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The Core Curriculum

Hypermobility of cervical spine

Objectives

1. Describe the anatomic differences between the immature and mature cervical spine
2. Describe the differences in mobility at the atlantoaxial and atlantoccipital joints in the immature and mature cervical spine
3. Describe the features of pseudosubluxation of the child's cervical spine
4. Define the spinolaminar line (Swischuk's line)
5. Define atlanto dens interval (ADI) and space available for cord (SAC)

Discussion points

1. Describe the anatomic differences in the 2 year old cervical spine, the 10 year old, and the adult
2. How can one differentiate between pseudosubluxation and a true instability of the child's cervical spine?

Discussion

The child's cervical spine differs from the adults in a number of ways. The vertebral bodies may appear wedged on the lateral view, secondary to the shape of the ossified body. Ogden has noted the planes of the facets of the lower cervical in the newborn is 30°, progressing to 65° in the adult. The C1-2 angles change from 55 to 70 degrees. The flatter facet angles in young children contribute to the pseudosubluxation of the younger child's cervical spine, most marked at C2-3. Cattell and Filtzer's paper noted that this level was hypermobile in 40% of children less than 8 years old. Swischuk described the spinolaminar line, connecting the anterior edges of the spinous processes of C1 and C3 should either pass through the cortex of the anterior edge of the spinous process of C2 or be less than 2 mm from the anterior cortex. Distances > 2mm indicate pathologic displacement. Shaw noted that pseudosubluxation is common in children evaluated in ER settings.

The atlantodens interval (ADI) and space available for cord (SAC) attempt to quantitate mobility at C1-2. The transverse atlantal ligament may be attenuated or weakened in such conditions as juvenile arthritis or Down's syndrome. The ADI is measured between the anterior dens (odontoid) and the posterior cortex of the anterior ring of the atlas. The SAC is measured between the posterior dens and the anterior cortex of the posterior ring of the atlas. The upper limits of the ADI compatible with physiologic mobility are generally set at 4.5 - 5mm for children; in adults, 3 mm. The SAC, values less than the transverse diameter of the odontoid are concerning. In adults and teenagers, the SAC should be > 13mm.

Tredwell and associates have described a method for determining atlantoccipital instability in children with Down's syndrome. Gabriel used the method described by Weisel and Rothman, using a perpendicular from a line passing from the posterior atlas to the antermost portion of the anterior ring. A perpendicular passing through the posterior margin of the anterior ring of the atlas is compared to the basion in flexion and extension. In adults, the distance should be < 1mm.

Wellborn noted a troublesome variability in interobserver measurements of cervical spine mobility, and in one participant, of intraobserver variation.

References

1. Brockmeyer D. Down syndrome and craniovertebral instability. Topic review and treatment recommendations. *Pediatric Neurosurgery* 1999;31(2):71-7.
2. Cattell HS, Filtzer DL. Pseudosubluxation and other normal variations in the cervical spine in children. *J Bone Joint Surg(Am)* 1965;47:1295-309.
3. Copley LA, Dormans JP. Cervical spine disorders in infants and children. *J Am Acac Orthop Surg* 1998;6:204-14.
4. Gabriel KR, Mason DE, Carango P. Occipito-atlantal translation in Down's syndrome. *Spine* 1990;15:997-1002.
5. Kuhns LR, Strouse PJ. Facet coverage in children on flexion lateral cervical radiographs. *Spine* 1999;24(4):339-41.
6. Ogden JA. *Skeletal Injury in the child*. Philadelphia: WB Saunders; 1990.
7. Shaw M, Burnett H, Wilson A, Chan O. Pseudosubluxation of C2 on C3 in polytraumatized children--prevalence and significance. *Clinical Radiology* 1999;54(6):377-80.
8. Swischuk LE. Anterior displacement of C2 in children: physiologic or pathologic? *Radiology* 1977;122((suppl 2)):759-63.
9. Swischuk LE, Swischuk PN, John SD. Wedging of C-3 in infants and children: usually a normal finding and not a fracture. *Radiology* 1993;188(2):523-6.
10. Tredwell SJ, Newman DE, Lockitch G. Instability of the upper cervical spine in Down's syndrome. *J Pediatr Orthop* 1990;10:602.
11. Wellborn CC, Sturm PF, Hatch RS, Bomze SR, Jablonski K. Intraobserver reproducibility and interobserver reliability of cervical spine measurements. *Journal of Pediatric Orthopedics* 2000;20(1):66-70.
12. Wiesel S, W., Rothman RH. Occipito-atlantal hypermobility. *Spine* 1979;4:187-91.