ISSN: 2581 – 3633
PubMed - National Library of Medicine - ID: 101745081

International Journal of Medical Science and Advanced Clinical Research (IJMACR)

Available Online at:www.ijmacr.com

Volume – 6, Issue – 2, April - 2023, Page No. : 308 - 313

Closed reduction and k-wiring with the kapandji technique for completely displaced pediatric distal radius fractures

[1]Dr. Chavan Pramod Babu, Assistant professor, Department of Orthopedics, HIMS, Hassan

[2]Dr. Sreeranga, Professor and HOD, Department of Orthopedics, HIMS, Hassan

[3]Dr. Devanagouda, Post Graduate, Department of Orthopedics, HIMS, Hassan

[4]Dr. Lakshmeesha T, Associate Professor Department of Orthopedics, HIMS, Hassan

Corresponding Author Dr. Chavan Pramod Babu, Assistant professor, Department of Orthopedics, HIMS, Hassan

How to citation this article: Dr. Chavan Pramod Babu, Dr. Sreeranga, Dr. Devanagouda, Dr. Lakshmeesha T, "Closed reduction and k-wiring with the kapandji technique for completely displaced pediatric distal radius fractures", IJMACR- April - 2023, Volume – 6, Issue - 2, P. No. 308 – 313.

Type of Publication: Original Research Article

Conflicts of Interest: Nil

Abstract

Background: The technique of intra-focal pinning described by Kapandji is used in the pediatric patients. We present the series of pediatric patients treated with Kapandji technique for unstable displaced distal radius fractures.

Methods: We retrospectively reviewed medical records and radiographs of a consecutive series of 36 pediatric patients who underwent closed reduction and fixation with Kapandji technique for unstable displaced metaphyseal fractures from 2021 September to September 2022. Percutaneous K-wires were inserted intra-focally to lever out, reduce and stabilize the distal fragment. The arm was immobilized with an above-elbow cast, and radiographic controls were scheduled at 1, 4, 8weeks, at least.

Results: The mean age at the time of the trauma was 11.5 years. The K-wires were removed at a mean of 5.6 post-operative weeks. An above-elbow cast was used for the first 3 weeks, afterwards a below-elbow cast for 2 weeks and a short-arm brace until the full recovery of motion. The mean follow-up was 9 months (range 3.5-12 months). No pin-related complications were seen. All fractures showed good healing, and the full function of the wrist was achieved in all the cases.

Conclusion: Kapandji pinning is a better technique in pediatric patients with unstable displaced distal radius fractures. It shows a lower complication rate and good outcome compared to other techniques.

Keywords: Kapandji Technique, Pediatric Patients, Displaced Distal Radius Fractures, Intra-Focal Pinning, K-Wires

Introduction

The distal radius is the most common site of fracture in the pediatric age group [(1)], which is approximately 31% of all pediatric fractures. Forundisplaced and moderately displaced fractures conservative methods are followed, completely displaced and angulated fractures are treated by various other methods, which include molding and casting, closed reduction and casting under anesthesia, closed reduction or open reduction with percutaneous K-wiring under anesthesia. Achieving adequate reduction of the fracture may be difficult in case of completely displaced pediatric distal radial (PDR) fractures by a regular closed reduction technique. The bayonet deformity is difficult to overcome in several cases. Traction was found to be ineffective [(2)] specially in intact ulnar fractures [(3)]. The complete greenstick ulnar fracture or osteoclasis of an intact ulna [(4)] has shown satisfactory fracture reduction. In case of displaced PDR fractures, reduction loss and re-displacement after closed manipulation and casting is reported. Fractures that re-displace may require further surgery or be allowed to heal which in turn may either remodel or mal-unite with reduced functional and poor cosmetic outcomes. This is often causing a dilemma for the treating physician. Percutaneous Kirschner (K) wire fixation has been recommended in order to prevent re-displacement but the indications vary and this technique is not without complications. As suggested by Proctor et al [(5)] with percutaneous K-wiring in all cases a perfect reduction could not be achieved. Oscan [(6)] recommended K-wiring for PDR fractures in case of ipsilateral ulnar fracture. According to Mostafa et al [(7)] primary procedure for PDR fractures should be percutaneous K-wiring involved with high risk of re-displacement. Whereas Zamzam [(8)] et al suggested for all displaced distal radius fractures primary K wire fixation even when a satisfactory closed reduction has been achieved. In completely displaced pediatric distal radial fractures, achieving satisfactory reduction is difficult with closed manipulation and maintenance of reduction with casting. Although the Kapandji technique of K-wiring is widely practiced for distal radial fracture fixation in adults, it is as such rarely used in pediatric acute fractures. Completely displaced fractures of distal radius in children from 7 to 16 years old were treated with closed reduction and K-wire fixation. Postoperative immobilization for 3 to 6 weeks with a short arm plaster of Paris cast, following which the K-wires were removed. Patients were followed up post operatively for a minimum of 9 months. Mean patient age was 9.5 years. In all the fractures near-anatomical reduction was achieved easily with the intrafusal leverage technique. On follow-up, there was no loss of reduction; manipulation was not performed in any of the cases. There were no pin-related complications. All fractures healed, and full function of the wrist and forearm was achieved in each and every case. Easy and near-anatomical closed reduction was consistently achieved with the Kapandji K-wire technique. Throughout the fracture-healing period reduction is maintained. The casting duration can be reduced if there is no loss of reduction and good functional results can be obtained.

