Pediatric Cervical Spine Clearance: Implications for Nursing Practice

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At Cincinnati Children's Hospital Medical Center, a 360-bed regional level I trauma center, an interdisciplinary team developed an algorithm for c-spine clearance (Figure 1). The guideline is based on the National Emergency X-Radiography Utilization Study decision instrument for obtaining c-spine radiography.[1]

Clinical practice guideline

A high clinical index of suspicion for traumatic c-spine injury should exist for any injured child.[2] Our first priority is completion of the primary survey, as indicated in Advanced Trauma Life Support guidelines. In-line immobilization of the c-spine is maintained for all patients throughout this assessment. A comprehensive history and physical is completed during the secondary survey. The neck is inspected and palpated for obvious deformities, point tenderness, crepitus, step-offs, or muscle spasm. Cervical range of motion includes evaluation of flexion and extension and lateral rotation. We perform a detailed neurologic examination to evaluate motor and sensory function, strength, and deep tendon reflexes. In the presence of impaired motor or sensory examination, we request a neurosurgical and orthopedic consult.

Clinical clearance

At our facility, to clear the spine clinically, a child must have no age or developmental concerns and demonstrate normal mental status, including no altered level of alertness or intoxication from drugs or alcohol. In addition, all of the following criteria must be met: normal neurologic examination, no tenderness to palpation of the cervical spine, no c-spine pain with active range of motion, and no distracting injuries. If these criteria are met, radiographic studies are

