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ORIGINAL ARTICLE

Comparative study between K-Wires and Cannulated Screws in Fixation of Lateral Condyle Fracture in Children

Mohamed Abdel Fattah Sabaei[1], Khaled Edris Abdel Rahman[2], Mohamed Ahmed Ibrahim Mohamed[3], Mahmoud Elsayed Elbadawy Thabet[4]
1 Assistant Professor of Orthopedic Surgery, Faculty of Medicine, Zagazig University.
2 Professor of Orthopedic Surgery, Faculty of Medicine, Zagazig University.
3 MBBCH, Faculty of Medicine, Zagazig University.
4 Assistant Professor of Orthopedic Surgery, Faculty of Medicine, Zagazig University.

Corresponding author:

Mohamed Ahmed Ibrahim Mohamed

Email:

dr.mido201227@gmail.com

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ABSTRACT

Background: Several methods could be utilized for lateral condyle fractures fixation among children. Among metallic implants used for this fracture fixation, smooth Kirschner wires (K-wires) may be the most commonly used. This research aimed to compare between functional outcome of fixation of displaced lateral condyle fracture in pediatric age group by two different methods, either k wires or cannulated screws.

Methods: We carried out this prospective clinical study in Orthopedic Surgery department of Zagazig University Hospitals on 24 children with lateral condyle humeral fractures, who were categorized into two groups: Group 1: included 12 participants who were subjected to open reduction and internal fixation using K- wires, Group 2: included 12 participants who were subjected to open reduction and internal fixation using partially threaded 4 mm cannulated screws, with follow up period started from third day after operation till six months. We used Mayo Elbow Performance Score (MEPS) for assessment of functional outcome.

Results: In the K-wire group 75% of cases had excellent MEPS and 16.7% of cases had good MEPS. While in cannulated screw group, 83.3% of patients had excellent MEPS and 8.3% had good MEPS, 33.3% of children in K-wire group had lack of 10° of extension and 16.7% had flexion <120°, 8.3% of children in cannulated screw group had flexion <120°, The percentage of motion deficiencies, radiological deformities, complications were significantly higher after K-wire than after cannulated screw (p=0.028, 0.016, and 0.047 respectively).

Conclusion: Fixation for displaced lateral condyle fractures using cannulated screw has privilege over k-wire regarding post-operative range of motion, radiological outcomes and complications.

Keywords: Fixation, Lateral Condyle Fracture, K-Wires, Cannulated Screws.

INTRODUCTION

In children, 10–20% of all elbow fractures are lateral condyle fractures of the humerus, making them the second most prevalent type of elbow injury. Fractures affecting the lateral condyle typically occur in children around the age of six. Among the many possible problems that might arise from these fractures are: physeal arrest, neurological damage, fishtail deformity, osteonecrosis, cubitus

valgus or varus, avascular necrosis of ossific nucleus, and nonunion or mal union [1].

Avulsion of the condyle from a supinated forearm or radial head impaction on the capitellum from a fall onto an outstretched hand are two potential ways this injury might occur [2]. One non-operative alternative for lateral condyle fractures is plaster cast immobilization, which is used for fractures that are not displaced or only slightly displaced stable. Operative treatment is required for the displaced fractures of more than 2 mm [3].

The majority of metallic implants used to fixate fractures are smooth Kirschner wires, more commonly known as K-wires. Skin necrosis, pin-site infection, as well as pain are among the relatively prevalent complications linked to K-wire fixation. In addition, K-wire attachment does not offer enough rigid fixation and constricts early mobilization [4]. So, the current research aimed to compare between functional outcome of fixation of displaced lateral condyle fracture in pediatric age group by two different methods, either k-wires or cannulated screws.

METHODS

We carried out this prospective clinical study in the Orthopedic Surgery department of Zagazig University Hospitals on 24 children with lateral condyle humeral fractures, who were categorized into two groups: Group 1: included 12 patients who were subjected to open reduction and internal fixation using K- wires, Group 2: included 12 patients who were subjected open reduction and internal fixation using partially threaded 4 mm cannulated screws.

After institutional review board approval of IRB (#6939), Participants' parents were requested to sign an informed consent form. Following the guidelines laid out in the Declaration of Helsinki—a component of the Code of Ethics for Research Involving Humans—the study was carried out in compliance with the World Medical Association's Code of Ethics. Participation in this trial was restricted to children under the age of 12 who had a displaced lateral condyle humerus fracture. Neglected cases were excluded.

