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### **A prospective study of surgical management of the displaced supracondylar fractures of humerus in children with k wire fixation**

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#### **Abstract**

**Background:** Supracondylar fractures of humerus is the commonest injury, constitutes about 65.4% of all fractures about the elbow in children. Displaced supracondylar fracture of humerus demand great respect and challenging one to treat, since it requires accurate anatomical reduction and internal fixation to prevent complications. So, in this study, we reported the results of closed and open reduction and internal fixation with K-wires in the displaced supracondylar fracture humerus in children.

**Material and Methods:** Fourty cases of displaced (Gartland's type 2 and 3) supracondylar fractures treated by internal fixation with K-wires were studied between September 2013 to August 2015 at our institution and followed for an average of 24 months. Results: We came across 26male patients and 14 female patients. Majority of the cases were due to high energy trauma of road traffic accidents involving relatively younger patients. At the end of 5 months, all except four patients could mobilize independently without any aid. We did not come across complications like fracture of femur and failure of fixation and no reoperations were required.

**Conclusions:** Internal fixation with K-wires is the most commonly accepted treatment of displaced supracondylar fracture humerus in children when done at appropriate time. It gives more stable fixation, better anatomical reduction with negligible complication.

**Keywords:** Surgical management, supracondylar fractures, humerus, k wire fixation

#### **Introduction**

Supracondylar fracture of the humerus is the most common injury in children and makes up approximately 60% of all elbow injuries. But these days the incidence is decreasing, as the children are not playing outside much.

Considering the number of patients injured and the severity of the initial injury that occurs; great diligence is required to secure an excellent result and to avoid or minimize the crippling complications such as stiffness of elbow, Malunion leading to deformity, Myositis Ossificans, Volkmans Ischemic contracture and neurovascular injuries.

It is the general belief that accurate reduction in children is not essential for a good result, because growth may correct a deformity, but the same may not be true for the supracondylar fracture of the humerus in children. It is true that functional end results of malalignment are generally very good but is also true that the cosmetic results of malalignment are generally very poor. Stiffness of the elbow which sometimes follow relatively is rare these days because of the change in the trend towards the early fixation with anatomical reduction and early mobilization of the elbow injuries and the remarkable sensitivity of the injured joint to early passive movement add to the difficulties of treatment and prognosis.

These injuries of elbow demand respect because of the chance of involvement of the neurovascular structures around the elbow.

There is no controversy regarding management of undisplaced and partially displaced supracondylar fractures. But the completely displaced supracondylar fractures have got many treatment options and many controversies. various methods of treatment have been devised like closed reduction, blind pinning after reduction, pinning under x-ray control, open reduction, criss cross pinning, lateral pinning alone No longer it holds to say, 'not bad for A supracondylar fracture'.

**Objectives of the study**

To evaluate the results by the treatment of supracondylar fractures of the humerus in children by closed reduction and percutaneous pinning or open reduction and fixation with k-wires in terms of:

1. Duration of immobilization.
2. Restoration of the anatomy of the elbow in terms of carrying angle, varus and valgus deformity and range of motion.
3. Prevention of deformity due to the malunion and vascular compromise.
4. Evaluation of treatment related complications.

**Surgical procedure**

1. Closed reduction and percutaneous kirschner-wire fixation Anaesthesia-General anaesthesia.
2. Open reduction and internal fixation with the kirschner wires Anaesthesia: Genral Anaesthesia

**Procedure**

A standard posterior Campbells approach was used in all patients.

**Post-operative management**

The operated limb was elevated. A careful observation for any neurovascular deficit was observed at regular intervals. Appropriate antibiotics and analgesics were used. Check X-ray were taken on the 2<sup>nd</sup> post-operative day in 2 planes. Sutures were removed on 10<sup>th</sup> post-operative day. Fresh above the elbow dorsal plaster slab was applied with elbow in 90 degrees of flexion.

**Follow UP**

Patients were called for follow up after 2 weeks of discharge from the hospital. The slab was removed. Now X-rays were taken in two planes. In cases of adequate callus formation the K-wires were removed and active flexion and extension of the elbow was advised and in cases of inadequate callus formation the K-wires were retained and intermittent active flexion and extension of the elbow was advised after removing the slab for 2 more weeks. Patients were advised to avoid massage and passive stretching of the elbow. Patients were asked for the regular follow up. During the follow up the patients were examined clinically radiologically, assessed for range of motion and for union of fracture and for union of fracture and data was recorded in the data performa.

