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Outcomes of Joystick Manoeuvre in the Management of Pediatric Supracondylar Humerus Fractures

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ABSTRACT

Background: SCFH (Supracondylar humerus fracture) is one of the most common fractures noted in subjects from the pediatric age group. One of the commonly employed and novel therapeutic approach for close reduction and reduction is Joystick maneuver used for supracondylar humerus fracture.
Aim: The present study was aimed to assess the outcomes of Joystick manoeuvre in the management of pediatric supracondylar humerus fractures.
Methods: The present study assessed 136 subjects that had Supracondylar humerus fracture in the pediatric subjects. In all the subjects, demographic data were gathered along with clinical examination and all the outcomes were assessed in all the subjects for outcomes of the Joystick maneuver.
Results: The study results showed that majority of subjects were in age range of 7-9 years and majority of study subjects were male. The Flynn grading depicted that initially at 1 month follow-up, good outcome was seen in 86.66% (n=118) subjects and excellent outcomes in 11.76% (n=16) subjects, whereas, fair outcome was seen in 1.47% (n=2) subjects that improved significantly over one year and at end of 1 year. Outcome was excellent and good in 82.35% (n=112) and 17.65% (n=24) subjects with statistical significance and $p<0.001$.
Conclusion: The present study concludes that use of Joystick maneuver was for management of supracondylar humerus fracture in child subjects is an effective and safe procedure for closed reduction associated with the excellent functional outcomes in majority of the subjects and good in remaining subjects following the Flynn grading.

Keywords: *Closed reduction, Flynn grading, Joystick maneuver, Supracondylar humerus fracture.*

INTRODUCTION

SCFH (Supracondylar humerus fracture) is one of the most common fractures seen in subjects from the pediatric age groups that accounts for nearly 60% of the pediatric fractures seen. SCFH (Supracondylar humerus fracture) is commonly attributed to the history of fall on the outstretched hand and elbow joint in the hyperextension that could result in pushing of the distal fragment to the posterior side. These fractures are most commonly classified using the Gartland classification and also to guide the treatment of these fractures.[1]

Considering the need for operative management in these fractures, it is needed for Gartland type III and IV fractures. The aim of the treatment in these subjects is achieving the stable fixation and anatomical reduction along with the good functional outcomes. Surgical management options comprise of the closed or open reduction using the fixation by k-wire. Treatment using the cross k-wires is accepted globally and widely with the presentation of the successful results.[2]

Open reduction in these fractures has more association with the complications compared to the closed reduction methods including the increased risk of iatrogenic neurovascular injury, scar formation, infection, myositis ossificans, elbow stiffness, and loss of motion.[3]

Another therapeutic and novel method used for close reduction and fixation of the supracondylar fracture of the humerus is known as the Joystick Maneuver which is commonly used and widely accepted. However, its efficacy, use, and outcomes have not been widely evaluated using the Joystick maneuver.[4] Hence, the present study was aimed to assess the outcomes of Joystick manoeuvre in the management of pediatric supracondylar humerus fractures.

MATERIALS AND METHODS

The present prospective observational study was aimed to assess the outcomes of Joystick manoeuvre in the management of pediatric supracondylar humerus fractures. The study was done at Department of Orthopaedics, Saraswati Medical College, Unnao, Uttar Pradesh. Verbal and written informed consent were taken from all the subjects before study participation.

The present study assessed 136 subjects that had Supracondylar humerus fracture in the pediatric subjects and reported the Institute within the defined study period. The subjects were followed for one year after the treatment. The study included subjects aged 2-12 years with completely displaced Supracondylar humerus fracture in which movement of distal fragments in both extension and flexion were assessed immediately before surgery using multidirectional instability test. All the routine investigations as complete blood counts were done. Exclusion criteria for the study were subjects having fractures with vascular insufficiency, open fractures and compartment syndrome.

All the subjects were assessed for demographic data including age, gender, trauma mechanism, fracture type, injury site, associated fractures, time between presentation and surgical intervention and direction of initial deviation of the distal fragment. A comprehensive vascular and neurological assessment was done in the affected limb. This was followed by attempted closed reduction under intravenous (IV) sedation/ general anaesthesia using a 2-2.5mm K-wire inserted to outer cortex of both condyles just distal to fracture and at most outmost cortex at an angle of 40-50 degrees to joint line of the condyles that worked as joy stick under C-arm imaging. After k wire use to reduce distal fragment of fracture with stabilized proximal fracture fragment crossing cortex of opposite side and wires crossing each other proximal to fracture site.

