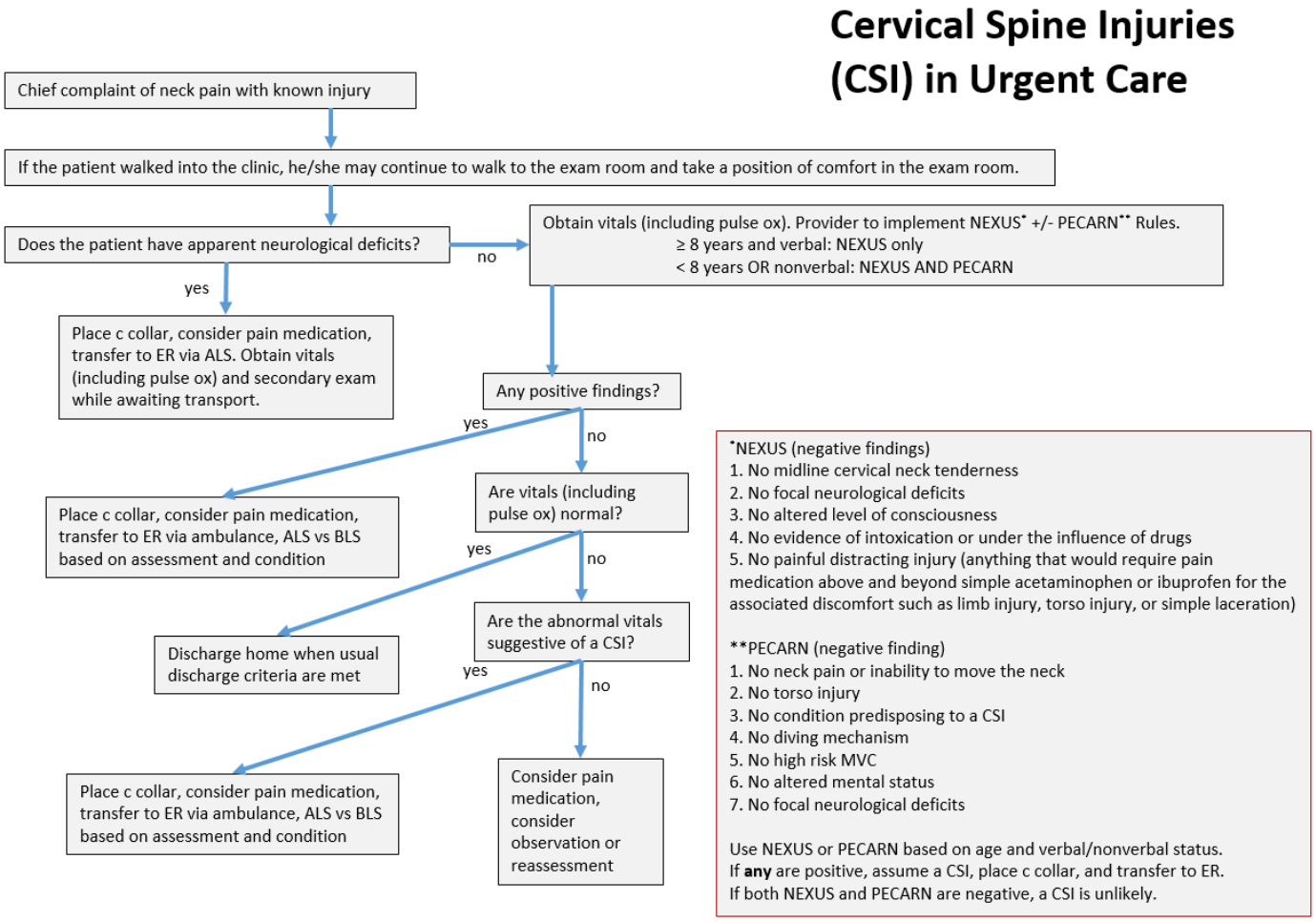
Children's Hospital and Health System, Inc.
Evidence Based Guideline
CW Urgent Care

SUBJECT: Cervical Spine Injuries



Supersedes: 12/2018
Approved by UC Clinical Practice Council and Medical Director 12/2018
Reviewed with mild revisions 4/2024
Next review due based on new recommendations coming soon

Purpose: To recognize and initiate protective management for any patient who may have a cervical spine injury to ensure patient survival, preserve residual cord function, and to safely transfer the patient to the ER for further diagnosis and treatment.

