Comparative study between intramedullary kirschner wires fixation and cast immobilisation in pediatric displaced diaphyseal both bones of forearm fractures

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Background
Forearm fractures involving the diaphysis are the third most frequent form of fracture in paediatrics. Conservative management is associated with higher risks of complications; therefore, the author aim to compare Kirschner (K) wire fixation with conservative management.
Methods
56 children with displaced diaphyseal ulnar and radial fractures were allocated and randomized into two groups at Kasr Al-Ainy University Hospital: the first group was managed by conservative management with cast immobilisation, and the second group was managed by K wire fixation. The primary outcomes were the degrees of postoperative ulnar and radial angulations, the required time of union, the limitation of movement degrees, and the functional outcomes. The secondary outcome was the rate of complications.
Results
K wire fixation had better significant results compared with the cast immobilisation regarding the residual radial angulation ($P < 0.001$), ulnar angulation degree ($P < 0.001$), the range of movement of forearm supination or supination ($P = 0.003$), and the functional outcome ($P = 0.049$); however, the time of union was significantly longer in the K wire group compared with the cast group ($P = 0.003$). Both groups were not significantly different in the complication rate ($P = 0.163$).
Conclusion
Cast immobilisation is safe in managing displaced diaphyseal in both bones of forearm fractures; however, K wire fixation is preferred and shows better results, especially when a good reduction cannot be achieved by conservative cast immobilisation.

Keywords:
cast immobilisation, forearm fractures, internal fixation, Kirschner wires

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Introduction

Forearm fractures involving the diaphysis are the third most frequent form of fracture in paediatrics [1,2]. Due to their innate instability, complete shaft fractures of the radius and ulna provide a treatment challenge [1]. Successful management is achieved when restoring anatomical alignment and a full range of movement [2].

The optimum treatment strategy is closed reduction and casting; however, the outcomes are still variable, and patients may need extra fracture manipulation or surgical intervention to treat the residual angulation. Therefore, internal fixation can be performed in case of failure of conservative management, in children who are approaching skeletal maturity, and in open fractures [3–5].

Poor remodeling and increased incidence of malunion are known complications for diaphyseal forearm fractures [6], leading to angulation or rotational deformities resulting in decreased supination and pronation range of movement, especially in old children who have decreased ability of remodeling. Therefore, the proper anatomical reduction becomes an important endpoint to be achieved to decrease the severity of malunion [7]. This can be performed by restoring the radial bow's magnitude and location to maintain the movement range [8,9].

Many options of internal fixation procedures are prescribed to manage unstable fractures like plates and screws, Kirschner (K) wires, or intramedullary nails (IMN). Their usage is increasing in pediatric forearm traumas, especially with IMN or K wires

[10,11]. Treatment with plate and screw requires open reduction and internal fixation, guaranteeing proper alignment and restoring the anatomical position. However, IMN has become more popular as it has a better cosmetic outcome, a shorter operation period, is easy to remove, and is associated with decreased soft tissue dissection [12–14]. Also, percutaneous K wiring is a safe, promising, effective, and convenient method for treating diaphyseal fractures. Also, it has decreased the incidence of complications and is easy to remove in the outpatient clinic [15]. To gain the best alignment and to decrease the difficulty of applying K wire or IMN, they are preferred to be done as early as possible before callus formation [15].

All of these advantages of the internal fixation treatment make it preferable over the conservative option to decrease the incidence of complications which are refracture, compartment syndrome, re-displacement, delayed union, residual deformation, and mobility loss [11,15]. Loss of rotation is the most common long-term complication of conservative management [16].

Therefore, the author aim to compare IM K wires fixation with cast immobilization in children with displaced diaphyseal forearm fractures in the functional outcome, union time, re-displacement, angulation, and other complications.