Every patient had a thorough medical history taken, with assessment of radial and median nerves and brachial pulsation. There were no neurovascular injuries. Early the primary management in the emergency department (ER) included providing all children with a well-padded above-elbow slab, sufficient analgesics, and close monitoring following the assessment and resuscitation.

***Radiological evaluation*:** Anteroposterior, Lateral and Internal oblique x-rays were applied for evaluation of the fracture pattern and displacement. Radiographic evaluation of the fracture was performed. An analysis was conducted to measure and record the displacement of the fracture fragment. The fracture gap was calculated by measuring the distance between the distal humerus's lateral metaphyseal cortex and the fracture fragment's lateral cortex. Total fracture displacement was defined as the largest displacement that could be detected by a single radiograph.

Laboratory investigations: Routine preoperative laboratory tests included: complete blood picture, kidney profile, liver profile, random blood sugar, and coagulations profile.

All patients were operated under general anesthesia. All of our patients received intravenous 3rd generation cephalosporin 30 minutes prior to the skin incision. All patients in supine position in the operation table with the affected elbow on the arm table and tourniquet applied.

Surgical technique

General anesthesia has been administered to every single patient. Patients were placed in a supine position, a tourniquet applied before operation. The use of intraoperative imaging (C-arm) was essential in all cases.

Following the administration of general anesthesia, the elbow underwent a traditional lateral approach. A lateral incision was done extending 4 to 6 centimeters proximal to the elbow joint and 2/3 of the distance distal to the joint. This incision was positioned between the brachioradialis and triceps muscles. The skin and subcutaneous layers were incised first, followed by the placement of the retractor and an incision in the fascia layers along the same line. The periosteum and soft tissues were spared as much harm as possible. To reveal the humerus's lateral supracondylar ridge, the extensor muscle was elevated. For exposing lateral condyle, only anterior dissection was performed and avoid as possible posterior dissection to avoid damage of blood supply. Anterior compartment muscle was lifted in the front. Dissection was performed down to the lateral humeral condyle. To preserve the vascular supply to the area, posterior dissection was minimized, and an anterior approach was employed for complete exposure of the lateral condyle.

The lateral humeral condyle was the target of the dissection.

The front surfaces of the joint were revealed by dividing the same extensor muscle mass's fibers. Just enough soft tissue was removed to expose the piece. It was common practice to rotate and shift the component as well. Following meticulous irrigation of the joint to remove debris and hematoma, the articular surface and metaphyseal fragment were reduced. Further observation of the articular surface, especially at the trochlea, confirmed the reduction. By dividing the common extensor muscle mass's fibers, surfaces were revealed. The amount of soft tissue that had to be detached in order to expose the fragment was strictly regulated. In most cases, the component was twisted in addition to being moved. To achieve and maintain accurate reduction, various instruments were utilized, including small tenacula, bone holders, towel clips, or percutaneous pins. Minimal dissection of the distal fragment's soft tissues was performed to meticulously define the articular surface and minimizing the avascular necrosis of the capitellum.

Fracture stabilization with K-wires or cannulated screws followed open reduction of the fracture. Screws or K-wires had to be threaded through the metaphyseal fragment. The K-wires were all inserted into the cracks by percutaneous methods. In a divergent technique, two smooth K-wires are passed through the medial humeral cortex, humeral metaphysis, and physis. Perpendicular to the fracture line, the guide wire was inserted. After ensuring adequate alignment, a 4 mm cannulated screw was inserted into the fracture site after drilling and tapping. With X-ray, we verified the accurate reduction. Stability was checked with elbow movement.

Postoperative:

A posterior splint was applied to the arm, right above the elbow, with elbow flexed at a 90-degree angle. Both the k-wire and cannulated screw fixations required the posterior splint to be worn for a duration of four weeks and two weeks, respectively. Following the operation, the patient was prescribed an oral broad-spectrum antibiotic and painkiller.

Follow up

The follow up started from third day after operation till 6 months. The patients were followed clinically during the first two weeks for assessment of the wound condition and removal of stitches. patients arranged for screw removal in operating theater after 8-10 weeks. Patients followed after 3 then 6 months to assess the complication of nonunion, mal union, range of motion of elbow joint.

