Thoracic fractures

Objective
1. Describe the anatomic and biomechanical differences between the mature and immature spine
2. Describe the distribution of site of involvement of SCIWORA (spinal cord injury without radiographic abnormality)
3. Describe the 3 column system for assessing stability of spine fractures
4. Discuss the most frequent causes of spinal cord injury in children
5. Describe treatment for compression fractures of the thoracic spine in children

Discussion points
1. What are some practical measures which could reduce the rate of spinal cord injury in children?
2. How much can the infant spinal cord stretch? How much can the infant spinal canal stretch?
3. At what vertebral level does the infant spinal cord end?

Discussion

Thoracic spine fractures are rare in children, and the treatment of thoracic bony injuries is seldom a difficult problem. Neurologic injury is however, unfortunately more common. There are a number of anatomic differences in the immature and mature spine that contribute to the differing patterns of injury. The infant spinal cord, which ends at the L3 level at birth, can only be stretched 0.25 inch before rupturing, but the infant spinal canal can elongate 2 inches before failure. This elasticity of the spinal column contributes to the much higher incidence of spinal cord injury without radiographic abnormality in young children. The thoracolumbar junction has a high rate of SCIWORA. The child's disk has a higher water content, and is a better shock absorber than the adult. Multiple compression fractures are more common in the child’s spine than the adult. There are also cartilaginous vertebral endplates which contain hyaline cartilage near the disc, and physeal cartilage near the bone. The vertebral apophyses start to appear as bony densities near the end of the first decade, with a wide range, and do not fuse with the centrum completely until the early 20's. The apophyses are thicker at the periphery than at the center, thus are known as ring apophyses. Fractures of the immature spine often traverse the growth plate, just as in the appendicular skeleton. Aufermauer has well demonstrated the pathology of vertebro endplate fractures. The ability to investigate the pathology of SCIWORA in the child has been greatly enhanced with the advent of MRI.
The three column system described by Dennis has become widely used in the assessment of spinal fractures, with 4 major types of injury resulting: Compression, a failure of the anterior column with an intact middle column; Burst, a failure of the anterior and middle columns; Flexion-distraction, with compression of the anterior column and distraction of the middle and posterior (resulting in either ligamentous or bony injury), and fracture-dislocation, which results from rotary forces. Compression fractures in children usually require little treatment, with a good longterm outlook. Fractures with less than 10 degrees of wedging require no treatment. Growth disturbance is very rare. Other injury types occur more frequently in the thoracolumbar and lumbar spines.

Spinal cord injury can occur in the infant from trauma, a number of injuries secondary to abuse have been reported. The older child is injured more often by violent trauma, in recent years, gunshot wounds have become much more prevalent in the US.

References