Material and methods

Study population and design

Our randomized controlled clinical trial was performed in the Orthopaedics Surgery Department in Kasr Al-Ainy Hospital from February 2020 to March 2021 after ethical approval from the Ethical Committee of Kasr Al-Ainy Faculty of Medicine. The inclusion criteria were male and female children with closed simple displaced diaphyseal forearm fractures without any epiphyseal involvement and older than 8 years old. We excluded patients with open, comminuted, and pathological fractures. Also, Monteggia and Galeazzi fractures were excluded. Unstable diaphyseal forearm fractures were defined in this study as angulation greater than 10° in either the coronal or the sagittal plane, and/or mal-rotation greater than 30°, and/or shortening and overlap. All patients who met the eligibility criteria were randomized by a simple randomization tool generated by computer software and then were allocated using sealed opaque envelops into two groups: the first group was managed conservatively by above elbow cast, and the second group was managed by IM K wire fixation. All patients' parents signed confirmed consents before enrollment into the study. All the study details were explained to the parents, and they were free to withdraw from the study at any stage.

Assessment and management of the patients

We carefully assessed all patients by taking a full clinical history and performing a detailed physical examination. Regarding the history, we asked about the personal and present history of the fracture. The physical examination included general examination by performing primary and secondary surveys for resuscitation of the patients. Then, we performed a local examination to know detailed information about the site and type of fracture and to exclude any associated vascular, neurological, and soft tissue injuries. Then, a radiological assessment (X-ray) of the whole forearm, including both elbow and wrist, was done to diagnose the patients.

Conservative management

The first group was managed by closed reduction and immobilization by the cast at the minor operation room in the emergency department under sedation. The reduction was achieved by sustained traction combined with manipulation, followed by immobilisation by below elbow cast. Then, a radiograph was done to confirm an acceptable reduction and immobilisation was maintained with above elbow cast. We fixed the wrist at flexion position at 10 to 15° and in ulnar deviation with 0 – 30° while we fixed the forearm in the neutral position in mid-diaphyseal fractures and in supination position for proximal one third fractures and in pronation position in distal one third fractures. This was done to decrease the dislocation force. Figure 1 shows an example of conservative cast immobilisation.

Figure 1

Shows 9 years old child with a diaphyseal of both bones forearm fracture (A) was managed conservatively, closed reduction was done (B and C), and a cast was applied above the elbow (D).

The following criteria were used to assess the quality of initial reduction: anatomical reduction (no translation or angulation), good reduction (dorsal angulation of 10° or translation of 2 mm), fair reduction (angulation of 10–20° or translation of 2–5 mm, or any radial deviation of 5° or a combination of dorsal angulation of 5–10° and translation of 2 mm). If the degree of angulation was greater than 20°, the level of reduction was considered poor which is not accepted.

Re-manipulation and cast wedging were done to restore the alignment in the case of the reduction not meet the acceptable This was done only in five patients in two of them well re-reduction was achieved and in the other three patients the re-reduction was inadequate, we went on management operatively by IM K wires fixation.

After reduction, the patients were assessed for any associated neurovascular deficit and any limitation of range of movement at the MCP joint. Then, the patients were followed for 24 h at the emergency department and asked for follow-up visits after 2, 4, 6, 8 weeks and 3 months.

Operative management

All patients in the second group were operated on under general anesthesia. General spectrum prophylactic third generation cephalosporin antibiotic was administered to all patients and was continued for three days postoperatively. The patients were supinely positioned, and the arms were extended on the arm table. Intraoperative imaging with both anterior-posterior and lateral views was performed.

Preparation of K wires implants

The ulna and radius K wires were usually the same, but each child's anatomy could require a smaller ulnar wire. The diameter of the k wires was between 1.5 and 2 mm. The wire tip was curved 30–40° with a 3–4 mm leading end to smoothly turn at the metaphyseal/diaphyseal junction. K wires were contoured to 40–50°. Sometimes, we used two wires for radius curvature to achieve three-point fixation. The operation ended with the curvature apex at the fracture site. Bending and contouring helped reduce as the rotating wire engaged the opposite fragment. The wire forced across the fracture automatically realigned the displaced fragment.

Retrograde K wire for radius

Two entries were used: 1. The dorsal physical sparing entry point was proximal to the Lister's tubercle and was used in 12 (42.9%) patients. 2. The first dorsal extensor compartment's floor was used as a lateral entry point in 16 (57.1%) patients. Skin incision: A 20 mm longitudinal incision was made halfway between the dorsal and volar sides of the distal radius above the intended entry hole. The entry hole was 10–20 mm above the preserved distal physis on the lateral side of the distal metaphysis. The radial nerve's sensory branches and cephalic vein were protected during dissection.

