

A comparative study of the results of closed reduction and percutaneous kirschner wire fixation under image intensifier control of displaced supracondylar fracture of humerus in Children

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ABSTRACT

Introduction – Supracondylar fractures of humerus are very common fractures in children between age of 4-8 years, being the most common fracture in children around the elbow. There management is controversial and treatment option depends on the treating orthopedician. Close reduction and application of POP slab and close reduction and fixation with kirschner wire fixation are the most commonly used treatment modalities. In this study, we compared both these methods and evaluated which is a better treatment option.

Materials & Methods – In this study, we evaluated 40 patients with displaced supracondylar fracture of humerus which were admitted in our hospital, out of which 25 were treated with POP slab and 15 with Kirschner wire fixation. All patients were evaluated by **Mitchell and Adams criteria**⁵.

Results – Out of 40 cases, 4 were open fractures with puncture wound in cubital fossa. All fracture healed without any consequences. In group which was treated with POP slab, excellent result was seen in only 20% of cases as compared with excellent result in 60% cases treated with Kirschner wire. Also fewer complications were seen in patients treated with kirschner wire.

Conclusion - Closed reduction and POP slab should be reserved for minimally displaced fractures. Further attempts at closed reduction should not be made, as repeated manipulations increases incidence of myositis ossifications and residual stiffness. For cases with displaced fractures, use of kirschner wire under image intensifier control is better and give excellent results.

Keywords – Supracondylar fractures, humerus, kirschner wire, POP slab

INTRODUCTION

Supracondylar fractures of humerus constitute 60% of the fractures around elbow in children, thus being the commonest fracture around the elbow in children. The management of displaced supracondylar fractures is controversial, there are no set guidelines as to which reduction is acceptable and which is not. Surgeon treats the fracture according to his personal preference or according to the method prevalent in his Centre.

Two types of the supracondylar fractures of humerus are encountered in children

1. The Extension type : which is more common

2. The flexion type : which is less common

Fall onto the outstretched hand with the elbow in full extension leads to supracondylar fracture of humerus. Laxity of ligaments which allow hyperextension of elbow to occur. **Henrikson**¹(1966) had shown that children with supracondylar fractures of humerus are more likely to have hyperextension of normal elbow and also children with hyperextension are more susceptible to repeated supracondylar fractures.

The rarer type is the flexion type of fracture. It is caused by the direct fall on the flexed elbow and its distal fragment is displaced anteriorly. Although the extensive literature on this fracture describes several methods of treatment, both conservative and operative, it would appear that none is suitable for all fractures, not has any method gained universal acceptance. Therefore, this fractures has been rightly nick named as the misunderstood fracture by **Gartland**² (1949).

Gartland proposed a useful classification for supracondylar fractures:

Type I : Undisplaced fracture,

Type II : Displaced with intact posterior cortex.

Type III : Displaced with no cortical contact.

Modified Garland classification of supracondylar fracture

Type I : Undisplaced;

Type II : Hinged posteriorly

Type III : Displaced;

Type IV : Displaces into extension and flexion.

Whatever maybe the controversy in treatment, but the ultimate aim in the management of these fractures even today as what **Siris**³ suggested in 1939 is to prevent Volkman's ischaemic contracture and malunion, restore function to elbow, achieve satisfactory reduction, thus attaining cosmetically acceptable results.

The impulse for this clinical study of supracondylar fractures of humerus came chiefly from the fact that almost every day one or more patients with this fracture visited the emergency of our hospital. As compared to the Western countries, articles on this subject by Indian authors are much less. Thus, the field for the study on supracondylar fractures of humerus remains still wide open in the Indian patients.

MATERIAL AND METHODS

Forty cases were studied; all patients with displaced supracondylar fractures of humerus were admitted in the orthopedic emergency and subjected to detailed clinical and radiological examination.

These patients were subjected to closed manipulation and immobilization by plaster of paris slab, under general anesthesia as early as possible. All the closed reduction was carried out by the method described by Charnley⁴ (1961), which is briefly described below.

