Closed reduction and internal fixation with kirschner wires for supracondylar fracture humerus in children

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ABSTRACT

Background: Supracondylar fracture of humerus is the commonest injury around elbow in children. It constitutes about 60% of all the fractures about the elbow in children. **Aim**: To evaluate the results of supracondylar fractures treated by closed reduction and percutaneous K wire fixation. To evaluate post operative complications. **Results**: There were 16 boys (80%) and 4 girls (20%) with average of 7.2 patients. 14 patients (70%) presented with involvement of left side and 6 patients (30%) on the right side. No case sustained fracture due to a fall on a flexed elbow and all 20 cases fell on outstretched hand. Of the 20 cases, 6 had postero-medial displacement, 12 had postero-lateral, and 2 had posterior displacement. Traumatic median nerve injury (in three cases), Radial nerve palsy (one case), In present study 12 cases (60%) exhibited good , 6 cases (30%) exhibited fair and 2 cases (10%) exhibited poor results. 2 cases (10%) had poor results, which are considered as failures. Both cases had a Change in the carrying angle, more than 20 degrees, out of which both presented late at the hospital. **Conclusion**: Closed reduction with percutaneous pin fixation provides an accurate, stable reduction, is easy to perform and had found to give consistently good results.

Key words: Supracondylar fracture, Gartland's classification

Introduction

At the turn of the century, Sir Robert Jones echoed the opinion of that era about elbow injuries: 'The difficulties experienced by surgeons in making an accurate diagnosis; the facility with serious blunders can be made in prognosis and treatment; and the fear shared by so many of the subsequent limitation of function, serve to render injuries in the neighbourhood around elbow, less attractive than they might otherwise have proved'. These concerns are applicable even today. The presentation of a child with a swollen, injured elbow still brings some anxiety to the treating orthopedic surgeon. Supracondylar fractures of humerus are the most common elbow injury in children and makes up approximately 60% of all elbow injuries [1]. It becomes progressively more uncommon as the child approaches adolescence, the average age group of patients being 7½ years. It is the fracture, which involves the lower end of the humerus usually involving the thin portion of the humerus through olecranon fossa, or just above the fossa or through the metaphysis. 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 Volkmann's ischemic contracture, myositis ossification, stiffness, permanent nerve injuries and malunion. It is general belief that accurate reduction in children is not essential for a good result, because growth may correct a deformity. It is true that functional end results of mal alignment are generally very good but is also true, the cosmetic end results are very poor. Stiffness of the elbow which sometimes follows relatively minor injuries, remarkable sensitivity of the injured joint and

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too early passive movement adds to the difficulties of treatment and prognosis. Recurrence of displacement occurs in spite of accurate closed reduction and immobilization in flexion. These injuries of elbow demand respect because, their vascular damage and nerve injury they cause than any other injuries in the body [2]. There is no controversy regarding management of undisplaced and partially displaced fracture but the treatment of a completely displaced fracture is not one but many. Others have devised blind pinning after reduction or pinning under x-ray control. Some even advocate to the extent to accept an unsatisfactory closed reduction, perform an osteotomy to correct the deformity at a later stage. In the region of the elbow, however, there are often more indications for aggressive treatment, including operative management. No longer has it held to say NOT BAD FOR A SUPRACONDYLAR FRACTURE. Hence present study is done to evaluate the cause of failed closed reduction and results of supracondylar fractures treated by closed reduction on percutaneous K wire fixation under C-arm guidance with post-operative complications.

Materials and methods

In the present series, twenty cases that had completely displaced supracondylar fracture of the humerus were studied. The study was made in children up to the age of 12 years between 2012-2014 in Mahatma Gandhi Memorial Hospital, Warangal.

20 children of closed extension type of supracondylar fractures (Gartland's type III) of the humerus were treated by open reduction and internal fixation with K-wires Inclusion Criteria: Age of < 12 years , Irreducible fracture by closed reduction, Closed supracondylar fractures with vascular compromise, Open fractures.

Exclusion Criteria: Age >15 years., Patients medically unfit for surgery.

A detailed history of the mode of injury was obtained from the parents as well as the patient. The ethical clearance for this study was taken from the institution. All patients selected for this study were admitted and examined according to protocol and associated injuries if any were noted. X-rays were taken in two planes. In the coronal plane, the wires travel up each S.C. column, with wide separation at the fracture site. This provides the most rigid biomechanical construct. Patient was asked to review after 3 wk in out patient department and inspection done. Operated site was inspected for: a) swelling, b) extrusion of pins, c) pin tract infection if any d) stretch pain. Patients who were having neurological involvement were followed up 2 times weekly following surgery. Later follow-ups were made at six months.

