

Maintenance of Reduction of Pediatric Distal Radius Fractures With a Sugar-Tong Splint

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ABSTRACT

Distal radius fractures are common injuries in children. Displaced fractures have traditionally been treated with closed reduction followed by immobilization in a long arm cast. Because of variable success rates with this technique, a trend in the literature is toward operative fixation of these fractures. A popular alternative practice involves temporary immobilization in a sugar-tong splint, though we are unaware of any studies demonstrating the efficacy of this technique in children.

We present our experience in treating these injuries initially with a sugar-tong splint and then with a short arm cast. We retrospectively reviewed the cases of 53 patients (age range, 2-12 years) treated with closed reduction and a sugar-tong splint followed by conversion to a short arm cast after 2 to 3 weeks.

In 51 (96%) of 53 fractures, reduction was maintained without more aggressive intervention. The sugar-tong splint is effective in maintaining reductions in pediatric distal radius fractures and has none of the added risks associated with current alternative methods.

treated with closed reduction followed by immediate sugar-tong splinting, avoids the risks associated with surgical intervention. We conducted this retrospective review of cases in which our treatment protocol was used to determine whether, compared with long arm casting, our protocol improves maintenance of fracture reduction.

MATERIALS AND METHODS

The charts and radiographs of all forearm injuries treated in our emergency department from 1999 to 2002 were reviewed. Of these cases, distal radius fractures that required reduction (patients aged 2-12) were included in this study. Fractures were monitored to radiographic union. Fifty-three fractures in 49 patients had complete records and were included in the study.

There were 30 isolated distal-third radius fractures,

“Our treatment protocol... avoids the risks associated with surgical intervention.”

Distal radius fractures are among the most common orthopedic injuries in children. The goals of treatment include restoration of acceptable function and cosmesis, which has traditionally been achieved with nonoperative management. Traditional treatment of these fractures has included closed reduction followed by immediate long arm cast application. Recently, this treatment has been questioned because of the unacceptably high incidence (29%-91%) of loss of reduction requiring remanipulation.¹⁻⁴

The authors of these studies have recommended percutaneous pinning of these fractures in the operating room. Our treatment protocol, in which fractures are

17 distal-third radius fractures with concomitant distal-third ulna fractures, 4 Salter-Harris II fractures of the distal radial physis, and 1 Salter-Harris IV fracture. The system of Mani and colleagues⁵ was used to grade displacement: less than 50% translation, type I; more than 50% translation, type II. There were 28 type I fractures and 25 type II fractures.

Displacement was recorded for study purposes, but at our institution the decision to reduce a fracture is based on fracture angulation. Although apex radial and apex ulnar fracture angulation was measured, there were no fractures with angulation in this plane significant enough to warrant reduction. We therefore focused this study on apex volar and apex dorsal angulation.

Treatment Protocol

Our protocol is as follows. We accept no more than 15° of angulation in the sagittal plane (either apex volar or apex dorsal). Axial plane displacement of less than 50% is tolerated if the sagittal plane angulation is acceptable. Fractures with more than 50%

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Figure 1. (A) Anteroposterior and (B) lateral radiographs show an isolated distal radius fracture with 100% dorsal displacement.



Figure 2. Postreduction radiographs of the same fracture (Figure 1) show near-anatomic reduction and 3-point molding of the sugar-tong splint.

displacement are reduced regardless of the initial angular deformity (Figure 1). All fractures are treated with closed reduction followed by immediate sugar-tong splint placement in the emergency department. Hematoma block is used with or without intravenous sedation for anesthesia. Plaster casting tape (12-14 layers) is padded and applied in U fashion from the volar palm to the dorsum of the hand, with the bend around the elbow. Circumferential elastic bandages are used to secure the splint, and 3-point molding forces are applied (Figure 2).