Materials and Methods

From September 2021 to September 2022, patients younger than 15 years who sustained completely displaced, closed, distal radial fractures with or without ulnar fracture were prospectively enrolled in the study. Preoperative anteroposterior (AP) and lateral radiographs were obtained. Informed consent for the surgical procedure was obtained from the parents.

Surgical technique

The limb was positioned on a radiolucent side table after suitable an aesthesia (Figures 1-2). To achieve the radial length gentle traction and countertraction were applied. With the forearm in the lateral position and under image intensifier control, a K-wire was introduced into the fracture site from the posterior aspect (Figure 3). A 1.5-mm to 2mm K-wire was used based on age of the child. The K-wire was passed into the fracture area of the proximal fragment across the distal fragment. The posterior cortex of the proximal fragment was levered out posteriorly with the K-wire, reducing it to the posterior cortex of the distal fragment (Figure 4). Once the posterior cortices were aligned, the K-wire was pushed to the fracture obliquely to touch the anterior cortex of the proximal fragment. A drill was attached to the K-wire, and the wire was drilled through the anterior cortex, stabilizing the fracture. The forearm was checked on the AP view after fully pronating. If the fracture was reduced, as it would be in most cases. In case if on the AP view there was residual lateral translation of the distal fragment, another intra focal K-wire was passed through the fracture site laterally. The lateral translation was reduced by a leverage method, and the k wire was pushed and drilled into the medial cortex of the proximal fragment. The K-wires were bent just outside the skin and cut (Figure 5). Between the K-wire and the skin's surface, sterile gauze dressings were placed. In all the cases followed by K-wiring, a well-padded below-elbow plaster of Paris cast was placed. If the child was admitted in the morning, was discharged day 1 after the procedure. Postoperative AP and lateral radiographs were taken before discharge. An initial review on postoperative day 3 or 4 was done. Subsequent reviews were performed depending on the age of the child. For a minimum of 10 days to a maximum of 20 days the cast was worn followed by a ready-made wrist splint application. When the cast was changed to a splint the K-wire dressing was changed. After 3 to 8 weeks, radiographs were obtained. If healing was satisfactory, K wire was removed as an outpatient procedure. After K-wire removal, a compression bandage application and wrist mobilization were started. For a minimum of 9 months patients were followed up postoperatively later to ascertain the appearance and function of the wrist. When there was any complaint related to the operated wrist, they were advised to return to the hospital for review.

Fig 1 & 2: Preop x-ray and positioning of patient.

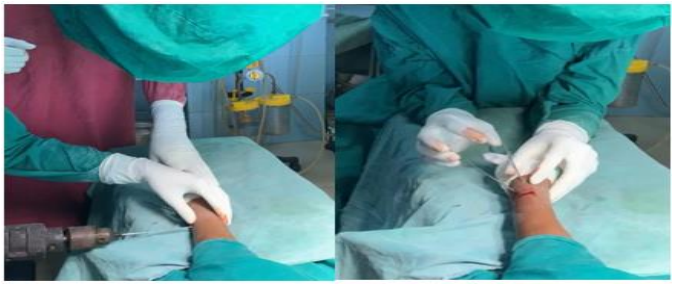

Fig 3 & 4: showing intraop images of kapandji method and reduction technique

Fig 5: Showing k wire bend outside the skin and fluoroscopy image of reduction.