All fractures were classified according to Gartland's classification chart:

Type I - Nondisplaced

Type II - Displaced (with intact posterior cortex)

Type III - Displaced (no cortical contact) a) Posteromedial , b)Posterolateral.

Operative Procedure

Closed reduction and percutaneous pin fixation with criss-cross Kirschner wires, under C-arm guidance under general anaesthesia. Position is Supine. The posterior triangle of the elbow is outlined. The fracture was reduced by applying longitudinal traction; extending the fracture; and manipulating with thumbs to correct the lateral tilt, medial impaction, or posterior displacement. The elbow was flexed from neutral. Antero posterior and lateral reduction images were checked with aid of image intensifier. A 1.5mm K-wire was mounted over a power drill. The K wire was passed from the medial epicondylar ridge obliquely across the fracture site to engage the opposite cortex. The medial pin was angled 40 degrees from the axis of the humeral shaft and 10 degrees posteriorly, avoiding the ulnar nerve. In a similar fashion, another 1.5 mm K wire was passed from the lateral epicondyle obliquely across the fracture site to engage the opposite cortex. The pins were cut off beneath the skin and bent. Radial pulse was noted. K wire placement. The reduction & stability of fracture was checked and the movements of the elbow verified both clinically and under C-arm guidance on the table.

Results

Observation and analysis of results were done in 30 patients who were operated in our hospital in relationship to age, sex, type of injury, laterality of fracture, fracture pattern, associated injuries, time of surgery, duration of hospital stay, complications of treatment and functional outcome.

Table 1: Age-Gender wise Distribution in study

Age in years	Number of patients	Percentages
4-6	9	45%
6-8	4	20%

8-10	5	25%
10-12	2	10%
Gender		
Boys	16	80%
Girls	4	20%
Side of involvement of hand		
Left side	14	70%
Right side	6	30%

The average period from injury to presentation was 10 hours, the mean age being 7.2 years. There were 16 boys and 4 girls.14 patients presented with involvement of left side and 6 patients on the right side.

Table 2: Nature of injury in study

Nature of injury	Number of patients	Percentages
Fall from bicycle	**4**	**20%**
Fall while playing	**10**	**50%**
Fall from tree	**6**	**30%**

10 patients in study have fall while playing is the nature of injury

Table 3: Post operative Complications

Complications	Number of patients	Percentages
median nerve injury	1	5%
diffuse swelling	2	10%
Puckering of the skin	4	20%
Superficial pin tract infection	3	15%
Iatrogenic ulnar nerve palsy	2	10%
Migration of K-wires	1	5%
Malunion – varus	2	10%

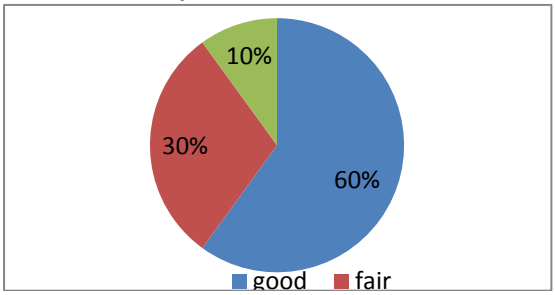
2 cases of postero lateral displacement and 1 case of posterior displacement were accompanied with median nerve injury. 1 case of postero medial displacement was accompanied with radial nerve injury. These were traumatic neuropraxias and recovered completely in 10-12 weeks. Vascular injury: In 3 patients, the radial pulse was feeble. Of these, 2 patients presented with diffuse swelling of the affected limb and 1 patient had a tight bandage around the arm extending to the forearm, Puckering of the skin was seen at the site of fracture in 4 cases. 2 patients had fracture blebs and presented after 2 days. All the patients had shortening of the arm as compared to the normal side.Proposed the criteria for evaluation of the end results of supracondylar fractures. (Mitchell and Adam)

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

Fair: Change in the carrying angle from 5-15 degrees or limitation of elbow

Motion 10-20 degrees.

Poor: Change in the carrying angle, more than 20 degrees or limitation of elbow motion, more than 20 degrees



Graph 1: Assessment of Results of Present Study

In present study 12 cases (60%) exhibited good , 6 cases (30%) exhibited fair and 2 cases (10%) exhibited poor results. 2 cases (10%) had poor results, which are considered as failures. Both cases had a Change in the carrying angle, more than 20 degrees, out of which both presented late at the hospital.

