POSNA

The Core Curriculum

Fractures of the shaft of the radius and ulna

Objectives

1. Describe the anatomy and kinesiology of the radius and ulna.
2. Discuss the role of muscle origin and insertion on displacement patterns in fractures of the radial and ulnar shafts.
3. Describe a useful classification system, including degree of completeness, direction of deformity, level of fracture, and disruption of radioulnar joint.
4. Discuss management of greenstick fractures.
5. Describe the amount of remodeling that can be expected following a midshaft fracture of the radius and ulna. Discuss how this can be applied to management decisions in the older child with such a fracture.
6. Describe plastic deformation and its management.
7. List treatment options currently used for management of radial and ulnar shaft fractures. Describe indications for each option listed.
8. List complications of midshaft both bones fracture of the forearm, their incidence and management.

Discussion points

1. What is the incidence by age of shaft fractures of the radius and ulna?
2. What is (are) useful method(s) of assessing the rotational relationship of the fracture fragments in a greenstick fracture? In a complete fracture?
3. How much displacement or rotational malalignment is compatible with a satisfactory functional result?
4. Discuss the merits of internal fixation versus cast management? Include functional outcome and cost of treatment?
5. Describe technical requirements for a good result of a displaced midshaft fracture managed with cast immobilization. With internal fixation.
6. What is the rate of refracture of midshaft fractures? What factors contribute to a higher rate of refracture?
7. What treatment is effective for plastic deformation?

Discussion

Fractures of the shaft of the radius and ulna are much less common than more distal metaphyseal fractures. Injuring forces are generally indirect and more force is required to fracture the compact diaphyseal bone. Younger children more commonly sustain these fractures, presumably because

their bone is less strong. Practically, it is useful to classify these fractures as greenstick, complete, or plastic deformation. With greenstick fractures, direction of deformity (apex volar or dorsal) is critical in determining the reduction maneuver. Muscular forces displacing the fractures are related to the level of fracture. It is mandatory to be able to assess rotation of the fragments radiographically for planning reduction of displaced fractures. The clinical appearance of the forearm with a greenstick fracture is helpful (a pronation injury will have a prominence dorsally of the radius at the site of injury with further pronation of the distal fragment), but not for a completely displaced fracture. Evans' classic article described the effects of forearm rotation on the appearance of the bicipital tuberosity. A good AP view is required and the amount of pronation of the proximal radial fragment can also be assessed for confirmation of the bicipital tuberosity position.

Practically, greenstick fractures are treated by correcting the rotational and angular malalignment simultaneously by reversing the mechanism of injury. Recurrence of deformity can occur without proper immobilization technique and the refracture rate after greenstick fracture is higher than with completely displace fractures. Complete shaft fractures can be managed with cast immobilization (Jones). Rotation of the distal fragment is matched to the proximal; most will be in neutral position or some supination. The radial bow should be restored. The cast should be molded to widen the interosseous space, and the ulnar border straight. Subsidence of initial swelling often necessitates a cast change. Casting in extension can sometimes maintain position better than elbow flexion (Shaer). Ten degrees (10() of angulation is acceptable at any age, in children < 15-20 degrees is acceptable. Proximal fractures seem to remodel less than distal shaft fractures. A loss of 20-30 degrees of rotation does not impair function; loss of supination is more problematic than loss of pronation. Residual angulation of < 10 degrees does not result in functional loss of motion at any age. Children < 9 years of age can remodel up to 15 degrees of angulation, and 45 degrees of angulation. (Noonan) However, factors other than angulation can result in restriction of motion.

In recent years, scores of articles have appeared on open reduction of children's forearm fractures. Although plating has been recommended for children, the present emphasis is on flexible intramedullary nails or contoured K wires. Results are generally very good, complication rate is variable, but a good final result generally occurs (Cullen, Griffet, Luhman, Richter). Closed reduction with fluoroscopy or minimal open reduction are advantages of intramedullary nailing over plate fixation (van der Reis). Advocates of open reduction generally will accept less angulation that advocates of cast fixation. Techniques and results of intramedullary nailing have been extensively reported. One relatively clear indication for operative fixation is refracture, which occurs in about 5% of forearm fractures. Poor results are common after closed management.

Plastic deformation is an unusual injury in children. An attempt to partially correct the bony deformity is indicated, and clinical rotation should be affirmed before accepting the reduction. Complete correction of plastic bowing is unusual; but enough correction to restore motion should be achieved.

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