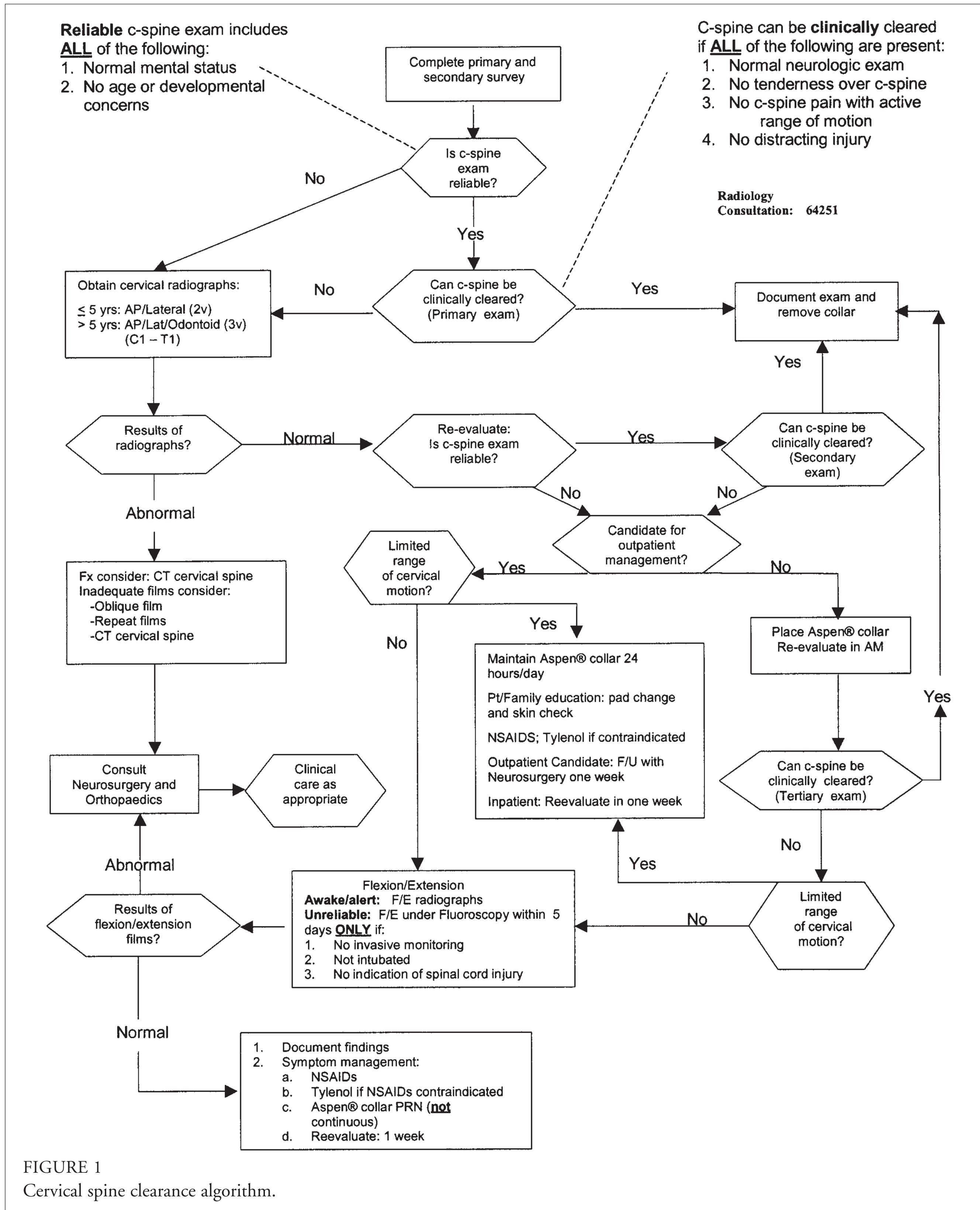

FIGURE 1
Cervical spine clearance algorithm.

not indicated and the child is considered to have a stable c-spine. The team documents the examination and removes the collar.

Radiographic evaluation

We obtain cervical radiographs if the patient is unreliable or cannot be clinically cleared based on the presence of any one or more of the defined criteria. To minimize delay or inappropriate radiographic orders, we developed guidelines based on age. For children older than 5 years, a 3-view series is ordered: anterior-posterior (AP), lateral, and odontoid radiographs. For children aged 5 years or younger, we order a 2-view series: AP and lateral radiographs. We do not obtain an odontoid view because its utility in young children is unclear and it is difficult to obtain.[3]

The lateral c-spine radiograph must be of good quality and visualize the base of the occiput to the upper part of the first thoracic vertebrae. AP c-spine radiographs must reveal the spinous processes of C2 to C7. Open-mouth odontoid radiographs must visualize the entire dens and the lateral masses of C1. Repeat radiographs or oblique films are obtained at the discretion of the radiologist. If films are inadequate, an oblique view or a computed tomography (CT) scan of the c-spine is considered. If a c-spine fracture is suspected, a CT scan of the c-spine is obtained. A neurosurgical and/or orthopedic consult are obtained if findings of radiographs are abnormal.

If findings of radiographs are normal, the reliability of the child is re-evaluated. If the child is reliable, we follow the clinical clearance arm of the algorithm. If the child is admitted for continued observation or care because of another injury, we place an Aspen cervical collar and re-evaluate the c-spine in the tertiary examination. Frequently, the symptoms have resolved and the c-spine can be cleared. If the symptoms persist or if the child is a candidate for outpatient management, we consider flexion-extension lateral c-spine radiographs.

Of note, we do not recommend flexion-extension radiographs for children with limited flexion-extension motion. These children would likely have inadequate motion to complete diagnostic testing, and the potential to yield false-negative results is too high. Our guideline requires that the patient be reliable, be able to self-protect, and be able to demonstrate persistent pain without neurologic deficit. It is imperative the child be able to cooperate and use pain to self-limit the degree of motion of the neck so as not to exacerbate any potential injury. In a retrospective study by Dwek and Chung,[4] results of flexion-extension studies were normal in all children who had normal neutral radiographs.[4] The authors conclude that the use of flexion-extension films is of "questionable use" after obtaining normal static films. We continue to use flexion-extension films in select patients, but clearly, further study is needed.

If we are unable to obtain flexion-extension radiographs, the cervical collar is maintained 24 hours a day. Nonsteroidal anti-inflammatory drugs or acetaminophen (Tylenol) are prescribed for pain management. Muscle relaxants are not recommended because of their possible adverse effects. Patient and family education is emphasized, including application and fit of collar, daily pad change, skin care, pain management, signs/symptoms of altered neurosensory status, and follow-up. Re-evaluation of these children will be conducted in the Neurosurgery Clinic in 1 week.

