

# COMPARISON OF TWO TECHNIQUES OF TREATING GARTLAND TYPE III SUPRACONDYLAR FRACTURE OF HUMERUS IN CHILDREN

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## ABSTRACT

**Background:** Supracondylar fractures of humerus are one of the largest sources of serious problems and treatment controversy in childhood fractures. The advantages and disadvantages of different methods of treating supracondylar fractures of humerus in children are still evolving and need to be investigated.

**Objective:** To compare the effectiveness of two techniques of treating Gartland type III supracondylar fractures of humerus in children

**Materials and Methods:** This quasi-experimental study was carried out at Orthopedic Unit, Jinnah Hospital, Lahore from 22<sup>nd</sup> August 2007 to 31<sup>st</sup> May 2008. Sixty patients selected by non-probability sampling with Gartland type III supracondylar fracture of humerus were divided in Group A and B with 30 patient in each group. After stabilizing patients, group A was managed with closed reduction and percutaneous pinning and group B with open reduction and internal fixation. Patients were discharged when stable and followed clinically and radiologically for effectiveness of reduction and union of fracture at 2, 4, 8 and 12 weeks.

**Results:** There were 78.3% males and 21.7% were females. Majority of patients (36.7%) were between 5-7 years of age. Right humerus was fractured in 63.3% of patients. Most common mode of injury (40%) was fall during play. Eighty percent of children were presented in 1<sup>st</sup> 24 hour of injury. Sixty percent of children in group A had a hospital stay of 2 days and in group B, 60% had hospital stay of 4-5 days. In group A, 16.6% patients developed post-operation complication and in group B, 46.7% developed complications. Functional outcome was excellent in 73.7% in group A and 60% in group B. Radiologically, callus formation was relatively poor to start in group B.

**Conclusion:** Closed reduction & pinning under image intensifier is as good as open reduction and internal fixation for these fractures in children with early callus formation.

**Keywords:** Supracondylar fracture of humerus, Closed reduction, Open reduction

## INTRODUCTION

Supracondylar fractures of humerus are one of the largest sources of serious problems and treatment controversy in childhood fractures. Injury patterns for children and adults are relatively dissimilar. Direct trauma or a fall onto an outstretched hand is responsible for most elbow fractures. Triceps muscle insertion on the olecranon often causes its displacement following fracture. Elbow joints are composed of radiocapitellar, ulnotrochlear and proximal radioulnar joints, all contained in synovial-lined capsule. This capsule typically encases hemarthrosis following injury. The brachial artery is most commonly injured, especially in supracondylar fractures. The median nerve is the most commonly injured nerve. Injury to nerve is often due to displaced supracondylar fracture.<sup>1</sup>

Supracondylar fracture of humerus is the second most common fracture in children and even more frequent before the age of 7 years. These fractures are managed by different techniques which mean that no single technique is suitable for all types of fractures.<sup>2</sup> In our setup, usually local bonesetters or pehalwans have already treated these patients. Most common complications are neurovascular injuries, decreased range of movement, angular deformities and myositis ossificans.

Different modes of treatment of displaced supracondylar fractures are closed reduction and plaster immobilisation, closed reduction and percutaneous K wire fixation. Another mode of treatment is skeletal traction and later percutaneous K wire fixation or open reduction and K wire fixation. In K wire fixation, anatomical reduction is always required because

malunion with cubitus varus does not remodel with growth. This deformity in 30% of cases is neither progressive nor due to epiphyseal injury.<sup>3</sup>

The aim of treatment is to gain functionally and cosmetically acceptable upper limb with normal range of movement. Closed reduction and immobilization in cast results in acceptable reduction but later in most cases displacement may occur, with high rate of re-operation (29%) and there are chances of non-union, infection and stiff elbow.<sup>4</sup> The advantages and disadvantages of different methods of treating supracondylar fractures of humerus in children are still evolving and need to be investigated.<sup>5</sup>

