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Management of supracondylar fractures of humerus by open reduction versus closed reduction in a tertiary hospital : A comparative study.

KEYWORDS: Baumann's angle, children, cubitus varus, complication, internal fixation

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ABSTRACT

Background: Supracondylar fracture of humerus is one of the commonest injury about the elbow in children. Anatomi cal reduction is required to prevent complications and improve cosmetic appearance. Objectives: To compare the results of the closed reduction and open reduction of the supracondylar fractures of humerus in children. **Materials and Methods:** The study was done in a tertiary care hospital of Lucknow with cases of supracondylar fractures in children of age group 5–15 years who visited orthopedic outpatient department and were confirmed with X-ray. They were divided randomly into two groups. Group I children were treated with open reduction and internal fixation, and group II cases were treated with closed reduction. Both the groups were followed up for 6 months and evaluated with X-rays. The results were expressed in mean and percentage. **Results and Observations:** All the fractures were found to be united clinically and radiologically when X-rays were taken at 5 weeks in group I and at 6 weeks in group II. Only 4% cases in group I and 40% cases in group II resulted in cubitus varus deformity as measured by the carrying angle. Only 20% cases in group I and 35% cases in group II showed unsatisfactory results. **Conclusion:** Open reduction and internal fixation give more stable fixation and better anatomical reduction with negligible complication. Treatment from untrained doctors of supracondylar fracture humerus should be discouraged owing to availability of surgical techniques giving excellent results.

Introduction:

The supracondylar fracture of the humerus is the most frequently seen fracture about the elbow in children. It comprises about 58% of the elbow fractures in children.[1] The common age group is 5–10 years At this peak age for the supracondylar fractures, there is commonly occurring hyperextension at the elbow, which makes susceptible the distal humerus to this type of fracture.[2] The increased occurrence of these fractures is due to more frequent falls in children and due to metaphysis being the weakest area around the elbow. This superimposed on the frequency of falls in small children while playing on ground, cycling or falling from household objects such as bed, sofa, etc., which is the factor responsible for the common occurrence of this fracture in children.

Timely and appropriate treatment must be delivered to these injuries to attain the best possible results. The supracondylar fracture of humerus demand great respect in treatment because, if it is not treated properly, it may lead to several complications such as Volkmann's ischemic contracture, neurovascular injury, myositis ossificans, stiffness of elbow, and malunion.[3] The need for accurate anatomical reduction for achieving good functional and cosmetic results can never be stressed more in any fracture than supracondylar fracture of humerus.

Several modalities of treatment have been suggested for the treatment of displaced supracondylar fractures of the humerus in children, such as closed reduction and plaster of paris (POP) slab application, skin traction, overhead skeletal traction, closed reduction and percutaneous pin fixation, and open reduction with internal fixation (ORIF).[4] During the initial phase of the century, there was a disinclination to suggest open reduction of supracondylar fracture. But now, several modifications in medical field have happened, chiefly in orthopedic trauma. A better knowledge of biomechanics, quality of implants, principles of internal fixation, soft tissue care, antibiotics, and asepsis have all contributed to the radical changes.

A number of studies have been conducted earlier in the past comparing the results of one form of treatment with the other with varying results. Majority of the studies show best results with operative intervention for these fractures in the form of internal fixation with Kirschner (K-wires).[5-7] Some studies have also shown excellent results with closed reduction and POP cast.[8,9] This variation may be owing to individual surgeons skill or owing to differences in surgical facilities.

Aim and Objectives:

This study was done to compare the results of the closed reduction and open reduction of the supracondylar fractures of humerus in children and to see the results in our tertiary hospital setting as it is the most common fracture in children, so that accurate and appropriate treatment can be to be decided.

Material and Methods:

The study was done in Dr. Ram Manohar Lohia Combined Hospital Gomtinagar, Lucknow, a tertiary institution in mid eastern belt of Uttar Pradesh. Duration of study was 1 year (January 2016 - December 2016) and it was a cross sectional prospective study. Of the total cases of supracondylar fractures who presented in the orthopedic department, 25 cases were randomly selected for treatment with primary ORIF with two crossed K-wires and included in group 1, and 25 other cases were selected for open reduction treated by the conventional method of closed manipulative reduction and POP splint and included in group II. All children in the age of 2–15 years with extension types II and III supracondylar fracture of distal humerus presenting within 7 days of injury were included in the study. Children of age older than 15 years and medically unfit for surgery were not included in the study. Informed consent was taken for parents to participate in the study, and approval of local institutional ethical committee was taken.

