

Functional outcome of closed reduction of supracondylar humerus fracture with cross Kirschner wire in children

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Objective: To evaluate the functional outcome of percutaneous cross two K wires fixation for Gartland types II and III fractures of humerus.

Methodology: This prospective study included 80 patients with supracondylar humeral fracture, who underwent closed reduction and fixation by two crossed Kirschner wires. We included children with age < 15 years with closed fractures with Gartland types II and III, while the patient with vascular injury, open, irreducible fractures were excluded. The patients were following up for 6 months and assessed functionally by Flynn's criteria.

Results: The mean age of patients was 8.1 years.

Trauma while child playing was the main mechanism of injury in 43 (59.8%) children and 46 (57.5%) fractures were of the type Gartland type III. Union was achieved between 6-8 weeks in all children. The functional outcome showed that 40 (50%) patients had excellent, 24 (30%) good, 16 (20%) fair, and none had a poor result as per Flynn's Criteria.

Conclusion: Percutaneous Kirschner wires fixation results in good functional outcome, short hospital stays and minimal complications.

Keywords: Closed, percutaneous reduction, supracondylar humerus fracture, kirschner wire.

INTRODUCTION

Supracondylar humerus fracture is the common round the elbow joint and the second commonest fracture in children overall.¹ The incidence rises in the first 5 years to reach the highest among 5 – 7 years of age.² Two types of these fractures with the extension deformity account up to 95% and the rest are flexion type of the fracture. Gartland in 1959 classified into three types according to the severity of displacement.³ Leitch et al in 2006 added type IV, which was characterized by being unstable in flexion and extension because of an incompetent periosteal hinge circumferentially.⁴

Direct trauma leads to comminution type or commonly indirect low energy trauma, like falls on an outstretched hand.⁵ Several complications can arise if not treated properly including malunion, stiffness of elbow, neurovascular injury, Volkmann's ischemic contracture, myositis ossificans, and the commonest of these is cubitus varus.⁶ Treatment is aimed to achieve a good functional outcome and preventing cubitus valgus or varus deformity by getting an anatomical reduction. Management by cast or plaster of Paris immobilization after reduction of the fracture usually no longer used, due to its complication.⁷

Closed reduction and image intensifier guided percutaneous K. wire fixation is the ideal technique for fixing Gartland types II and III fractures when surgery is indicated, but no agreement exists over the ideal pin

configuration (lateral versus crossed) and time to surgery.⁸ Biomechanically, a crossed pin wires affords good stability even with hazard of iatrogenic ulnar nerve injury.⁹ This study was aimed to assess cross K. wires fixation for displaced supracondylar humeral fractures.

METHODOLOGY

This prospective study included 80 children with supracondylar humerus fracture fixed by percutaneous fixation using two crossed Kirschner wires after closed reduction at Al-Kindy Teaching Hospital from January 2018 to April 2020. All patients were followed for at least 6 months. Written informed agreement was obtained from all patients' parents. Inclusion criteria were age < 15 years of both gender with closed fracture of Gartland types II and III. The exclusion criteria were fractures with vascular injury, open fractures, irreducible fracture closely and unfit medically. We used Gartland's classification to classify fractures (Fig. 1).³

After full clinical assessment and X-rays, under general anesthesia, closed reduction was done under C arm fluoroscopy. Kirschner wires 1.5mm or 2mm diameter were used in cross wire fashion. The child was discharge from the hospital after check X-ray, one day after operation, and elbow physiotherapy was started after removal of the back slab usually 2 weeks after surgery. Patients were followed in 2nd and 3rd

postoperative weeks and X-ray's images to visualize the callus around the fracture especially lateral views (Figure 2) and any sign of pin tract infection was observed. K. wire was removed after the sign of callus formation usually by 4 – 5 weeks' post-fixation and physiotherapy were continued. Elbow range of movements and the carrying angle was observed and evaluated by Flynn's criteria (Table 1) after six months.¹⁰

Statistical Analysis: The data were analyzed by using SPSS version 23.

RESULTS

Out of 80 patients, 45 were males and 35 females. The major age group was between 1 – 5 years 37 out of 80 patients (46.3%). Mean age was 8.1 years. Consolidation was seen in all children 6 – 8 weeks. Trauma while child playing regarded the main mechanism of injury (59.8%) and the most type of fracture were Gartland type III (57.5%).



Fig. 1a: X-ray of elbow joint AP and Lat. Views showing Gartland type III supracondylar fracture.