## MATERIALS AND METHODS

This quasi-experimental study was carried out at Orthopaedic Unit, Jinnah Hospital, Lahore from 22<sup>nd</sup> August 2007 to 31<sup>st</sup> May 2008. Children of either sex with age 2-12 years with Gartland type III supracondylar fracture of humerus, only those children were included who came within 7 days of fracture without any iatrogenic complications like compartment syndrome were included. Those children having multiple fractures, open fractures and other systemic illnesses like pneumonia and other infections were excluded. All patients admitted in the orthopedic department with supracondylar fracture of humerus (after getting informed consent and ensuring confidentiality) were assessed on the basis of history, clinical examination and radiologically and were classified according to Gartland classification. Supportive treatment like analgesics and intravenous fluids where required were given. Patients with Gartland type III fulfilling the inclusion criteria were divided into two groups with 30 patients in each group. Group A was treated with closed reduction and percutaneous fixation with wires using image intensifier. Group B was treated with open reduction and internal fixation technique. Post-operatively, all patients were shifted to ward, kept NPO for next 4 hours, intravenous fluids and 3 doses of first generation cephalosporin antibiotic were given. All the cases were checked for neurovascular deficit. Check X-rays were carried out on the same evening. Group A cases were discharged 2-4 days postoperative whenever satisfactory, with follow-up plans in OPD. In group B cases, drainage in the suction bottle was checked. On the 2<sup>nd</sup> postoperative day, the wound was examined and drain was removed. If the condition of the wound found satisfactory, these patients were discharged 3-5 postoperative day. One patient in group B who developed superficial infection was discharged on 7<sup>th</sup> day. Both these groups were followed at 2, 4, 8 and 12

weeks and assessed clinically for functional improvement and radiologically for union of fracture. The effectiveness of technique was assessed on the basis of hospital stay, union of fracture, hospital complications (anesthesia, superficial infections, deep infections, nerve injury, vascular injury) and functional improvement by Flynn grading system as excellent, good fair and poor (excellent if there was <5% of motion lost in flexion and extension and carrying angle was within 5 of normal side, good if there was 5-10 of motion lost and carrying angle was within 5-10 of normal side, fair if there was 5-10 of motion lost and carrying angle was within 10-15 of the normal side and poor if there was >15 motion lost and carrying angle was >15 of the normal side). Necessary investigations like complete blood count, ESR and blood culture were sent where necessary. All data entered and analyzed through SPSS-20.

## RESULTS

During the study period, 60 children with Gartland type III fracture of humerus were included. The mean age of presentation was  $6.9 \pm 0.83$  years. The age breakdown of the patients showed most of the children were between 5-7 years of age ( $n=22$ , 36.7%). The remaining children were within 2-4 years ( $n=6$ , 10%), 8-10 years ( $n=21$ , 35%) and 11-12 years [ $n=11$ , 18.3%] (Table 1). Most of these children were male ( $n=47$ , 78.3%) and females were  $n=13$ , 21.7%). Male to female ratio was 3.6:1 (Table 2). The frequency of right or left humerus involved in these children were right sided ( $n=38$ , 63.3%) and left sided ( $n=22$ , 36.7%). Regarding mode of injury, most of the children had fracture while falling during play ( $n=24$ , 40%). Mode of injury in remaining children were direct blow ( $n=5$ , 8.3%), road side accident ( $n=13$ , 21.7%), fall from height ( $n=16$ , 26.7%) and trauma due to collapse of wall [ $n=2$ , 3.3%] (Table 3). Majority of children ( $n=48$ , 80%) were presented within first 24 hours of injury. Out of remaining children, 7 cases (11.7%) presented on 2<sup>nd</sup> day, two cases on 3<sup>rd</sup> day, one case on 4<sup>th</sup> day and two cases on 5<sup>th</sup> day of injury. Mean presentation time was  $1.1 \pm 0.71$  days (Table 4). Mean hospital stay for group A patients was  $2.2 \pm 0.49$  days and for group B was  $3.9 \pm 0.95$  days. The difference was statistically not significant ( $P>0.05$ ) (Table 5).

