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Outcome of Gartland Type III Paediatric Supracondylar Humerus Fracture Fixation with the Kapandji Technique in the Prone Position

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Abstract

Introduction with Objective: *The aim of the present study was to evaluate the Outcome of Gartland Type III Paediatric Supracondylar Humerus Fracture Fixation with the Kapandji Technique in the Prone Position.* ***Materials and Methods:*** *This prospective study was carried out at the Department of Orthopedic Surgery at Chittagong Medical College Hospital, Chittagong within the defined period from January 2020 to February 2022. All the data were compiled and sorted properly and the quantitative data was analyzed statistically by using Statistical Package for Social Science. The results were expressed as percentage and mean ± SD and p<0.05 was considered as the level of significant.* ***Result:*** *Out of 30 patients, the mean ± SD age of the patients was 7.7 ± 2.2 years. Most of the patients (56.7%) belonged to male. Out of 30 patients, Most of the (n=13, 43.3%) patients time from injury to procedure was 5 days. Mean ± SD time from injury to procedure was 4.77 ± 1.331 (range: 3-7) days. Majority of the (n=12, 40%) patients needed 30 minutes for operation from manipulation to casting. Mean ± SD time of procedure was 30.5 ± 5.309 (range: 20-40) minutes. After 1st week follow-up, all the 30 (100%) patients' outcome was poor; after 4th week follow-up, 27 (90%) patients had fair and 3 (10%) patients had poor outcome and after 18th week final follow-up, excellent outcome was in 27 (90%) patients and good outcome was in 03 (10%) patients.* ***Conclusion:*** *After analyzing the Results of present study, it can be concluded that management of Gartland type III supracondylar humerus fractures in children using the Kapandji technique in the prone position is a feasible and safe method. So, it could be an alternative technique.*

Keywords: *Kapandji Technique, Paediatric, Supracondylar humerus fracture, outcome.*

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Introduction:

Supracondylar humerus fractures are the most common elbow injuries in children[1]. It accounts for 60% of all fractures around the elbow joint and represent approximately 3% of all fractures among children[2] with a peak incidence between the ages of 5 – 7 years[3], because this is the period of maximum ligamentous laxity. Supracondylar fractures of the humerus are the most common paediatric fracture requiring surgery[4]. Paediatric supracondylar fractures occurs at the supracondylar area or the metaphysic of the distal humerus. Among all the fracture in upper limb, supracondylar fracture of humerus is not only the most common injury but also it may cause serious complications including nerve injury, vascular injury, malunion and compartment syndrome if not treated appropriately[5]. The most common and widely accepted method

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of treatment consists of closed reduction, if needed, with percutaneous Kirschner wire fixation. Controversy exists regarding the optimal K-wire configuration in fixation of type – II and type– III fractures. Two main techniques are in use[6]. The cross-wire technique involves the placement of two K-wires, one inserted through the lateral condyle and another through the medial condyle[7,8]. The conventional treatment with closed reduction and application of plaster slab or cast is inappropriate in the management of Gartland type III supracondylar fractures of the humerus as this method is potentially hazardous to circulation, as it may enhance circulatory insufficiency which is already hallmark of supracondylar humerus fracture and it is difficult to obtain satisfactory reduction and to maintain the reduction. Hence, surgical management like percutaneous pinning after closed reduction or open reduction and internal fixation with K wires plays an important role in this type of fractures. Closed reduction and percutaneous pinning for extension Gartland type III supracondylar fracture of humerus has given new window of management which is excellent method.

Materials & Methods:

This Prospective Interventional Study study was carried out among 30 patients attending at the department of Orthopaedic Surgery at Chittagong Medical College Hospital, Chittagong for the treatment displaced paediatric supracondylar of humerus fracture within the defined period from January 2020 to February 2022. Ethical clearance was obtained from the Institutional Review Board (IRB) of CMCH. Purposive sampling was done according to availability of the patients. The collected data were entered into the computer and analyzed by using SPSS (version 20.1) to evaluate the Outcome of Gartland Type III Paediatric Supracondylar Humerus Fracture Fixation with the Kapandji Technique in the Prone Position. Outcomes were assessed by Flynn's Criteria. Flynn's Criteria were given below.

Result rating	Cosmetic factor (Carrying angle loss) in Degree	Functional factor (Loss of motion) in Degree
Excellent	0 – 5	0 – 5
Good	6 – 10	6 – 10
Fair	11 – 15	11 – 15
Poor	>15	>15

Results:

Table I shows, out of 30 patients, the mean ± SD age of the patients was 7.7 ± 2.2 years. The youngest and the oldest patient were 4.5 and 11.5 years. About 17 patients (56.7%) were male and 13 (43.3%) were female.