Other groups were treated using conventional arm board reduction maneuver considering fracture displacement followed by check reduction on c-arm followed by k-wire insertion and X-ray was done for assessment of reduction. Above elbow slab was applied after satisfactory reduction was achieved. K-wires were postoperatively removed after 3 weeks and after 4 weeks active elbow mobilization was started. Radiological assessment was done at 1, 3, 6, 9, and 12 months. Functional assessment n subjects was done at each follow-up utilizing the Flynn criteria.

The collected data was analyzed statistically by using SPSS software version 25.0 (IBM Corp., Armonk, NY, USA) chi-square test, Fisher's exact test, Mann Whitney U test, and SPSS (Statistical Package for the Social Sciences) software version 24.0 (IBM Corp., Armonk. NY, USA) using ANOVA, chi-square test, and student's t-test. The significance level was considered at a p-value of <0.05.

RESULTS

The present prospective observational study was aimed to assess the outcomes of Joystick manoeuvre in the management of pediatric supracondylar humerus fractures. The present study assessed 136 subjects that had Supracondylar humerus fracture in the pediatric subjects. In all the subjects, demographic data were gathered along with clinical examination and all the outcomes were assessed in all the subjects for outcomes of the Joystick maneuver.

It was seen that during the study no subject was lost during follow-up and hence, all 136 subjects completed the study. There were 53% (n=72) males and 47% (n=64) females in the study. Majority of the study subjects were in the age range of 7-9 years with 34% (n=460 subjects followed by 29.4% (n=40) subjects from 10-12 years, 26.4% (n=36) subjects from 4-6 years, and 10.29% (n=14) subjects from <3 years. Left side and right side was affected in 50% (n=68) subjects each. Gartland type II and III fractures were seen in 28% (n=38) and 72% (n=98) subjects respectively. Time from fracture to surgery was <24 and >24 hours in 72% (n=110) and 8% (n=26) subjects respectively. Mean surgery time in study subjects was 44.2±14.9 minutes (Table 1).

Table 1: Demographic and disease data in study subjects at baseline

S. No	Characteristics	Number (n)	Percentage (%)
1.	**Gender**		
a)	Male	72	53
b)	Female	64	47
2.	**Age range (years)**		

a)	<3	14	10.29
b)	4-6	36	26.4
c)	7-9	46	34
d)	10-12	40	29.4
3.	**Laterality**		
a)	Left	68	50
b)	Right	68	50
4.	**Gartland fracture type**		
a)	II	38	28
b)	III	98	72
5.	**Time from fracture to surgery (hours)**		
a)	<24	110	72
b)	>24	26	8
6.	**Mean surgery duration (min)**	44.2±14.9	

The study results showed that for functional outcome in study subjects after surgery, mean ROM extension at 1, 3, 6, 9, and 12 months in study subjects was 0.4±1.4, 1.5±2.2, 3.1±2.2, 3.7±1.9, and 4±2 which showed a significant increase to 12 months with p<0.001. Similar significant increase was seen from 1 month to 12 months in study subjects for mean ROM flexion, and MEPS (Mayo elbow performance score) with p-value of <0.001. However, a significant reduction was seen in study subjects from 1 month to 12 months for carrying angle loss and Baumann's angle with p<0.001.

On assessing the outcomes in study subjects concerning the Flynn grading, it was seen that fair grading was seen in 1.47% (n=2) subjects at 1 month and 3 months each. The Flynn Grading was excellent in 11.7% (n=16), 26.4% (n=36), 56% (n=76), 79% (n=108), and 82% (n=112) subjects respectively at 1, 3, 6, 9, and 12 months. The Flynn grading was good in 87% (n=118), 72% (n=98), 44% (n=60), 20% (n=28), and 18% (n=24) study subjects respectively. The difference was statistically significant with p<0.001 (Table 2).