Analysis of operative complication showed not even a single patient in each group developed any complication of anaesthesia, fracture displacement or deep infections. However, five patients (16.66%) in group A developed operative complications (pin tract infection in 4 cases and nerve injury in one case) while 14 patients (46.66%) in group B developed operative

complications (pin tract infection in 6 cases and superficial infections in 8 cases). Statistically the difference was not significant [ $p>0.05$ ] (Table 6). Functional outcome was excellent in 22 (73.7%), good in 6 (20%) and fair in 2 (6.7%) of patients in group A while it was excellent in 18 (60%), good in 8 (26.7%) and fair in 4 (13.3%) of patients in group B. radiological bone healing was observed at 2, 4, 8 and 12 weeks. Callus formation was poor to start in group B as compared to group A. However, healing was good in both groups at 12 weeks.

**Table 1:** Age breakdown of patients with Gartland type III supracondylar fracture of humerus

Age (years)	No.	%
2 – 4	6	10.0
5 – 7	22	36.7
8 – 10	21	35.0
11 – 12	11	18.3

**Table 2:** Frequency & percentage of genders

Gender	No.	%
Male	47	78.3
Female	13	21.7

**Table 3:** Mode of injury

Mode of Injury	No.	%
Direct blow	5	8.3
Roadside Accident	13	21.7
Fall from height	16	26.7
Fall during play	24	40.0
Any other	2	3.3

**Table 4:** Time of presentation

Time of presentation (days)	No.	%
1	48	80.0
2	07	11.7
3	02	3.3
4	01	1.7
5	02	3.3

**Table 5:** Hospital stay of the patients

Hospital stay (days)	Group A		Group B	
	No.	%	No.	%
2	18	60.0	-	-
3	08	26.7	11	36.7
4	04	13.3	15	50
5	-	-	3	10.0
7	-	-	1	3.3

**Table 6:** Operative complications

Complication	Group A		Group B	
	No.	%	No.	%
Pin tract infections	4	13.3	6	20.0
Superficial infections	-	-	8	26.7
Nerve injury	1	3.3	-	-
Vascular injury	-	-	-	-
Anesthesia	-	-	-	-
Fracture displacement	-	-	-	-
Total	5	16.67	14	46.7

## DISCUSSION

Supracondylar fracture of the humerus in children is one of the commonest fractures below the age of 12 years. Treatment of this fracture remains controversial and the complications are common. Elbow fractures are encountered commonly in the emergency department. Direct trauma or a fall on to an outstretched hand, is responsible for most elbow fractures. Median nerve is the most common and often is due to displaced supracondylar humerus fracture.<sup>6</sup> Management of supracondylar fractures of humerus in children is a problem for orthopaedic surgeons. These fractures are managed by various techniques, which recommend that no single technique is reasonable for a wide range of fractures

In our setup, usually these patients have already been treated by local bone setters. The most common complications associated with these fractures are neurovascular injuries, decreased range of motion, angular deformities and myositis ossificans.<sup>7</sup>

In our study, most of children (36.7%) of 5-7 years and remaining were 35% from 8-10 years, 10% from 2-4 years, and 18.3% from 11-12 years. Majority of the children were males (78.3%) with male to female ratio 3.6:1. This data is comparable with another study conducted in Pakistan showing that 71.7% of children with supracondylar fracture were between 5-10 years of age.<sup>8</sup> The males were extra exaggerated in the same study with male to female ratio 3.2:1, which is also comparable to our study. Predominance of males in affected group was also noted in another study conducted in Turkey in which 73.4% of males were affected with supracondylar fracture of humerus.<sup>9</sup> In our study, 63.3% of children had supracondylar fracture of right humerus. This is contrary to another study, conducted at Hyderabad, Pakistan, in which 69.1% children were presented with left humerus.<sup>10</sup> Left humerus was also described as more fractured in another Pakistani study conducted at Abbotabad.<sup>11</sup> The common mechanism of injury in our study was fall while playing (40%) followed by fall from out stretched hand (26.7%) and fall from height (21.7%). However