Radiological monitoring of the patients was conducted utilizing X-ray AP and lateral views in the following ways: Evaluation of the fracture status will be conducted after three days. Postoperative problems, such as secondary displacement or infection, were documented monthly for a duration of six months during the follow-up period. To measure the functional outcome, the Mayo Elbow Performance score was used. The four subscales used by this particular test are pain, mobility, stability, and everyday functioning. Score of 100 overall, including a 90 for excellence. Good: 75–89, Fair: 60–74. The result is below 60, which is quite poor [5].

Statistical analysis

We used SPSS version 27 to do the statistical analysis. In order to illustrate continuous data, we used standard deviations and means, and for categorical data, we used frequencies and percentages. When comparing continuous variables, independent t-tests were employed. When comparing categories of variables, we used Fisher's exact test or chi-square.

RESULTS

The patients' ages when the fractures occurred varied from 2.5 to 8 years. The majority of included children in both groups were males, Side of injury was right in 54.2% and left in 45.8%. The Mechanism of injury was fall from height in the majority of included children (83.3%) and road traffic accident in 16.7%,66.7% of children in K-wire group had Jackob III fracture and 33.3% had Jackob II fracture. 83.3% of children in cannulated screw group had Jackob III fracture. The displacement of fracture was 5.85±1.98 mm in K-wire group and 5.4±1.64 mm in cannulated screw group (Table 1).

With no statistically significant difference between the groups, the time it took for both groups to union ranged from 6 weeks to 10 weeks. One child in the cannulated screw group and two children in the K-wire group experienced non-union (Table 2).

Regarding outcome, 75% of patients in K-wire group had excellent MEPS and 16.7% of patients in the same group had good MEPS. While in cannulated screw group, 83.3% of patients had excellent MEPS and 8.3% had good MEPS with non-statistically significant difference between the both groups (Table 3).

Regarding post-operative range of motion, the flexion and extension were 125.4±10.33 and 8.8±4.37, respectively in k-wire group. The flexion

and extension were 132.9±17.22 and 5.83±1.25, respectively in cannulated screw group. The post-operative total range of motion was significantly higher in cannulated screw group than in K-wire group (p=0.011). Regarding post-operative deficiencies in ROM, 33.3% of children in K-wire group had lack of 10° of extension and 16.7% had flexion <120°, 8.3% of children in cannulated screw group had flexion <120°. The percentage of motion deficiencies was higher after K-wire than after cannulated screw (p=0.028) (Table 4).

Regarding radiological deformities, lateral prominence was observed in 3 children underwent fixation using k-wire, while no cases with lateral prominence were observed in cannulated screw group. A single patient in the K-wire group exhibited a fish-tail deformity. Non-union occurred in 2 patients in K-wire group and one child in cannulated screw group. The percentage of radiological deformities was significantly higher in k-wire group than cannulated screw group (p=0.016) Regarding complications, 2 children who underwent fixation using K-wires suffered from superficial infection and 2 children suffered from elbow stiffness. Compared to the cannulated screw group, the k-wire group had a significantly higher percentage of complications (p=0.047). Antibiotics taken orally and applied topically were effective in treating the infections, the K-wires were held in place by plaster splinting was increased to seven or eight weeks (Table 5).

A 6 years old male had a left humeral lateral condyle fracture of Jackob type II, managed using cannulated screw, time to union was 9 weeks he had postoperative excellent MEPS with no complications (Figure 1).

A 4 year old male, had a left humeral lateral condyle fracture Jackob type III, managed using K-wire, time to union was 6 weeks he had postoperative excellent MEPS with no complications (Figure 2).

Table (1): Baseline characters of included patients both studied groups (n=24)

	Total	**K-wire**	**Cannulated screw**	**MD**	**P value**
age	5.55±2.38	5.47±2.58	5.63±2.22	0.2	0.8
	N (%)	**N (%)**	**N (%)**	**X^2**	**P value**
Gender					
male	16(66.7%)	7(58.3%)	9(75%)	0.75	0.386
female	8(33.3%)	5(41.7%)	3(25%)		
	Total	**K-wire**	**Cannulated screw**	**X2**	**P value**
	N (%)	**N (%)**	**N (%)**		
Side of injury					
right	13(54.2%)	7(58.3%)	6(50%)	2.68	0.168
left	11(45.8%)	5(41.7%)	6(50%)		
Mechanism of injury					
Fall from height	20(83.3%)	9(75.0%)	11(91.7%)	1.2	0.273
road traffic accident	4(16.7%)	3(25.0%)	1(8.3%)		
	Total	**K-wire**	**Cannulated screw**	**X2**	**P value**
type	**N (%)**	**N (%)**	**N (%)**	0.889	0.346
Jackob II	6(25%)	4(33.3%)	2(16.7%)		
Jackob III	18(75.0%)	8(66.7%)	10(83.3%)		
	mean±SD	mean±SD	mean±SD	MD	P value
Displacement (mm)	5.63±1.79	5.85±1.98	5.4±1.64	0.5	0.5