**Materials and methodology**

The present study consists of 40 patients of displaced Supracondylar fractures of humerus which were treated by closed/open reduction and internal fixation using kirschner’s wires. This study was conducted in the Department of Orthopedics, S.S.I.M.S & R.C, Davangere.

**Inclusion criteria**

Displaced type of supracondlar fracture of the humerus (Gartland type 2 and 3), Compound type of supracondylar fracture of humerus with neurovascular compromise, Bilateral supracondylar fracture. Children <12 years.

**Exclusion criteria**

Gartlands type 1 fracture, Poor general health of the patients, Associated hemorrhagic shock, head injuries, Cases aged more than 12 years.

**Follow UP**

After the fracture was stabilized either by closed/open

reduction and internal fixation with the kirschner’s wire the limb was immobilized in A/E dorsal slab for 2-3 weeks and cases were followed up in the OPD at regular intervals for up to 6 months.

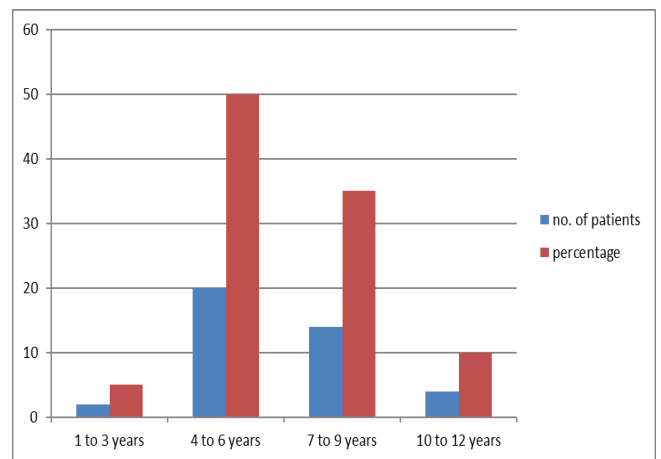
**Observations and results**

The following observations were made from the data collected during this study:

**Table 1:** In our study age distribution was from 1-12 years.

Age in years	No. of patients	Percentage
1-3	2	5
4-6	20	50
7-9	14	35
10-12	4	10

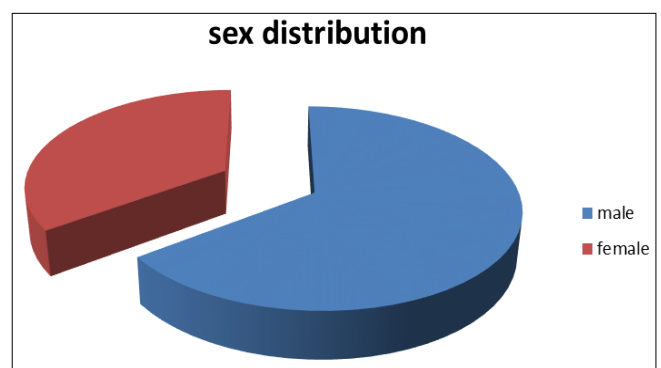
This fracture primarily occurs in the first decade of life. The incidence increasing during the first 5 yrs to 8 yrs of age. Following this there is decrease until the age of 15 years. In our series age distribution was from 1-12 years. 50% of the patients were in the age group of 4-6 years. Ramsey in his study of supracondylar fracture reports the average age of 7 years. Fowles *et al*, in their study of supracondylar fracture report the average age of between 5-10 years.



**Sex distribution**

In this series of 40 patients 26 patients were male and 14 patients were female. This shows preponderance of males over females.

Sex	No of patients	Percentage
Male	26	65%
female	14	35%



In our study 26 patients were male and 14 were female. Many authors have reported male preponderance. J.V. Fowles *et al*.

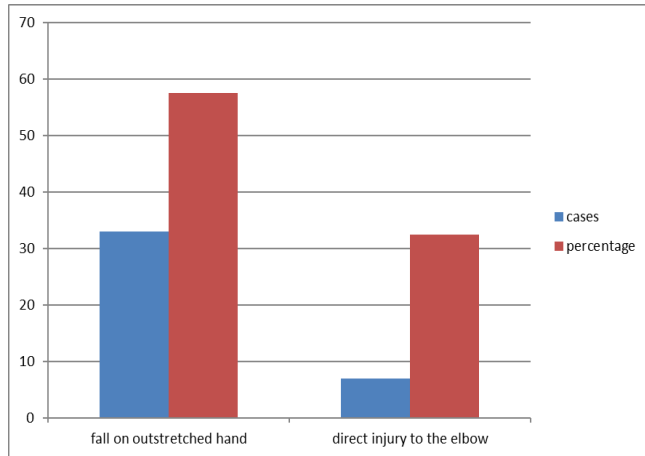
Canada in their of 105 cases there were 89 (84.7%) males and 21 (15.3%) females.

