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Research article

MANAGEMENT OF SUPRACONDYLAR HUMERUS FRACTURE WITH CROSS K WIRES BY TRICEPS SPARING APPROACH

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ABSTRACT

Background: Supracondylar fracture accounts for 60% of all fractures about elbow in children and represent 3 % of all fractures in children. The rate of supra condylar fractures steadily increases with age and reaches peak by 5-7 years. It is a fracture involving thin portion through coronoid, olecranon fossa or above the fossa or metaphysis of humerus. **Aim:** This study aimed to anatomical stable reduction of fracture and prevention of injury to ulnar nerve. **Material and Methods:** We performed prospective study of 122 supracondylar humerus fracture type 3 in children by open reduction and internal fixation with crossed Kirshner wires over 7years duration. The method of surgery was posterior triceps sparing. Diagnoses were made on Gartland's classification. To study the technique [triceps sparing approach] and evaluate results of open reduction internal fixation with cross k wires. **Results:** Average duration of follow up of each child was one year and on overall 94 % of parents was satisfied with the results and 6% were unsatisfactory. Boys were more in number compared to girls and left elbow being more in incidence compared to right. Triceps sparing approach showed better elbow movements. **Conclusion:** Our study concludes that posterior approach gives better visualization of fracture, the delineated ulnar nerve enables passing of k wires without injury.

Keywords: Supracondylar fracture, Anatomical stable reduction of fracture, Ulnar nerve

INTRODUCTION

Supracondylar fracture accounts for 60% of all fractures about elbow in children and represent 3 % of all fractures in children [1]. The rate of supra condylar fractures steadily increases with age and reaches peak by 5-7 years[2]. It is a fracture involving thin portion through coronoid, olecranon fossa or above the fossa or metaphysis of humerus. Pitfalls in management occur frequently and continue to plague the doctor and patients especially in respect to displaced supracondylar humerus fractures even to the most experienced surgeon [3].

Closed manipulation reduction with splint or cast immobilization has tradionally been recommended for supracondylar humerus fractures, impending vascular compromise reported, however loss of reduction resulting in malunion of valgus and varus deformity [4]. In displaced fractures trial closed reduction should be discouraged because it predisposes to myositis ossificans, wastes time, energy and anaesthesia. Displaced Supracondylar fracture is juxtaarticular fracture, hence require perfect anatomic restoration and early mobilization. This is difficult; almost impossible to achieve by closed methods [5]. Surgical treatment has the advantage of decreased hospital stay, anatomical stable fixation and early mobilization [6] as the

hematoma is washed away myositis ossificans is prevented[3]. Lateral divergent k wires fixation is equally stable however cross k wires usage is more stable as it prevents axial rotation[7,8]. Triceps sparing approach causes less soft tissue damage.

MATERIALS AND METHODS

Study design: We conducted cohort prospective study

Sample size & study place: 122 supracondylar humerus fractures of type 3 with age range of 1-12 years, 87 male children and remaining female were studied and followed up in MNR medical college, Sangareddy from January 2007 to February 2014. Ethical clearance and informed consent were taken from patient.

Inclusion criteria: Cases selected were displaced humerus fractures extension type 3 supracondylar, irreducible fractures and fractures with neurovascular complications.

Each case was examined clinically and radiologically on arrival, detail status of neuro vascular structures and soft tissue injuries were noted. Pre operatively carrying angle of unaffected elbow noted. Injection tetanus toxoid and prophylactic antibiotic were administered. 1mm to 1.5 mm k wires thickness used in this series[2]All patients were given posterior elbow slab in flexion and monitoring of pulse is done and the limb kept in elevation. Surgery performed in lateral position under general anesthesia. Under tourniquet control posterior midline incision given Ulnar nerve identified and isolated figure (2). Triceps sparing approach was used in all cases. Triceps mobilized from medial and lateral side helping in better visualization of lateral, medial pillar and fracture could be manipulated with ease figure (1), (2). Under vision fracture reduction, k wire was passed figure (3). In some cases of metaphyseal comminution 3 k wires were used and the rest with two. Lateral wire passed through lateral epicondyle directed upward and medially at angle of 35^0 to 45^0 to sagittal plane of humerus at 10^0 posterior to coronal plane of humerus [9], medial pin passed through center of medial epicondyle which crossed 3 cm above fracture\ and the position confirmed with c-arm. Post-operative vascular status monitoring was performed. All cases were discharged on 3rd post-operative day. Every 10 days patients were called for follow up. On 12th day sutures removed slab weakened at elbow and gentle active motion started. The slab was removed at the end of third week. Pre-operative and post-operative x rays figure (4). Patients follow up was done on 3rdmonth, 6th month, and at one year. Clinical analysis of photos after consent figure (5). Range of motion and carrying angle were compared to normal side by Flynn criteria [9].

