

INTRAFOCAL AND EXTRAPHYSEAL PINNING-A SAFE SURGICAL TECHNIQUE IN TREATMENT OF DISPLACED METAPHYSEAL DISTAL END OF RADIUS FRACTURE IN CHILDREN

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Abstract

Background: The objective of this retrospective study is to assess the functional and radiological outcomes of displaced metaphyseal distal end of radius fractures in children treated by percutaneous intrafocal extraphyseal pinning. **Materials and Methods:** The study was conducted in 20 children with displaced metaphyseal distal radius fractures from May 2020 to May 2023 in our institute. 14 were males and 6 were females. The mean age in our study group was 8 years. The common modes of injury were slip and fall while playing (15 cases), followed by fall from height (4 cases), assault (1 case). All fractures were displaced dorsally and laterally. **Result:** The average time for surgery since injury was 1 day. All patients were operated in supine position on an arm table. C arm was used in all cases. All cases were done by closed reduction only. 2 k wires of 2mm were used in most of the cases. The average duration of surgery was 35 minutes. Wrist function were assessed using Mayo wrist score in all patients. Visual analogue scale was used to check pain, appearance and functional movements of the wrist. All had good to excellent outcomes in our study. (range, 85 to 100). The mean score was 95 in our study. All cases were put in a cast for 2 weeks. The average time to union was 8 weeks. Average follow up was 6 months. **Conclusion:** Percutaneous intrafocal technique is a useful tool to get good anatomical reduction. Pinning the fracture extraphyseal prevents growth disturbances in children. It is a safe and reproducible procedure for displaced metaphyseal fractures in children.

INTRODUCTION

Paediatric distal radius fractures are one of the most common injuries in childhood following a simple fall. Simple and undisplaced fractures are treated by closed reduction and cast application with good to excellent outcomes. Well displaced distal end of radius and ulna fractures are difficult to reduce and maintain it with plaster application. The chances of initial malalignment, displacement are high. Though paediatric bones are capable of rapid healing and remodelling, the residual deformity may not be acceptable to the child and their parents. Repeated attempts to reduce these fractures when presented late can lead to more swelling and compartment syndrome. Surgical treatment consists of closed reduction and percutaneous pinning with k wires. In conventional method due to the close proximity of the fracture to physis, k wires are passed through the fracture site for stability. Another wire inserted in

Criss cross fashion. The chances of physeal injuries are present. Kapandji intrafocal technique is a proven technique for adult distal radius fractures. This technique not routinely used for paediatric displaced distal radius fractures. The number of literature evidence using this technique in paediatric fractures are less. In our series we have used this intrafocal technique in displaced paediatric distal radius fractures without crossing the physis with good functional outcomes.

MATERIALS AND METHODS

We have done a retrospective study of paediatric series of displaced distal end of radius fractures treated by intrafocal pinning from May 2020 to May 2023.

Patients with the following criteria were included in our study

- Children aged 5-15 years

- Complete and displaced fractures of distal end of radius and ulna
- Failed conservative treatment or redisplacement within 2 weeks of injury

Patients with following criteria were excluded from our study

- Children less than 5 years of age
- Comminuted fractures
- Fractures extending to shaft of radius
- Fractures with good reduction by conservative casting
- Fractures with neurovascular injury

Findings

Surgical technique

Under anaesthesia patient in supine position local parts painted and draped. Under c arm control fracture fragments visualised. Usually distal fragments are displaced laterally and dorsally. Closed reduction attempted. A 2mm k wire inserted through the fracture site over a dorsal stab incision. It is levered dorsally over distal fragment to control the sagittal deformity. Position checked in c arm in lateral view and once found satisfactory it is drilled into the proximal volar cortex. Now the lateral tilt noted in AP view. Another 2mm k wire inserted through lateral incision over fracture site and the distal lateral fragment levered medially and reduction checked in c arm. After satisfactory reduction k wire is drilled into the proximal medial cortex. Both wires are inserted intrafocally and extraphyseal. Final stability checked in all range of movements. It is checked under fluoroscopic guidance. K wires are bent and cut outside the skin. Sterile dressing applied.



Figure 1: Shows the Pre-Op X-rays



Figure 2: Shows the intra OP C ARM pictures



Figure 3: Shows the Intra Op Clinical Pictures

Post-Op Protocol

Patient maintained in below elbow cast for a period of 2 weeks. Serial X rays are taken at the end of 2,4,6 weeks. After 2 weeks active wrist movements started as tolerated. Wrist brace given after 2 weeks. K wire removal done around 4 to 6 weeks depending on fracture healing clinically and radiologically. After 12 weeks patient allowed to lift weights and return to normal activities.