As it was a random selection, only children fit for surgery were included in the study. The results of both these methods were compared after a minimum follow-up of 6 months. Open reduction was performed under general anesthesia; the area was cleaned, and Opsite (sterile transparent drape) was applied after proper draping proximally and distally. Injection ceftriaxone/ cefoperazone (500 mg) was given. Bilateral approach was used in all the cases, exposing the distal fragment from the medial and lateral sides. Reduction was judged from the alignment of the supracondylar ridges on the proximal and distal fragments. Two K wires were put in, one K-wire was put from below the lateral epicondyle across the fracture line into proximal fragment obliquely and the second K-wire was put from below the medial epicondyle across the fracture into the proximal fragment. The wounds were stitched in layers, and a POP back splint was given from the axilla up to the knuckles with the elbow in 90° flexion and the forearm in neutral position.

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Two injections of ceftriaxone (500 mg) were given at 6 h interval after the operation to avoid and sepsis. Radiographs injections of ceftriaxone (500 mg) were given at 6 h interval after the operation. Radiographs were taken in anteroposterior and lateral views to see the reduction and calculate the postreduction Baumann's angle. Patients were discharged when the condition was found to be satisfactory.

Patients were called after 3 weeks when the plaster splint was discarded, stitches were removed, and active exercises of the elbow were advised with wires in situ. Patients were called after 2 weeks when X-rays were taken, wires were removed, and physiotherapy was continued. In the patients treated by conservative method, the plaster splint was removed after 6 weeks, and the same instructions were given.

Patients were called after 6 weeks, 3 months, and 6 months interval when the improvement of the elbow movements was noticed, and any complaint by the patient was asked and dealt with. The Mitchell and Adams criteria was formulated for grading of the results.10

Excellent: change in the carrying angle of less than 5 degree, and restriction of movement in any plane is less than 10 degree;

Good: change in the carrying angle from 5 degree to 15 degree (i.e., not beyond cubitus rectus), and restriction of flexion, extension, or rotation by 10 degree–20 degree;

Unsatisfactory: when the changes surpass the abovementioned limits.

At the first follow-up after 3 weeks, the things looked were evidence of infection, condition of the wound, any migration of wires, any evidence of the neurovascular deficit, and any other observation. Wires were removed 2 weeks later. Thereafter, at every follow-up, measurements were taken, any other specific observation was recorded, and advice was given accordingly. At last, the results were evaluated, and comparison between the results of the patients treated by closed reduction and those treated by ORIF and statistical significance were determined.

Results and Observations:

The range of elbow movements were documented at the last follow-up and recorded. All the fractures were found to be united clinically and radiologically when X-rays were taken at 5 weeks in group I and at 6 weeks in group II. The range of elbow movements was documented at the last follow-up and recorded [Table 1].

Extension lag in degrees	Group I		Group II		Total	
	No.	%	No.	%	No.	%
Normal or upto 10	21	84%	23	92%	44	88%
10-20	01	4%	02	8%	03	6%
More than 20	03	12%	00	0%	03	6%

Table 1: Extension lag in elbow movement in both groups

21 patients in group I and 23 in group II had full range of flexion or <10 degree of lag in flexion [Table 2].

Limitation of flexion in degrees	Group I		Group II		Total	
	No.	%	No.	%	No.	%
>20	3	12%	01	4%	04	8%
10-20	2	8%	00	0%	02	4%
<10	20	80%	24	96%	44	88%

Table 2: Limitation in flexion movement

One (4%) case in group I and 10 (40%) cases in group II resulted in cubitus varus deformity as measured by the carrying angle [Table 3].