After fluoroscopic confirmation of the proper insertion position, an awl or drill bit was used to make a unit-cortical entrance hole. Drilling proximally across the radius at 30° enlarged the hole.

Semi-rotatory movements with axial traction were applied to the patient's hand as the wire was advanced upward.

Fluoroscopy verified the radial wire's position and tip orientation. As mentioned, the radial fracture was reduced, checking them in the frontal and sagittal planes and rotating the patient's upper limb. The wire tip faced the opposing fragment. To accomplish this, the T-handle could turn 90° in either direction. After achieving adequate alignment, the wire was slowly advanced with light hammer blows. Advancing of the wire was monitored by imaging till reaching the radial neck to regain the radial bow. Finally, the wire's length was readjusted to reach the final position. Open reduction was performed in the case of closed reduction failure after many trials, which was indicated in only four cases.

The antegrade ulnar wire

We used two entry points:

(1) The anconeus starting point is located along the postero-lateral surface of the olecranon through the metaphysis in 3 (10.7%) patients.
(2) Apophyseal starting point through the top of the olecranon in 25 (89.2%) patients.

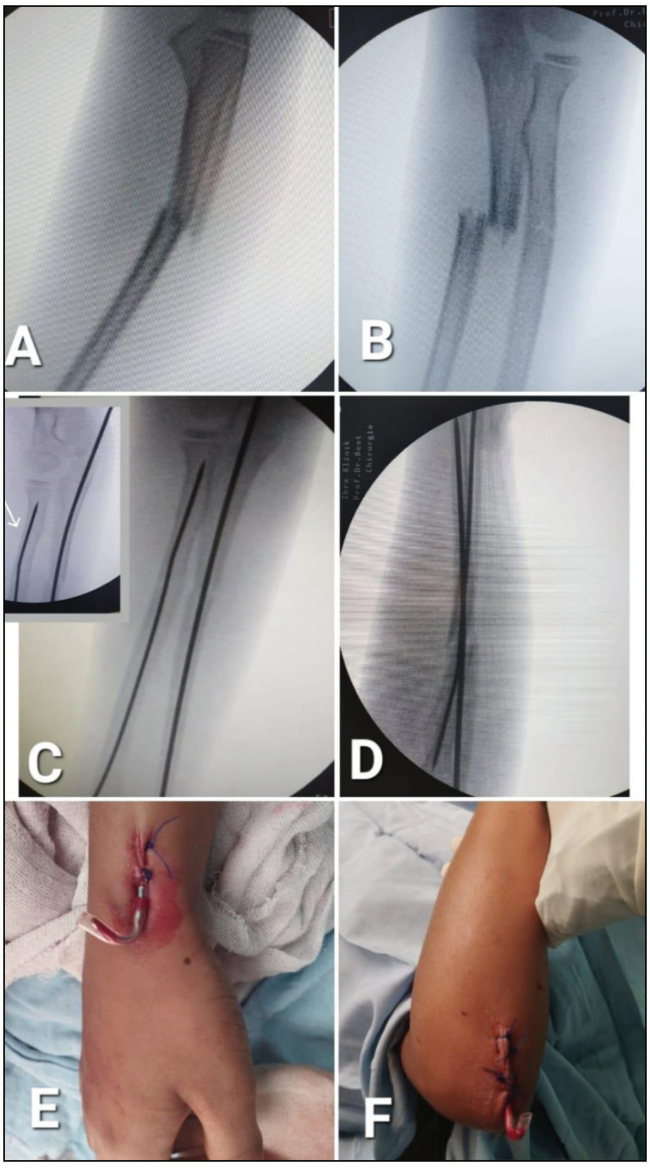
The olecranon was accessed through flexion and internal rotation of the arm. An incision of about 20 mm was performed below the tip of the olecranon by 20 mm along the posterolateral surface of the bone. Blunt dissection was carefully carried out down to the surface of the bone to prevent cutting into the muscles. We carefully inserted the drill or short awl into the cancellous bone, avoiding slippage towards the elbow joint or olecranon's medial aspect. Fluoroscopic imaging guided drilling from the apophysis to the IM canal. The wire was carefully advanced into the shaft of the ulna, and the maximum curved tip's length should be 3 mm because of the smaller ulnar diameter. When the wire reached the location of the fracture, the reduction was performed.