The patients are anesthetized; the radial pulse is palpated before starting the manipulation. The elbow is gently extended and a strong longitudinal traction exerted by gripping the patients wrist and distal forearm. The distal forearm moves into line by straight longitudinal traction and any lateral displacement is automatically corrected by tension of surrounding soft parts. If lateral displacement has not been overcome; some lateral pressure while the elbow is extended completes the reduction. Now the surgeon grips the lower end of distal humerus in his passive or fixing hand maintaining traction in the long axis of the forearm, the thumb of the passive fixing hand pushes the olecranon forwards as the elbow is flexed. The fingers of the passive hand pull the proximal fragment backwards. The elbow should be hyper flexed (to 120 degree) or to a position where the radial pulse is normal. Now an above elbow plaster of paris slab is applied and the limb is elevated and a close watch is kept on the digital circulation and radial pulse. The patients elbow is immobilized for 3 weeks after which mobilization of the joint started.

The patients' with unsatisfactory reductions will be reduced under general anaesthesia. Traction is applied to the forearm in supination, and the shortening and lateral or medial displacements are corrected. Once adequate reduction have been achieved, as confirmed with the image intensifier, then under all aseptic precautions two kirschner wires 1.5 to 2 millimeters in diameter are introduced, one through the lateral epicondyle and one through the medial epicondyle. These two kirschner

wires are directly obliquely and proximally unit they pass through the opposite side of the cortex. In order to secure sufficient fixation of the fracture, it is imperative that the two wires must pass through the proximal fragment or shaft. The final position of the wires is checked under the image intensifier and if found satisfactory, the protruding parts of the wires are cut off below the skin surface and an above elbow plaster splint is applied, with elbow at right angle and the forearm in neutral position. Check x-rays are taken and the limb examined for any postoperative neurological deficit. After three weeks, the plaster slab is removed and elbow mobilization started. The Krischner wires are removed after four weeks under local anaesthesia.

Results obtained were graded according to **Mitchell and Adams criteria⁵ (1961)** and presented as given below.

- Excellent :** Change in carrying angle of less than 5 degree loss of range of motion of less than 10 degree. No symptoms
Good : Change in carrying angle of 5-15 degree. Loss of range of motion of 10-20 degree. No symptoms.
Poor : Change of carrying angle or reduction of motion above these limits. Any notable symptoms.

RESULTS

Table1: Demographic characteristic of patients in both groups

Factors	Closed reduction and plaster of paris slab	Closed reduction internal fixation with Kirchner wire	P value
Mean Age (in years)	7.92±2.99	8.40±2.44	0.602
Sex (male/female)	20/05	12/03	0.992
Hospital stay (days)	2.36±1.18	2.20±1.01	0.664

Table2: Comparison of the two modalities of treatment

Types	Closed reduction and plaster of paris slab	Closed reduction internal fixation with Kirchner wire	P value
Excellent	05	09	0.01
Good	10	04	0.502
Poor	10	02	0.152
Total	25	15	

