Zagazig University Medical Journal
www.zumj.journals.ekb.eg
https://doi.org/10.21608/zumj.2021.97325.2390 Volume 30, Issue 3, May 2024

Manuscript ID ZUMJ-2110-2390 (R1)
DOI 10.21608/ZUMJ.2021.97325.2390
ORIGINAL ARTICLE

Percutaneous K wire fixation for Paediatric monteggia fracture

Saad B. S. Alzyani[1 *], **El Sayed E. Soudy**[2], **Ahmed M. Abdel Wahab**[2], **Ehab M. Shehata**[2]
[1] Orthopedics and Traumatology Department, Faculty of Medicine – Tripoli University- Libya
[2] Orthopedics and Traumatology Department, Faculty of Medicine, Zagazig University, Egypt

***Corresponding Author:**
Saad Bashir Saad Alzyani, Orthopedics and Traumatology Department, Faculty of Medicine, Tripoli University- Libya
E-mail: Sdalzyany20@gmail.com

Submit Date 2021-11-04
Revise Date 2021-11-29
Accept Date 2021-12-03

ABSTRACT

Background: Monteggia, an Italian surgeon, first to describe the combination of a proximal ulna fracture and dislocated radial head. With the use of Kirschner wires, surgical stabilization could be achieved. The aim of the study was to determine closed reduction and percutaneous k-wire fixation can maintain satisfactory reduction and fixation in pediatric Monteggia fractures.

Methods: Twelve patients with Monteggia fractures were admitted to Zagazig University Hospital and Tripoli University Hospital-Libya in this prospective study. All were treated by close reduction and percutaneous k-wire fixation. Postoperatively, patients were weekly dressed and checked for pin sites. AP / Lat X-rays elbow at 6 weeks for fracture union, wires removed. Using the Stewart Hundley, VAS, Mayo, and DASH scoring systems, the elbow and forearm were evaluated for a range of motion in all directions.

Results: Age was distributed as 7.88±2.63 years, regarding gender distribution males were 55.6% and females were 44.4%. Mechanism of injury FD was majority with 72.2% and DT 27.8%. Bado classification majority were type I 41.7%, type II 33.3%, type III 25%, and type IV no cases. The time of union was distributed as 2.72±0.80 months. Stewart Hundley's score excellent was the majority with 83.3%, good 8.3%, and fair 8.3%. Mayo's score was distributed as 88.33±10.44; regard Mayo's excellent were majority with 66.7% then good and fair with 16.7% each. And regarding DASH excellent was also the majority but with 61.1% then good 22.2% then fair 11.1% then poor only one case 5.6%.

Conclusions: Closed Reduction and Percutaneous Kirschner Wires Fixation of Monteggia Fracture in Children are less invasive, and give satisfactory radiological and clinical outcomes. Percutaneous interventions could be an option for Monteggia Fracture in Children.

Keywords: Percutaneous Kirschner Wires Fixation, Monteggia Fracture Management.

INTRODUCTION

In 1814, Italian surgeon Giovanni Batista Monteggia described the combination of a proximal ulna fracture and radial head dislocation. [1].

Only 0.4 percent of all forearm fractures in children and 1 percent of all pediatric upper extremity fractures involve a Monteggia fracture [2].

An outstretched hand or pronated forearm can

cause a Monteggia fracture-dislocation as well as a direct blow to the forearm which could be attributed to traffic accidents, typically manifested restriction in movement of the elbow joint and pain with swelling and bruising, as well as forearm and elbow deformities [3].

Dissociation was possible because both the proximal radioulnar joint, and the radiocapitellar, were torn apart by ruptured annulus and quadrate ligaments, interosseous membrane and triangular fibrocartilage complex are intact, nevertheless, this is because the anatomic reduction of the ulnar fracture, which preserves these radioulnar connections, usually restores congruity of the proximal radioulnar joint and, therefore, the radiocapitellar articulation [4].

