Evaluation of Functional Outcome of Percutaneous Lateral Pinning Compared with Crossed Pinning in Supracondylar Fracture of Humerus (Gartland Type-III) in Children

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Abstract

Background: Of the various methods available for the treatment of Gartland type III fractures percutaneous K-wire fixation either in a cross medio-lateral patternor through a lateral entry is the treatment of choice. Purpose of the study was to evaluate the functional outcome of percutaneous lateral pinning compared with crossed pinning in supracondylar fracture of humerus (Gartland Type–III) in children.

Materials and methods: This quasi-experimental study was carried out in the Department of Orthopaedic Surgery, Chittagong Medical College Hospital from July 2018 to January 2020. Thirty patients with age limit below 12 years having supracondylar fracture of Humerus (Gartland Type-III) were taken by purposive sampling technique as per set criteria and were treated either by lateral pinning or crossed pinning. Every alternate patint ws included in the same group.

Results: In this study, Out of 30 patients, 15 patients were undergone fixation with lateral pinning and15 patients were undergone fixation with cross pinning. Male 26(86.7%) were more than female 4(13.3%), left side involvement was 76.7% and right side was 23.7%. Lt. side was more as most of the patients were Rt. Dominant and was trying to protect during fall with the help of non dominant hand. In 73.43% had used 2 pin, 26.57% had used 3 pin during procedure. Mean ± SD interval from injury to procedure in the study subjects were 4.33 ± 2.496 days (Range: 1-10 days). Mean ± SD time in lateral pinning group was 31 ± 4.424 minutes and in cross pinning group was 30.07 ± 4.234 minutes. No patient had ulnar nerve injury in lateral pinning group, but 13.33% patients had ulnar nerve injury during procedure in cross pinning group. Functional outcome was 67.7% excellent and 33.3% good in lateral pinning group and 73.3% excellent and 26.7% good in cross pinning group according to Flynn Criteria. Mean ± SD change in Humerocapitellar angle in lateral pinning group was 5.47 ± 0.640 degree and in cross pinning group was 6.07± 1.223 degree. Mean ± SD change in baumann's angle in lateral pinning group was 3.53 ±0.64 and cross pinning group was 5.00 ±1.00 degree.

Conclusion: This study showed techniques of lateral pinning and medio-lateral cross pinning are equally effective for fixation of paediatric supracondylar fracture of humerus.

Key words : Flynn's Criteria; Iatrogenic; Lateral cross-pinning; Radial nerve palsy; Supracondylar humeral fracture.

Introduction

Supracondylar fractures of the humerus are the most common elbow fracture among children and makes up approximately 60% of all elbow injuries.[1,2] The incidence peaks between the ages of 5-8 years.[2] The peak age of occurrence is infirst decade of life and it become progressively more uncommon as the child approaches adolescence the average age group of patient being 7½ years.[1] The main cause for this fracture is fall on out stretched hand and indirect injury to elbow.[3] Left nondominant side is most commonly involved.[4] There are two types of supracondylar fractures of humerus in children according to the direction of distal fragment that is Extension type (97%-99%) and Flexion type (1-3%).[1,3] Extension variety is further divided into three types: Type I being non-displaced, Type II being displaced but with an intact posterior cortex and Type III being displaced and without anycortical contact although there are more recent modifications.[5,6] Wilkins further classified Type III fractures on the basis of coronal displacement as Type-IIIA (Posteromedial) and IIIB (Posterolateral). Pattern based classification by Bahk et al 4 coronal (Typical transverse, medical oblique, lateral oblique, high) and 2

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Submitted on : 03.07.2023
Accepted on : 24.01.2024

sagittal (Low sagittal, high sagittal).[7] Among them low sagittal and medial oblique can not stabilized by only lateral pinning. Cross pinning is needed for the setwo pattern. The main complications associated with supracondylar fractures are malunion, is chemiccontracture and neurovascular damage.[8,9]

The most common and widely accepted method of treatment consists of close dreduction, if possible, with percutaneous Kirschner wire fixation.[10] Controversy exists regarding the optimal K-wire configuration in fixation of type-II and type–III fractures. Two main techniques are inuse.[10,11]

The cross-wire technique involves the placement of two K-wires, one inserted through the lateral condyle and another through the medial condyle.[11] Alternative fixation technique involves insertion of two K-wires through the lateral cortex which can be done in three configuration: parallel, divergent and cross.[12] The purpose of the study to compare the functional outcome of percutaneous lateral pinning compared with crossed pinning in supracondylar fracture of humerus (Gartland Type-III) in children.