**Nature of injury**

In our study the following were the nature of the violence:

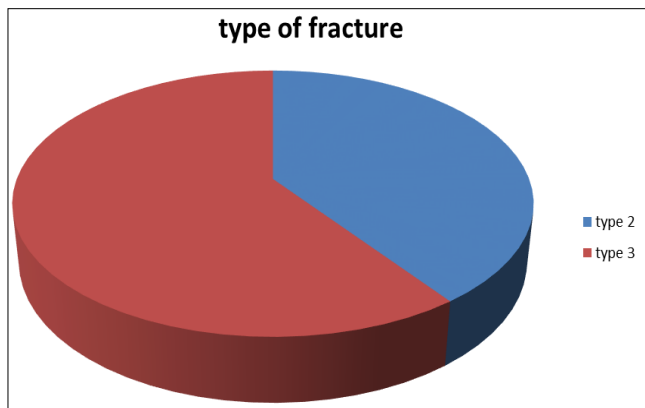
1. Fall on an outstretched hand 33(57.5%)
2. Direct injury to the elbow 7(32.5%)

The most common mode of injury in our series was fall on an outstretched hand. Our occurrence is same that of the Wright *et al* (1962).



**Type of fractures**

Type of fracture (Gartland)	No. of cases	percentage
Type 2	16	40
Type 3	24	60

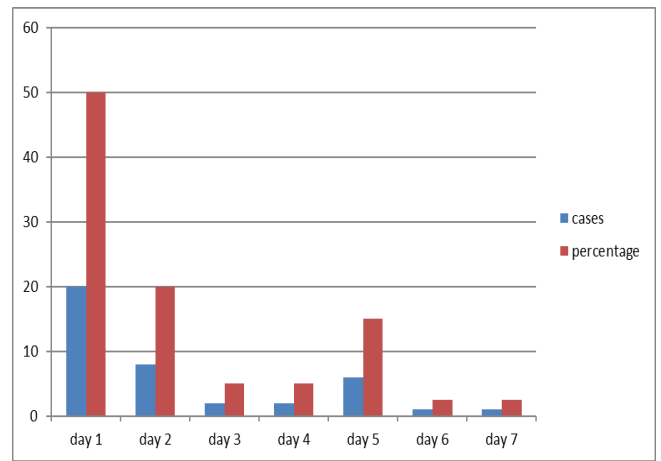


In our series we had 16(40%) cases of Gartland type2 and 24 (60%) cases of type 3 fracture.

**Time of injury**

All cases included in the study group were fresh fractures who underwent surgery at the earliest possible. All patients were operated with 7 days of initial trauma.

Time of surgery	No of cases	Percentage
Day 1	20	50
Day 2	8	20
Day 3	2	5
Day 4	2	5
Day 5	6	15
Day 6	1	2.5
Day 7	1	2.5



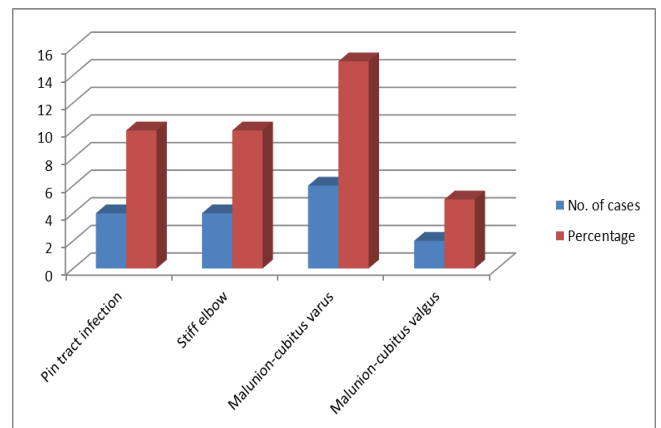
The functional results will be very good if the surgery is performed at the earliest.

Ramsey R.H. in his study of 15 cases of supracondylar fracture reports that all his patients were operated within 24 hours of admission to hospital and he has reported excellent results in 12 cases.

20 cases (50%) in our series were operated on the 3<sup>rd</sup> day following injury.

