

Determining Clinical Assessment Sensitivity in Evaluating the Cervical Spine of Pediatric Trauma Patients

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Abstract. Introduction: The National Emergency X-Radiography Utilization Study (NEXUS) was a prospective, observational study on a decision instrument based on clinical criteria. The intention of the study was to help physicians identify patients who need radiograph evaluation of the cervical spine. Based on NEXUS study results, researchers recommended that the decision instrument may be safely used as a decision algorithm to evaluate for cervical spine injury in adult trauma patients. A similar decision instrument has not been developed for pediatric patients with possible cervical spine injury (CSI). Pediatric patients of blunt trauma have anatomical and developmental characteristics that make it difficult to assess their risk of CSI. Methodology: To determine if clinical assessment is sensitive enough to clear the pediatric cervical spine, a comprehensive literature review was performed. Four articles were identified that fit the inclusion criteria set by this evidence based literature review. Results: To assess the pediatric patient it should be determined if the patient is “low-risk” (at low risk of having obtained a CSI) or “high-risk” (at high risk of obtaining a CSI.) The patient’s clinical stability can be assessed by the presence or absence of each of the five low-risk criteria. The patient is considered low-risk if there is an absence of the following criteria: midline cervical tenderness, evidence of intoxication, altered level of alertness, focal neurologic deficit, and presence of distracting painful injury. Non-verbal children are high-risk because they are unable to verbalize pain. Patients that meet low-risk criteria may be cleared. Patients considered high-risk should undergo plain film radiography. Conclusion: Clinical assessment performed well in pediatric patients and reduced the number of patients undergoing radiography. Based on the lack of high quality evidence, a recommendation can not be made on applying clinical assessment to pediatric patients.

1. Introduction

There are approximately 200,000 people in the United States with spine injuries, and between 1 and 10 percent of them are children. [1] It is estimated that 1100 children sustain spinal cord injuries annually. [1] Road traffic accidents (particularly pedestrians hit by cars, or passengers involved in high speed vehicular accidents), sports/playground injuries, and falls from a height are the most common causes of cervical spine injuries in children. [2] The major anatomic components of the cervical spine are the vertebrae, joints, ligaments and intervertebral disks, as well as the spinal cord, muscles, nerves, and vessels of the neck. Cervical spine injury is relatively uncommon, but can be devastating. An injury to the cervical spine may result in paralysis and death. Ruling out injury to the cervical spine (“clearing” the cervical spine) is a two-step process. The clinician must determine if there has been an injury to either the bony structures or ligamentous structures. Evidence-based criteria has been developed for “clearing” the cervical spine in adults, but similar criteria for pediatric patients does not exist at the current time. Adult recommendations for clearing the cervical spine are commonly used for pediatric patients. An adult with a possible cervical spine injury may be cleared utilizing the criteria suggested by The National Emergency X-Radiography Utilization Study (NEXUS). NEXUS uses a decision instrument to rule out cervical spine injury based on 5 low-risk criteria: the patient does not have tenderness at the posterior midline of the cervical spine, does not have focal neurologic deficit, does not have any evidence of intoxication, does not have a clinically apparent, painful injury that might distract them from the pain of a cervical spine injury and they have a normal level of alertness. If a patient is positive for any of the 5 criteria, the patient should be further evaluated for cervical spine injury. Children brought to the emergency room with potential cervical spine injury present a diagnostic dilemma. Clinical assessment is more difficult and there are potential communication problems between the child and health care provider. The physical exam may be limited by lack of cooperation in an anxious, crying child and a child may not be able to verbalize pain or sensory changes. The purpose of this study is to determine if clinical assessment utilizing adult criteria is sensitive enough to detect cervical spine injury in a pediatric trauma patient.

2. Methodology

The research methodology utilized to conduct this research was an evidence based literature review. A comprehensive literature search was conducted utilizing Medline and other databases from 1980-2006. Articles chosen for review were based on their level of evidence, publication in peer reviewed journals, relevance of the data, and publication in the English language. Inclusion criteria also included articles which specifically studied pediatric patients ranging from infancy to 18 years old with potential for cervical spine injury. A total of 4 articles met the inclusion criteria.