Monteggia fractures have a variable location of the ulnar shaft fracture, with 60 percent of cases occurring between the middle and proximal third of the ulnar shaft, 15 percent in the middle third, and 25 percent in either the olecranon region or distal ulnar shaft, with no significant difference. When it comes to the ulnar fracture, it can appear as a complete greenstick fracture, or as a simple bowing of the ulnar ridges [5].

The distal radius and/or ulna can be injured as a result of the child's wrist injury. For this reason, a thorough physical examination of the hand, wrist, and entire forearm are essential to prevent secondary injuries from occurring [6].

Bado divided the Monteggia lesions into four groups based on fracture patterns: When the radial head dislocates, the ulnar shaft is always angulated in the same direction, An extension-type ulnar fracture accompanied by anterior displacement of the radial head characterizes type 1. Among Monteggia fractures, this is the most common fracture type. After an angle of 90 degrees, the ulnar shaft fractures are classified as type 2. (It's rare to see the ulnar shaft rotate and the radial head dislocates at the same time, but it does happen occasionally Flexion-type ulnar fracture). Due to this, the dorsally dislocated radial head is in type three. As with type 1, the ulnar shaft fracture and radial head dislocation patterns are similar in type 4, but there is an additional radial shaft fracture at the distal end of the ulna [7].

If the ulnar malalignment has not been corrected, repositioning the dislocated radial head is the primary goal of treatment. Repositioning the Monteggia fracture usually requires general anesthesia because the goal of fracture treatment in childhood is to minimize pain [8].

Surgery to stabilize the ulna has become more common in recent years in the treatment of Monteggia lesions. A secondary displacement and subsequent radial head redislocation are to be avoided with this technique; we believe that surgical stabilization should be performed because general anesthesia is administered at the time of primary reduction. Kirschner wires and intramedullary elastic nailing techniques can be used to perform this procedure with the least amount of invasiveness possible. If the fracture is greenstick, bowing, or incomplete, the remaining ulnar flexibility can prevent the radial head from being retained during cast immobilization. To neutralize the forces, the ulna should be completely fractured. The radiocapitellar joint and ulnar alignment can also be protected by a present K wire [1].

Among the risk factors for a poor outcome are delayed treatment, forearm rotation restriction, ulnohumeral instability, and in the case of very proximal ulnar lesions arthrosis and incongruity of the ulnohumeral joint [9].

We aimed in this work to determine whether closed reduction and percutaneous k-wire fixation can maintain satisfactory reduction and fixation of the elbow joint in the surgical management of Monteggia fractures in children.

METHODS

Patients and Methods:

This prospective cohort study was conducted on 12 patients with Monteggia fractures who were admitted to the Orthopedic Department of Zagazig University Hospital and Tripoli University Hospital-Libya during the period from 02/2021 to 09/2021. Written informed consent was obtained from all participants, the study was approved by the research ethics committee of the Faculty of Medicine, Zagazig University. The study was done according to

The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

Inclusion criteria:

Patients with acute monteggia fracture dislocation, less than two weeks, aged from 3 to 15 years old.

Exclusion criteria:

Patients with missed monteggia fracture dislocation after two weeks, children with preexisting vascular or neurological deficits, and patients with infection at the operation site.

Operational design:

Careful history taking was done for all patients as full history, name, age, sex, cause and the time of injury, any previous injuries and previous surgical interventions, any medical comorbidity, and medications. Detailed orthopedic examination and clinical evaluation. Primary stabilization of the patients was done. X-ray films with an anteroposterior and Lateral view were obtained, and all patients in the study were classified according to Bado classification. Under general anesthesia, supine position, an aseptic condition was preserved for the patient to perform the surgery. Using longitudinal traction on the forearm with the elbow bent, the pressure was applied on the radial head to reduce a dislocation, in patients with extension fracture-dislocation. Traction on the forearm with extended elbow and pressure over the radial head also reduced the adduction injury, closed reduction was done to reduce the dislocated radial head by gentle pressure, with gentle traction on the forearm and counter traction the arm, the fracture was reduced by using K-wire. Starting at the olecranon process of the ulna. The average k-wire diameter varied from 1.5 – 2 mm for children younger than 9 years and 2 – 3 mm for those aged 9 – 12 years. As soon as the k-wire crossed the metaphyseal area, it was inserted in an ante grade fashion, crossing the apophysis, and aiming towards the center of the medullary canal in AP and Lateral views under C-arm control, in order to reduce the proximal ulnar deformity, and then passed down the medullary canal by gently rotating the proximal metaphysis, once reached the fracture site. Traction, rotation, and angulation correction are used to correct the fracture site. In the opposite fragment, the medullary canal and positioned up to the metaphyseal area of the ulna without crossing physics can be achieved. The k-wire impacted then bent, cut, and dressing gauze is applied around the k-wire end. Above the elbow, a cotton sleeve is applied. POP is applied to the elbow in 100°-110° flexion and supination to maintain the reduction of the radial head, weekly X-rays for the first three weeks after surgery to ensure good reduction, good position of the k-wire, and good alignment of the ulna. K-wires were removed at 6 weeks, and patients were advised to begin active elbow and wrist movement. Two months of no high-impact and group sports were recommended to reduce the risk of refracture. Patients with pin tract infections were identified. Local pin site care and a short course of oral antibiotics were successful in treating this condition. Using the Stewart Hundley Score, VAS, Mayo elbow, and DASH scoring systems, the elbow, and forearm were evaluated for a postoperative range of motion in all directions (flexion, extension, supination, and pronation).

Statistical analysis

Microsoft Excel software was used to code, enter, and analyze data collected during the patient's History, basic clinical examination, laboratory investigations, and outcome measures. We analyzed the collected information Depending on the data type (qualitative or quantitative), by a statistical package called SPSS (Statistical Package for the Social Sciences version 20.0) The P value was set at 0.05 for significant results, and at >0.001 for highly significant results. The following tests were used to test the significance of differences based on the type of data: Differences and associations between qualitative variables using the Chi-square test (X2). Differentiation between quantitatively independent groups using the t-test. An acceptable P-value was set at 0.001 for highly significant results.

RESULTS

The demographic data of the studied groups were regarded males 58.3% and females 41.7% and the mean age was 8.0±2.86 years.

The majority were right at 58.3% and left at 41.7%, Regarding mechanism, FD was the majority with 75.0% and DT at 25.0%, Regarding Bado classification majority were I with 41.7% then II at 33.3% then III at 25.0% and no case IV.

The time of union was distributed as 2.87±0.83 with a minimum of 2 and a maximum of 4 months.

Stewart distribution among the studied group showed that excellent was the majority with 83.3%, good at 8.3%, and fair at 8.3% (Table 1).

VAS was distributed as 1.55±1.5 with a median of 1.0 and minimum of 0 and maximum of 5 (Table 2).

Mayo score was distributed as 88.58±10.95 and DASH score was 9.75±8.67, regard Mayo excellent was majority with 75.0% then fair with 16.7%, and good 8.3%, and regard DASH excellent was also majority but with 75.0% then good, fair and poor with 8.3% each (Table 3).

Table 1: Stewart distribution among the studied group (N=12).

		N	%
Flexion elbow	Excellent	10	83.3
	Good	0	0.0
	Fair	2	16.7
Extension elbow	Excellent	9	75.0
	Good	2	16.7
	Fair	1	8.3
Supination	Excellent	10	83.3
	Good	0	0.0
	Fair	2	16.7
Pronation	Excellent	9	75.0
	Good	2	16.7
	Fair	1	8.3
Elbow Stewart movement	Excellent	10	83.3
	Good	1	8.3
	Fair	1	8.3
	Total	12	100.0

Table 2: Table 2. VAS distribution among the studied group (N=12):

	VAS
Mean± SD	1.55±1.50
Median (Range)	1.0 (0-5)

Table 3: Mayo and DASH score distribution among the studied group (N=12).