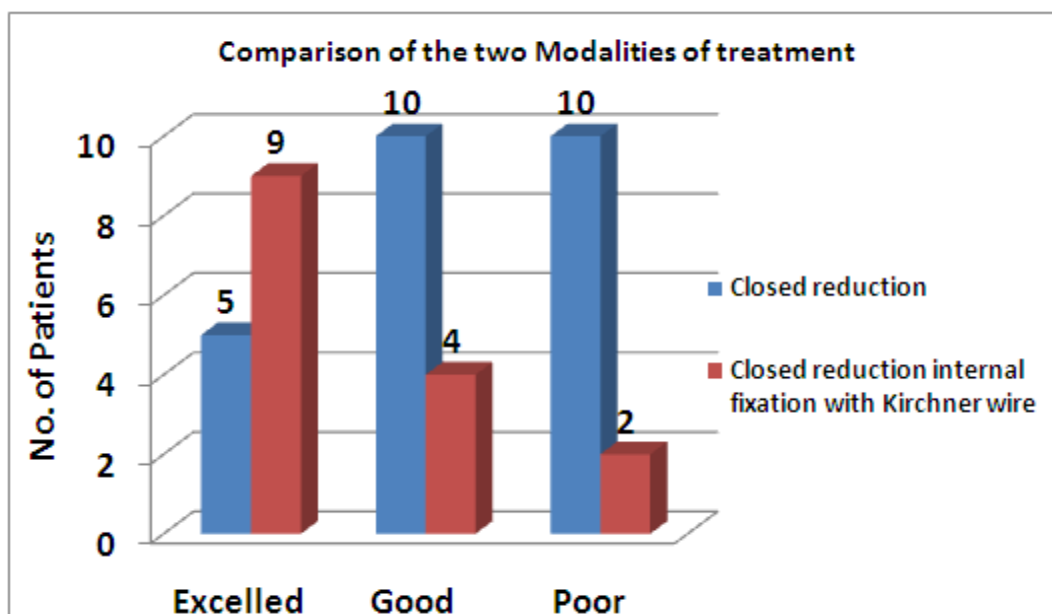


Table 3: Types of complication in both groups

Types of complication	Closed reduction and plaster of paris slab	Closed reduction internal fixation with Kirchner wire	P value
Vascular	02	00	0.519
Neurological	00	01	0.375
Loss of motion	00	01	0.375
Myositis ossificans	00	00	00
Superficial infection	00	02	0.134
Cubitus varus	08	01	0.11
Cubitus valgus	00	00	00
Hyper extension of elbow	01	00	0.432

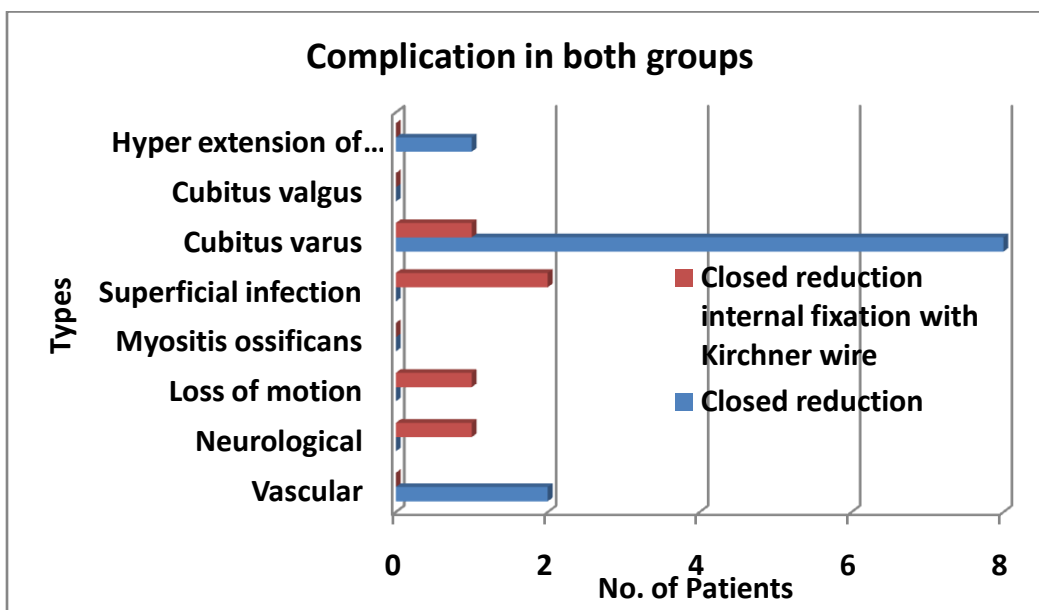


Table 4: Modified Gartl and classification

Type	No. of Cases	Percentage
II	10	25
III	18	25
IV (Extension)	10	25
Flexion	02	05

DISCUSSION

Supracondylar fractures of humerus as the “misunderstood fracture” because in present problems in management in the form of vascular complications, cosmetically unacceptable deformities and stiff elbows to say the least. Unfortunately no uniform mode of treatment is available which is suited to all grades of fractures, in order to achieve consistently acceptable and a normal functioning elbow.