3. Results

Viccellio et al. (2001) performed a prospective, multicenter study to evaluate the efficacy of the NEXUS decision instrument in a population of trauma patients younger than 18 years. The decision rule correctly identified all pediatric cervical spine injury victims. The study found that the NEXUS decision instrument performed well in children, and its use could reduce cervical spine imaging by nearly 20%. [3] The study does suggest that caution should be used in applying the NEXUS criteria to infants and toddlers due to the small number in the study. [3] Jaffe et al. (1987) performed a retrospective chart and radiologic review to define a subset of injured children for whom emergency cervical radiography may be unnecessary. A clinical algorithm was developed utilizing the following eight variables: neck pain; neck tenderness; limitation of neck mobility; history of trauma to the neck; and abnormalities of reflexes, strength, sensation, or mental status. [4] This algorithm correctly identified 58 of the 59 children with cervical spine injury and reduced the need for radiographs by 38%. [4] In the Lee et al. (2003) study, nationwide standards, guidelines, and experiences across disciplines were reviewed, and a consensus pathway evolved for cervical spine clearance in children 8 years and younger. A short term retrospective review (5 months) was performed to assess initial performance. Pediatric patients with the following risk factors for cervical spine injury undergo cervical immobilization and radiographic evaluation: (1) unconscious patient or patient with abnormal neurologic examination finding; (2) mechanisms of injury potentially associated with cervical spine injury; (3) neck pain; (4) focal neck tenderness or inability to assess secondary to distracting injury; (5) abnormal neurologic examination findings; (6) history of transient neurologic symptoms suggestive of spinal cord injury without radiographic abnormality (SCIWORA); (7) physical signs of neck trauma; (8) unreliable examination secondary to substance abuse; (9) significant trauma to head or face; (10) inconsolable children. [5] There were no missed cervical spine injuries using this clinical assessment. Also the time required for cervical clearance in nonintubated children decreased. Smart et al. (2003) was a retrospective review of radiographs and pediatric records. A clinical algorithm was developed and applied to the cases. Clinical features that would have justified imaging included: major trauma; high risk mechanism of injury and painful injury elsewhere; unconscious or lack of cooperation; neck pain; neck tenderness and abnormal neurologic exam. [6] If this clinical assessment would have been used, 68 instead of 76 pediatric patients would have required imaging. [6] There was no incidence of cervical spine injury or SCIWORA in this study, so no cervical spine injuries were missed. The study advised cautious application of the clinical assessment.

4. Conclusion

The studies conclude that a decision instrument that is similar to the NEXUS criteria performs well in pediatric trauma patients with suspected cervical spine injury, and that a well performed clinical assessment will reduce the number of patients undergoing radiograph evaluation. A clinical assessment algorithm should not be applied to children younger than 4 because of their inability to communicate pain and because of the low number of patients studied in this age group. Based on the lack of studies, a recommendation can not be made on applying clinical assessment to pediatric trauma patients.

[1] Strange GR, Ahrens WR, Lelyveld S, Schafermeyer RW. *Pediatric Emergency Medicine*. 2nd ed: McGraw-Hill Companies, Inc; 2002.

[2] Slack SE, Clancy MJ. Clearing the cervical spine of paediatric trauma patients. *Emergency medicine journal : EMJ*. Mar 2004;21(2):189-193.

[3] Viccellio P, Simon H, Pressman BD, Shah MN, Mower WR, Hoffman JR. A prospective multicenter study of cervical spine injury in children. *Pediatrics*. Aug 2001;108(2):E20.

[4] Jaffe DM, Binns H, Radkowski MA, Barthel MJ, Engelhard HH, 3rd. Developing a clinical algorithm for early management of cervical spine injury in child trauma victims. *Ann Emerg Med*. Mar 1987;16(3):270-276.

[5] Lee SL, Sena M, Greenholz SK, Fledderman M. A multidisciplinary approach to the development of a cervical spine clearance protocol: process, rationale, and initial results. *J Pediatr Surg*. Mar 2003;38(3):358-362; discussion 358-362.

[6] Smart PJH, D M G Buckley, J M Somers, N J Broderick, K E Haliday, L Williams. Cervical spine injuries to children under 11: should we use radiography more selectively in their initial assessment? *Emerg Med J*. 2003;20:225-227