		MAYO score	DASH score
Mean± SD		88.58±10.95	9.75±8.67
Median (Range)		93.0 (62-96)	4.5 (3-36)
		N	%
Outcome Based on MAYO	**Excellent**	9	75.0
	Good	1	8.3
	Fair	2	16.7
Outcome Based on DASH	**Excellent**	9	75.0
	Good	1	8.3
	Fair	1	8.3
	Poor	1	8.3
	Total	12	100.0

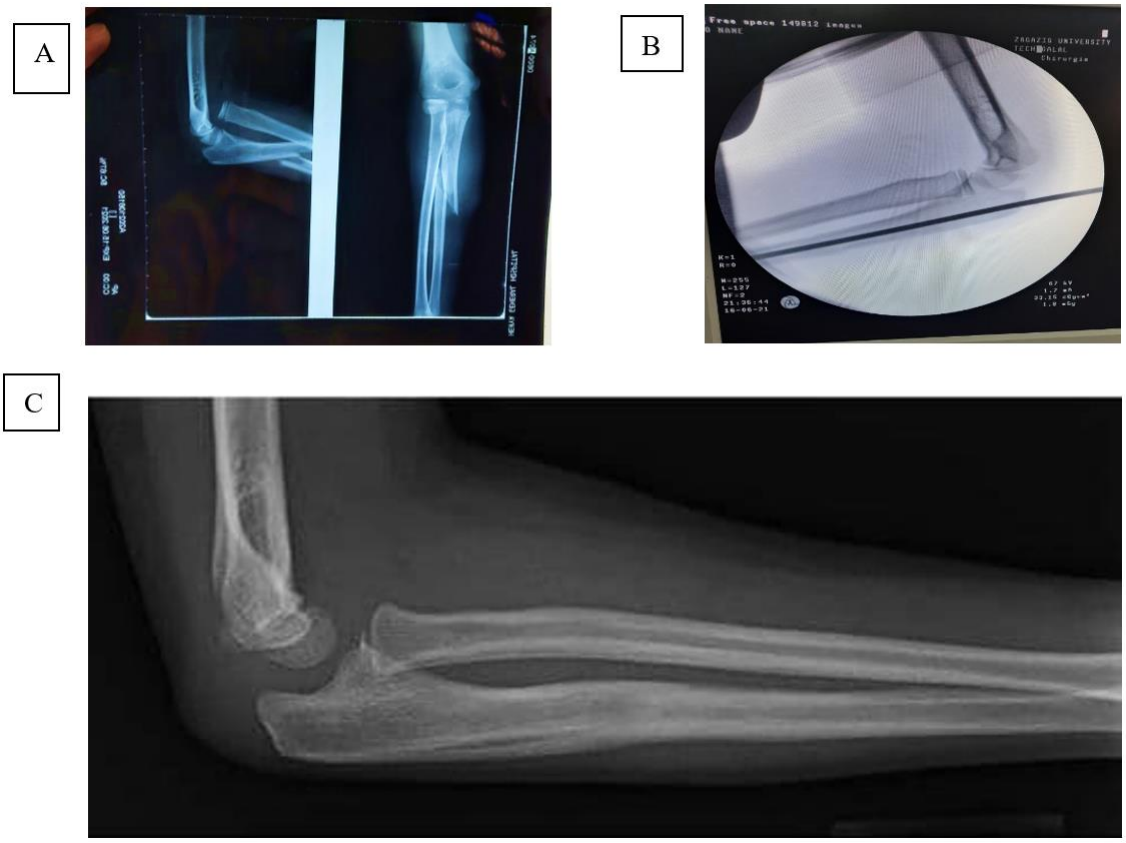

Figure 1: (A) Male patient 9 years old presented with a history of falling from the swing, Bado type 1, and the operation was done the same day of admission, gentle traction was applied on the forearm and gentle pushing of the head of the radius applied and anatomical reduction obtained k wire inserted, the patient follow up for six (6) months and final result according to Stewart handly, VAS and DASH scoring system was excellent. The boy =, sustaining a Bado type-I Monteggia injury (B) Intraoperative CMR and wiring, (C) Check x-ray.