All patients are seen for the first follow-up visit within 1 week of the injury. The limb is evaluated for excessive swelling or other problems, and, if necessary, the sugar-tong splint is rewrapped. Residual angulation is assessed on repeat anteroposterior and lateral radiographs using the same criteria as for the initial reduction. If the fracture alignment has become unacceptable, manipulation is repeated, either under



Figure 3. Radiographs of the same fracture (Figures 1, 2) 6 weeks after injury show excellent sagittal and coronal plane alignment, with bridging callus formation.

conscious sedation in the clinic or under general anesthesia in the operating room. When a repeat manipulation is required, it is followed by application of a new sugar-tong splint. If the fracture position has been maintained, the patient is seen 1 week later (approximately 2 weeks after the fracture), with another radiographic examination of the fracture and a check of the condition of the splint. The third visit is 1 week later (approximately 3 weeks after the fracture), with another radiograph taken in the splint. If the fracture has maintained its position and the child has minimal fracture tenderness, then the sugar-tong splint is replaced with a short arm cast at that visit.

The child is next seen in 3 weeks (6 weeks after fracture) with another radiograph taken in the cast. If there is adequate callus, the short arm cast is removed, precautionary instructions are given to the parents, and the child is next seen 4 to 6 weeks later (Figure 3). At that time, activity is assessed. Most children are seen 1 year after the fracture for a final assessment of fracture position, remodeling, clinical function, and range of motion.

RESULTS

Initial angulation ranged from 16° to 45° apex volar or dorsal (mean, 25°). Angulation at radiographic union ranged from 0° to 12° . Fifty-one (96%) of 53 fractures were successfully treated to radiographic union using this protocol. The parameters for remanipulation were the same as for the original fracture; therefore, any angulation of more than 15° required remanipulation.

Two fractures required remanipulation. One patient had a Salter-Harris II fracture of the distal radius, initially reduced to near anatomic position. Week 2 radiographs showed loss of reduction with apex volar angulation of 20° . The fracture was remanipulated under general anesthesia, and the patient was again placed in a sugar-tong splint. Follow-up was conducted weekly, and the patient went on to heal with 5° of apex volar angulation.

The other patient, with an isolated distal radius fracture with 30° apex volar angulation, was initially reduced to 5°. Within the first week, he had fallen again, onto his splinted arm. Follow-up radiographs showed 18° of apex volar angulation. This fracture was remanipulated under sedation in the clinic, and another sugar-tong splint was applied. Follow-up was conducted weekly, and the patient achieved radiographic union with apex volar angulation of 7°. Both patients had excellent cosmetic and functional results at their final follow-up.

There were no neurovascular complications in this study.

ily acquired skill, and the experience of the physician placing the cast was an important factor in its success or failure.

We have found the technique of applying a well-molded sugar-tong splint to be quickly learned and consistently reproducible. These splints are routinely applied by our junior resident staff. We feel that the elastic bandage offers a tremendous advantage, as it continues to apply 3-point pressure on the arm even as the initial swelling decreases. The failure of long arm casting is possibly due in part to the inability of the cast to maintain the initial molding forces as swelling subsides.

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DISCUSSION

Distal radius fractures are common injuries in children. Traditional treatment of these fractures has included closed reduction followed by long arm cast application in the emergency department. Recently, this treatment has been questioned because of an unacceptably high (22%-91%) incidence of loss of reduction requiring remanipulation.¹⁻⁴

The authors of these studies have recommended percutaneous pinning of these fractures in the operating room. Our treatment protocol avoids the risks associated with surgical intervention and shows excellent maintenance of fracture reduction.

The trend in the literature suggests that treatment of displaced distal radius fractures by immediate long arm casting is suboptimal. The high incidence of remanipulation is cited by some as support for percutaneous fixation of all such fractures.¹⁻⁴ However, the comparisons in the literature have been directed toward the inconsistent results obtained with long arm casting of these fractures as primary treatment.

Chess and colleagues⁶ had excellent results with “well-molded” short arm casts as primary treatment. Nineteen of their 558 fractures required remanipulation. All the failures were noted to have poor casting technique, as evaluated by “cast index.” By the authors’ admission, proper molding of the cast is not an eas-

CONCLUSIONS

Distal radius fractures are common injuries in children. Long arm casting has been shown in several studies to have variable results. Some authors are now advocating percutaneous pinning of all such fractures. We know of no previous study of sugar-tong splint immobilization followed by short arm casting in pediatric patients. Our study demonstrates that sugar-tong splints are an effective and noninvasive way of maintaining reduction of displaced distal radius fractures in the pediatric population.

AUTHORS’ DISCLOSURE STATEMENT AND ACKNOWLEDGMENTS

The authors report no actual or potential conflict of interest in relation to this article.

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This paper will be judged for the Resident Writer’s Award.