Materials and methods

This Quasi experimental study was done in the Department of Orthopaedics and Traumatology, Chittagong Medical College Hospital, Chattogram, Bangladesh from July 2018 to January 2020. Thirty (30) paediatric patients undergoing surgery for supracondylar fracture of Humerus (Gartland Type-III). Purposive type of non-probability sampling technique. Ethical issue: The protocol was approved by the Ethical Review Committee, Chittagong Medical College Hospital, Chattogram, Bangladesh.

Results

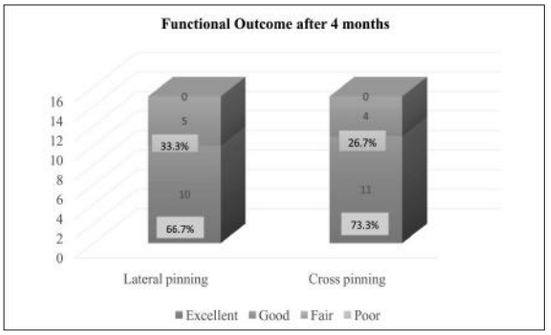

Figure 1 Funcitional Outcome after 4 months

The mean age was 8.47 ± 2.295 in lateral pinning group and 7.93 ± 1.944 in cross pinning group.

Out of 30 patients, 26 (86.7%) were male and 4 (13.3%) were female. In lateral pinning group, 14 (93.3%) patients were male and 1 (6.7%) patient were female. Incross pinning group, 12 (84.6%) patients were male and 3 (15.4%) patients werefemale. Accordingto pvalue, result was non-significant.

Among 30 patients, according to side of injury, 76.7% patients had injury on left side. According to pin number used in the procedure, maximum patients (73.3%) needed 2 pin.

Mean ± SD interval from injury to procedure in the study subjects were 4.33 ± 2.496 days with a range between 1-10 days.

Table I Time of radiological union (n-30)

Duration of radiological union in weeks	Total	Lateral Pinning	Cross Pinning	p value .05ns
Mean ± SD	5.66±0.156 weeks	5.73 ± 0.131 weeks	5.60±0.161 weeks	
Range	4-6 weeks	4-6 weeks	4-6 weeks	

Table I shows that, out of 30 patients, average mean ± SD time for radiological union was 5.66±0.156 weeks and rang was 4-6 weeks. Mean ± SD time for radiological union in lateral pinning group was 5.73 ± 0.131 weeks and in cross pinning group was 5.60 ± 0.161 weeks. According to p value, result is statistically non-significant.

Out of 30 patients, average mean ± SD Change in Baumann's angle was 4.27 ± 1.112 and range was 3-7. Mean ± SD Change in Baumann's angle inlateral pinning group was 3.53 ± 0.640 and in cross pinning group was 5.00 ± 1.00. According to p value, result is statistically not significant.

Discussion

In this study, Average mean ± SD was 8.20 ± 2.107 and range was 6-12 years. The mean age was 8.47 ± 2.297 in lateral pinning group and 7.93 ± 1.944 in cross pinning group. p value was 0.498, statistically non-significant. Mean age of the patients was 8.4 years.[13] The mean age in the lateral pin group was 8.25 years and 8.55 years in the medial–lateral pin xation group. p value was 0.314. In other study showed common age group

was (3-7 years) which is more susceptible to sustain traumatic supracondylar fracture humerus.[14] Another study revealed 12(37.5%) belonged to age group 6-9 years, 10 (31.25%) in 3-6 years, 6 (18.75%) in 1-3 years while only 4 (12.5%) children were older than 9 years.[15] Peak incidence of the fractures was between the ages of 5-7 years.[16]

Present study showed, out of 30 patients, 26 (86.7%) were male and 4 (13.3%) were female. In lateral pinning group, 14 (93.3%) patients were male and 1 (6.7%) patients were female. In cross pinning group, 12(84.6%) patients were male and 3 (15.4%) patients were female. In (17) there were 24 (75%) male and 8 (25%) were female children. According to sex distribution, boy is more susceptible than girl to be exposed to supracondylar fracture humerus as he is usually more active than the girl.[17] In cross pinning group, 80 patients (80%) were male and 20 patients (20%) female.[18] Male tofemale ratio was 4.0:1. In lateral pinning group, 78 patients (78%) was male and 22 patients (22%) were female with male to female ratio of 3.54:1.