DISCUSSION

Monteggia fractures, it is usually caused by a fall on an outstretched hand, a direct blow to the proximal forearm, or as a result of a road traffic accident injury, and is characterized by pain, swelling, and bruises as well as restriction of elbow joint movement and deformity of the forearm and elbow joint [3].

The implant used for intramedullary fixation varies. The titanium pins [10,11]. We're different from those used in Rush pins [12]. The final results were not affected by this variation in implants. K-wires and elastic stable intramedullary nails were the subjects of a comparative study, which found no difference between the two implants [13].

Using closed reduction and percutaneous k-wire fixation, this study evaluated the clinical and radiological outcomes of Monteggia fractures in children.

From February 2021 to September 2021, 12 patients with Monteggia fractures were admitted to the Orthopedic Departments of Zagazig and Tripoli University Hospitals.

Maximum and minimum ages ranged from 4 to 12 years, with 58.3% males and 41.7 % females.

In accordance with many authors, the onset of pediatrics Monteggia fractures occurs around the age of 10 [6,7].

Males were more likely than females to suffer a Monteggia fracture as children, according to numerous research studies [9,10]. As a result of males' greater involvement in sports and traffic, they are more prone to injuries. In contrast, other sources have reported similar numbers. Males made up 58.3 percent of our study,

while females made up 41.7 percent.

About 67.8% of pediatric Monteggia fractures occurred on the right side of the body, while 32.2 percent occurred on the left side [14]. Closed reduction and percutaneous K-wires fixation of Monteggia fracture in children did not affect the Side – right: left ratio of 7:14, as reported in another study[15].

The majority of Monteggia fractures were caused by FD (75.0 percent) and DT (25.0 percent) in the present study. A study found that 60.0 percent of Monteggia fractures were due to FD, (40.0 percent) due to DT [16].

According to our research, the mean time to union was 2.87±0.83, with a minimum of 2 and a maximum of 4 months [17,18].

Based on Bado's classification, our study showed that the majority of cases were type I 41.7% then type II 33.3% then type III 25.0% and no case type IV which correlated with studies of showed 79% of cases to be Type-I, 12% of cases Type II, 6% of cases Type III, and 3% of cases Type IV [19]. In the studied group the Dislocations were Type I 14.5%, Type II 79.25%, Type III 2.09%, and Type IV 4.16% [9]. About 70% Type I, 18% Type II, 12% Type IV, and none are Type III, according to one study group [20].

The functional result of our cases was assessed by determining the range of motion and evaluated using the Stewart-Hundley scoring system [21]. Excellent was the majority with 83.3%, good at 8.3%, and fair at 8.3%.

One study reported that 37.5 percent of cases had excellent results, 43.75 percent had satisfactory results, 8.5 percent had unsatisfactory results, and 10.45 percent had failures [9]. reported that 30 percent of the cases were satisfactory, 20 percent were unsatisfactory, and 50 percent were failures, according to his research [22].

No case had excellent outcomes. Unsatisfactory cases make up 58% of the cases, while nonunion cases make up 23% [23]. Sixty-seven percent of respondents had excellent results, while 15% reported satisfactory results and 18 percent reported unsatisfactory ones, according to previous reports [24].

