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K Wire fixation of supra-condylar humerus fractures in children. Is ulnar nerve at risk?

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Abstract

Objective: To compare iatrogenic ulnar nerve injury in lateral entry pin fixation versus medial and lateral entry pin fixation in the treatment of supracondylar fractures of the humerus in children. Measurement of clinical parameters in terms of elbow range of motion and postop radiographic alignment was also targeted.

Methods: The retrospective cohort study was conducted at Aga Khan University Hospital, Karachi, and comprised data of paediatric patients who underwent closed reduction and percutaneous pin fixation for the treatment of displaced extension type supracondylar fractures of the humerus between July 2007 and June 2012. Data regarding socio-demographic status, disease and procedure variables was collected from patient files and was analysed using SPSS 19.

Results: There were 71 patients; 37(52%) in the lateral entry group and 34(48%) in the medial and lateral entry group. The two groups were similar in terms of mean age, gender distribution, and preoperative displacement, comminution, and associated vascular and nerve status ($p>0.05$ each). There were no cases of iatrogenic ulnar nerve injury in either group and no significant differences between groups with respect to the elbow range of motion and radiological parameters ($p>0.05$ each).

Conclusions: With the use of the specific techniques employed, both lateral entry pin fixation and medial and lateral entry pin fixation were effective in the treatment of displaced extension type supracondylar humerus fractures in children.

Keywords: Humerus fracture, Supracondylar fracture, K wire fixation, CRPP. (JPMA 65: S-202 (Suppl. 3); 2015)

Introduction

Supracondylar fractures of the humerus are the most common type of elbow fracture in children. They account for 50% to 70% of all elbow fractures and are seen most frequently in children aged 6-9 years.¹⁻¹⁰ Extension type is more common, accounting for about 95% to 98% of all supracondylar fractures.^{10,11} Due to the close proximity of delicate nerves and vessels around the condyles, these structures can be damaged either by impact of trauma or at risk during fracture reduction and fixation.¹² The incidence of traumatic and iatrogenic nerve injuries with this type of fracture have been recorded to be 12% to 20%.^{10,13} Reduction and percutaneous pin fixation is considered the standard method of management.¹⁴ The configuration of pins remains a source of debate, with crossed medial-lateral pin fixation providing more stability compared to two lateral pins but having the risk of iatrogenic ulnar nerve injury.¹⁵

Supracondylar humerus fractures are a common problem affecting the community and maintenance of anatomical reduction by smooth pins is crucial in the outcome.¹⁶ Iatrogenic ulnar nerve injury still forces the operating

surgeon to use 2 lateral pins, compromising the maximal stability provided by the construct. The safety of using cross-pin fixation in terms of iatrogenic ulnar nerve injury has been mentioned in literature.^{4,12,17,18}

The current study was planned to compare iatrogenic ulnar nerve injury in lateral entry pin fixation versus medial and lateral entry pin fixation in the treatment of supracondylar fractures of the humerus in children. Measurement of clinical parameters in terms of elbow range of motion and postop radiographic alignment was also targeted.

Materials and Methods

The retrospective cohort study was conducted at Aga Khan University Hospital, Karachi, and comprised data of paediatric patients who underwent closed reduction and percutaneous pin fixation for the treatment of displaced extension type supracondylar fractures of the humerus between July 2007 and June 2012. Patients were identified from the Health Information Management System (HIMS), All patients between age 2 and 15 years, extension type supracondylar humerus fracture who underwent closed reduction and K wire fixation were included. All patients were operated by or under direct supervision of the consultant orthopaedic surgeon. Decision regarding the lateral pin fixation or medial and

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lateral pin fixation was governed by the choice of the operating surgeon. Patients with pre-operative ulnar nerve injury and age <2 years or >15 years were excluded.

Data regarding age, gender, fixation method, iatrogenic ulnar nerve injury, range of motion (ROM) at 6 weeks post-operative was collected by an orthopaedic Resident. All pre operative and 6-week post operative radiographs were assessed and data regarding alignment, Bauman angle and carrying angle were calculated. SPSS 19 was used for data analysis and $p < 0.05$ was taken as significant.

Results

A total of 105 files were identified of which 34(32%) did not meet the inclusion criteria and had to be discarded. The final study sample stood at 71. Among them, 37(52%) underwent lateral pin fixation; 17(46%) males and 20(54%) females with overall mean age of 5.67 ± 3.4 years (range: 2-15 years). Likewise, 34(48%) patients had medial and lateral cross-pin fixation; 16(47%) males and 18(53%) females with a mean age of 6.4 ± 2.6 years (range: 2-15 years) (Table-1).

There were no cases of iatrogenic ulnar nerve injury in

Table-1: Demographic Data.

Patients characteristics N=71	Medial-lateral pin entry group N=34	Lateral pin entry group N=37	p-value (significant if $p < 0.05$)
Mean Age (years)	6.4 ± 2.6	5.67 ± 3.4	0.11
Gender			0.83
Male	16	17	
Female	18	20	

Table-2: Iatrogenic ulnar nerve injury.

Complications	Medial-lateral pin entry group N=34	Lateral pin entry group N=37	p-value (significant if $p < 0.05$)
Post-operative Iatrogenic ulnar nerve injury	0	0	1.0

Table-3: Outcome at follow-up.

Assessment measures	Medial-lateral pin entry group N=34	Lateral pin entry group N=37	p-value (significant if $p < 0.05$)
Elbow (Degrees)			
Total Range of motion	$0-131 \pm 4.2$	$0-129 \pm 3.8$	0.50
Carrying angle	6.1 ± 1.5	6.6 ± 1.3	0.31
Baumann angle	80.0 ± 3.2	79.3 ± 3.0	0.73

either group (Table-2).

At 6-week follow-up, there were no significant differences between the groups regarding carrying angle, total elbow motion, Baumann angle and change in Baumann angle and loss of reduction ($p > 0.05$ each) (Table-3).

Discussion

Results of both cross-pin fixation and lateral pin fixation were comparable in terms of iatrogenic ulnar nerve injury, elbow ROM and radiological parameters.⁷ Fortunately, no iatrogenic ulnar nerve injury was encountered in any of our patients, emphasising the safe use of cross-pin construct.

Literature suggests that crossed medial-lateral pin fixation provides increased biomechanical stability, but there is a risk of iatrogenic ulnar nerve injury from placement of the medial pin (14) whereas the two lateral pin fixation avoids the danger of iatrogenic ulnar nerve injury, but it provides less biomechanical stability.^{14,19}

However, a study¹¹ has suggested that it is difficult to compare various studies because pinning technique, pin size and position of elbow during pinning differs and most of the studies have a sample size of less than 50.²⁰

A systematic review in 2010 suggested that the risk of iatrogenic ulnar nerve injury is more with the crossed pinning compared with the lateral pinning.¹⁶ However, paucity of local literature still exists about the issue and many surgeons are found to be apprehensive in placing the medial entry pin to obtain a stable cross-pin construct.¹⁵ Although there is a potential risk of iatrogenic ulnar nerve injury, but with vigilant technique it can be minimised to such an extent that it is to be considered a desirable option in all unstable situations.¹⁶

Conclusion

Both percutaneous fixation techniques are effective in terms of efficacy and safety if a uniform and standardised operative technique is followed in each method.

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