The maximum incidence of supracondylar fracture in present study was seen in 6-10 years of age group and the average was 7.27 years.

Males outnumber females in all age groups. The ratio being 4:1 in favour of males. This is a consistent feature in series reported by **Holmberg⁶ (1945)**, **Maylahn and Fahey⁷ (1958)** and **Henrikson¹ (1966)**, the fracture being twice more common in males than females.

The left side was injured in 27 cases (67.5%) and right side in 13 cases (32.5%) respectively. This agrees with the findings of **Holmberg⁶ (1945)**, **Maylahn and Fahey⁷ (1958)** and **Edman and Lohr⁸ (1963)**.

Flexion type of supracondylar fracture of humerus is less common than the extension type. In the present study only 2 cases (5%) of flexion type were seen. Incidence in Western literature ranges from 2.5% to 10%.

The majority of cases were of the closed type (36 cases) in the present series. Four cases of open fracture were seen with all having a punctured wound in the cubital fossa. All four of the fractures healed without any consequences.

Twenty nine cases came to the hospital more than 12 hours after the injury. The parents ignored the child's cry probably due to ignorance till the elbow became swollen and severely painful.

In all patients an initial attempt at closed reduction under general anesthesia was carried out. Subsequently, 25 cases were definitively continued on conservative treatment with plaster of paris splinting and 15 cases by close reduction and Kirschner wires fixation under image intensifier control.

Grading the end results according to **Mitchell and Adams⁵ Criteria (1961)**, we classified the results into two groups (1) Satisfactory [Excellent + Good] and (2) Unsatisfactory [Poor]. We got 40% poor results with closed reduction and plaster of paris splinting and 60% were satisfactory.

Close reduction and fixation with K wires under Image Intensifier gave maximum percentage of excellent results (60%). Closed reduction gave 20% excellent results. Closed reduction and fixation under image intensifier has following main advantages.

1. It makes accurate reduction possible
2. Hospital stay is shortened

The average time taken for gaining elbow motion was more with close reduction and internal fixation with K wire under image intensifier cases. Time taken is more because soft tissues around the elbow are subjected to surgical trauma.

The overall incidence of nerve involvement was 3.92% in the present series, with one case of radial nerve and one of medial nerve involvement. Ulnar nerve involvement was not encountered. Both these cases were treated with expectant lines and both recovered completely within 9 weeks.

The overall incidence of cubitus varus in the present study was 22.5% which compares favorably with the average incidence of 30% given by **Siris³ (1939)**, **Brewster and Karp⁹ (1940)**, **Sandegard¹⁰ (1943)**, **Aikten¹¹ (1943)** and **Madsen¹² (1955)**. No case of cubitus valgus was seen in the present series.

CONCLUSION

Closed reduction and plaster of paris splinting should be reserved for minimally displaced fractures. Further attempts at closed reduction should not be made, as repeated manipulations increase incidence of myositis ossificans and residual stiffness.

In all other cases, closed reduction and fixation with Kirschner wires under image intensifier control should be attempted. If it is done as a last resort after repeated manipulation the percentage of poor results increases. Thus, closed reduction and Kirschner wire fixation under image intensifier is advisable for displaced supracondylar fractures of humerus. It should be performed as early as possible (not later than five days) and should not be done when patient has undergone repeated manipulations because of the high incidence of myositis ossificans and stiffness of elbow postoperatively.

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CASE 1: Case treated with k-wire fixation



A. – Pre-op xray AP view



B. – Pre-op xray lateral view



C. – Post-op xray lateral and AP views



D. & E. – Clinical photographs showing range of motion after union



F. Clinical photograph showing carrying angle

CASE 2 – Treated with close reduction and POP Slab



A – Pre-reduction xray AP & lateral views



B – Post Reduction xray AP & lateral views



C&D – Showing range of motion at elbow



E- Showing carrying angle