Table (2): Time to union both studied groups (n=24)

	Total	K-wire	Cannulated screw	Fisher exact test	P value
	N (%)	N (%)	N (%)		
6 weeks	6(25.0%)	4(33.3%)	2(16.7%)	4.602	0.52
7 weeks	7(29.2%)	4(33.3%)	3(25%)		
8 weeks	4(16.7%)	2(16.7%)	2(16.7%)		
9 weeks	2(8.3%)	0(0%)	2(16.7%)		
10 weeks	2(8.3%)	0(0%)	2(16.7%)		

Table (3): Mayo Elbow Performance Score (MEPS) both studied groups (n=24)

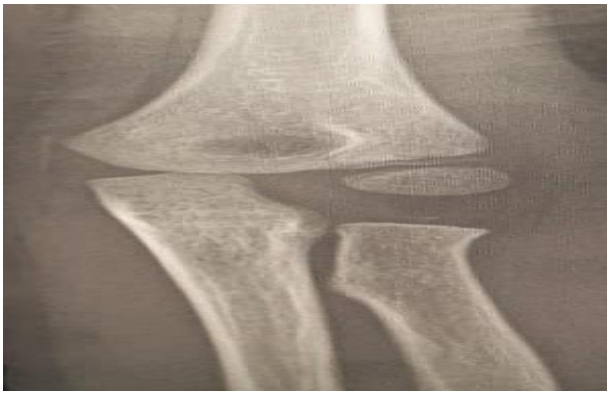
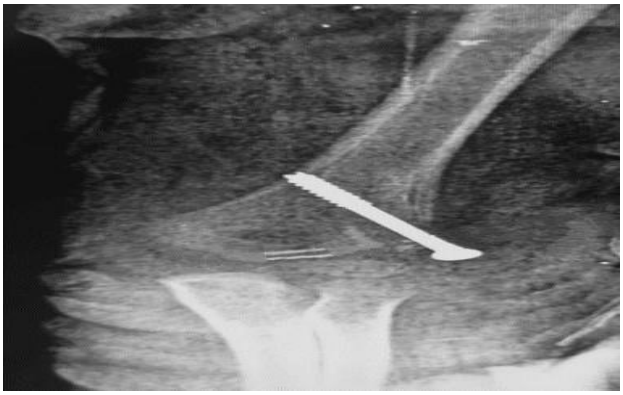
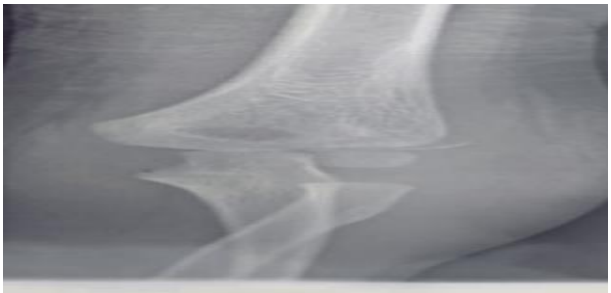
MEPS	Total	K-wire	Cannulated screw	Fisher exact test	P value
	N (%)	N (%)	N (%)		
Excellent	19(79.2%)	9(75.0%)	10(83.3%)	.708	0.824
Good	3(12.5%)	2(16.7%)	1(8.3%)		
Fair	2(8.3%)	1(8.3%)	1(8.3%)		

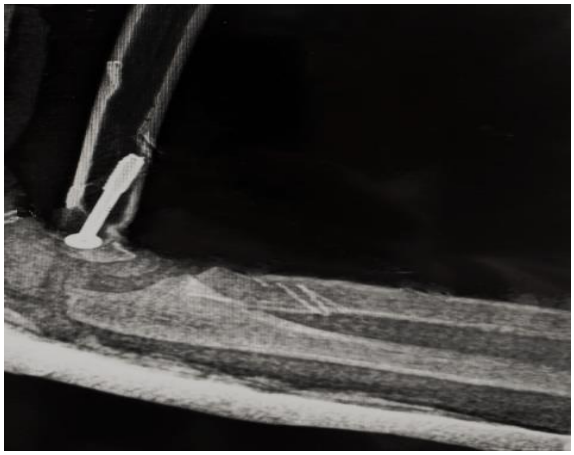
Table (4): Post-operative range of motion both studied groups (n=24)