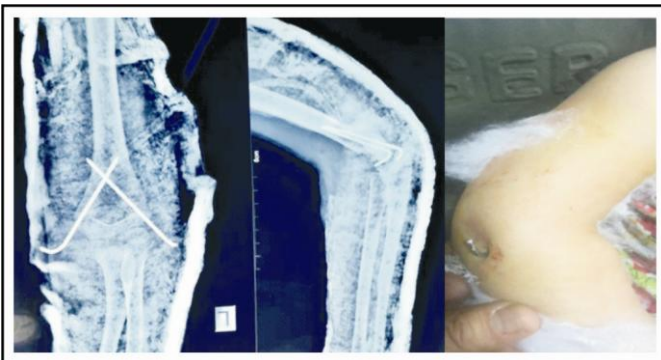


Fig. 2:

Table 1: Flynn's criteria.¹⁰

Result	Rating	Cosmetic Factor: Carrying Angle (°)	Functional Factor Motion Loss (°)
Satisfactory	Excellent	0 – 5	0 – 5
	Good	> 5 – 10	> 5 – 10
Unsatisfactory	Fair	> 10 – 15	> 10 – 15
	Poor	> 15	> 15

Table 2: Distribution according to gender, age, mode of injury, types of fracture, and complications.

Item	Types	No.	%
Sex	Male	45	65.3
	Female	35	43.7
Age	1 – 5 years	37	46.3
	6 – 10 years	28	35
	11 – 15 years	15	18.7
Nature of injury	Bicycle trauma	26	32.5
	Sports trauma	43	59.8
	Fall from height	11	13.7
Types of fracture	Gartland Type II	34	42.5
	Gartland Type III	46	57.5
Complications	Pin tract infection	25	31.3%
	K-wires migration	22	27.5%
	Varus malunion	1	1.2%
	Nerve injury	0	0

Table 3: Functional results according to Flynn's criteria.

Criteria	No.	%
Excellent	40	50
Good	24	30
Fair	16	20
Poor	none	0
Total	80	100

Superficial pin tract infection and K. wires migration were common complications (Table 2). Infection healed well after pins removal and daily dressing with oral antibiotic supplementations. Functional outcomes according to Flynn's grading system showed that 40

(50%) patients had excellent, 24 (30%) good, 16 (20%) fair, and none of them had poor outcome (Table 3).

DISCUSSION

Over the past decade, it has come to be recognized that, fixing supracondylar humerus fractures by percutaneous cross K. wire fixation is more useful for fracture healing and function than other available methods of treatment like casting.¹¹ Our study result is similar to Lucas Moratelli et al 2019 study, but lower than the result of Shamim et al 2016.^{12,13} In our study, all of the fractures are extension types and majority of fracture in non-dominant hand (81.3%), our result similar to results of Moratelli et al¹² and Cekanuska et al.¹⁴

Injury during playing was seen in 43 (59.8%) children in our study. Our results are against to result of Gopinath et al in which 80% injuries were from falling off the height.¹⁵ Gartland type III involves about two-third of our patients (57.5%), which is against the study of Moratelli et al.¹²

In our work, we use two cross wires pins for fracture stabilization, although clinical and biomechanical studies have revealed that the cross-pin wires did not increase stability of the fracture as did two parallel lateral pin configuration, other surgeons have used two crossed pins with good results.^{8,12,16} A study by Moratelli et al showed that K-wire pinning did not affect the outcomes apart from increasing the chance of ulnar nerve injury.¹² In our result, none of our 80 patients develop the sign of ulnar nerve injury because we palpated the nerve before introduce the medial pin this is similar to conclusions of other studies.¹⁷

In our study, pin tract infection was the main problem in 31.3%; this is higher than other studies by Bhat et al¹³ and Zamzam and Bakarman.¹⁸ The high percentage in our patients was due to personal hygiene's as all patients with pin site infection were from poor families with low socioeconomic status without any carefulness about the cleaning of pins insertions while the arm protected by the back slab. All infections were superficial and treated by oral antibiotics and complete healing occurs after removing pins. No case of deep infection occurred and is it similar to previous studies.^{13,18}

K. wire migration was seen in 27.5% of our patients without loss of reduction and this result was higher than studies of Sahu¹⁹ and Lee et al (7%).²⁰ The cause behind high percentage is due to sensitivity from ulnar nerve injury while insertion of K. wires rather than stable fixation, and this similar to Lee et al.²¹

According to Flynn's grading system, 50% patients had excellent result, 30% had good, and only 20% had fair results. Our results are higher than those of Moratelli

et al¹² and lower than Sahu¹⁹ and Dekker et al.²² None of our patients had poor results and these similar to previous studies Moratelli et al,¹² Sahu,¹⁹ and Dekker et al.²²

Cubitus varus deformity is regarded as the most important disability after this malunited fracture. In our result, cubitus varus occurred in one patient only (1.2%). This was higher than Kallio et al.²³ We agree with the study of Aronson et al that cubitus varus results from poor reduction.²⁴

CONCLUSION

Percutaneous k. wires fixation for supracondylar fractures of the humerus Gartland type II and III resulted in good functional outcome, short hospital stays and minimal complications It is regarded as an acceptable method for fixing such fractures.

Author Contributions:

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Drafting of the article: Mohammed Shihab Al-Edanni.

Critical revision of article for important intellectual content: Mohammed Bagir Al-Sharaa, Statistical expertise: Mohammed Shihab Al-Edanni.

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