Results

Among the 36 patients who were opted during the study period, all patients completed the follow-up criteria. Mean patient age was 11.5 years (range, 7-14 years). Mean procedure time for K-wiring was 12 minutes (range, 10-15 minutes). Two and 3 K-wires were used for radius fixation in 27 and 9 patients, respectively. Open reduction was not performed in any of the case. On immediate postoperative radiographs, there was no residual angulation or translation. Sixteen patients had a 3 weeks of wrist immobilization in a short arm plaster of Paris cast. The rest of the patients underwent immobilization for 4 to 6 weeks. Mean follow-up was 9 months (range, 3.5-12 months). All fractures healed (Figure 8). All patients achieved full wrist flexion and extension and forearm rotation (Figure 10). Mean time to achieve full wrist range of motion after immobilization was 3 weeks (range, 2-5 weeks). There was no loss of reduction or re-manipulation. No cast- or K-wire–related complications were observed.

Discussion

Many treatment methods are available for completely displaced PDR fractures: gentle molding without proper reduction and casting without an aesthesia, closed reduction and casting under an aesthesia (CRC), and closed reduction and K-wiring (CRW) under an aesthesia. Completely displaced PDR fractures are at risk for Redis placement after closed manipulation and casting. Redis placement may require another intervention or prolonged follow-up. Despite good long-term functional and radiographic outcomes in a majority of malunited PDR fractures, loss of reduction is a concern. Some factors that need to be considered before a method of treatments are age of the child, the severity of initial angulation and Redis placement angulation in a given child. Although achieving optimal closed reduction by any technique is the essential first step, the more important step is to maintain the reduction throughout the fracture healing period. 2 options available for maintaining fracture reduction are molded cast and percutaneous K-wiring. Perfect casting may not be possible because of inadequate or excessive padding, too-quick or too-delay in handling of plaster of Paris. Cast-related issues can be avoided with K-wiring method. McLauchlan et al[9] in a prospective randomized controlled trial compared 33 children treated by CRC with 35 children treated by CRW. Loss of reduction was observed in 14 of 33 patients treated by CRC. Manipulation was required in 7 patients in the CRC group and none in CRW group. They concluded that fixation with K-wire maintained reduction significantly better along with reducing the need for follow-up radiographs while reducing the need for further procedures to correct the loss of position. In a prospective, randomized study of 100 distal radius fractures in adults treated by K-wiring, Strohm et al[23] found that compared to conventional (Willenegger) technique both the functional and radiographic outcomes of the Kapandji method to be significantly better. The Kapandjiintrafocal K-wiring technique serves to achieve fracture reduction in addition to fracture fixation, which is useful in irreducible PDR fractures. With conventional K-wiring, Choi et al[20] reported an 8% incidence of open reduction and a 6.4% incidence of loss of reduction in a series of 140 patients with severely displaced PDR fractures. Closed reduction was possible in all cases with the Kapandji technique in the current series; open reduction was not necessary. There was no loss of reduction after K-wiring. Parikh et al22 in 10 patients with PDR fractures described intra focal pinning and

compared the results with conventional pinning in 26 patients. They concluded that the intra focal pinning technique has the added advantage of being used as a reduction tool. The overall duration of surgery, anesthesia, and radiation exposure is nearly the same for both CRC and CRW. Above or below-elbow cast application is done at the discretion of the surgeon after CRC, but below-elbow casting is sufficient after CRW. Crawford et al[24] observed that simple molding and CIC-A is sufficient to obtain good functional outcomes and reduces the treatment cost compared with CRC and CRW. In their study, mean age of the patients was 6.9 years while the treatment method was offered to children younger than 10 years when good remodeling can occur. The current authors obtained postoperative radiographs only twice: once in the immediate postoperative period and once at K-wire removal. They used to perform only 2 follow-up examinations after K-wire removal, the first after 2 to 3 weeks and the second 2 to 3 weeks after the first. With CRW, the caregivers were satisfied with the wrist cosmesis at the first visit after K-wire removal. By the second visit after K-wire removal, most patients achieved full wrist range of motion and were discharged from observation. McLauchlan et al[9] and Ozcan et al[21] has also observed increased follow-up intervals and decreased radiographic frequency in patients treated with K-wire fixation. The outcome of the current study showed complete recovery and adequate range of motion with no complications.

Conclusion

In completely displaced PDR fractures the Kapandji method is useful in achieving and maintaining adequate reduction. Near-anatomical closed reduction was easily achieved with minimal force by this technique. The casting period can be reduced with no fear of re-displacement and clinical deformity. The authors recommend kapandji technique in all completely displaced PDR fractures that require reduction under an aesthesia.