	Total	K-wire	Cannulated screw	MD	P value
Flexion	134.17±16.48	125.4±10.33	132.9±17.22	-17.5	0.0
Extension	8.33±4.20	8.8±4.37	5.83±1.25	3.0	0.0
Total range of motion	121.8±26.33	123.7±16.8	130±21.48	16.25	0.011
Range deficiencies	**Total**	**K-wire**	**Cannulated screw**	**Chi square**	**P value**
	N (%)	N (%)	N (%)		
lack of 10° of extension	4(16.7%)	4(33%)	0(0%)	5.52	0.028
Flexion <120°	3(12.5%)	2(16.7%)	1(8.3%)		

Table (5): Radiological deformities and Complications among both studied groups (n=24)

Radiological deformities	Total	K-wire	Cannulated screw	Chi square	P value
	N (%)	N (%)	N (%)		
nonunion	3(12.5%)	2(16.7%)	1(8.3%)	5.80	0.016
fish-tail deformity	1(4.2%)	1(8.3%)	0(0%)		
lateral prominence	3(12.5%)	3(25%)	0(0%)		
complications	Total	K-wire	Cannulated screw	Chi square	P value
	N (%)	N (%)	N (%)		
Superficial infection	2(8.3%)	2(16.7%)	0(0%)	6.35	0.047
Elbow stiffness	2(8.3%)	2(16.7%)	0(0%)		