RESULTS

Our observations made in this study were: incidence was higher in boys(72%) than girls (28%), peak age of incidence was 4-6 years, non-dominant elbow was more prone to injury compared to dominant. All cases were of extension type. 84% were postero medial type and 16% were lateral displacement. Age and Sex wise distribution shown in Table 1&2.In present study maximum age incidence of supracondylar fracture is in 4-6 years (48%) the next was 10-12 years (28%). The average age incidence is 7.6 years. (Table 2).Non dominant elbow was more commonly involved in supracondylar fractures. (Table 3).All cases in this report were of extension type supracondylar fractures with postero medial displacement. (Table 4). In our series 52% came by 12hrs but 48% presented late. (Table 5).7.2% of complications was due to injury itself. Associated fractures were lower end radius. Two crossed k used wires in 93 patients. 3 k wires used in 23patients with medial comminution(Table 6).In our series the overall incidence of postoperative complication was 3% patients had restriction range of motion. Not a single case of cubtis valgus or varus deformity or other complications seen (Table 7). 3.2 % of patients had poor result, 13.2 % were good and 83% had excellent range of movement. As regards the carrying angle 92 % were excellent and 8% were good. In overall para meters according to Flynn criteria is cosmetic factor is carrying angle, functional factor is movement. (Table 8).Grading of results [Flynn [9] criteria] shown in (Table 9).

Table1. Sex wise distribution

Sex	No of cases	Percentage %
Male	87	72%
Female	35	28%

Table 2: Age wise distribution

Age group	No. of patients	Percentage%
0-3 years	1	0.8%
4-6 years	58	48.%
7-9 years	29	23.8%
10-12years	34	28%

Table 3: Side distribution

Side	No. cases	Percentage%
Right side	14	12%
Left side	107	88%

Table 4: Fracture type [Gartland's [10]classification] Radiological displacement of distal fragment as follows.

Type	Displacement	No of cases	%
Extension type	Posteromedial	103	88
	Posterolateral	19	12
Flexion type	Anterior	0	0

Table 5: Duration of presentation since trauma

Duration	No. of .cases.	Percentage%
0-12 hours	64	52%
12-48 hours	39	32%
2-7 days	19	16%
More than 7 days	0	0

Table 6: Preoperative complications

Complications	No. of cases	Percentage
Severe edema	3	2.4%
Nerve injury (median nerve)	4	3.2%
Puncture wound	0	0
Associated factures	2	1.6%
total	9	7.2%

Table 7: Post-operative complications

Complications	No of cases	%
Vascular injury	00	00
Nerve injury	00	00
Infection	00	00
Restriction of motion	04	3%
Deformity [varus or valgus]	00	00
Myositis ossificans	00	00
Total	04 patients	3.2

Table 8: Restriction of motion

Result	Loss of movement (range)	No of cases	%
excellent	$0\text{-}5^0$	102	83.6 %
Good	$6\text{-}10^0$	16	13.2 %
Fair	$10\text{-}15^0$	00	00
Poor	$15\text{-}20^0$	4	3.2%

Table 9: Grading of results [Flynn [9] criteria]

Results	Loss of carrying angle No. of cases	Loss of carrying angle % of cases	Loss of movement No. of cases	Loss of movement .% of cases
Excellent	112	92%	102	83,6%
Good	010	08%	16	13.2%
Fair	00	00	00	00
Poor	00	00	O4	3.2%

Fig1: Triceps sparing approach, lateral k wire passed after fracture reduction(Triceps sparring method)