Carrying angle in degrees	Group I		Group II		Total	
	No.	%	No.	%	No.	%
Negative carrying angle	01	4%	10	40%	11	22%
0	01	4%	04	16%	05	10%
1-10	12	48%	08	32%	20	40%
11-15	06	24%	02	8%	08	16%
>15	03	12%	00	0%	03	6%
Couldn't be determined	02	8%	01	4%	03	6%

Table 3: Comparison of carrying angle in both groups

Two (8%) of cases in group I developed complication in the form of treatable infection. No long-term complication, except the cosmetic deformity of cubitus varus was reported 10 in group II and one in group I [Table 4].

Type of complications	Group I		Group II		Total	
	No.	%	No.	%	No.	%
Superficial wound infections	01	4%	00	0%	01	2%
Deep wound infections	01	4%	00	0%	01	2%
Myositis ossificans	00	0%	00	0%	00	0%
Total	02	8%	00	0%	02	4%

Table 4: Comparison of complications in both groups

The final results were graded as per the Mitchell and Adam's criteria. Excellent, good, and poor results were 50%, 30%, and 20%, respectively, in group I, and 45%, 20%, and 35%, respectively, in group II [Table 5].

Response Grading	Group I (% of cases)	Group II (% of cases)
Excellent	50%	45%
Good	30%	20%
Unsatisfactory	20%	35%

Table 5: Comparison of response grading amongst both groups

Discussion:

It is a universally accepted fact that the supracondylar fractures of the humerus account for the majority of the fractures about the elbow. Owing to the high incidence of these fractures, 58% of the elbow fractures per year1, the concern about the treatment of this fracture has always been a subject of interest among the orthopedic surgeons.

In group I, all the patients were subjected to X-rays after 5 weeks of surgery after removing the K-wires, although the splint was discarded at 3 weeks. There was clinical and radiological union at this stage. In group II, all the cases showed clinical and radiological union at 6 weeks when the X-rays were taken in both the planes after discarding the POP slab. There was a significant reduction in range of movement (extension lag more than 100 or more than 100 limitation of flexion in eight cases of group I and three cases in group II).

In similar studies done in 44 cases treated by open reduction and crossed K-wire fixation, there was restriction in range of motion of elbow in eight cases, which matches closely with that of our series.6 Thus, as far as the range of movement is concerned, the results found are comparable in groups I and II as were found in a similar study, which reported that functional results are similar with closed reduction and open reduction.[11] This may be because the main function of the elbow is flexion and extension, and the functional results are similar in two groups.

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Carrying angle in one patient of group I showed clearly demonstrable cubitus varus deformity in the form of negative carrying angle, whereas in group II there were 10 such patients. Our observations were similar to a study, where it was observed that, by ORIF by crossed K-wires, the functional results are similar to those obtained by closed methods but the incidence of cubitus varus is decreased in the former.[11]

Baumann's angle is considered the best indicator for assessing postreduction alignment. It is measured in the anteroposterior projection and defined as the angle which makes physeal line of the lateral condyle and the longitudinal axis of the humerus—the line that divides the humerus in two equal parts in the longitudinal direction. In a study done on 35 cases of supracondylar fractures, the mean Baumann's angle observed was 6.6 degree Baumann's angle in ORIF and 8.7 degree Baumann's angle in closed reduction.[12] In this study, Baumann's angle was of 6.5 degree in open reduction in group I and 5.7 degree in group II. The difference in closed reduction may be attributed to the fact that it was done without any radiographic control.

One cases developed superficial and one case deep wound infection in group I [Table 4]. Our results were similar to study done in 115 patients, which reported three pin tract infections among 115 patients treated operatively and were cured by antibiotic therapy.[13]

Following the Mitchell and Adam's criteria10 for grading the results, we obtained excellent results in 50% of group I cases and 45% of group II cases. The results were good in 30% of group I and only in 20% of group II cases. The results were unsatisfactory (poor) in 20% of group I and 35% of group II cases. A similar study also reported higher percentage of poor results (28.6%) and 28% with closed reduction when compared with ORIF (12.8%) poor results.[14,15]

Conclusion:

Our study indicated that primary open reduction and internal fixation of this fracture by two K-wires achieves good functional and cosmetic results. With the use of this method incidence of cubitus varus is less. This study helps to develop faith and confidence in the treatment of surgeon and will refrain parents from taking to un experienced doctors doing malpractices.

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