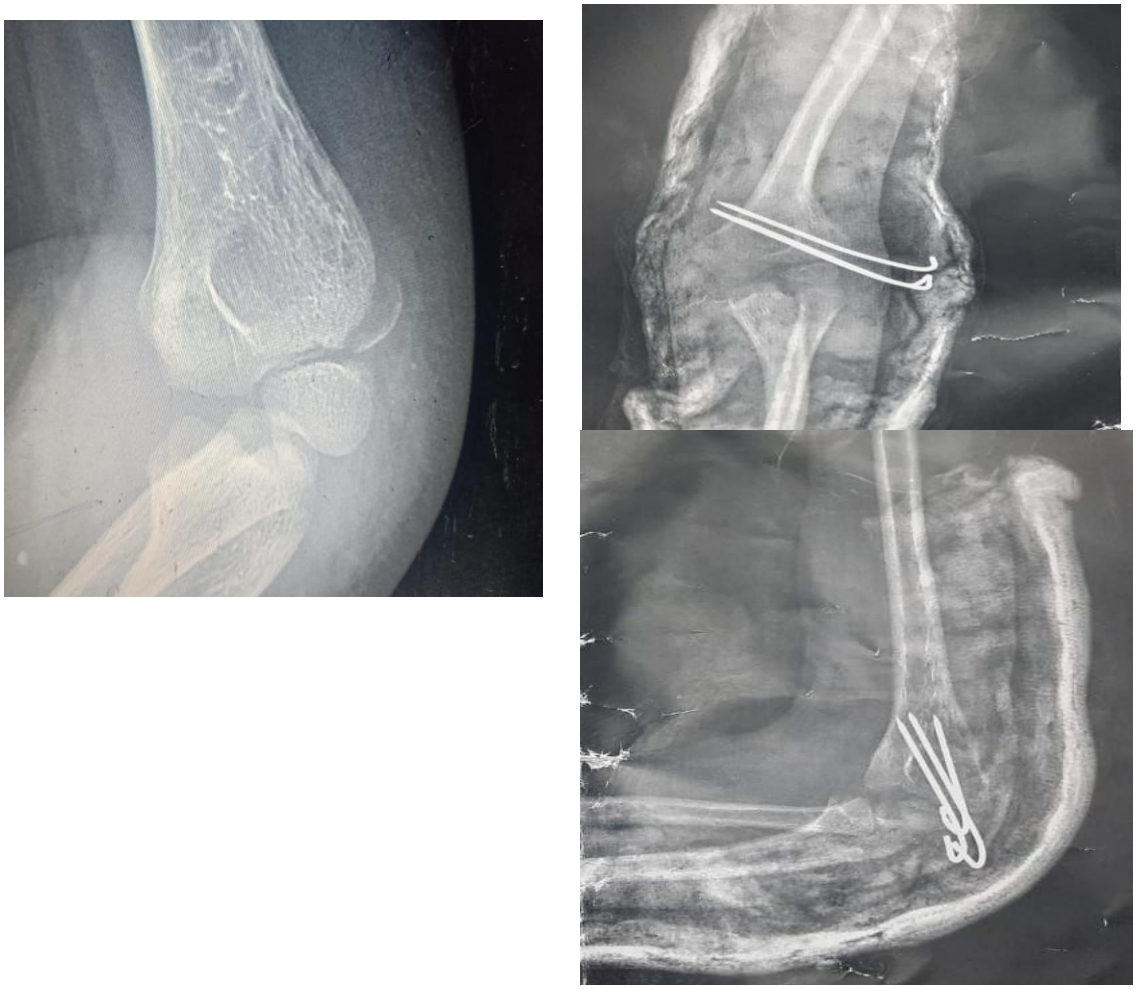






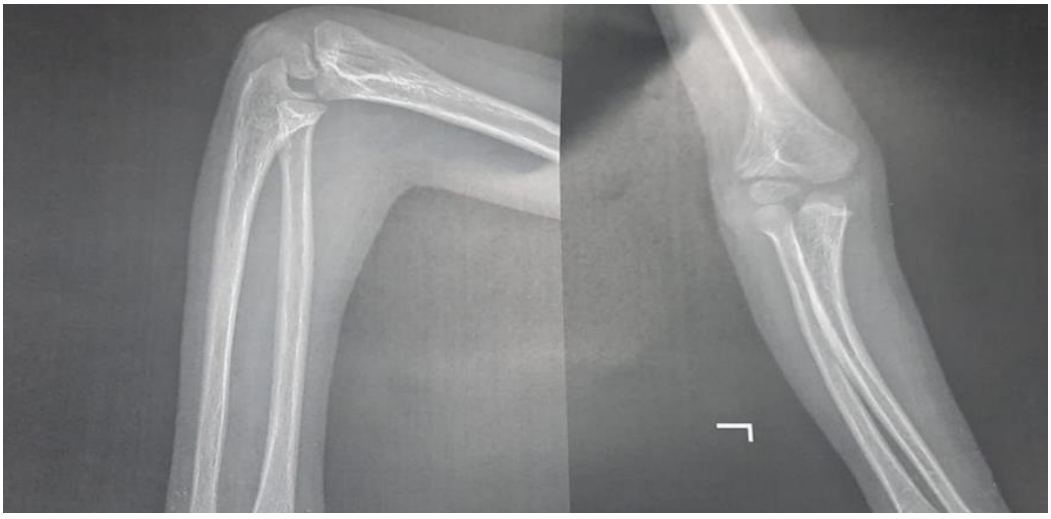
(A) **(B)**

(C)

Figure 1: A 6 year old Male managed using cannulated screw (A): Pre-operative x-ray., (B): Immediate Postoperative x ray., (C): Follow up x-ray after 9 weeks



(A) **(B)**



(C)

Figure 2: A 4 year old male managed using k-wires (A): Pre-operative x-ray., (B): follow up x ray after 4 weeks (C): Follow up x-ray after 6 weeks

DISCUSSION

The most prevalent physeal injury in this area is a lateral condyle fracture of the distal humerus, which occurs often in children and accounts for as much as 20% of all elbow fractures. It is still a problem for orthopedic surgeons to manage displaced fractures of the lateral condyle in children [6]. There are various treatment options for these types of fractures. For non-displaced or mildly displaced patterns, simple immobilization is sufficient. For displaced patterns, surgical reduction and fixation using Kirschner wires (K-wires) or screws may be necessary [7].

Although screw fixation has become more common, the traditional treatment for displaced lateral condyle fractures with displacement more than 2 mm was K-wire fixation using either open or closed methods. However, there is still debate over the optimal method for treating displaced lateral condyle fractures. [6,8].

This randomized clinical trial included 24 children with lateral condyle fractures. Their ages when the fractures occurred varied between 2.5 and 8 years. The majority of included children in both groups were males. Study included 16 males (66.7%) and 8 females (33.3%).

In the same line, in Bakarman et al. [9] study, they included 106 patients, including 74 males (69.8%) and 32 females. At the time of fractures, their ages varied between three and ten years (average, 5.8 ± 2.069). Based on their ages, the patients were categorized into three groups: one for children aged 3-5 (48.1% of the total), another for children aged 6-8 (39.6% of the total), and a third for children aged 9-10 (12.3%).