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If flexion-extension radiographs are normal, the team documents the findings and removes the collar. Symptom management may include nonsteroidal anti-inflammatory drugs and intermittent use of the cervical collar. We recommend intermittent use to prevent the tendency to exacerbate muscle weakness and pain. We do not recommend using a soft collar. Follow-up for these children will be conducted in the trauma clinic in 1 week for re-evaluation of symptoms.

For children who are unable to participate reliably in a clinical examination, such as patients with severe head injuries, flexion-extension radiographs under fluoroscopy may be obtained to document stability of the c-spine.

Within the guideline, this study is only performed if the child is not intubated, has no invasive monitoring, and has no indication of a spinal cord injury. *Any* abnormality of flexion-extension mandates immediate neurosurgical consultation and continued c-spine immobilization until a treatment plan is outlined.

We do not use CT and magnetic resonance imaging (MRI) to "clear" the c-spine but as tools to further evaluate the c-spine. Our indications for obtaining a CT scan of the c-spine include fracture or other bony abnormality identified on radiograph or to further evaluate a suspicious area(s) or region of interest not adequately visualized on the cervical radiographs.[5] Indications for MRI include neurologic deficit attributable to spinal cord injury, neurologic deficit unexplained by brain injury, or documented injury to the c-spine. MRI may provide important information about ligamentous injury that may influence surgical management and may provide prognostic information regarding neurologic outcome.[5]

Staff education

Upon implementation of the c-spine clearance algorithm, we initiated a housewide education effort. In-service sessions were held for nurses and residents to discuss the algorithm, indications for c-spine immobilization, and proper application and fit of the cervical collars. We developed a standard of care for patients maintained in a cervical collar to ensure adequate size and fit of the collar, as well as optimal skin care. A parent education sheet for c-spine collar care was developed to facilitate patient and family education and continued care at home.

Performance review

Following implementation of the c-spine guideline, 3 problem areas were identified related to order writing, staff access to the c-spine clearance guideline, and daily pad changes. Trauma orders within the computerized clinical order system included the need to maintain the cervical collar but did not include orders to ensure appropriate size and fit of the collar or daily skin care. Staff access to the c-spine clearance algorithm was also limited to a hard copy stored in a binder on the unit, which limited its use. Collaborative efforts with Information Services resulted in the development of clinical order sets for cervical collar care and access to the c-spine clearance algorithm online. Feedback from nursing identified their perceived need to order a second cervical collar to perform daily pad changes. This perceived need impeded patient care and posed concerns regarding cost-effective care. These issues were revisited with the Equipment and Standards Committee and resulted in the institution of storage of replacement pads, which was much more cost-effective than ordering a second collar.

Preliminary findings of 2003 audit filters demonstrate improved documentation and reduction in the time frame to clear the c-spine. To date, no patients have had problems with pressure ulcer formation.

Conclusion

Health care practitioners must maintain a high index of suspicion for c-spine injury in the pediatric trauma patient. We have found that spine clearance guidelines can promote safe, efficient, and cost-effective care.

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REFERENCES

1. Hoffman JR, Wolfson AB, Todd K, Mower WR. Selective cervical spine radiography in blunt trauma: methodology of the National Emergency X-Radiography Utilization Study. Ann Emerg Med 1998;32:461-9.
2. Patel JC, Tepas JJ, Mollitt DL, Pieper P. Pediatric cervical spine injuries: defining the disease. J Pediatr Surg 2001;36:373-6.
3. Bohn D, Armstrong D, Becker L, Humphreys R. Cervical spine injuries in children. J Trauma 1990;30:463-6.
4. Dwek JR, Chung CB. Radiography of cervical spine injury in children: Are flexion-extension radiographs useful for acute trauma? Am J Roentgen 2000;174:1617-9.
5. Management of pediatric cervical spine and spinal cord injuries. Neurosurgery 2002;50(suppl):S85-S99.

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