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The Core Curriculum

Cervical Spine Fractures

Objectives

1. Describe the incidence and pattern of cervical spine fractures in children
2. Discuss the anatomical features of the child's cervical spine which result in the pattern of injury recorded
3. Describe the optimum management of transport of the young child with an injured cervical spine
4. Discuss evaluation and imaging of the child with a possible cervical spine injury
5. Describe os odontoideum
6. Describe SCIWORA
7. Discuss management of upper and lower cervical spine fractures
8. Describe the natural history of untreated ligamentous injuries in the lower cervical spine of children

Discussion points

1. What percentage of upper cervical spine injuries in children are accompanied by head injury? What are the consequences?
2. What fracture patterns are most common in upper cervical spine fractures in children?
3. What is the present role of MRI for children's cervical spine injuries? Discuss how MRI may affect our present concepts of SCIWORA.
4. What complications have been reported following use of the halo cast in children?
5. What is the etiology of os odontoideum? Treatment?
6. What are the indications for surgical treatment for children's cervical spine injuries?

Discussion

The child's cervical spine is very different from the adult. The facets are more horizontal than the adult, the atlas has three ossification centers, and the axis has an additional center which ultimately forms the odontoid. The ossification center of the odontoid usually fuses to the body of the axis and neural arches between age 3-6. The young child's cervical spine is hypermobile, more mobile the cord. This hypermobility, coupled with the large head of the young child, renders the young child's upper cervical spine particularly vulnerable. Cervical spine fractures are rare in childhood; one series of 300 injuries studied by Bohlman reported only 15 younger than age 15. Most, but not all series, report that the upper cervical spine is most often injured in the young child, and the lower in the older. Head injuries often accompany cervical spine injury, especially in the young child where the rate has been reported as about 50%. Many upper cervical spine injuries in the young

child are fatal (Nitecki). Motor vehicle injuries are more frequent causally in the young, sports injuries and falls in the older child. Spinal cord injury without radiographic abnormality (SCIWORA) is more frequent in the younger child's upper cervical spine. Aufdermaur demonstrated cartilaginous endplate injuries in autopsy studies to account for some SCIWORA injuries; recent MRI studies also incriminate ligamentous injury not visualized radiographically.

Physical exam can be difficult, especially with altered consciousness; and worsening of paralysis has been reported during evaluation of cervical spine injuries in the emergency room. The child's head is relatively large, so the body is best supported on a mattress pad to avoid flexion of the cervical spine. A lateral view is adequate for screening, but a complete set of films is necessary to clear the spine. Flexion-extension films should only be made when the child is alert and cooperative. CT and MRI studies can be helpful with occult injury; the MRI is more helpful for evaluating the spinal cord and ligamentous structures.

The more common injuries include odontoid fracture, which can usually be managed by reduction in extension and immobilization with a halo or Minerva cast. The os odontoideum almost certainly represents a nonunion of an odontoid fracture; posterior fusion is recommended if there is pain or instability. Spondylolisthesis of C2, or the hangman's fracture is successfully managed nonoperatively. Fractures of the lower cervical spine are usually a result of flexion injuries. The bodies of younger children are normally wedge shaped, sometimes rendering diagnosis difficult. The natural history of ligamentous injury in the lower cervical spine is not favorable (Schwarz), and surgical stabilization is indicated.

The cervical spine is difficult to immobilize. The halo is regarded as most effective, but difficult to apply in the young child as the skull is so fragile. Ten pins have been recommended for the young child, but a study of halo problems reported no reduction in frequency of complication with multiple pins. Immobilization of the young child's cervical spine is laborious, however, the effort must be made when it is necessary.

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