Table 2: Functional outcomes in study subjects

S. No	Outcome	1	3	6	9	12	p-value
1.	**Mean ROM extension**	0.4±1.4	1.5±2.2	3.1±2.2	3.7±1.9	4±2	**<0.001**
2.	**Mean ROM flexion**	113.4±9.7	125.2±6.7	128.3±5.5	131±5.0	132.6±4.5	**<0.001**
3.	**MEPS**	54.1±6.5	73.4±7.7	77.0±5.5	79.3±4.3	82.1±4.5	**<0.001**
4.	**Carrying angle loss**	3.7±2.8	3.1±2.4	2.3±2.4	2.0±2.4	2.0±2.3	**<0.001**
5.	**Baumann's angle**	5.7±2.8	4.2±1.9	3.6±2.1	2.9±2.4	2.8±2.2	**<0.001**
6.	**Flynn grading n (%)**						**<0.001**
a)	Fair	2 (1.47)	2 (1.47)	0	0	0	
b)	Excellent	16 (11.7)	36 (26.4)	76 (56)	108 (79)	112 (82)	
c)	Good	118 (87)	98 (72)	60 (44)	28 (20)	24 (18)	

DISCUSSION

The present study assessed 136 subjects that had Supracondylar humerus fracture in the pediatric subjects. In all the subjects, demographic data were gathered along with clinical examination and all the outcomes were assessed in all the subjects for outcomes of the Joystick maneuver. The data and design of the present study was comparable to the previous studies of Kumarjuvekar SA et al[5] in 2024 and Basaran SH et al[6] in 2015 where authors assessed subjects with demographic and adopted design similar to the present study in their studies.

The study results showed that during the study no subject was lost during follow-up and hence, all 136 subjects completed the study. There were 53% (n=72) males and 47% (n=64) females in the study. Majority of the study subjects were in the age range of 7-9 years with 34% (n=460 subjects followed by 29.4% (n=40) subjects from 10-12 years, 26.4% (n=36) subjects from 4-6 years, and 10.29% (n=14) subjects from <3 years. Left side and right side was affected in 50% (n=68) subjects each. Gartland type II and III fractures were seen in 28% (n=38) and 72% (n=98) subjects respectively. Time from fracture to surgery was <24 and >24 hours in 72% (n=110) and 8% (n=26) subjects respectively. Mean surgery time in study subjects was 44.2±14.9 minutes. These results were consistent with the findings of Zhou H et al[7] in 2021 an Novais EN et al[8] in 2013 where demographic and fracture characteristics reported by the authors were comparable to the results of the present study.

It was seen that for functional outcome in study subjects after surgery, mean ROM extension at 1, 3, 6, 9, and 12 months in study subjects was 0.4±1.4, 1.5±2.2, 3.1±2.2, 3.7±1.9, and 4±2 which showed a significant increase to 12 months with p<0.001. Similar significant increase was seen from 1 month to 12 months in study subjects for mean ROM flexion, and

MEPS (Mayo elbow performance score) with p-value of <0.001. However, a significant reduction was seen in study subjects from 1 month to 12 months for carrying angle loss and Baumann's angle with p<0.001. These findings were in agreement with the results of Kumar B et al[9] in 2022 and Aktekin CN et al[10] in 2008 where results for functional outcomes similar to the present study were also reported by the authors.

Concerning the assessment of the outcomes in study subjects concerning the Flynn grading, it was seen that fair grading was seen in 1.47% (n=2) subjects at 1 month and 3 months each. The Flynn Grading was excellent in 11.7% (n=16), 26.4% (n=36), 56% (n=76), 79% (n=108), and 82% (n=112) subjects respectively at 1, 3, 6, 9, and 12 months. The Flynn grading was good in 87% (n=118), 72% (n=98), 44% (n=60), 20% (n=28), and 18% (n=24) study subjects respectively. The difference was statistically significant with p<0.001. These results were in line with the findings of Aktekin CN et al[11] in 2008 and Ozkoc G et al[12] in 2004 where results for outcomes in study subjects concerning the Flynn grading reported by authors were comparable to the results of the present study.

CONCLUSION

The present study, considering its limitations, concludes that the use of Joystick maneuver was for management of supracondylar humerus fracture in child subjects is an effective and safe procedure for closed reduction associated with the excellent functional outcomes in majority of the subjects and good in remaining subjects following the Flynn grading.

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