We started with radial reduction as the ulnar reduction was easier; however, in case of observing any difficulty in ulnar reduction, we withdrew the radial wire about 10 to 20 mm proximal from the location of the fracture. This, in turn, increased radial mobility and facilitated ulnar reduction. Under fluoroscopic guidance, the wire's tip was guided toward the distal fragment. Finally, finishing this step, the wire was further advanced to reach distal metaphysis. Figure 2 shows an example of closed reduction and K wire fixation of both bones' forearm fracture.

Final steps of reduction and closure of the wound

The proper construct was achieved when the curved tip of the radial wire pointed to the medial side, and the tip of the ulnar wire pointed to the lateral side. This guaranteed that the wires had opposite concavities and ensured that the elastic memory stabilized the structure by tightening the interosseous membrane.

Figure 2



Shows (A and B) pre-reduction x rays (C and D) postreduction and K wires fixation technique for both the ulna and radius, the white arrow shows restoration of the normal curvature of the radius, (E and F) after skin closure of ulnar and radial entry points with the k wires protruding out of the skin.

To create a clean incision that did not harm the subcutaneous tissues and surrounding structures, the trailing ends of the wires were slightly bent 1 cm out of the skin at the end stages of the process. Without draining the wound, the dressing was compressed and closed. After the operation, the patients were placed in an above-elbow posterior slab for 4 weeks. Then, they were fixed in below elbow posterior slab for another two weeks. The patients returned for follow-up visits nearly every 2 weeks for 2 or 4 months following fixation. The k wires were removed at the minor operation room at the outpatient clinic after complete union was achieved (average 6.7 weeks).

Outcomes measures and follow-up

The primary outcomes were to assess the degrees of postoperative ulnar and radial angulations, the required time of union in weeks, the limitation of movement degrees in supination and pronation measured by Goniometer (the normal supination degree is 85° and the normal pronation degree is 70°), the elbow and wrist limitations of movements, and the functional outcome according to the outcome grading system developed by the criteria of Price *et al.* [17,18] (Table 1).

The secondary outcomes were the complications like pin tract infection, superficial radial nerve palsy, olecranon bursitis and elbow pain, nonunion, synostosis, excoriation elbow crease, re-displacement, malunion, and transient neuropraxia.

Follow-up schedule

The patients were followed to the bone union determined by the formation of callus and consolidation in radiology. The reduction quality was assessed using the final intraoperative or initial postoperative radiograph. Serial radiographs were made 2, 4, 6, and 12 weeks after surgery were evaluated.

2 weeks: check neurovascular, encourage finger movements, radiography forearm anteroposterior/lateral plains to ensure reduction in both groups.

4 weeks: changing the posterior slab to below elbow posterior slab, radiography forearm anteroposterior/lateral plains and start elbow range of motion in the K wires fixation group.

6 weeks: removal of the cast in the cast group and posterior slab in K wires fixation group, assessment of

Table 1 Outcome Grading System by Price and Noonan criteria [17,18]

Outcome	Symptoms	Loss of forearm rotation
Excellent	No complaints with strenuous activity	Up to 10°
Good	Mild complaints with strenuous activity	From 11 to 30°
Fair	Mild complaints with daily activity	From 31 to 90°
Poor	All other results	More than 90°