**Post-operative complications**

Complication	No. of cases	Percentage
Pin tract infection	4	10
Stiff elbow	4	10
Malunion-cubitus varus	6	15
Malunion-cubitus valgus	2	5



Various authors have reported pin tract infection and the infection were controlled by the use of appropriate antibiotics. We had 4 cases of pin tract infection which were controlled by the appropriate antibiotics. No. cases of deep infection were encountered.

Andrew. J. Weiland *et al.* in their study reported 13 case of cubitus varus and 2 caeses of cubitus valgus.

In our series we had 6 cases of cubitus varus and 2 cases of cubitus valgus. In adequate results with medial abgukation was associated with residual varus deformity. Anatomical reduction with accurate fixation prevents this complications. And we had 4 cases of elbow stiffness.

In the present study we had not come across any case of non union or vascular complications.

**Functional results**

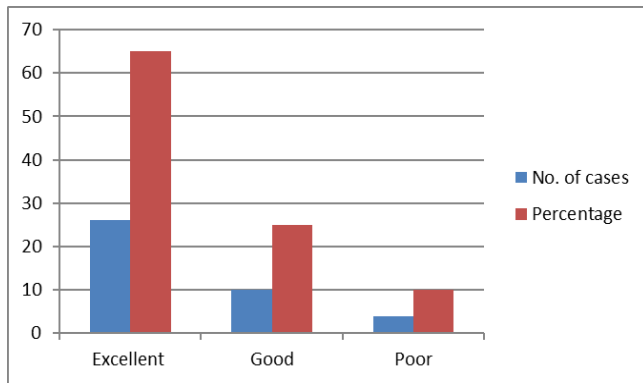
Grading of the results were according to the Michell and Adams criteria excellent results.

Change in the carrying angle of less than 5 degree or limitation of the elbow motion less than 10 degree Good results.

Change in the carrying angle 5-15 degree or limitation of the elbow motion 10-20 degree Poor results.

Change in the carrying angle more than 15 degree or limitation of elbow more than 20 degrees. In our series we had 26 (65%) cases with excellent results. 10(25%) good results. 4 (10%) poor results.

Results	No. of cases	Percentage
Excellent	26	65
Good	10	25
Poor	4	10



**Discussion**

This study was conducted between in SSIMS & RC, Dvg. The aim of this clinical study is to study the epidemiology of the supracondylar fracture, the mechanism of injury, the associated complications, and the role of the surgical management.

During the study period we had treated 40 cases of supracondylar fractures. Majority of the patients reported to the hospital with in 24 hours of the injury. In this study the mean age was 6.6 years. This correlates with the studies done by the other authors. Have reported an average age of 7.2 years. Had found the peak incidence of 5-7 years of age. In this study the youngest patient was 2 years and the eldest was 12 years. The same has been observed by Fowles and Kasab. In the present study the most common mode of injury was fall on an outstretched hand accounting for 33 and 7 were due to direct injury due to fall on the pointed elbow. In this study left side was more commonly involved about 65%. This finding corresponds with the reports of the He observed that left side was involved in 70 % of the supracondylar fractures. In the present study there was 1 case of compound fracture (2.5%). In this study 8 cases (95%) were extension type and 2 cases were (5%) were flexion type. Fowles and Kasab have reported extension type (90%) and flexion type 10%.

In our study we have used Gartland’s classification (1959).

Gartland type	No. of cases
Type2	14
Type 3	26

Majority of the cases were type 3 gartland

Out of 40 cases only 2 had absent radial pulsation. In these cases the radial pulse appeared after the reduction and stabilization with the K-wires. None of our cases developed Volkmann’s ischemic contracture. In the present study we had 1 case of median nerve injury with posterolateral displacement and it was treated by closed reduction and

percutaneous K-wire fixation which recovered after 8 weeks. Have also reported that majority of their cases with nerve injuries of neuropraxia type. In the present study we came across 4 (10%) cases of elbow stiffness. We defined the elbow stiffness as the loss of more than 25 degree of flexion or extension. the mean loss of flexion and extension was found to 10 degrees in cases treated by percutaneous K-wire fixation and 14 degrees in cases treated with open reduction. Henricson *et al.* [28] have analysed in detail regarding the follow up of range of motion of the elbow, they have reported that fracture treated by closed methods the average loss of flexion was 4% and loss of flexion with the open reduction was found to be 6.5%. The greater loss of elbow motion in the study may be attributed to the shorter follow up period when compared to the other studies.