Discussion

Supracondylar fractures of the humerus in children are common injuries and complete displacement of the fragments occurs in many of the cases. Vascular complication is preventable to a great extent. However, cubitus varus deformity seems to be the most common complication with any of the methods of treatment. In John Dunlop in his observation, noted "transcondylar or a bicondylar" fracture of the humerus offered the most important stumbling block to reduction, not because the fragments cannot be brought end to end, but because of a difficulty in maintaining the reduction. It was observed that upper and lower fragment became rotated in their relation to each other. The fracture surface at that particular level consists of an extremely narrow edge rarely more than 4-5mms. The many so called reductions were obtained by "rotation of the fragments" resulting in their locking. When such a reduction was obtained, deformity was a sure outcome. Indeed these observations were collaborated by Mitchell and Adams [3].In 1960, 38 of the 83 patients had a varus deformity following treatment. 60% of those of the above 38 who showed a varus deformity were treated by manipulative reduction and immobilization and 18% of those 38 patients who were treated by Dunlop's traction, exhibited such a deformity[4].The average change in the carrying angle was greater in the group that was treated by manipulation and immobilization only. Skeletal traction is the only method besides surgery, which can prevent the error of internal or rarely external rotation that persists after manipulative reduction or even skin traction. This however requires precision management of the traction system and confines the child to the bed. In the present series, all the patients have been followed up for a period of a 6 months, some patients more than 1 yr. 6 patients were in addition subjected to local massage by an osteopath according to the history, but clinic -radiologically showed no evidence of myositis ossificans. The considerable soft tissue oedema is an expression of the underlying injury and its severity, and it indicates a regional vascular compromise. Immediate exploration in these cases achieves good soft tissue decompression, allows ease of reduction and as a result of anatomic restoration of the span of soft tissue, the progression of oedema was arrested.Flexion types of S.C. fractures are much less common than the extension types, with a reported frequency ranging from less than 1% to 10% of S.C. fractures. It must be remembered that the posterior periosteum is torn, and the anterior periosteum now functions as a tension band by extending the arm. Having the elbow extended is useless and it does not control the proximal migration of the fracture. Open reduction and pinning is therefore recommended for displaced flexion type of S.C. fractures. The overall results at the end of one year are Good (60%), Fair (30%) and Poor (10%) This evaluation thus takes into account strictly the resultant change in the carrying angle, when it comes to classifying the results, despite the good range of elbow movement at the end of one year. All our patients were discharged from the hospital on an average after 7 days. The patient turnover is thus rapid unlike in those protocols of treatment where overhead traction or Dunlop traction is advocated. Conservative management of displaced supracondylar fractures requires adequate facilities in the hospital for maintenance of the traction system as well as for the nursing care of the children. The results presented by us compare well with the results observed by other authors in literature. These results are better than equivalent results in series, both for the change of carrying angle is concerned as well as the motion of the elbow is consider.

Table 4: Comparison with Other Series

Age Group		
Authors	Average Age(in years)	Common Age Group
D. Ambrosia[5]	7	4-10
Fowles & Kassab[6]	7.2	5-10
Andrew J.W.[7]	6.6	2-13
Kurer & Regan[8]	8	5-12

Present series	7.2	2-12	
Gender			
Authors		Male (%)	Female (%)
D. Ambrosia[5]		69	31
Fowles & Kassab[6]		81	19
Edward[9]		50	50
Present Series		80	20
Types of Fractures			
Authors		Extension Type (%)	Flexion Type (%)
Watson & Jones[10]		96	4
Fowles & Kassab[6]		90	10
Present Series		100	0

Table 5: Nerve involvement and result in comparison with Other Series

Nerve involvement			
Author	**Radial nerve (%)**	**Median nerve (%)**	**Ulnar nerve (%)**
Boyd & Attenberg[1]	2.4	1.5	0.5
Fowles & Kassab[6]	2.7	2.7	0.9
Present series	5	15	Nil
Comparison of Results			
Authors	Good (%)	Fair (%)	Poor (%)
Sharkawi & Fattah	72.4	14	14
Holmberg[12]	56	28	16
Gruber & Hudson	65.3	13	21.7
Kurer & Regan[8]	62.9	21.2	15.9
Present Series	60	30	10

Conclusion

Closed reduction with percutaneous pin fixation provides an accurate, stable reduction, is easy to perform and had found to give consistently good results. In a country where the hospitalization costs are high, and the wards are congested, operative treatment of these fractures allows a rapid patient turn over. This is of great economic significance to a developing country such as ours. We strongly advocate closed reduction of displaced supracondylar fractures of the humerus in children with percutaneous pin fixation with K wires for the various reasons discussed above in the study.

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