

# Functional and Radiological Outcome of Closed Reduction and Percutaneous Pinning in Supracondylar Fractures Humerus Gartland Type III

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Radiological Outcome of Closed Reduction Fixation with Percutaneous Pinning in Supracondylar Humerus Fractures

## ABSTRACT

**Objective:** This study is aimed to determine the functional and radiological outcome of close reduction fixation with percutaneous pinning in Gartland type III Supracondylar humerus fractures and thereby to strategize fracture plan for a fracture which is commonly mismanaged.

**Study Design:** Study design was descriptive case series

**Place and Duration of Study:** This study was conducted at the Department of Orthopedic Surgery, Bolan Medical Complex Hospital, Quetta from 15th January 2018 to 15th January 2019.

**Materials and Methods:** 61 patients age of 2 years to 12 years with Gartland type III Supracondylar humerus fractures were treated with close reduction and percutaneous pinning, carrying angle and range of motion were measure and results were graded as per Flynn criteria and fracture reduction and healing were assessed Radiologically with consolidation of fracture. The radiological assessment was making with the Baumann's angle; all results were compared with normal limb.

**Results:** At six months follow up, 48 patients (78.7%), patient had excellent results 10 patients (16.3%) good, Fair in 2 patients (3.3%) and Poor in one (1.6%) on patient Flynn criteria. Mean Baumann's angle, was 64° to 81° in 58 (95.1%) patients and < 64° in three (4.9%) patients.

**Conclusion:** Closed reduction and percutaneous K-wire fixation has been stand the best option of treatment for supracondylar fractures of the humerus in children. It is safe, cost effective, and easy to perform in terms of no open surgery and use of c-arm, no use of suture material and short hospital stay. It gives comparative better results than open reduction. However, it needs expertise to develop for meticulous close reduction and proper placement of percutaneous pins, which is the mainstay of outcome.

**Key Words:** Supracondylar, Fracture Humerus, percutaneous pinning, close reduction.

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## INTRODUCTION

Paediatric elbow injuries including supracondylar fractures of humerus are very common and accounts for 60 to 70 per 100,000. Extension type is most common type of supracondylar fracture<sup>1,2</sup>.

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Gartland classify supracondylar extension type fractures into type I, undisplaced; type II, displaced with intact posterior cortex; and type III, displaced with no cortical contact. Type III fractures causing stripping of the periosteum leading to difficulties in reduction and maintenance, they there for almost always require fixation.<sup>3</sup>

Majority of these fractures treated by various methods including, closed reduction and long arm casting, traction by different methods, closed reduction percutaneous pinning and open reduction stabilization with Kirschner wires in various directions. Closed reduction with casting and traction treatment has been associated with high rates of complications like cubitus varus or valgus, elbow stiffness, neurovascular damages and compartment syndrome.<sup>4,5</sup> Open reduction and internal fixation leads to better anatomical reduction and but its absolute indications are open fractures, failed close reduction and ischemic pale hand that doesn't revascularise with fracture reduction and late complication is elbow stiffness.<sup>6</sup>

Whereas, the percutaneous pinning is providing greater skeleton stability with excellent results whether there is lateral or cross pinning techniques both provides adequate stability and similar functional and radiological outcome.<sup>7,8</sup>

The Published literature reports closed manipulative reduction and percutaneous pinning as a safe, cost effective, time saving reliable and widely accepted method of treatment in Gartlands type III Suprachondylar fractures of the Humerus and provides good fracture stability, good union rate thereby reduce the chances of complications.<sup>9,10</sup> Therefor the current preferred method of choice for treatment of displaced fractures has been the closed reduction and percutaneous pinning.<sup>11,12</sup>

## MATERIALS AND METHODS

61 patients age of 2 years to 12 years were treated in the Department of Orthopedic Surgery, Bolan Medical Complex Hospital, Quetta from 15th January 2018 to 15th 2019, sustaining Gartland's type III Supracondylar Humerus fracture.

After taken the informed consent for the surgery, all cases operated on Elective list. Under general anaesthesia, closed manipulation and reduction performed and reduction was confirmed by the Image Intensifier (C-Arm). With acceptable reduction two K-wires the each from lateral side and the medial side was inserted from lateral and medial condyls of Humerus through cortex in the shaft of Humerus. Ulnar nerve was protecting by pushing it posteriorly away from the medial pin introduction site. Placement of pins was confirmed under Image Intensifier, Pin end kept out of the skin. Long arm posterior splint cast was applied after protecting the pin site by sterile dressing pads to immobilize the elbow at 90-degree flexion and forearm in neutral position. Posterior plaster splint was removing after 3 weeks and active exercises started. The k-wires were removed after 6 weeks under local anesthesia. All the patients were review at 6 weeks, 9 weeks and 3 months. Carrying angle and range of motion were measure by using goniometer. Results were graded as per Flynn criteria (table.1) fracture reduction and healing were assessed Radiologically with consolidation of fracture. The radiological assessment was making with the Baumann's angle; all results were compared with normal limb.