In the present study we encountered 6 cases of cubitus varus deformity, out of these four were seen in cases treated with closed reduction and percutaneous pinning and other 2 were found in the cases with the open reduction and internal fixation with the K-wires. We feel that the varus deformity was the result of residual displacement of the distal fragment in a medial direction and also incomplete correction of the internal rotation. This concept is widely accepted by the many authors. The incidence of the cubitus varus in this study was 10% by closed method and 5% in open method. Pirone, A.M, *et al.* (1988) have reported that the incidence of 14% with the closed method and 3% in open methods.

We came across 2 cases of cubitus valgus in the study. One was treated by open means. We feel that the valgus deformity was the result of residual displacement. Langenskiold A and Kiralaakso R (1967) in a study of 14 cases of the elbow valgus deformity was noted in 3 cases tardy ulnar nerve palsy developed in 1 case and we did not have any case of tardy ulnar nerve palsy.

The average period of immobilization in this study was 3.15 weeks, and the average period of follow up 8.6 months.

Result	No. of cases	Percentage
Excellent	26	65
Good	10	25
Poor	4	10

In our study 32 cases were treated by closed reduction and percutaneous pinning among these result were excellent in 23 cases and good in 7 cases and was poor in 2 cases.

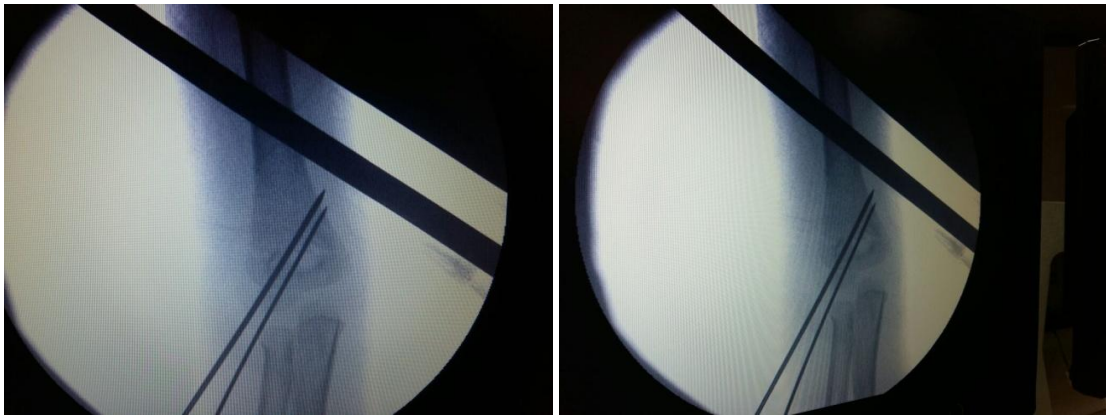
And 8 cases treated by open reduction. The fracture was opened in 2 cases of flexion type of fracture and 6 case of extension type where we were unable to do closed reduction because of soft tissue interposition. The results can be attributed to the poor follow up following the discharge from the hospital and in one case the last follow up was 2 months back, and he had stiffness in the elbow which may improve in the course of time. Holmberg (1945) has treated 50 patients with open reduction and internal fixation with K-wires. His results were excellent in 30, good in 13 and poor in 7 cases. Gruber and Hudson 1964 have treated 22 patients with open reduction and internal fixation with the K-wire. Their results were excellent in 14 cases, good in 1 and poor in 7.

In our series the poor results were due to poor follow up. They reported to OPD after 8 weeks of discharge and they developed stiff elbow. In our series the shortest follow up period was 2 months and maximum was 12 months.

Preop xray



Intraopxray



Follow up xray





### Conclusion

Supracondylar fracture of the humerus in the children is common between the age group of 5-10 years. Incidence in boys is more than in girls. Fall on an outstretched hand is the commonest mode of injury. Left elbow is more involved than the right. Closed / Open reduction and internal fixation of the supracondylar fracture of the humerus in children is based on the principles of the treatment of juxta articular fractures namely; anatomical restoration, stable internal fixation and early mobilization. Results of closed/open reduction and internal fixation are predictable and good if carried out early. Repeated closed manipulation of supracondylar fracture of the humerus is not advisable as stiffness of elbow is a dangerous complication. Conservative treatment of grossly displaced supracondylar fracture may give rise to poor functional results and ugly deformity of the elbow.

- The results obtained justified the use of operative treatment of displaced supracondylar fracture of the humerus not being adequately managed by the closed means alone.

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