Table I: Age and Gender Distribution of the study patients (n=30)

Parameter	Mean ± SD	Range
Age (years)	**7.7 ± 2.2**	**4.5-11.5**
Gender Distribution	**Number**	**Percentage**
Male	17	56.7
Female	13	43.3

Data was expressed as frequency (%) or mean ± SD (range)

Histogram showing, Out of 30 patients, Most of the (n=13, 43.3%) patients time from injury to procedure was 5 days. Mean ± SD time from injury to procedure was 4.77 ± 1.331 (range: 3-7) days.

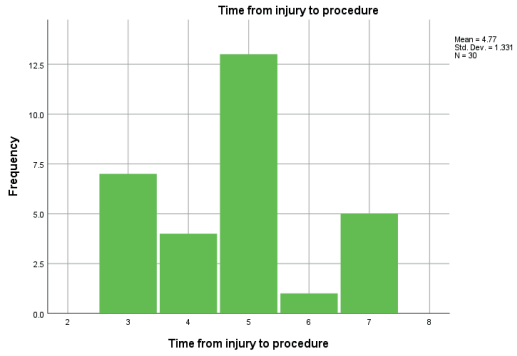

Figure 1: Time from injury to procedure (n=30)

Histogram showing, among 30 patients, Majority of the (n=12, 40%) patients needed 30 minutes for operation from manipulation to casting. Mean ± SD time of procedure was 30.5 ±5.309 (range: 20-40) minutes.

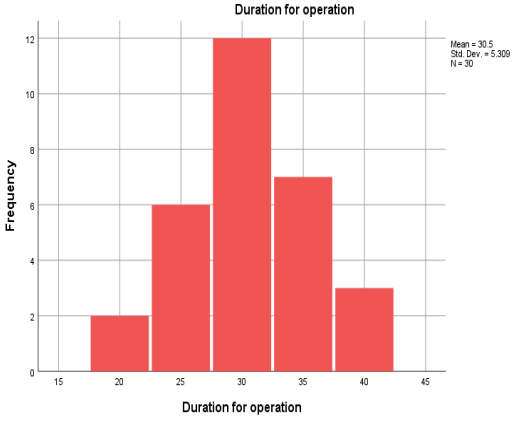

Figure 2: Duration of operation (n=30)

Table II shows, mean ± SD of Baumann's angle after 18th week, Baumann's angle of healthy side and Baumann's angle changes were 70.4 ± 5.5 (range: 60-81), 71.5 ± 4.2 (range: 64-80) and 4.5 ± 3.6 (range: 1-18) degree. Mean ± SD of humerocapitellar angle after 18th week, humerocapitellar angle of healthy side and humerocapitellar angle changes were 35.6 ± 10.1 (range: 15-59), 40.4 ± 12.4 (range: 23-70) and 7.4 ± 6.0 (range: 0-25) degree.

Table II: Baumann's and Humerocapitellar angle change of the patients (n=30)

Variables	Mean ± SD	Range
Baumann's angle (o)		
After 18th week	70.4 ± 5.5	60-81
Healthy side	71.5 ± 4.2	64-80
Change	4.5 ± 3.6	1-18
Humerocapitellar angle (o)		
After 18th week	35.6 ± 10.1	15-59
Healthy side	40.4 ± 12.4	23-70
Change	7.4 ± 6.0	0-25

Data was expressed as mean ± SD (range)

Figure III showing, among 30 patients, 11 (36.7%) patients ROM of elbow after 18th week was 140o. Mean ± SD range of motion of elbow was 139.6 ± 5.403 (range: 130- 150) degree.

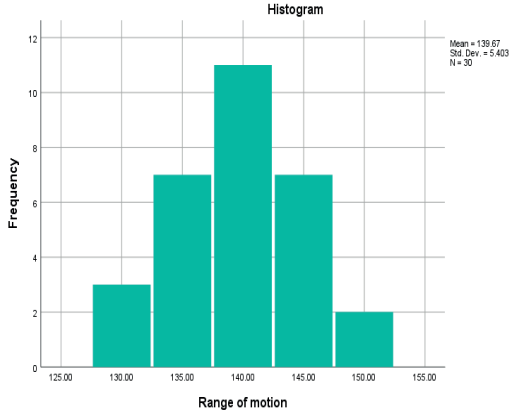

Figure 3: Range of motion (ROM) of elbow of the patients after 18th week (n=30)

Table III shows, mean ± SD loss of carrying angle was 4.1 ± 1.4 (range: 2-8) degree and mean ± SD loss of motion was 4.8 ± 5.0 (range: 3-8) degree.

