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COMPARATIVE STUDY ON FUNCTIONAL AND RADIOLOGICAL OUTCOMES OF LATERAL VERSUS CROSSED PINNING TECHNIQUE IN SUPRACONDYLAR HUMERUS FRACTURES IN CHILDREN

Orthopaedics

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ABSTRACT

Supra-condylar fractures of the humerus constitute the most common elbow injuries in children. For displaced Supra-condylar Humerus fractures, the gold standard treatment is Closed reduction and percutaneous pinning. However, the debate persists in optimal pin configuration. The conventional Crossed pinning technique carries the risk of Iatrogenic Ulnar nerve injury. A prospective, randomized comparative study, with 30 cases of Supracondylar humerus fractures in children, was carried out at Department of Orthopaedics, Mahatma Gandhi Medical College and Hospital, Jaipur. Patients of age <15 years with Gartland type 2B, type 3, type 4 fractures were included. 14 cases were treated with lateral pinning, while the rest 16 cases with crossed pinning. There was no statistically significant difference with regard to loss of range of motion at elbow and loss of reduction between the two groups. Iatrogenic ulnar nerve injury (IUNI) occurred in two cases (6.6%) after crossed pinning which recovered by three months. To conclude, Lateral pinning technique offers indistinguishable radiological and functional outcomes as compared to crossed pinning technique while safeguarding the ulnar nerve simultaneously.

KEYWORDS

Supracondylar fracture, Pinning, Ulnar nerve, Carrying angle

INTRODUCTION

Supra-condylar fractures of the humerus constitute the most common elbow injuries in children and make up roughly 60 percent of all elbow injuries in the first decade of life1. Supra-Condylar Humerus fractures are widely classified as extension and flexion type with the former being more common2. An anterior tension force is created by a linear applied force. Posteriorly, this force pushes olecranon process into the depths of olecranon fossa. As this bending force continues, there is a failure anteriorly in the thin supra-condylar area of distal humerus.3 Modified Gartland's classification holds the test of time for these injuries.4 For displaced Supra-condylar Humerus fractures, the gold standard treatment is Closed reduction and percutaneous pinning. However, the debate persists in optimal pin configuration. Though crossed pinning provides more biomechanical stability, it concurrently carries the pitfall of Iatrogenic Ulnar Nerve Injury (IUNI) (5%) due to medial pin placement.5 The purpose of the current study is to compare the functional and radiological outcomes of Lateral vs Crossed Pinning technique in Supracondylar Humerus Fractures.

MATERIALS AND METHODS

A prospective, randomized, comparative study was conducted at the Orthopaedic Department of Mahatma Gandhi Medical College and Hospital from January 2020 till June 2021. 30 children with Supra-condylar fracture of humerus who presented to the Orthopaedic outpatient or casualty were included in study.

Inclusion Criteria

1. Age <15 years.
2. Patients with Supra-condylar Humerus fractures
3. Patients who are medically fit and willing to consent for operative method.

Exclusion Criteria

1. Patients more than 15 year age
2. Supra-condylar Humerus Fractures Gartland Type 1, Type 2A.

30 patients (<15 year age) presenting with Supra-condylar Humerus fracture were selected for the study in sequence of their presentation. X ray Elbow (AP and Lateral views) was taken with application of Above Elbow slab in 30o flexion. Routine pre operative blood investigations were carried out. Randomization was done and patients were allotted one among two groups for lateral or crossed pinning technique. All the patients under study were evaluated clinically and radiographically at one week, four weeks, three months, and six months. Clinical outcome was evaluated using Flynn's Criteria6 while radiological outcome using Skagg's criteria7

Case Illustrations

Case I

Figure 1

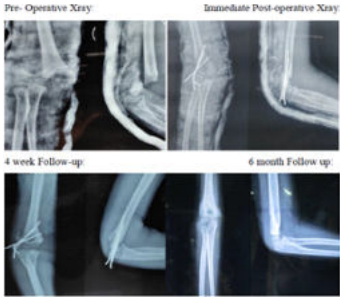

Figure 2

Case II

Figure 3

Figure 4

RESULTS

In our study, Peak incidence was found in age groups 11-14 years with a mean age of 8.63±3.95 years. Out of the 30 patients included in study, 17 were males (56.66%) with a male to female ratio of 1.3. 60% of the supra-condylar fractures of humerus involved the right side. Most of the fractures (90%) were of Gartland type 3. Out of those, 77.7% cases were of Type 3A (Postero-medial). 1 patient out of 30 had feeble radial pulse at the time of presentation. 1 patient had Median nerve palsy at the time of presentation. Average time for radiological union was 3.81±0.91 weeks in cross pinning group and 3.86±0.86 weeks in lateral pining group. The difference was not statistically significant. In cross pinning group, 15 patients (93.7%) had satisfactory results (1 excellent, 12 good, 2 fair) and 1 patient had poor result while in lateral pinning group 12 patients (85.7%) had satisfactory results (1 excellent, 9 good, 2 fair) and 2 patients had poor result according to functional Flynn's criteria. In cross pinning group, 16 patients (100%) had satisfactory results (15 excellent, 1 good) while in lateral pinning group 13 patients (92.8%) had satisfactory results (9 excellent, 4 good) and 1 patient had poor result according to cosmetic Flynn's criteria. According to Skaggs's Grading, 9 patients in cross pinning group and 5 patients in lateral pinning group had no displacement. 7 patients in cross pinning group and 8 patients in lateral pinning group had mild displacement. 1 patient in lateral pinning group had major displacement. 2 patients in Cross pinning group developed ulnar nerve palsy after surgery.