The current study involved 24 patients with lateral condyle fractures; 16 were males (66.7%) and 8 were females (33.3%). There were thirteen patients whose right elbows were affected and eleven whose left elbows were implicated. Also, A total of 37 patients were enrolled, with 22 males and 15 girls, as shown by Qiao et al. [10] in their study. Thirteen patients had problems with their right elbow and twenty-four with their left.

In our study, fracture classification, 66.7% of children in K-wire group had Jakob III fracture and 33.3% had Jakob II fracture. 83.3% of children in cannulated screw group had Jakob III fracture. The displacement of fracture was 5.85±1.98 mm in K-wire group and 5.4±1.64 mm in cannulated screw group. These findings were in line with the findings of Leonidou et al. [1] who included 105 pediatric patients with displaced lateral humeral condyle fractures. Of these, 76 were male and 29 were female. The Jakob displacement classification system was used to classify 38 fractures as type II and 67 as type III.

Cannulated screw fixation is a relatively new alternative for conventional fixation techniques that has the potential to increase union rate, give earlier range of motion, and provide a more stable construct. [8,11].

The current study results revealed that, time to union in both groups ranged from 6 weeks to 10 weeks with non-statistically significant difference between groups as regards time to union and MEPS. In line with this, Loke et al. [12] assessed 34 cases who had cannulated screws placed and had an average follow-up of 24.5 months; they discovered that the average time to radiographic union was 6.9 weeks.

In the present study, the follow up time was limited to 6 months, with non-significant statistical difference regarding the time needed for union. At ten years of follow-up, researchers in 3 studies [6,13,14] discovered no discernible variations in physeal arrest or rates of avascular necrosis (AVN) among the groups who underwent lateral condyle fracture fixation with K-wire or lag screws.

In the present study, post-operative range of motion, the flexion and extension were 125.4±10.33 and 8.8±4.37, respectively in k-wire group. The flexion and extension were 132.9±17.22 and 5.83±1.25, respectively in cannulated screw group. Cannulated screw patients were found to have a greater overall range of motion following surgery compared to K-wire patients, and the percentage of patients with mobility limitations was higher in the K-wire group compared to the cannulated screw group (p=0.028).

Additionally, patients who had screw fixation showed considerably more total arc of motion and median flexion, according to Gilbert et al. [6], no statistically significant difference was seen in the number of patients reporting a clinically significant range of motion deficit at the minimum 3-month follow-up (three patients in each group experienced a loss of extension of 10 degrees or more, and three

patients in each group experienced a loss of flexion of 120 degrees or less).

In the same line, Sharma et al. [15] conducted a follow-up study of 37 pediatric patients who underwent fixation with 4.0 mm cancellous lag screws. The mean follow-up duration was 4.8 years. Painless, full range of motion was observed in 36 of the 37 patients

The metaphyseal lag screw was used to treat 27 out of 66 fractures that were investigated by Hasler et al. [14], all twenty-seven surgical cases showed complete range of motion, symmetrical carrying angles with the unaffected side, and anatomic union after a mean follow-up of ten years.

In order to avoid crossing the growth plate, screw fixation can either use the metaphyseal spike or, like K-wires, be put across the plate. In a model of Milch II fractures in synthetic bone, screw fixation offered more stability than divergent K-wires [13].

According to Franks et al. [16], cannulated screws placed laterally are better than K-wires for treating Milch II lateral condyle fractures. When it came to energy absorption, maximal force to failure, and stiffness, the lateral screw construction trumped the K-wire fixation and the oblique screw when tested with an anterior force. Wirmer et al. [17] recommended screw/wire fixation as the preferred method for operative treatment of lateral condyle fractures of the humerus in pediatric patients. Ayubi et al. [18] demonstrated that screw fixation yielded superior outcomes for pediatric patients older than 5 years with a displacement greater than 2 mm. They recommended implant removal 3 to 4 months following radiographic evidence of union.

In the present study, radiological deformities, lateral prominence was observed in 3 children who underwent fixation using k-wires. One patient in K-wire group had fish tail deformity. Non-union occurred in 2 patients in K-wire group and one patient in cannulated screw group. The percentage of radiological deformities was higher in k-wire group than cannulated screw group.