VAS was distributed as 1.55±1.5 with a median of 1.0 and minimum of 0 and a maximum of 5. Closed reduction and percutaneous k-wires fixation of Monteggia fracture in children has been described by many authors as providing rapid pain relief [20,25-27].

Despite the fact that some authors did not use postoperative immobilization and allowed early postoperative motion [28]. After surgery, some doctors recommended a brief period of immobilization [29, 30]. support the idea of supplemental plaster cast immobilization after intramedullary fixation after intramedullary fixation by K-wires; they recommend a plaster cast immobilization as a supplement [31].

On the other hand, a multi-center study found two cases where the union was delayed in patients. There were no cases of a delayed union in our study [32].

Plate and intramedullary fixation will provide worthwhile functional results in the treatment of Monteggia fracture in children, when compared to plating, intramedullary nailing was found to be safe, effective, and easy to perform in the treatment of Monteggia fracture in children [33].

Limitations of this study: Small sample size, Short period of follow-up, lack of comparative study with another method of treatment.

CONCLUSION

Closed Reduction and Percutaneous Kirschner Wire Fixation were used on our patients who had Monteggia Fractures. Supination and pronation were achieved to a near-anatomical degree, as well as full flexion and extension in the final stages. Percutaneous reduction with Kirschner Wires can be performed successfully. As a result of their less invasive techniques. Closed Reduction and Percutaneous Kirschner Wires Fixation of Monteggia Fracture in Children is indicated with excellent and good results.

REFERENCES

1. Rehim SA, Maynard MA, Sebastin SJ, Chung KC. Monteggia fracture-dislocations: a historical review. J Hand Surg Am. 2014; Jul;39(7):1384-94.
2. Yuan Z, Xu H, Li Y, Li J, Liu Y, Canavese F. "Functional and radiological outcome in patients with acute Monteggia fracture treated surgically: a comparison between closed reduction and external fixation versus closed reduction and elastic stable intramedullary nailing. J Pediatr Orthop B. 2020; 29(5):438-444.
3. Benjamin HJ, Hang BT. Common acute upper extremity injuries in sports. Clini Pediatr Emerg Med Pract. 2007; 8(1):15-30.
4. Eathiraju S, Mudgal CS, Jupiter JB. Monteggia fracture-dislocations. Hand clin. 2007; 23(2): 165-77.
5. Ogden, John A. Skeletal injury in the child. Springer Science & Business Media Apr 28. (2006).
6. Theodorou SD, Ierodiaconou MN, Roussis N. Fracture of the upper end of the ulna associated with dislocation of the head of the radius in children. Clin Orthop Relat Res. 1988; (228):240-9.
7. Bado JL.(1967). "7 the Monteggia Lesion." Clinical Orthopaedics and Related Research (1976-2007) 50: 71-86.
8. Morrey BF, Sotelo JS, Morrey ME. Morrey's The Elbow and Its Disorders E-Book. Elsevier Health Sciences. (2017).
9. Ring D, Tavakolian J, Kloen P. Loss of alignment after surgical treatment of posterior Monteggia fractures: salvage with dorsal contoured plating. J Hand Surg Br. 2004; 29(4), 694-702.
10. Toussaint D, Vanderlinden C, Bremen J. Stable elastic nailing applied to diaphyseal fractures of the forearm in children. Acta Orthop Belg. 1991;57(2), 147-53.
11. Amit Y, Salai M, Chechik A, Blankstein A, Horoszowski H. Closing intramedullary nailing for the treatment of diaphyseal forearm fractures in adolescence: a preliminary report. J Pediatr Orthop. Mar-Apr 1985;5(2):143-6.
12. Popkov D, Lascombes P, Journeau P. Popkov A. Current approaches to flexible intramedullary nailing for bone lengthening in children. J Child Orthop. 2016; 10(6), 499-509.
13. Calder PR, Achan P, Barry M. Diaphyseal forearm fractures in children treated with intramedullary fixation: outcome of K-wire versus elastic stable intramedullary nail. Injury, 2003;34(4), 278-82.
14. VILLASENOR-OVIES, Pablo. Clinical anatomy of the elbow and shoulder. Rheumatol Clin. 2012;8: 13-24.
15. Palastanga N, Soames RW, Palastanga D. Anatomy and Human Movement Pocketbook E-Book. Elsevier Health Sciences (2016).
16. Adamczyk G. Biomechanics of the Elbow Joint in Overhead Athletes. In Elbow and Sport (pp. 13-21). Springer, Berlin, Heidelberg (2016).
17. Rahman M, Sharifi Renani M, Cil A, Stylianou AP. Musculoskeletal model development of the elbow joint with an experimental evaluation. Bioengineering. 2018; 5(2): 31.
18. Hubbard J, Chauhan A, Fitzgerald R, Abrams R, Mubarak S, Sangimino M. Missed pediatric Monteggia fractures. JBJS reviews. 2018; 6(6), e2.
19. Reckling FW. Unstable fracture-dislocations of the forearm (Monteggia and Galeazzi lesions). J Bone Joint Surg Am. 1982 Jul;64(6):857-63.
20. Wilkins KE. Changes in the management of Monteggia fractures. J Pediatr Orthop. 2002; 22(4), 548-54.
21. Lammens J, Bauduin G, Driesen R. Treatment of nonunion of the humerus using the Ilizarov external fixator. Clin Orthop. 1998; 353:223–30.
22. Son WP, Fanelli DG, Winthrop ZP. Acute Monteggia Fractures in Children. In Pediatr Elbow Fractures. 2018; 185-94.
23. Bookman J S, Mclaurin TM. Monteggia Fracture-Dislocation: Ulna Fixation Only. In: Fractures of the Elbow. 2019; 151-8.
24. Jungbluth P, Tanner S, Schneppendahl J, Grassmann JP, Wild M, Hakimi M, et al, The challenge of Monteggia-like lesions of the elbow: mid-term results of 46 cases. J Bone Joint Surg. 2018; 100(2), 212-8.
25. Mathur N, Lau KK. Monteggia fracture: an easy fracture to miss. Emerg Radiol. 2020. 27(4), 377-81.
26. Jungbluth P, Tanner S, Schneppendahl J. The challenge of Monteggia-like lesions of the elbow: mid-term results of 46 cases. J Bone Joint .2018;100(2), 212-8.
27. Ring D, Jupiter JB, Waters PM. Monteggia fractures in children and adults. JAAOS- J Am