According to side of injury, among 30 patients, according to side of injury, 76.7% patients had injury on left side. involvement of the left side was 77.4 % and 22.6 % for the right side.[13] Right side was fractured in 14 (35%) patients and left side was fractured in 26 (65%) patients.[16] Left side 38 (76%) was the most dominantsite of fracture as compared to the right side 12 (24%).[19]

Regarding ulnar nerve injury, total 2 (6.7%) patients had ulnar nerve injury during procedure. All 2 (13.3%) patients was in cross pinning group. ten cases of iatrogenic ulnar nerve palsy following medial pinning (21%) in the medial–lateralentry group-one case had paraesthesia along the ulnar nerve distribution.[20] p value was 0.491. There was iatrogenic nerve injury (Ulnar nerve) in cross pinning group but no iatrogenic nerve injury (Ulnar nerve) was foundin lateral pinning group.[14]

Among 30 patients having complete radiological union range 4-6 weeks, Total Mean ± SD was 5.66 ± 0.156 weeks. In lateral pinning group Mean ± SD was 5.73 ± 0.131 weeks, in cross pinning Mean ± SD was 5.60 ± 0.161 weeks. p value was more than .05 which is statistically not significant. Out of 30 patients, average mean ± SD change in Baumann's angle was 4.27 ± 1.112 and range was 3-7. Mean ± SD change in Baumann's angle in lateral pinning group was 3.53 ± 0.640 and in cross pinning group was 5.00 ± 1.00. According to p value, result is statistically not significant. One study showed baumann‘s angle change 6.4±4.8 for cross pinning and 4.7±3.2 for the lateral pin group.[21] It was not statistically significant.

In this study out of 30 patients, average mean ± SD loss of carrying angle in degree was 4.23 ± 1.654 and range was 2-8. Mean ± SD Loss of carrying angle in degree inlateral pinning group was 4.40 ± 1.882 and in cross pinning group was 4.07 ± 1.438. According to p value, result is statistically non-significant. Carrying angle change inlateral entry group mean ±SD is 7.3±1.7and cross entry group mean ±SD is 7.2±1.9.[8] This difference was not statistically significant.

In this study at 4th month‘s final follow-up, out of 30 patients after 4 months follow-up, 21 (70%) patient‘s functional outcome was excellent and 9 (30%) patient‘s functional outcome was good. In lateral pinning group, 10(67.7%) patient‘s functional outcome was excellent and 5 (33.3%) patient‘s functional outcome was good. In cross pinning group, 11 (73.3%) patient‘s functional outcome was excellent and 4 (26.7%) patient‘s functional outcome was good. According to p value, result is statistically non-significant. According to Flynn criteria, the nalresult was excellent in 79.03 % and good in 20.97 % of cases.[13] The result for the medial-lateral entry group was excellent in 83.87 % and good in 16.12 % cases and the result for the lateral entry group was excellent in 74.19 % and good in 25.82 %(p=0.533). Outcome based on Flynn‘s grading, there was no significant difference of proportion of excellent, good and fair between patient groups receiving lateral pinning and crossed pinning.[15] According to Flynn‘s modified criteria excellent results were 11 (55%) inlateral pinning group while it was 13 (72.22%) in cross pinning group, good results were 5 (25%) inlateral pinning group and 4 (27.77%) in cross pinning group, fair results 2 (10%) in lateral pinning group while it was 1 (5.55%) in cross pinning group.[14] They got no poor results (no patient) 0% in Group cross

pinning group, while unfortunately they got 2 patients (10%) with poor results in lateral pinning group.[14] Another study conducted at department of Orthopaedics, Gauhati Medical College and Hospital, Guwahati, Assam, India in 2016, Out of 31 patients treated with medial-lateral cross K-wire fixation were 26 (83.87%) excellent results 8 (16.12%) good results. Out of 31 patients treated with 2 lateral K-wire fixations were 23(74.19%) excellent and 8 (25.82%) were good results.[13]

Limitations

Due to time constraint adequate sample size could not be included in the study.

Conclusion

This is concluded that no significant difference between lateral pining and cross pinning interms of union time, boumannsangle change, humero-capitellar-angle change, functional outcome and stability. Both techniques have almost equal results.

Recommendations

- Proper preoperative planning and good anatomical reduction is needed for less complication.
- Provide early surgical management for better functional outcome.
- As present study was done on a relatively small sample, a large scale study should be conducted to make the findings of the study generalized to reference population.
- A multicenter study could be undertaken to interpret such results better.

Acknowledgement

We are obliged and grateful to Department of Community Medicine, Chittagong Medical College, who helped us much for computerized Data analysis of this study. We are indebted to our patients and OT stuffs for their co-operation during the period of this study.

Contribution of authors

SKM-Conception, acquisition of data, data analysis, drafting & final approval.

MTA-Design, interpretation of data, critical revision & final approval.

MARF-Acquisition of data, data analysis, drafting & final approval.

SB-Data analysis, critical revision & final approval.

SC-Interpretation of data, drafting & final approval.

KMBU-Data analysis, interpretation of data, drafting & final approval.

Disclosure

All the authors declared no conflict of interest.

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