Table 2 Shows the baseline data of included patients

Outcomes	Cast group (28 patients)	K wires group (28 patients)	*P* value
Age in years	9.82 ± 2.1	10.57 ± 1.95	0.22
Sex			
Male	23 (82.1%)	22 (78.6%)	0.737
Female	5 (17.9%)	6 (21.4%)	
Mode of trauma			
Fall to ground	16 (57.1%)	19 (67.9%)	1
Direct trauma	9 (32.1%)	7 (25%)	
Road traffic accidents	3 (10.7%)	2 (7.1%)	
The affected forearm side:			
Right	21 (58.3%)	23 (66.7%)	0.194
Left	7 (41.7%)	5 (33.3%)	
The dominant side:			
Right	28 (100%)	27 (93.3%)	0.999
Left	0	1 (6.7%)	
Fracture location:			
Proximal third	3 (10.7%)	4 (14.2%)	1
Middle third	20 (71.4%)	18 (64.2%)	
Distal third	5 (17.9%)	6 (21.4%)	
Fracture pattern:			
Transverse	18 (64.3%)	15 (53.5%)	1
Oblique	10 (35.7%)	13 (46.4%)	
Follow-up duration in weeks	33.89 ± 9.15	29.11 ± 7.22	0.056
Duration from injury to surgery in days	NA	1.82 ± 0.82	
Time of surgery in minutes	NA	32 ± 5.15	
Duration of immobilisation postoperatively in weeks	NA	5.75 ± 0.75	
Type of reduction:			
Closed	NA	24	
Open	NA	4	
Fluoroscopy time in seconds	NA	70.67 ± 14.14	
Time of implant removal in weeks	NA	6.79 ± 0.88	

NA, Not Applicable.

union clinically and radiologically, radiography of forearm anteroposterior/lateral plains and the start of forearm range of motion.

12 weeks: radiography forearm to assess union, record range of movement by Goniometer and the functional assessment using the Outcome Grading System developed by Price and Noonan, which was compared with the contra-lateral forearm [17,18].

Union was assessed clinically and radiologically and considered full when pain and tenderness disappeared at the fracture site with sufficient callus bridging the fracture site in both anteroposterior and lateral radiography views.

Statistical analysis

SPSS version 22 was used in statistical analysis. Categorical variables were represented by number and percentage, while the qualitative variables were represented by mean and standard deviation. Student's *t*-test was used to compare the continuous outcomes, while the χ^2test was used to compare the categorical outcomes. Results with *P* values less than 0.05 were considered significant.

Results

56 patients were eligible to be included in our study and were randomized into two groups: 28 underwent cast immobilisation, and the other 28 underwent K wire fixation. The baseline characteristics were similar in

both groups regarding age, sex, mode of injury, affected side, dominant side, fracture location, and fracture pattern. The mean of follow-up period was 33.89 ± 9.15 weeks in the cast group and 29.11 weeks±7.22 in the K wires group, $P = 0.056$.

The patients who underwent surgeries for K wire fixation were operated in 32 ± 5.15 min, had a mean of 1.82 ± 0.82 days from injury to operation, had 5.75 ± 0.75 weeks of postoperative immobilisation, were exposed for 70.67 ± 14.14 s by fluoroscopy, and their implants were removed after 6.79 ± 0.88 weeks. 24 patients underwent closed reduction, while only four had an open reduction. Table 2 presents the full description of baseline characteristics in both groups.

Outcomes

Both radial and ulnar angulations were decreased in patients who underwent K wires fixation compared with those who had cast immobilisation, *P* less than 0.001. However, the K wire fixation had an increased union time with 6.71 ± 1.08 weeks compared with the cast immobilisation with 5.71 ± 1.27, $P = 0.003$.

Table 3 Shows the results of the outcomes in both cast and K wires groups

Outcomes	Cast group (*N*=28)	K wire group (*N*=28)	*P* value
Residual radial angulation	7 ± 4.72	1.43 ± 2.41	< 0.001
Residual ulnar angulation	6.21 ± 4.61	1.07 ± 2.46	< 0.001
Time of union (weeks)	5.71 ± 1.27	6.71 ± 1.08	0.003
Forearm range of movement limitation (loss of supination and pronation)	11.61 ± 11.71	3.93 ± 5.83	0.003
Elbow range of motion:			
Limited	0	0	
Full	28 (100%)	28 (100%)	
Wrist range of motion:			
Limited	0	0	
Full	28 (100%)	28 (100%)	
Price *et al.* functional outcomes assessment criteria:			
Excellent	19 (67.9%)	26 (92.9%)	0.049
Good	6 (21.4%)	2 (7.1%)	
Fair	3 (10.7%)	0	
Poor	0	0	

Data are presented in mean±standard deviation or number (percentage).
N, the number of patients.