Acad Orthop Surg Glob Res Rev. 1998; 6(4), 215-24.

28. Schulte D, Habernig S, Zuzak. Forearm fractures in children: split opinions about splitting the cast. Eur J Pediatr Surg. 2014; 24(02), 163-7.
29. Bhaskar A. Missed Monteggia fracture in children: Is annular ligament reconstruction always required? Indian J Orthop. 2009; 43(4), 389.
30. Moro JK, Werier J, MacDermid J. Arthroplasty with a metal radial head for un reconstructible fractures of the radial head. JBJS, 2001; 83(8), 1201-11.
31. Luhmann SJ, Gordon JE, Schoenecker PL. Intramedullary fixation of unstable both-bone forearm fractures in children. J Pediatr Orthop. 1998; 18(4), 451-6.
32. Lieber J, Joeris A, Knorr P. ESIN in pediatric Montagenia fractures. Eur J Trauma. 2005; 31:3-11.
33. Visna P, Beitl E, Pilny J."Interlocking nailing of pediatric Montagenia fractures." Acta Chir Belg. 2008;108(3): 333-8.T

To Cite:

Alzyani, S., soudy, E. S., abdelwahab, A., Shehata, E. Percutaneous K wire fixation for Paediatric monteggia fracture. Zagazig University Medical Journal, 2024; (786-793): -. doi: 10.21608/zumj.2021.97325.2390