Table 1. Skagg's grading on final follow-up

Skagg's grade	Cross pinning Group		Lateral Pinning Group	
	No.of patients	*Percentage*	*No.of patients*	*Percentage*
No displacement	9	30.00	5	16.66
Mild displacement	7	23.33	8	26.66
Major displacement	0	0	1	3.33
Result (p value)	0.352 (NS)			

Table 2. Flynn's critera (functional and cosmetic) on final follow-up

	Flynn's grade	Cross pinning Group		Lateral Pinning Group	
		No.of patients	*Percentage*	*No.of patients*	*Percentage*
SATISFACTORY	*Excellent*	1	3.33	1	3.33
	Good	12	40.00	9	30.00
	Fair	2	6.66	2	6.66
	Poor	1	3.33	2	6.66
	Result (p value)	1.00 (NS)			

	Flynn's Grade	Cross pinning Group		Lateral Pinning Group	
		No.of patients	*Percentage*	*No.of patients*	*Percentage*
SATISFACTORY	*Excellent*	15	50.00	9	30.00
	Good	1	3.33	4	13.33
	Fair	0	0	0	0
	Poor	0	0.00	1	3.33
	Result (p value)	0.123 (NS)			

DISCUSSION

There is a continuing debate regarding best fashion of pin fixation of displaced Supracondylar humerus fracture in children. We found that by application of technically correct practice like proper site of entry of pin ,the configuration of pin and the number of pins applied via lateral side, can also provide equal stability as that obtained with cross pinning. Average time for radiological union was 3.81 weeks in cross pinning group and 3.86 weeks in lateral pining group. The average loss of range of movement was 10.35 degrees for cases with crossed pinning and 10.53 degrees for cases with lateral pinning at 6 month follow up.

So, both groups showed excellent or good range of movements. Similar results were shown by Kocher et al.8, Mostafavi and Spero9, and Aronson and Prager10. The mean Loss of Carrying angle seen in Crossed pinning group was 2.44 degree while in Lateral pinning group was 4.21 degree. one case in lateral pinning group had more than 15 degree loss of carrying angle. This could be explained based on fact that lateral pins used to fix were little convergent rather than divergent which has resulted in fragile purchase on medial column, resulting in displacement and loss of carrying angle. So, the greater strength seen with divergence of the pins can be attributed to the location of the intersection of the two pins and greater divergence between the two pins. Bloom et al.11 reported that three lateral entry divergent pins were bio mechanically equivalent to cross pinning. According to the functional criteria by Flynn, 15 patients (93.75%) had satisfactory results and 1 patient had poor result in cross pinning group, while 13 patients (85%) had satisfactory results and 2 patients had poor result in lateral pinning group. According to Skaggs's Grading, 9 patients in cross pinning group and 5 patients in lateral pinning group had no displacement. 7 patients in cross pinning group and 8 patients in lateral pinning group had mild displacement. In a previous study of eight other cases of Supra- Condylar Humerus fractures, which lost reduction, Sankar et al.12 reported that the loss of fixation in all cases was because of technical errors that were evident on the intra-operative fluoroscopic images. They identified three types of pin-fixation errors12: A failure to engage both fragments with two or more pins, A failure to achieve a bi-cortical fixation with two or more pins, and failure to obtain appropriate pin separation of more than 2 mm at the fracture site. 2 patients (6.6%) in Cross pinning group developed ulnar nerve palsy after surgery. A report done in 2012 by Woratanarat et al.13 included 18 studies which concluded that the risk of iatrogenic ulnar nerve injury to be 4.3 times higher in cross-pinning technique.

CONCLUSION

Supra-condylar Humerus fractures are one of the most common fractures seen in paediatric age group with a history of fall on outstretched hand. Lateral Pinning done by keeping adequate divergence between pins at fracture site and by using three pins for fixation, offers equivalent bio-mechanical rigidity as crossed pinning. To conclude, we can state that the radiological and functional outcome parameters are quiet comparable for both Lateral and Cross pinning technique, however, lateral pinning technique offers indistinguishable Bio-mechanical as well as functional and radiological outcomes when compared with the traditional Cross pinning technique while preserving ulnar nerve simultaneously.

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