Definition: Injury to the cervical spine in children is rare, with an incidence of 1-2% per year. Cervical spine injuries (CSI) comprise 60-80% of all pediatric spinal traumas, with motor vehicle accidents, sports activities and falls being the most common underlying causes. The most common cause for all CSIs is motor vehicle accidents, accounting for 44-56% of all CSIs. Of these cases, 65% of children were not wearing a seat belt or were not properly restrained. Cervical vertebral fractures followed by dislocations, ligamentous injuries, and distractions (stretching) are the most common CSIs. Sixty eight percent of children sustain CSIs to C1-C4, 25% C5-C7 and 7% to both. Although the overall incidence of cervical spinal injuries is rare, the morbidity and mortality associated with it is high, with most estimates ranging from 16-18% but can be as high as 47%.

Etiology

- Birth: Vaginal delivery of infants in a breech position
- Birth to 8 years old: Motor vehicle accidents, falls, and child abuse
- Over 8 years old: Motor vehicle accidents, bicycle accidents, and sports injuries (sports that have the most reported cases of CSIs include: football, diving, gymnastics, hockey, and wrestling)
- High Risk Mechanism of Injury
    - Patient directly struck by a motorized vehicle (auto versus pedestrian)
    - Motorized Vehicle Collisions or Non-Motorized Vehicle Collisions (cars, ATVs, sleds, bicycles, skateboards, etc.) where the collision occurred at high speed (60 mph or greater), airbag deployment, rollover, ejection of the patient, or death of a passenger in the same vehicle.
    - Axial load to the head: diving, football, rugby, hockey, wrestling, gymnastics, cheerleading, or trampoline

Differential Diagnosis

- Neck sprain/strain
- Traumatic Torticollis

Guideline

Within CW Urgent Care, the best and safest management for a patient with a presumed CSI is to provide neck immobilization and stabilization of the patient followed by transfer to the CW ER.

- A patient should be assumed to have a CSI, and the cervical spine should be **immediately immobilized, and transfer initiated**, if they have sustained a high-risk mechanism of injury, or have cervical spine tenderness, or any have any alterations on their NEXUS Criteria or PECARN Rules.

- If the provider assessing the child feels clinically uncomfortable, or if the provider feels clinically comfortable and is concerned for a CSI, we should place a collar and arrange medical transfer of the patient to the ER.

Subjective Data/History

- Neck Pain
  - Location
  - Radiation
  - Duration
  - Causation
  - Interventions prior to arrival
- Associated Signs and Symptoms
  - Numbness
  - Burning
  - Tingling
  - Loss of function/weakness
  - Mental status changes
  - Injury to other parts of the body
  - Nausea/Vomiting
  - Headache
- Under the Influence of
  - Drugs
  - Alcohol
- Underlying Health Conditions
  - Down Syndrome
  - Klippel-Feil Syndrome
  - Morquio Syndrome
  - Larsen Syndrome
  - Rheumatoid arthritis
  - History of cervical arthritis
  - History of Cervical Spine Injury

Objective Data/Physical Exam – To be performed in the order listed

- Glasgow Coma Scale (GCS):
  - A score of **13 or higher** correlates with mild brain injury
  - A score of **9 to 12** correlates with moderate injury
  - A score of **8 or less** represents severe brain injury

	Score
Eye opening	
Spontaneous	4
Response to verbal command	3
Response to pain	2
No eye opening	1
Best verbal response	
Oriented	5
Confused	4
Inappropriate words	3
Incomprehensible sounds	2
No verbal response	1
Best motor response	
Obeys commands	6
Localizing response to pain	5
Withdrawal response to pain	4
Flexion to pain	3
Extension to pain	2
No motor response	1
Total	

- GCS score should be obtained and documented, at minimum, upon initial presentation and discharge in order to assess for an associated intracranial head injury.
- A single GCS score is of limited value, but serial GCS scores are valuable. A low GCS that remains low or an initial high GCS that decreases is more predictive of a poor outcome.
- A single high GCS score does not rule out the possibility of a significant intracranial injury. Of patients with an initial GCS score of 15, 13% eventually developed coma.

- Vital Signs:
    - Weight
    - Temperature
    - Respiratory rate
    - Heart rate
    - Blood pressure
    - Pulse oximetry

  Vitals sign changes that may be present with a CSI:
    - Temperature instability
    - Low respiratory rate
    - Low heart rate
    - Low blood pressure
    - Low pulse oximetry

- Neck Exam:
    - Inspection: Examine the skin integrity of the neck. Assess the posture or position of the neck. The loss of cervical lordosis or the presence of torticollis suggests muscle spasms which may or may not suggest a further underlying injury.