Figure 3

Shows an 8-year-old boy with a both-bones fracture of the right forearm, which was managed conservatively (A and B) prereduction, (C and D) postreduction and cast immobilisation and (E and F) full union, (G and H) full supination and full pronation were achieved.

All patients in both groups achieved the full ranges of movements in both wrist and elbow joints; however, K wire fixation was associated with less degree of limitation in supination and pronation (3.93±5.83) compared with the cast immobilisation (11.61±11.71), $P = 0.003$.

Finally, the K wire fixation showed a higher significant incidence of excellent outcomes (26 patients) than cast immobilisation (19 patients), $P = 0.049$. Table 3 shows the full results of the outcomes in both cast and K wires groups. Figures 3 and 4 show the outcomes of both treatment options in two patients.

Complications

Only three patients from the group with K wire fixation had complications like pin tract infection in

Figure 4

Shows a 10-year-old boy with a both-bones fracture of the right forearm, managed with closed reduction and K wires fixation. (A and B) prereduction, (C and D) postreduction and K wires fixation and (E and F) after full union and removal, (G and H) full supination and full pronation were achieved.

Table 4 Presents the types of complications in both groups

Complications	K wires (28 patients)	Cast (28 patients)	*P* value
	Number (Percentage)	Number (Percentage)	
Re-displacement	0	4 (14.30%)	0.111
Nonunion	0	0	
Synostosis	0	0	
Malunion	0	3 (10.70%)	0.236
Elbow bursitis and pain	0	0	
Excoriation elbow crease	0	0	
Transient neuropraxia	0	0	
Penetration of the opposite cortex	0	NA NA	
Superficial Radial nerve injury	1 (3.60%)	NA NA	
Pin tract Infection	2 (7.10%)	NA NA	
Total	3 (10.70%)	7 (25.00%)	0.163

NA, Not Applicable.

two patients and superficial radial nerve injury in only one. Seven patients had complications in the cast group, like re-displacement in the first 2 weeks in four patients in which repeated reduction and cast immobilisation was done and malunion in three patients with minimal functional impairment so conservative management was done. The total rate of complications did not significantly differ in both groups, $P = 0.163$. Table 4 shows the full details of reported complications in both groups.

Discussion

Our clinical trial found that K wire fixation was associated with better outcomes in redial and ulnar angulation, forearm range of pronation/supination movements, and functional outcomes assessment. Also, the rate of complications did not significantly differ between the two groups. However, K wire fixation was associated with increased time of union.

K wire fixation is a less invasive procedure associated with less soft tissue loss, can preserve the extramedullary blood supply, keeps the bone aligned, and accelerates healing. All of these advantages lead to avoiding large open surgeries. Moreover, it decreases the risk of growth arrest that results from the iatrogenic injury of the physical plate Kose and colleagues [19]. In addition, the conservative management by cast leads to many problems as the sustained reduction is difficult to be achieved, and oedema can decrease the muscular spasm, which increases the risk of displacement inside the cast Kutsikovich and colleagues [20]. The IM fixation can guarantee stability and maintain the periosteal vascular blood flow, accelerating the healing process. Simultaneously, the micromotion of IM fixation stimulates callus formation, and their insertion within the subcutaneous tissue does not cause any dissection or insertion of other devices. This gives superiority to K wire fixation over conservative cast immobilisation, as we found in our article Pugh and colleagues [21]. However, K wire fixation requires more time than cast immobilisation which supported our results Ali and colleagues, Akgulle and colleagues [22,23].

