Dynamic Chiropractic

Trauma to the Growth Plate

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Injuries to the immature skeleton can result in serious residual disabilities. Approximately 15 percent of fractures to the tubular bones occur in children under the age of 16. Forces that produce ligamentous tearing and joint dislocation in adults may lead to growth plate injury in the child, as the joint capsule and ligamentous structures are two to five times stronger than the growth plate. Early diagnosis and treatment can prevent significant growth disturbance and deformity.

The hypertrophic zone of the growth plate is the most vulnerable to shearing and avulsion injuries. The germinal cells are usually spared and growth will continue as long as there is a blood supply. The younger the patient, the longer the period of growth and the greater the potential for future deformity. Once a deformity has appeared, its progression may be stimulated by abnormal mechanical forces.

There are four types of stresses that may produce growth plate injury: shearing or avulsion forces account for most injuries; splitting and compressive forces occur less frequently. The hypertrophic zone of the growth plate is often affected by a shearing injury and is influenced by the growth rate. An increase in the thickness of this zone during periods of rapid growth may promote epiphyseal separations. Avulsion injury to the growth plate is seen most often at sites of apophyses. The age of the appearance of the injury is dependent upon the time of appearance and fusion of the apophysis. The avulsed cartilage may continue to demonstrate osteogenesis, producing small or large bony ossicles. A splitting injury of the growth plate produces a fracture that crosses the entire epiphysial complex, perpendicular to the growth plate. The healing callus may take place across the plate, anchoring the epiphysis to the metaphysis, causing cessation of growth to occur at this focus, as the remainder of the epiphyseal complex continues to grow, causing a deformity. The most widely accepted classification of growth plate injuries is that of Salter-Harris:

Place Figure I here

A. Type I: A split in the growth plate occurs through the zone of hypertrophic cells. The periosteum is intact.

B. Type II: The growth plate is split and the fracture enters the metaphysial bone, creating a triangular fragment. The periosteum about the fragment is intact, whereas that on the opposite side may be torn.

C. Type III: A vertical fracture line extends through the epiphysis to enter the growth plate. It then extends transversely across the hypertrophic zone of the plate.

D. Type IV: A fracture extends across the epiphysis, growth plate, and metaphysis. Note the incongruity of the articular surface and the violation of the germinal cells of the growth plate.

E. Type V: Compression of a portion of the growth plate may be unassociated with immediate radiographic abnormalities.

There are five types of Salter-Harris growth-plate injuries.

Type I occurs in approximately six percent of cases and represents a pure epiphyseal separation, with the fracture isolated to the growth plate itself. A shearing or avulsion force causes cleavage through the hypertrophic zone. This type of injury has a favorable prognosis and occurs mainly in children under five years.

Type II occurs in approximately 75 percent of cases and is the most common type of growth plate injury. This injury is the result of a shearing or avulsion force that splits the growth plate for a variable distance before entering the metaphysial bone, separating a small fragment of the bone. The periosteum on the side of the metaphysial fracture remains intact, but that on the opposite side is disrupted in conjunction with the growth plate separation. The common age for this injury is 10 to 16 years and prognosis is generally favorable.

Type III occurs in about eight percent of cases. With this injury the fracture line extends vertically through the epiphysis and growth plate to the hypertrophic zone, and then horizontally across the growth plate itself. This injury occurs most often in children between the ages of 10 and 15. If reduction is good and displacement is minimal, generally prognosis is good. If reduction is not complete, the gap in the growth plate may become replaced with bone.

Type IV occurs in 10 percent of cases. This is a vertically- oriented splitting force which produces a fracture that extends across the epiphysis, the growth plate, and the metaphysis, producing a fragment that consists of a portion of both the epiphysis and the metaphysis, This injury often requires open reduction and careful realignment so that growth arrest and joint deformity are not encountered at a later date.

Type V occurs in one percent of cases. This is crushing injury to the end of a tubular bone which can lead to injury to the vascular supply in the germinal cells of the plate. Radiographically, this injury is not initially apparent. Premature osseous fusion of the injured portion of the plate may occur. This injury is found in between the ages of 12 and 16, and is associated with a poor prognosis.

It is important to recognize these fractures early as, without proper treatment, growth impairment, premature growth plate fusion, epiphyseal malposition and rotation, and osteonecrosis may result causing permanent deformities.

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