- Palpation: Assess for point tenderness of the entire vertebral spinous processes
  - **If there is point tenderness of any cervical vertebral spinous process, do not proceed to range of motion or special tests. Stop, place collar, and transfer.**
- Range of motion: Assess cervical flexion, extension, lateral bending and lateral rotation
- Special tests to consider:
  - Axial Compression: While the patient is sitting or standing, the provider puts his/her hands on top of the patient's head. A positive test results in the reproduction of pain or radiating symptoms.
  - Spurling or Neck Compression: The patient extends their neck and rotates it toward the side of pain while the provider pushes the head down. If radiating pain is created, cervical root compression is highly suspected. A negative test does not rule it out, however.
  - Manual Cervical Traction: The provider applies vertical traction while the patient is seated or standing. This decreases pressure on the discs and facet joints, and hence, relieves compression of nerve roots.

- Neurologic Exam: assess motor and sensory skills, balance and coordination, mental status, reflexes, and function of the cranial nerves
  - Mental status – This assessment should involve input from family members
    - Child's level of awareness
    - Child's interaction with the environment
    - Child's ability to follow directions
    - Child's memory pre and post event
    - Child's quality and sensibility of speech
    - Child's orientation to person, place, and time
    - Child's affect
  - Sensory: Assess for recognition of dull/sharp, soft/rough, and hot/cold on the patient's arms and legs
  - Reflexes: If the peripheral nerves are injured, there will be a decreased reflex response. If the spinal cord is involved, there will be an increase in reflex response.
  - Motor function/balance (age and developmentally appropriate)
    - Patient pushes/pulls against arms and legs
    - Patient squeezes examiner's fingers
    - Observe the child walk, hop and skip
    - Observe child balance on one leg
    - Romberg: Observe balance as the patient stands in airplane stance with eyes closed, provider may gently push on the patient
    - For infants, observe that the patient moves all extremities equally and fully
  - Cranial nerve assessment
    - CN 1: sense of smell. Have the child smell an object with their eyes closed.
    - CN 2: vision. Perform visual acuity test.
    - CN 3, 4, 6: eye and pupil movement. Shine a light into the child's eyes to check for pupil response. Assess extra ocular movements.
    - CN 5: This nerve is involved in chewing. Have the child chew and bite down.

- CN 7: This nerve is involved in facial expressions. Have the child smile, wrinkle forehead, close eyes, and/or show you their teeth.
- CN 8: This is the nerve of hearing. Perform a hearing test or use objects that make sound and hold by the child's ears.
- CN 9, 10: These nerves are involved in taste and swallowing. Use a tongue blade to assess for a gag response.
- CN 11: This nerve is involved in the muscles of the shoulder and neck. Have the child perform range of motion of the head and neck, as well as shrug his/her shoulders.
- CN 12: This nerve is involved in tongue movement. Have the child stick out their tongue and wiggle it from side to side.

Interpretation of the NEXUS Criteria and PECARN Rules:

- If a child is less than 8 years old or is nonverbal, the patient should be assessed through using both the NEXUS and PECARN Rules.
- For the patient who is 8 years of age or older and verbal, only apply the NEXUS Criteria.

Negative Findings with the NEXUS Criteria

1. No midline cervical neck tenderness
2. No focal neurologic deficits
3. No altered level of consciousness
4. No evidence for intoxication or under the influence of drugs
5. No painful distracting injury (anything that would require pain medication above and beyond acetaminophen or ibuprofen for the associated discomfort, such as a limb injury, torso injury, or laceration)

Negative Findings with the PECARN Rules 2017

1. No neck pain or inability to move the neck
2. No torso injury
3. No condition predisposing to a CSI
4. No diving mechanism
5. No high risk MVC
   - If any of the elements of the NEXUS are positive for the child, assume a CSI and implement C-spine precautions.
   - If there are positive findings on PECARN, even if the NEXUS was negative, assume a CSI and implement C spine precautions.
   - If both the NEXUS and PECARN are negative, a CSI is very unlikely.
   - NEXUS has a sensitivity of 99% and a negative predictive value of 99.8%. That means that 2 out of every 1000 patients with a negative NEXUS will have a CSI. The PECARN Rules are 98% sensitive.
   - Patients with a negative NEXUS alone, or patients with a negative NEXUS and a negative PECARN together, may be presumed to not have a CSI. They do not need immobilization, imaging, or transfer to the ER.

Diagnostic Studies
None indicated for Urgent Care setting – x-rays will be obtained as indicated in the ER.