Table III: Loss of carrying angle and loss of motion of the patients (n=30)

Variables	Mean ± SD	Range
Loss of carrying angle (o)	4.1 ± 1.4	2-8
Loss of motion (o)	4.8 ± 5.0	3-8

Data was expressed as mean ± SD (range)

Table IV shows, after 1st week follow-up, all the 30 (100%) patients' outcome was poor; after 4th week follow-up, 27 (90%) patients had fair and 3 (10%) patients had poor outcome and after 18th week final follow-up, excellent outcome was in 27 (90%) patients and good outcome was in 03 (10%) patients.

Table IV: Outcome after 1st week, 4th week and 18th week according to Flynn's Criteria (n= 30)

Outcome	1st week	4th week	18th week
Excellent	0	0	27 (90%)
Good	0	0	03 (10%)
Fair	0	27(90%)	0
Poor	30 (100%)	03 (10%)	0

Discussion:

The results of current study demonstrate, the mean (± SD) age of the patients was 7.7 ± 2.2 years. The youngest and the oldest patient was 4.5 and 11.5 years. Similarly, Gular et al. (2016) found the mean ± SD age was 6.9 ± 1.5 years among the patients of prone position in their study[9]. In their study by Havlas et al. (2008) found that the mean age was 7.5 years (range: 3-14 years)[10]. Present study shows, among 30 patients, 17 (56.7%) were male and 13 (43.3%) were female. Similarly, male prominence was found in the study by Kao et al. (2014)[11]. Mean ± SD Baumann's angle after 18th week, Baumann's angle of healthy side and Baumann's angle changes were 70.4 ± 5.5 (range: 60-81), 71.5 ± 4.2 (range: 64-80) and 4.5 ± 3.6 (range: 1-18) degree. Kao et al. (2014) found the mean Baumann's angle was 71.2 degrees (range, 60–80 degrees) immediately after K-wire fixation and 72.8 degrees (range, 63–87 degrees) 3 months later[11]. When the change in radiographic measurement was presented in absolute value, the mean change in the Baumann's angle was 5.1 ± 3.9 degrees (range, 1–20 degrees). In their study by Guler et al. (2016) reported the mean ±SD Baumann angle was 73.1º±3.5º. Mean ± SD humerocapitellar angle after 18th week, humerocapitellar angle of healthy side and humerocapitellar angle changes were 35.6 ± 10.1 (range: 15-59), 40.4 ± 12.4 (range: 23-70) and 7.4 ± 6.0 (range: 0-25) degree 9. In the study by Kao et al. (2014), the mean lateral humerocapitellar angle was 37.9 degrees (range, 13–61 degrees) after K-wire fixation and 43 degrees (range, 23–95 degrees) 3 months later[11]. The mean change in the humerocapitellar angle was 9 ± 10 degrees (range, 0–55 degrees). Among 30 patients, 11 (36.7%) patients ROM after 18th week were 140o. Mean ± SD range of motion was 139.6 ± 5.403 (range: 130-150) degree. Kao et al. (2014) found that, the mean range of elbow motion was 139.6 degrees (range, 120–160 degrees) at the last follow-up[11]. In this study, mean ± SD loss of carrying angle was 4.1 ± 1.4 (range: 2-8) degree and mean ± SD loss of motion was 4.8 ± 5.0 (range: 3-8) degree. Outcome was determined by Flynn's criteria. After 1st week follow-up, all the 30 (100%) patients' outcome was poor; after 4th week follow-up, 27 (90%) patients had fair and 3 (10%) patients had poor outcome and after 18th week final follow-up, excellent outcome was in 27 (90%) patients and good outcome was in 03 (10%) patients. Kao et al. (2014) showed the clinical outcome was excellent in 31 patients, good in 2, and poor in 1 (97% excellent or good) patient, using the criteria of Flynn et al. (1974)[11]. Venkatadass et al. (2015) found satisfactory result in 87% of patients in their study[12]. Another study by Guler et al. (2016) revealed that 23 patients' outcome was very good and 4 patients' outcome was good[9].

Conclusion:

After analyzing the results of present study, it can be concluded that management of Gartland type III supracondylar humerus fractures in children using the Kapandji technique in the prone position is a feasible and safe method. The range of elbow motion was restored properly. So, it could be an alternative technique.

Conflict of Interest: None.

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