RESULTS



Figure 4: X-Rays at 5 weeks follow up

A total of 20 paediatric distal radius fractures included in our retrospective study. 14 were males and 6 were females. The mean age in our study group was 8 years. The common modes of injury was slip and fall while playing (15 cases), followed by fall from height (4 cases), assault (1 case). All fractures were displaced dorsally and laterally. Intraarticular and physeal injuries were excluded. 12 cases had associated distal ulna fractures. The average time for surgery since injury was 1 day. All patients were operated in supine position on an arm table. C arm was used in all cases. All cases were done by closed reduction only. 2 K-wires of 2mm were used in most of the cases. In Younger age patients and those with small fracture fragment we had used 1.8 mm k wire. All k wires were passed intrafocally and

extraphyseal. No K-wires were passed through physis. The average duration of surgery was 35 minutes. In obese patients 2-0 ethilon was used to suture the k wire entry incision. All cases were put in a cast for 2 weeks . The average time to union was 8 weeks. Average follow up was 6 months . The mean time for k wire removal was 6 weeks. All patients were sedated for implant removal and wrist mobilisation was carried out. Radiological union was defined as callus formation in 3 cortices in AP and lateral radiographs. Final follow-up was done at the end of 6 months. The range of motion of wrist and supination, pronation were assessed and compared with normal limb. Grip strength of the hand was

measured. Wrist function were assessed using Mayo wrist score in all patients. Visual analogue scale was used to check pain, appearance and functional movements of the wrist. All had good to excellent outcomes in our study. (range,85 to 100). The mean score was 95 in our study.3 patients had superficial pin track infection. After k wire removal wound debridement was done. They were started on oral antibiotics for a period of 7 days. Eventually it healed in all three patients. 1 patient had one k wire loosening during the course. He was maintained in cast for a period of 4 weeks. Fracture had healed without any secondary displacement. These were the complications reported in our study.

Table 1: Mean values in our study

Mean age (years)	Mean operating time (mins)	Mean follow up(months)	mean time for union (weeks)
8	35	6	8

Table 2: MAYO WRIST SCORE

Outcomes at the final follow-up	
WRIST JOINT PAIN	
Mild	1
Moderate	0
Severe	0
WRIST FUNCTION	
Excellent	17
Good	3
Satisfactory	0
Poor	0

Table 3: Complications

Pin Tract Infections	3
Malunion	0
Non-Union	0
Pin Migration	0
Pin loosening	1

DISCUSSION

Paediatric distal end of radius fractures is one of the common injuries reported. They may be greenstick fractures or complete fractures. Distal radius and ulna metaphyseal fractures are highly unstable fractures. They are difficult to reduce. The proximal end of the fracture buttonholes through the periosteum and giving longitudinal traction will be difficult. Also the pronator quadratus muscle gets torn and might interpose between the fracture ends.^[1] It does not allow anatomical reduction in some cases. There is a rotational deformity at the fracture ends and should be considered while doing a closed reduction. Giving forceful traction and manipulation should be avoided. It may increase the swelling on multiple attempts. Percutaneous reduction technique employed in our study is easy and minimally invasive. Initially the k wire is inserted manually into the fracture site.^[2] Precautions are taken not to injure the extensor tendons dorsally. During Lateral wire insertion superficial radial nerve is protected. After the k wire insertion manually, we have to gradually increase the angle of wire dorsally and reduce the dorsal tilt.^[3]

Now the k wire is attached to a battery-operated power drill and inserted over the volar cortex. Similarly the lateral wire inserted is drilled into the medial cortex after correcting the lateral shift of distal fragment. Repeated attempts should be avoided to prevent the inadequate purchase of k wire.^[4] The use of smooth wires reduces the friction and heat generation. To prevent thermal injury saline is used to cool the wire during drilling. Kamat et al,^[5] found that the chances of redisplacement are higher in children who received manipulation and casting alone. Mcquinn et al,^[6] explored the reasons for redisplacement in their study. They found the initial radiographs with greater amount of displacement tend to redisplace. Also the inability to get proper anatomic reduction is another risk factor for fractures getting displaced during the course of treatment.

CONCLUSION

The use of intrafocal extraphyseal k wire fixation for metaphyseal fractures in children is recommended for good outcomes with least complications. This technique can be employed in complete displaced

fractures with angulation more than 30 degrees, fractures that could not be satisfactorily reduced by closed reduction. With good clinical and radiological outcomes reported, this technique is easier to attain a stable fixation. We need a larger study group to further validate our study.

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