K wires had a low incidence of malunion, as reported in only two patients from 17 with angulation of about 20° who had cosmetic and functional problems Fuller and McCullough [24]. The same was observed in Daruwalla [9], who found that only 6% of the patients had about 30° of forearm rotation. Also, other studies showed that these degrees of malunion were not noticeable by patients due to shoulder compensation or the functional outcomes that were achieved in them Hogstrom and colleagues, Morrey and colleagues [25–27]. Moreover, the degrees of pronation and supination were not improved in long-term follow-up with conservative cast management Sinikumpu and colleagues [28]. The angulation criteria were also not achieved in 51% of the patients who underwent conservative cast management Bowman and colleagues [29]. This supports our result as we found lower residual radial and ulnar angulation degrees than cast immobilisation. On the other hand, conservative cast immobilisation had decreased time of union (8.13 ± 1.77 weeks) compared with the K wire fixation (9.07 ± 1.28 weeks), which was found by Ibrahim and colleagues [30]. This aligned with our findings and Akgülle and colleagues [23].

Excellent functional outcomes were also achieved mostly when applying K wire fixation, as observed in Hadizie and Munajat, who found that 39 patients out of 44 had excellent functional outcomes, and the rest had good [31]. Also, McLauchlan and colleagues [32] found that the reduction loss was only observed in 21% of patients who underwent cast immobilisation, and no patients with K wire fixation had any reduction loss. Compared with conservative cast fixation, these significantly improved functional outcomes after K wire fixation.

Regarding the complications, pin site infection is a specific complication for K wire fixation; however, its rate was low, with about five patients from a total of 553 patients, as reported by Fernandez and Langendorfer [33]. It can be easily treated by careful care of the local pin location and antibiotic use Ali and colleagues [22]. Also, superficial radial nerve injury is a suspected complication after K wire fixation; however, it also had little incidence, as found in only 15 patients from about 553 pediatric patients Fernandez and Langendorfer [33]. The injuries were presented by hypoesthesia and were temporary in about thirteen patients. Only two had persistent hypoesthesia Fernandez and Langendorfer [33].

According to cadaveric research, IM fixation makes it harder to accurately determine the magnitude and position of the radial bow Schemitsch and colleagues [34]. Nail contouring is useful for restoring the radial bow, but in our experience, carefully planned nail contouring is often reduced when the nail is advanced in the medulla. Furthermore, the larger the nail, the more accurate the reduction will be achieved. The removal of plate fixation necessitates extensive dissection, in contrast to the removal of IM fixation. Additionally, due to the risk of refracture, immobilisation is advised after the removal of plates Beaupre and Csongradi, Rumball and Finnegan [35–37]. In the study conducted by Shah [38], it was determined that the extent of radial bow

restoration was nearly fully achieved in both the groups undergoing open reduction and internal fixation (ORIF) and IM nailing. However, it was observed that the IM nailing group exhibited a distal translation of the maximal radial bow location. Notwithstanding this discovery, there was no discernible distinction observed between the groups that underwent ORIF and IM nailing in terms of their ability to regain forearm rotation during the final follow-up period. The group that underwent IM nailing did not experience any significant complications, whereas the group that underwent ORIF encountered a total of five major complications. There was no statistically significant difference observed in the average duration of union between the IM nailing and ORIF groups Shah [38].

The single bone fixation has demonstrated efficacy comparable to that of both bone fixation in the treatment of unstable forearm both bone fractures in pediatric patients. According to a meta-analysis, there is no statistically significant distinction observed in terms of rotational loss, union duration, or complications when comparing single bone fixation with both bone fixation. In contrast, patients who underwent single bone fixation treatment demonstrated a tendency towards re-angulation Yong and colleagues [39].

Strengths and limitations

Our clinical trial empowered the evidence of the superiority of K wire fixation over cast immobilisation in improving postoperative outcomes. Also, the long follow-up period in our study ensured this superiority in long-term periods. However, the only limitation was that the results from only one medical centre and results from multicenter studies could confirm our findings.

Conclusion

Cast immobilisation is safe in managing displaced diaphyseal in both bones of forearm fractures; however, K wire fixation is preferred and shows better results, especially when a good reduction cannot be achieved by conservative cast immobilisation.

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Conflicts of interest

None.

Authors' contribution

M.S.H., A.M.E., I.S.G., and M.A.A. were responsible for analysing and interpreting the patient data. M.S.H. was responsible for statistical analysis and revising the manuscript.

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