A common complication of lateral condyle fractures was the formation of lateral prominence. A prominent prominence over the lateral humeral condyle was observed in 40% of patients who had K-wires, as reported by Thomas et al. [19]. Overgrowth of bone under the osteoperiosteal flap may be the reason for this protrusion. Lateral prominence was reported by 36.7% of K-wire recipients compared to screw recipients. In terms of lateral prominence, a statistically significant difference was seen between the two groups.

According to Thomas et al. [19], screws may help stabilize the fracture and decrease the likelihood of lateral prominence, while K-wires may lead to increased bone callus due to their relatively low level of stabilization. On the other hand, bone callus development and extensive periosteal dissection could account for the lateral prominence. Therefore, it is important to minimize broad dissection and protect the periosteum in the metaphyseal fragment.

Also, out of 16 fractures that were fixed with K-wires in the study by Jenyo et al., [20] one of them had malunion due to a loosening K-wire, and one case had nonunion, which meant that bone grafting and screw fixation were needed.

The functional outcome was unaffected in the 22 patients treated with open reduction by Agarwal et al. [21], 4 of them had premature closure of phyis and 7 had fishtail deformity.

Fracture geometry, fixation method, and component location all interact to determine the stability of a fixation in a lateral condyle fracture. It was found after testing that the displacement was caused by the fragment being rotated and translated, which in turn displaced the joint surface [8].

Recent biomechanical research on children lateral condyle fractures (Milch type II) found that, when evaluated axially, single screw fixation was more stable than 60° divergent K-wires [13].

In the present study, 2 children who underwent fixation using K-wire suffered from superficial infection and 2 children suffered from elbow stiffness. The k-wire group had a greater percentage of complications compared to the cannulated screw group.

On the other hand, complications including pin-site infections, skin necrosis, soreness, and discomfort are somewhat common after K-wire fixation. In addition, K-wire attachment does not offer enough rigidity and hinders early mobilization [16]. Skin infections and loosening of the K-wires are both made more likely by their protrusion from the skin [22].

In the present study, we found that no patients got skin infections over cannulated screws, while 16.7% of patients who had K-wire fixation ,got infections surrounding the wires. This showed that percutaneous K-wires were associated with a higher rate of infection in patients compared to screws. Consequently, it is recommended that one takes measures to protect their skin against infections. It is recommended to administer oral antibiotics and provide wound care as part of infection treatment. Despite the lack of infection in the screws group, removing the screws required an additional operation, which increased both the cost and length of stay, patients with lateral condyle fractures fixed using K-wires, K-wires left exposed through the skin in all patients. Oral antibiotics were prescribed to 3.8% of patients who developed skin infections surrounding K-wires, according to Weiss et al. [23].

All the K-wires were left exposed in the study by Leonidou et al. [1], They proposed that patients might have their exposed wires removed in the outpatient department, which would reduce the need for a second round of general anesthesia. One out of 105 patients (0.9%) had a superficial infection around the K-wires; nevertheless, this infection responded favorably to oral medicines. There were no reports of serious infections. Consider keeping the wires exposed after open reduction and internal fixation (ORIF) of a lateral condyle fracture, according to the study by De et al. [24].

Displaced fractures (defined as displacement exceeding 2 mm) can be effectively treated with open reduction and internal fixation using either K-wires or screws, achieving excellent outcomes. Smooth pin fixation preferably with two pins, either through the epiphysis or through the metaphyseal spike providing the high success rate for fracture healing and the ease of removing Kirshner wires in an office setting and disadvantages of the possibility of loss of fixation with brief use of K-wires, radiological deformities and occurrence of infection with their prolonged use. Screw fixation preferably through the metaphyseal area providing more stable fixation, resulting in a higher union rate, with decreased duration of casting leading to an improved range of motion. Cannulated screw can reduce the possibility of lateral prominence, the largest disadvantage of screw fixation is the need for subsequent surgery for implant removal, along with the cost and risks associated with a second surgery.

There are some limitations to the study including a small number of patients, not evaluating the long-term outcomes, having a heterogeneous study population and not comparing the results with different fixation modalities.

Conclusion

Displaced fractures (defined as displacement exceeding 2 mm) can be effectively treated with open reduction and internal fixation using either K-wires or screws, achieving excellent outcomes. K-wires or screws should be removed once radiographic evidence of fracture union is confirmed on follow-up imaging. For displaced lateral condyle fractures, cannulated screw fixation is preferred over K-wire fixation due to its superior postoperative range of motion, radiographic outcomes, and lower complication rates.

Conflict of interest : None
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