another study conducted in Egypt demonstrated roadside accident was the frequent cause of Gartland type III supracondylar fracture of humerus. This Egyptian study also included Gartland type II fracture.<sup>12</sup> Most of the patients (80%) in our study presented in hospital within 1<sup>st</sup> 24 hours of injury. This increasing awareness among people about consultation with orthopaedic surgeons is also shown by another study conducted at Nawabshah, Pakistan, in which 87% patients were managed within 1<sup>st</sup> 24 hours of fracture.<sup>13</sup> The patients who were treated with closed reduction and percutaneous pinning with K wire were discharged earlier as compared to the patients who were managed by open reduction and internal fixation (87.7% patients discharged on 3<sup>rd</sup> post operative day and all by 4<sup>th</sup> day in group A while in group B, 36.7% were discharged on 3<sup>rd</sup> day, 50% patients on 4<sup>th</sup> day, 10% on 5<sup>th</sup> day, all discharged by 7<sup>th</sup> post operative day). This difference is statistically not significant. The reason for this may be small sample size. Short hospital stay in patients with supracondylar fracture of humerus managed by closed reduction and percutaneous pinning was observed in another Pakistani study, in which majority of the patients were discharged on 2<sup>nd</sup> post operative day but this study was conducted over a period of 2 years.<sup>8</sup>

In our study, no patient developed a complication due to anaesthesia. In group A, 16.6% children developed operative complications including pin tract infection (13.3%) and nerve injury in (3.3%) of patients. In group B, 46.7% patients developed operative complications including pin tract infection (20%) and superficial infection (26.7%). This relation is also statistically not significant (P value >0.05). In another study conducted at Madrid, Spain, 11.7% patients treated with closed reduction and percutaneous pinning developed complications including infection (3.9%), pulse less pink hand (5.2%) and nerve lesions (2.6%). This Spanish study was a retrospective study and only patients managed by closed reduction were reviewed.<sup>14</sup> Another study conducted at Mayo hospital, Lahore, Pakistan, showed a frequency of 16% pin tract infection among patients managed by closed reduction and percutaneous pinning.<sup>15</sup> A study conducted in Pakistan studied only the effectiveness and complications of patients managed by open reduction and internal fixation (as image intensifier was not available) showed 32% patients with complications.<sup>13</sup> This study included Gartland type II and III patients. A retrospective study conducted in Lithuania, after reviewing the 2 year data explored no early and late complications managed by type I, II, and III supracondylar fractures of humerus in children.<sup>16</sup>

In group A, functional outcome was excellent in 73.7% of patients, good in 20% and fair in 6.7% of patients. In group B, functional outcome was excellent in 60% of patients, good in 26.7% and fair in 13.3% of patients. An Indian study conducted at Aligarh demonstrated even better results with closed reduction and percutaneous pinning. This study showed excellent results in 88.8% and good in 4.44% of patients. This study had same sample size but duration of study was 28 months.<sup>17</sup> However, a Pakistani study showed a relatively high frequency of poor functional outcome (15%). This study was conducted over a period of 4 years.<sup>11</sup> A study from Nepal showed excellent outcome in 68% of patients and poor outcome in 11%. This study was conducted over a period of 5 years and sample size was larger (142 patients) and included all three types of Gartland fractures.<sup>18</sup>

Radiological healing was observed at 2, 4, 8 and 12 weeks. Callus formation was poor to start in Group B as compared to group A. At 12 weeks, bone healing was found good in both groups. These results are comparable with international studies.<sup>19</sup>

The role of different methods of treating supracondylar fractures of humerus in children regarding their advantages, disadvantages and complications has been established. Opinions vary in the literature as to the best of treatment of supracondylar fractures.

## CONCLUSION

Percutaneous K wire fixation is a safe and effective method for the management of Gartland type III supracondylar fractures of humerus in children with minimal hospital stay and with risking vascular compromise.

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