Fig 2: Triceps retracted ulnar nerve isolate

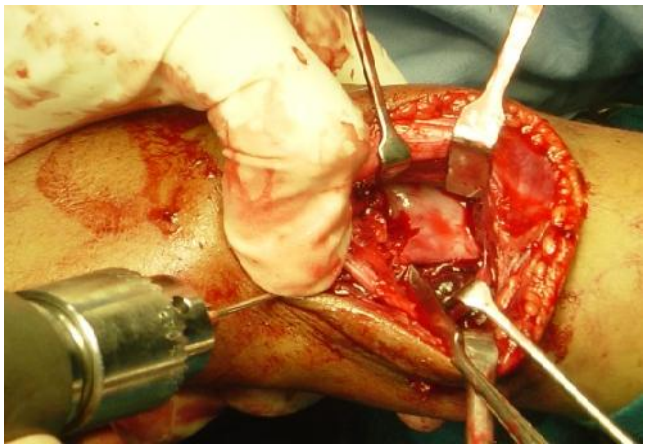


Fig3: k wire passed under vision after fracture reduction

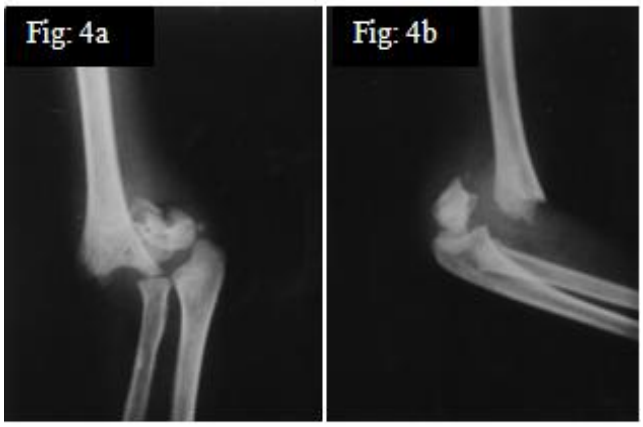
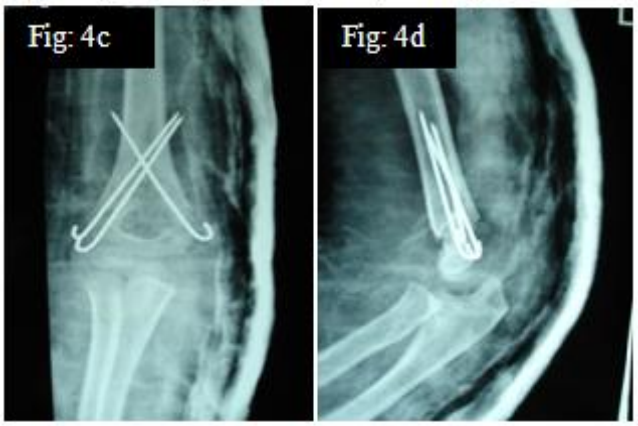


Fig 4: a) Pre Operative AP b) Pre Operative LAT



4c) Pre Operative AP 4d)Post Operative LAT

4e) Post Operative AP 3 months later 4f) Post Operative LAT 3 months

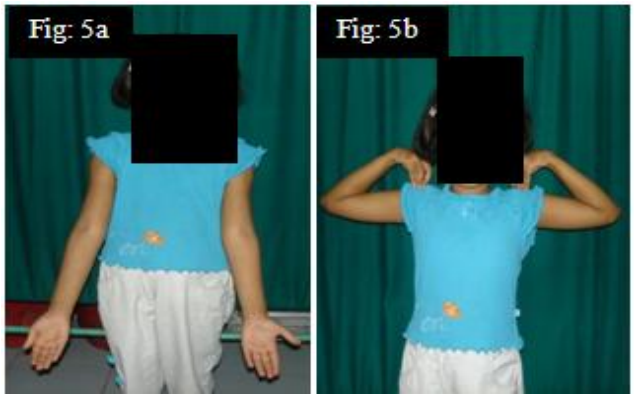


Fig 5: a) Elbow in Extension b) Elbow in Flexion with comparison

DISCUSSION

Displaced supracondylar fracture is a dilemma[11]. Type 3 supracondylar fractures can lead to adverse physical, social and emotional consequences if they are not treated well [12]. Displaced supracondylar fracture should be reduced accurately and stabilized to have satisfactory results [13, 14]. Acceptance of compromised fracture position leads to imperfect results leading to elbow varus or valgus deformity. Peak age incidence in our article was 7.6 years which is comparable to other studies [15, 16], incidence was related to weak bone architecture and also anatomical factors [17, 18]. Our study and other author's articles were similar in sex wise distribution of supracondylar fractures. Non-dominant or left limb is frequently used in protective reflex to support a fall [19] hence the predominance of left.

Extension type of supracondylar humerus fracture were more common [20, 21] and posteromedial displacement is probably secondary to pull of triceps which originates medially and also aided by biceps, the pull of which is also medial.

Majority of patients came within 12 hours of injury whereas others came late as they were referred from primary health care center or had some treatment elsewhere which is comparable.

In our study we had 3.2% of pre-operative median nerve palsy which almost recovered by 5weeks comparable to fowels about 2.7 and bhan 3.0%. We didn't have pre-operative or post-operative vascular injuries. Associated with lower end fracture of radius were 3.2% almost the same [22].

We had no pin tract infection as we buried k wires under skin unlike other articles which had pin tract infection [23] due to the percutaneous placement. We had no ulnar nerve injury as k-wires were passed under vision and buried away from the nerves course while others [24] with percutaneous insertion had 1.1% ulnar nerve injury [25], out of 375 patients 19 recovered but 2 had permanent damage [26] lateral pinning showed 3.4 % nerve injury, 4% with medial pinning [27].

Range of motion was 96% satisfactory, comparing to other studies ours was much better. This probably is due to the sparing of the entire triceps from any injury

and scarring which would allow recovery of flexion and extension as its tone and strength are maintained. Over and above the posterior approach allows anatomic reduction and the usage of crossed k wires in addition to giving a stable fixation prevents angular rotation [28]. 3.2% had poor results as they were little irregular in follow-up due to economic (poverty) and social (far off distance) factors.

Imperfect anatomical alignment and unstable fracture fixation leads to loss of carrying angle [29]. We had 24 % medial comminution so in those patients, we used lateral two pins and medial pin to give better rotational stability [30, 31], and probably this is reason for no cubitus varus cases in our study. We didn't have migration of k-wire as they were bent and flushed with bone. No pin tract infection was seen as the k wires were not left outside the skin.

CONCLUSION

Our study concludes that posterior approach gives better visualization of fracture, the delineated ulnar nerve enables passing of k wires without injury. Median nerve injuries protected by pinning the k wire 10^0 postero-lateral to coronal plane. Triceps sparing approach has less scaring so better flexion and extension, cross k wire gives more stability to enable early mobilization.

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Conflict of Interest: Nil

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