Dynamic Chiropractic

PEDIATRICS

Torus and Greenstick Fractures of the Forearm in Children

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Forearm fractures are second only to the hand in occurrence for the most common fracture site in children under 12 years of age. Generally, the affected region is the distal third of the forearm and involves both the radius and ulna. Most of these fractures can be put into two categories: simple torus fractures and greenstick fractures. These are considered incomplete fractures which present with cortical breaking on one side and or a bulging or buckling of the cortex.

The torus or buckling fracture is the most common of the two categories. It is unique to childhood because of the weakness of the immature mineralization of the bone. When compressive force is placed on a tubular bone's long axis, the axial stress on the bone causes a buckling reaction.

Figure 1

The etiology of a torus fracture is usually a fall on an outstretched arm. The child will present with a painful, swollen wrist. Radiographic signs of buckling are often seen better on the lateral films than on the anterior-posterior projection. In a trauma like this, it is wise to film both the wrist and elbow to rule out dislocation of the proximal and distal radioulnar joints. Occasionally, radiographic signs will not be present on the initial x-ray and the diagnosis must be made off of the clinical findings. In this case, a second set of radiographs would be warranted one to three weeks posttrauma. When radiographic signs are present, there will be a definite cortical bulge usually occurring at the metaphysis, two to four centimeters from the distal growth plate. Although a torus fracture can occur in any long bone, the distal radius is the most common site. This type of fracture does not displace further and can usually be managed by a well-fitting immobilizing cast for a period of two to four weeks. This mainly serves to relieve the pain. Some authorities believe that a cast that crosses the elbow is necessary for the prevention of an angulation deformity of the bones during healing. Because of the compressive forces on the radius and the proximity of the two bones, there is often involvement in the ulna as well. This is usually manifested in a bowing deformity of the thinner, long bone.

This leads us to the second category of fractures: the greenstick or hickory stick fracture. This fracture usually occurs from a quick twisting motion accompanied by axial compression such as a fall backwards on the outstretched hand. The twisting can be from hyperpronation. A supinated twist puts more tensile or pulling forces on the palmar surface of the bone so the fracture will angulate towards the palm, whereas a pronation injury will result in a dorsal angulation of the involved bone.

Figure 2 and 3

If a longitudinal force is applied on a long bone, the elasticity will cause the curvature of the bone to increase as the ends approximate. The bone will return to normal unless the elastic limit has been reached. At that point, microfractures will develop and a plastic deformation will result without a

disruption of the cortex. This plastic deformation is known as greenstick bowing and is not generally a significant clinical problem, though some sources are now giving more attention to it. After the maximum tensile strength is reached at the edge of the bone, a rupture in the cortex will appear on the radiograph.

Figure 4

Because of the elasticity of a child's bone, a bowing deformity will also occur on the opposite side of the bone from the break. Quite often there will be a buckling on the concavity resembling a torus fracture. As in a torus fracture, the close proximity of the forearm bones during a trauma tends to involve both the radius and ulna. It is also wise to irradiate both the wrist and elbow to evaluate the radioulnar joints.

The child with a greenstick fracture will clinically present like that of a torus fracture: a swollen, painful wrist, however there will usually also be a definite pronation/supination carrying of the affected arm, depending on the method of injury. The treatment of a greenstick fracture is to reverse the torsional mechanism of injury, i.e., pronating the fracture with palmar angulation of the bone and supinating the dorsally angulated bone. Gentle manipulation of the arm is required to do this. Overcorrection will generally complete the fracture and an audible click will be heard. If completion of the fracture is not done, then the bowing deformity may reappear during the healing process, therefore great care should be taken to monitor the progression of the child's rehabilitation. Most greenstick fractures, that are not overcorrected, heal within three to four weeks without any complications.

With both torus and greenstick fractures it is rare to have any vascular or permanent neurological damage. In the mid-arm, the median nerve is protected from the bone by muscular layers, but the ulnar nerve, because of its closeness to the bone, may be damaged. There have been reported cases of complete but temporary paralysis of the flexor pol. longus and index finger branch of the flexor digitorum profundus. Just distal to the head of the radius there are anterior interosseous nerve branches of the median nerve that may be temporarily damaged. Most of these will heal within three to four weeks; this is important to know. Evaluation of the median nerve must be done in distal third fractures of the forearm.

The most common problem of a forearm fracture is the loss of normal rotation; normal rotation is 180^{o} with the distal and proximal radioulnar joints moving together. Although a child with 50 percent loss of rotation could adapt, care must be taken to minimize the loss as much as possible. Improper manipulation during the reduction of a greenstick fracture can cause decreased rotation. Forceful pronation during reduction can cause a malrotation of the fracture site which, regardless of the age of the child, will not correct itself. The position of the arm (supination/pronation) during the casting can also cause a decreased rotation. Also be aware that mild manipulation up to five weeks posttrauma, when the bone ends are still 'sticky,' is acceptable and often helps reduce the risk of decreased rotation. Other factors pertaining to the degree of rotation upon healing are the tension of the muscles and interosseous membranes; the angulation of the fragments; the degree of flexion and extension of the elbow; and the soft tissue edema.

After mild manipulation and casting of the forearm, a preventative monitoring program is the best way to keep on top of rotational problems that can occur with the greenstick or torus fracture of the forearm.

References

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AUGUST 1992