Data feeding and analysis was done on computer packages SPSS 16.0. Clinical characteristics were summarized in terms of frequency and percentage for categorical/qualitative variables mean and standard deviation for continuous/quantitative variables. Statistical t-test will be used to compare two means and P-value <0.05 will be considered statistically significant.

## RESULTS

Out of sixty-one patients included mean age of the patients was 6.8 years (range 2-12 years). Males and females were 46 and 15 respectively. Fifty-six patients had fall on outstretched hand and five patients sustained road traffic accident that fell on outstretched hand as well. 36 patients (59%) had left side injury while 25 (41%) had right side. Forty-eight (78.6%) patients achieved excellent score on Flynn's criteria, good in 10 patients (16.3%), Fair in 2 patients (3.3%) and Poor in one patient (1.6%) detail given (Figure-I). Mean range of motion and carrying angle was  $6.31 \pm 3.014$  (Table-I). Mean Baumann's angle postoperative immediately was  $71.43 \pm 6.823$  and at last follow up was  $72.72 \pm 4.390$ , was in range of 64-81 in 58 patients (95.1%) and < 64 degree in three patients (4.9%) detail given in (Table-II). The t-test was done to compare two means of initial and final Baumann's angles and the difference between initial and final range of motion and carrying angle was statistically insignificant which was  $0.052 (p > 0.05)$ . Five patients developed complication without any permanent residual defect. Iatrogenic ulnar nerve injury occurred in 1 patient that recovered in 3 months. Superficial pin tract infection observed in 4 patients which resolved with removal of pins oral antibiotics and dressing. None of these patients developed compartment syndrome, cubitus Varus or myositis ossificans. In 36 patient reduction was achieved with single attempt, whereas 25 patients require 2-3 attempts of reduction due to gross swelling. The placement of percutaneous pins was also difficult in these 25 patients and 5 other cases with unstable fracture, particularly in initial of cases. However, these difficulties were overcome with time and cases done. The penetration time from completion of draping to cast application recorded between 30 to 40 minutes that too reduced with improvement in later curve phase.

The range of motion after removal of cast gradually improved at 3 weeks to 6 months it which was  $45^\circ$  at 6 weeks,  $110^\circ$  in majority of cases at 6 months improved further to  $138.61^\circ$  at more than 6-9 month follow up. Our observation for improvement in ROM was in accordance with published series. Zions et al.<sup>22</sup> reports 86% return of range of motion at the elbow at 3 months' post injury, rising to 94% at 6 months and Wang YL et al.<sup>23</sup> showed 90% return to range of motion at 6-7 weeks. However, Flynn's observe no further recovery of ROM after one year of surgery. 12 In our case the mean carrying angle at last follow up  $6.31 \pm 3.014$  was comparable to other reports by Nedim S24 who report as  $5 \pm 6.11^\circ$ . At 4th week after removal of pins and plaster slab the ROM and carrying angle in our cases were satisfactory and functionally also there was gradual improvement on Flynn's criteria. At last follow up outcome was excellent 80.3% and good in 14.8%, that too is comparable to other studies.<sup>27,28</sup>

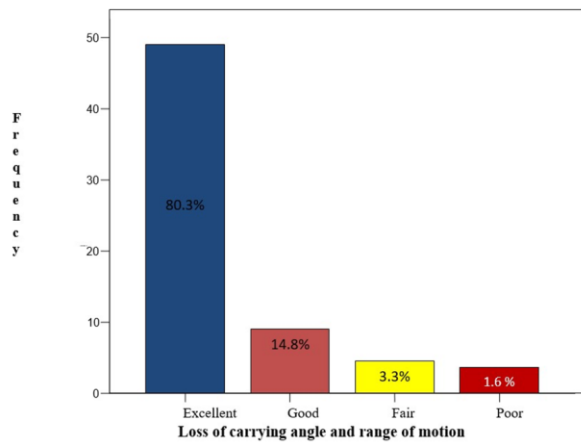


Figure No.1: Functional outcome as per Flynn's Criteria n=61

Table No.1: Descriptive statistics of Baumann's angle and Flynn's criteria n=61

1) Baumann's angle Normal range(64-81 degree)	Mean ± SD	Maximum	Minimum
1 <sup>st</sup> postoperative day	71.43.±6.823	81	60
Postoperative 6 <sup>th</sup> month	72.72.±4.390	81	60
2) Flynn's criteria on 6 <sup>th</sup> month	6.31±3.014	20	5