Treatment (See Algorithm)

- Immobilize the head and neck by holding the head and neck in a neutral position while the head of the bed is at zero degrees. If the child is sitting in a chair when you conclude concern for a CSI, allow the patient to remain sitting in the chair in an upright position. Immobilize the head and neck while they are sitting and proceed with C collar placement while they are in that position.
- If the child has an obvious neck deformity, do not try to reduce the neck deformity in order to place the patient in a neutral position. Rather, immobilize the neck in a position of comfort.
- While one staff member maintains neck immobilization, an additional 1-2 staff members apply the c-collar.
- Providers, nurses, and MAs are responsible for maintaining their own knowledge regarding application of a c-collar.
- Once in the cervical collar, the child may be maintained in a position of comfort, this includes supine, semi-supine, or upright.
- Transfer to ER by ambulance. If no associated neurologic deficits, the patient may be transferred by BLS. If any associated neurologic deficits or other concerns, they should be transferred by ALS.

Education of Patient/Family

- Prepare the family that the patient will be transferred to the ER by ambulance.
- The ER will assess the patient's C-spine; this may or may not require imaging**.**

Amy Romashko, MD
Medical Director, CW Urgent Care

This guideline is designed to serve as a reference for clinical practice and does not represent an exclusive course of treatment nor does it serve as a standard of medical care. Providers should apply their professional judgment to the management of individual patient conditions and circumstances. Children's Hospital and Health System (CHHS) does not make any representation with respect to any sort of industry recognized standard of care for the particular subject matter of this clinical guideline. Additionally, CHHS form documents are subject to change, revision, alteration, and/or revocation without notice.

References

Brown, R.L., Brunn, M.A., & Garcia, V.F. (2001). Cervical spine injuries in children: A review of 103 patients treated consecutively at a level 1 pediatric trauma center. *Journal of Pediatric Surgery*, *36*(8), 1107-14.

Decker, J.E., & Hergenroeder, A.C. (2016). Overview of musculoskeletal neck injuries in the child or adolescent athlete. *UpToDate.* Retrieved from http://www.uptodate.com

Decker, J.E., & Hergenroeder, A.C. (2016). Approach to the child or adolescent athlete with neck pain or injury. *UpToDate.* Retrieved from http://www.uptodate.com

Decker, J., & Hergenroeder, A. (2016). Field care and evaluation of the child or adolescent athlete with acute neck injury. *UpToDate.* Retrieved from http://www.uptodate.com

Dorney, K., Kimia, A., Hannon, M., Hennelly, K., Meehan, W. P., … Mannix, R. (2015). Outcomes of pediatric patients with persistent midline cervical spine tenderness and negative imaging result after trauma. *Journal of Trauma Acute Care Surgery, 79*(5), 822-827.

Evidence Based Medicine. (2016). Emergency evaluation of the pediatric cervical spine. Mechanisms and Types of Injury. Retrieved from http://www.ebmedicine.com

Evidence Based Medicine. (2016). Emergency evaluation of the pediatric cervical spine: ER Evaluation. Retrieved from http://www.ebmedicine.com

Gibbs, A., & Jones, A. (2001). Cervical spine injury: A state of the art approach to assessment and management. *Journal of Emergency Medicine Practice*.

Goltesfield, S., & Jagoda, A. (2000). Mild head trauma: Appropriate diagnosis and management: The initial assessment of the mildly head injured patient. *Journal of Emergency Medicine Practice*.

Hansebout, R., & Kachur, E. (2016). Acute traumatic spinal cord injury. *UpToDate*. Retrieved from http://www.uptodate.com

Hazlip, J., & Scherrer, P. (2008). Emergency evaluation of the pediatric cervical spine. *Pediatric Emergency Medicine Practice*.

Hoffman, J., Mower, W., Wolfson, A. B., Toald, K. H., Zucker, M. I. (2000). Validity of a set of clinical criteria to rule out injury to the cervical spine in patients with blunt trauma. *The New England Journal of Medicine*, *343*(2), 94-100.

Leonard, J., Leonard, J. C., Jaffe, D. M., Olsen, C. S., & Kuppermann, N. (2015). Age related differences in factors associated with cervical spine injuries in children. *Journal of the Society for Academic Emergency Medicine*, *22*(4), 441-446.

Leonard, J., Kuppermann, N., Olsen, C., Babcock-Cimpello, L., Braun, K., … Joffe, D. M (2011). Factors associated with cervical spine injury in children after blunt trauma. *Journal of Emergency Medicine*, *58*(2), 145-155.

Lidsky, K. ABC's of pediatric spine management. Department of Pediatric Critical Care. Retrieved from http://www.uhhospitals.org

McCall, T., Fassett, D., et al. (2006). Cervical spine trauma in children: A review. *Neurosurgery Focus*, 20(2).

McFadyen,J.G., Ramaiah, R., et al. (2012). Initial assessment and management of pediatric trauma patients. *International Journal of Critical Illness and Injury Science*, *2*(3), 121-127.

Treatment information also provided by Lorin Browne, MD, Children's Hospital of Wisconsin EDTC, (personal communication, 2018, 2023).