimuli
 - ◆ Perseverating speech
 - Penetrating skull injury
 - Acute focal neurologic deficit
 - Evidence of skull fracture
 - ◆ Open / depressed skull fracture
 - ◆ Signs of basal skull fracture (Hemotympanum, otorrhea, rhinorrhea, Raccoon eyes, Battle's signs)
 - Large/boggy occipital, parietal or temporal scalp hematoma
 - History of worsening headache or persistent vomiting
 - Loss of consciousness or post-traumatic seizure
 - Dangerous mechanism of injury
 - ◆ MVC: high velocity, ejection, rollover, or death on scene
 - ◆ Pedestrian or cyclist struck vehicle
 - ◆ Fall $\geq 1\text{m}$ (< 2 years old) or $> 1.5\text{m}$ (≥ 2 years old)
 - ◆ Direct blow to the head with a high impact object
 - ◆ Suspected non-accidental trauma
 - Consider CT head for patients with a history of coagulopathy
- MRI for acute traumatic brain injuries should be done only after consultation with [Neurosurgery](#).

HEAD AND NECK BCVI^{7,8,9,10,11,12,13,14}

BCVI describes carotid and vertebral artery injuries secondary to blunt trauma. Incidence of BCVI in pediatric patients is around $< 0.5\%$. Unfortunately, these injuries have high morbidity and mortality, and diagnosis is often delayed. Screening should focus on high-risk patients while minimizing unnecessary radiation exposure. Currently, there is no universally accepted screening tool or criteria.

CTA of the head and neck should be performed for

1. Focal neurological deficit
2. Carotid canal and/or petrous temporal bone fracture
3. Cerebral infarction on CT

CTA of the head and neck should be considered in the following:

1. Penetrating injuries
2. Strangulation injuries
3. Clothesline injuries
4. High energy mechanism of injury* and:
 - a. LeFort II and III
 - b. Cervical spine fractures with:
 - i. Compromise of the vertebral foramen
 - ii. Vertebral subluxation
 - c. Significant Zone 2 neck injury

*High energy mechanisms include: high force vectors, rapid deceleration, direct blow to the head, face, and neck, c-spine hyperextension with contralateral rotation, excessive cervical flexion

SPINE IMAGING^{15,16,17,18}

High risk for c-spine injury:	
<p>PECARN Decision Rule</p> <ul style="list-style-type: none"> ▪ Neck pain (>2yr old) ▪ Altered mental status ▪ Focal neurological deficits (Paresthesia, loss of sensation, motor weakness, etc.) ▪ High risk MVC or diving ▪ Substantial torso injuries ▪ Torticollis (limited ROM or difficulty moving neck) ▪ Predisposing conditions 	<p>Other high-risk features</p> <ul style="list-style-type: none"> ▪ Traumatic injury above the clavicles ▪ Signs/symptoms of spinal cord injury ▪ Palpable deformity or distracting injury ▪ Fractures at other levels of the spine ▪ High risk MOI <ul style="list-style-type: none"> ○ Axial load to the head (diving, trampoline, fall from height) ○ Forced neck hyperflexion ○ Vehicular ejection ○ MVC: high velocity, head on collision, rollover, unrestrained/improperly restrained, death on scene, pedestrian ○ Fall >3m ○ "Clothesline" injury

Please refer to the TAC National Pediatric C-Spine Evaluation Pathway (2011):

- If no high-risk features, attempt to clinically clear the c-spine and remove c-collar.
- If unable to clear c-spine: proceed to x-ray and neurological exam
 - Uncooperative patient: C-spine AP and lateral
 - Cooperative patient: C-spine AP and lateral with odontoid view
- If abnormal neurological exam:
 - Maintain c-collar and consult Neurosurgery
 - Consider MRI or CT c-spine
- If abnormal x-ray:
 - Maintain c-collar and proceed to CT c-spine
 - Neurosurgery consult if abnormal CT
 - Reassess patient if normal CT
- If normal x-ray
 - Age ≤8
 - ♦ Reassess patient for c-spine clearance vs further imaging
 - ♦ If a CT head is being performed, include C1-3
 - Age >8
 - ♦ Reassess patient for c-spine clearance vs further imaging

- On reassessment:
 - Normal exam: assess for clinical c-spine clearance and removal of collar
 - Abnormal neurological exam:
 - ◆ Maintain c-collar and consult Neurosurgery
 - ◆ Consider MRI or CT c-spine
 - C-spine tenderness
 - ◆ Maintain c-collar and consult neurosurgery
 - ◆ Consider flexion/extension x-rays and possible MRI
- If a CT Head is being done, consider the mechanism of injury and the age of the child to potentially include the entire C-spine (skull base to T1)
- MRI of the C-spine should only be done after consultation with Neurosurgery
- Spinal reconstructions will be done routinely from chest and abdomen CTs for trauma patients
- All efforts will be made to clear the full spine as soon as possible with documentation on the Spinal Clearance Sheet

CHEST IMAGING^{19,20,21}

- Chest X-ray will be done according to ATLS principles.
 - Clinically significant thoracic injuries are unlikely in the setting of a normal physical exam and CXR
- One of the following suggested a CT scan of the chest is indicated:
 - Injury found on CXR requiring further imaging as discussed with Radiologist
 - Clinical presentation warrants further imaging (tachypnea & hypoxia)
 - Concern for great vessel injury
 - Wide mediastinum, hemothorax, etc.
 - Concern for esophageal injury
 - Proximal clavicular injury with concern for a mediastinal injury or neurovascular compromise
 - Penetrating torso injury

ABDOMINAL / PELVIC IMAGING^{22,23,24}

- Pelvis X-ray will be done according to ATLS principles.
- One of the following suggests a CT scan of the abdomen/pelvis is indicated:
 - Patients with a mechanism of injury that would suggest a potential injury with:
 - ◆ Hypotension without severe hemodynamic instability (or able to stabilize prior to imaging)
 - ◆ Abdominal/ pelvic bruising or tenderness
 - ◆ Frank hematuria
 - ◆ Pelvic fracture on x-ray
 - ◆ Unreliable exam (neurological deficit, altered LOC, EtOH, young age)
 - ◆ Positive FAST
 - Patients with multisystem injuries
 - Penetrating torso injury (consider contrast CT)

INTUBATED TRAUMA PATIENTS

- The obtunded or intubated trauma patient is at high risk of missed injury and the following routine images are suggested:
 - CT head & C-spine to T1 if > 8yrs and to C3 (+ spine AP and lateral plain films) if < 8 yrs – consult radiologist and/or neurosurgeon to see if CTA is needed
 - Chest X-ray

- CT chest and abdomen as outlined above
- T & L spine X-ray if CT chest and abdomen/pelvis not done
- Pelvic X-ray if CT abdomen/pelvis not done
- Extremity X-rays as clinically warranted

Please refer to the [ACH Trauma Manual](#) for more detailed imaging guidance

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