References

1. Randsborg PH, Gulbrandsen P, SaltyteBenth J, et al. Fractures in children: epidemiology and activity-specific fracture rates. J Bone Joint Surg Am. 2013; 95(7):e421- e427.
2. Fernandez DL. Conservative treatment of forearm fractures in children. In: Chapchal G, ed. Fractures in Children. New York, NY: Thieme-Stratton; 1981.
3. Woodbury DF, Fischer B. An overriding radius fracture in a child with intact ulna: management considerations. Orthopaedics. 1985; 8:763-765.
4. Skillern PG Jr. Complete fracture of the lower third of the radius in childhood with greenstick fracture of the ulna. Ann Surg. 1915; 61:209-225.
5. Compere CL, Carr CR, Tracy HW. Management of fractures of the distal forearm in children. South. Med J. 1965; 57:540-550.
6. Gibbons CL, Woods DA, Pailthorpe C, Carr AJ, Worlock P. The management of isolated distal radius fractures in children. J PediatrOrthop. 1994; 14:207-210.
7. Zamzam MM, Khoshhal KI. Displaced fracture of the distal radius in children: factors responsible for redisplacement after closed reduction. J Bone Joint Surg Br. 2005; 87:841-843.
8. Proctor MT, Moore DJ, Paterson JM. Redisplacement after manipulation of distal radial fractures in children. J Bone Joint Surg Br. 1993; 75:453-454.
9. McLauchlan GJ, Cowan B, Annan IH, Robb JE. Management of completely displaced metaphyseal

fractures of the distal radius in children: a prospective, randomised controlled trial. J Bone Joint Surg Br. 2002; 84:413-417.

10. Mani GV, Hui PW, Cheng JC. Translation of the radius as a predictor of outcome in distal radial fractures of children. J Bone Joint Surg Br. 1993; 75:808-811.
11. Kamat AS, Pierse N, Devane P, Mutimer J, Horne G. Redefining the cast index: the optimum technique to reduce redisplacement in pediatric distal forearm fractures. J PediatrOrthop. 2012; 32(8):787-791.
12. Mostafa MF, El-Adl G, Enan A. Percutaneous Kirschner-wire fixation for displaced dise815 ORTHOPEDICS | Healio.com/Orthopedics n Feature Article tal forearm fractures in children. Acta Orthop Belg. 2009; 75:459-466.
13. McQuinn AG, Jaarsma RL. Risk factors for redisplacement of pediatric distal forearm and distal radius fractures. J PediatrOrthop. 2012; 32(7):687-692.
14. Hove LM, Brudvik C. Displaced paediatric fractures of the distal radius. Arch Orthop Trauma Surg. 2008; 128:55-60.
15. Lefevre Y, Laville JM, Boullet F, Salmeron F. Early correction of paediatric malunited distal metaphyseal radius fractures using percutaneous callus osteoclasis ("calloclasis"). OrthopTraumatolSurg Res. 2012; 98(4):450-454.
16. De Courtivron B. Spontaneous correction of the distal forearm fractures in children. Paper presented at: European Pediatric Orthopaedic Society Annual Meeting; 1995; Brussels, Belgium.
17. Roberts JA. Angulation of the radius in children's fractures. J Bone Joint Surg Br. 1986; 68:751-754.
18. Hang JR, Hutchinson AF, Hau RC. Risk factors associated with loss of position after closed reduction of distal radial fractures in children. J PediatrOrthop. 2011; 31(5):501-506.
19. Alemdaroglu KB, Iltar S, Cimen O, Uysal M, Alagöz E, Atlihan D. Risk factors in redisplacement of distal radial fractures in children. J Bone Joint Surg Am. 2008; 90(6):1224-1230.
20. Choi KY, Chan WS, Lam TP, Cheng JCY. Percutaneous Kirschner wire pinning for severely displaced distal radial fractures in children. J Bone Joint Surg Br. 1995; 77:797-801.
21. Ozcan M, Memisoglu S, Copuroglu C, Saridogan K. Percutaneous Kirschner wire fixation in distal radius metaphyseal fractures in children: does it change the overall outcome? Hippokratia. 2010; 14(4):265-270.
22. Parikh SN, Jain VV, Youngquist J. Intrafocal pinning for distal radius metaphyseal fractures in children. Orthopedics. 2013; 36(6):783-788.
23. Strohm PC, Müller CA, Boll T, Pfister U. Two procedures for Kirschner wire osteosynthesis of distal radial fractures: a randomized trial. J Bone Joint Surg Am. 2004; 86(12):2621-2628.
24. Crawford SN, Lee LS, Izuka BH. Closed treatment of overriding distal radial fractures without reduction in children. J Bone Joint Surg Am. 2012; 94(3):246-252.