Table No.2: Percentage of final outcome after three months of follow up n=61

Grade	Flynn's criteria			Baumann's angle		
		No	%		No	%
Satisfactory	Excellent	48	80.3%	64 -81°	58	95.1%
	Good	10	14.8%			
Unsatisfactory	Fair	2	3.3%	< 64°	3	4.9%
	Poor	1	1.6%			

## DISCUSSION

Supracondylar humeral fractures (SCHF) are the most common fractures seen in children. It has a greater rate of malunion, nerve injury, and poor results than any type of extremity fracture.<sup>13</sup> Severely displaced SCHF are challenging injuries and require technically expertise to achieve a normal appearing and functioning elbow.<sup>14</sup> The closed reduction and plaster of Paris cast, and open reduction with fixation used tube the commonly practiced method. The invention of C-Arm imaging has revolutionized fracture managed with percutaneous trans fix after pinning including SCHF and it has become gold standard practiced method today. The procedure is very reliable, safe, and convenient; reproduce less complications and early functional recovery.<sup>15</sup> Two methods of percutaneous pinning are commonly used medial and lateral cross pinning combination and another using lateral two pins. The choice is based upon stability of the construct and avoidance of injury to the ulnar nerve.<sup>16</sup> we adopted two cross k-wires combination from medial and lateral side as this is more stable and biomechanically strong fixation.<sup>17</sup>

Iatrogenic ulnar nerve injury has been reported at significant risk in the crossed pinning technique, Kalenderer O et al.<sup>18</sup> Report 1.4% to 15.6%. Ulna nerve injuries, we too have similar incidence that recovered completely without any residual complication 3 months after removal of cross pins. Another reported complication was osteomyelitis reported by Griffin PP,<sup>19</sup> 4 cases in his study. We do have osteomyelitis, who did not report after surgery and came 4 weeks after surgery to pin tract infection & pain that resolved in

next few weeks after, removal of pin and regular dressing and antibiotics. Other complication observed in our cases where pin tract infection that was seen in 6.6% cases and were at higher rate than other next reports by Iqbal J18 and Afridi HD et al.<sup>20</sup> who reports that in 3.9% to 16% of their cases pin tract sepsis in our cases developed 1 week after surgery and settled after pin removal and antibiotic therapy. None of our cases developed nonunion, radiological union was seen in 90% cases in third week while remaining 10% had union in fourth week.

The mean Bauman's angle in our study on immediate postoperative x-rays of injured limb was 71.60 degrees and at last final follow up that was 72.98 degrees with standard deviations 6.578 and 3.814 respectively the Baumann's angle only observed at 6 months followed remain constant critic deterioration. This was almost similar to study done by Leung KK,<sup>21</sup> reports in Chinese children and warlock PH.<sup>22</sup> report in many countries.

The range of motion after removal of cast gradually improved at 3 weeks to 6 months it which was 45° at 6 weeks, 110° in majority of cases at 6 months improved further to 138.61° at more than 6-9 month follow up. Our observation for improvement in ROM was in accordance with published series. Zionts et al.<sup>23</sup> reports 86% return of range of motion at the elbow at 3 months' post injury, rising to 94% at 6 months and Wang YL et al.<sup>24</sup> showed 90% return to range of motion at 6-7 weeks. However, Flynn's observe no further recovery of ROM after one year of surgery.<sup>25</sup> In our case the mean carrying angle at last follow up 6.31°±3.014 was comparable to other reports by Nedim S,<sup>26</sup> who report as 5±6.11°. At 4th week after removal

of pins and plaster slab the ROM and carrying angle in our cases were satisfactory and functionally also there was gradual improvement on Flynn's criteria. At last follow up outcome was excellent 80.3% and good in 14.8%, that too is comparable to other studies.<sup>27,28</sup>

## CONCLUSION

We concluded that closed reduction and percutaneous pinning in the management of supracondylar fractures of the humerus in children is safe because it's not open surgery and perform under c-arm, cost effective procedure because there is no use of suture material and short hospital stay and gives excellent results. However, it needs expertise to develop close reduction and insertion of pins. The meticulous Postoperative follow up and pin tract care is of paramount importance to prevent sepsis and osteomyelitis. Timely removal of cast & physiotherapist rehabilitation plays important role to achieve progressive ROM improvement.

### Author's Contribution:

Concept & Design of Study:	Muhammad Aslam Mengal
Drafting:	Mohammad Tariq Hasani, Khawand Bakhsh Umrani
Data Analysis:	Parvez Ahmed, Nasir Khan Achakzai, Suresh Kumar Valbani
Revisiting Critically:	Muhammad Aslam Mengal, Mohammad Tariq Hasani
Final Approval of version:	Muhammad Aslam Mengal

**Conflict of Interest:** The study has no conflict of interest to declare by any author.

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