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THE FUNCTIONAL OUTCOME OF LATERAL KIRSCHNER WIRES VS CROSSED KIRSCHNER WIRES IN FIXATION OF PAEDIATRIC SUPRACONDYLAR HUMERUS FRACTURES (EXTENSION TYPE)

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Abstract

Background:-The normal treatment for displaced supra condylar fractures is closed reduction and percutaneous pinning with Kirschner wires, though there are still some disputes about the positioning of the pins. A cross K-wire technique is known being physically more effective than a lateral k-wire alone, while using the latter one can more easily harm the ulnar nerve. In light of this, we agreed to research the functional outcome by comparing the two methods by percutaneous pinning in children's supracondylar fractures. **Method:-**55 children were subjected to k-wire fixation during the period of August 2018 to March 2020. They were divided into 2 groups undergoing lateral k-wire pinning and cross k-wire pinning. Patients were followed up regularly at 2 wks, 6 wks and 12 wks post operatively and were assessed radio logically for reduction and union, and clinically for movement and carrying angle by using Flynn's & Skagg's criteria. **Results:-**27 patients (21 males and 6 females) and 28 patients (17 males and 11 females) were in Group A& B respectively. In group A there was no operative ulnar nerve damage. In Group A, the average Baumann loss of angle, Capitohumeral loss of angleand carrying loss of angle were 5.4, 6.2 and 3.7 degrees, respectively and maximum elbow movement was 129 degrees. Excellent results in 23 patients, good in 3 and fair in 1 patients in Group A were shown by Flynn's grading. Skagg's criteria were adequate in Group A in 25 patients. Among group B, 4 children experienced postoperative ulnar ulnar damage. For Group B, the mean Baumann loss of angle, Capitohumeral loss of angle and carrying loss of angle were 5.8, 6.40 and 3.57 degrees respectively. Maximum elbow movement was 127 degree. Excellent results in 21 patients, good in 5 patients and fair in 2 in Group B patients were shown by the Flynn's grading. Skagg's criteria were satisfactory in 24 patients in Group B. **Conclusion:-** Both constructs or methods of fixation lateral k-wire and cross k-wire were comparable to each other in terms of results.

Keywords-- supracondylar fracture, k-wire, Baumaan's angle, Flynn's criteria

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INTRODUCTION

Paediatric supracondylar humerus fractures (SCHF) are common injury and constitute majority of the elbow fractures[1-3]. This fracture is more common in children 5 to 7 years old. This fracture declines in incidence after 12 years of age[2]. These fractures predominantly affect the male sex and are prevalent as a consequence of the extension mechanism[4]. Supracondylar fracture is usually known as the flexion and extension types. Approximately 97-99 per cent of cases are extension sort[5,6].

The major hurdle for early care seeking is cost and accessibility[7]. There are different therapeutic methods for the treatment of paediatric supracondylar fractures including closed reduction and application of plaster, traction with closed reduction, reduction along with percutaneous k-wire fixation and open reduction internal fixation with osteosynthesis.[8] The most recent treatment of displaced supracondylar fractures includes closed reduction with percutaneous pin fixation using Kirschner wire. However some controversies are still prevalent regarding the placement of k-wires[9-11].The proper placement of the pins is also being debated. A cross k-wire technique is physically safer than a lateral pin alone, while using the last one can more easily harm the ulnar nerve. Slobogean[12]. Recognized a greater risk of intro perative ulnar nerve damage with cross k-wires or lateral k-wires in children with supracondylar humerus fracture. In light of this, we agreed to research the functional outcome by comparing the two methods by percutaneous pinning in children's supracondylar fractures.

MATERIALS & METHODS

It is a prospective clinical study of paediatric displaced surpracondylar fracture admitted to the Department of Orthopedic Surgery at Datta Meghe Medical College, Nagpur in collaboration with the Department of Orthopedic Surgery at Jawaharlal Nehru Medical College, Datta Meghe Institute of Medical Sciences, Sawangi, after having received informed consent from fathers of children or close relatives between August 2018 and March 2020. Displaced paediatric extension type supracondylar fractures under 12 years of age (Gartland classification type 2 and 3), fractures occurring within the first four days, no prior similar fractures in the same limb and open fractures or fractures requiring open reduction, inability to conduct neurological tests, floating elbows, supracondylar flexion type fractures were excluded.

Surgical technique

Under general anesthesia with aseptic precautions, closed manipulative reduction with percutaneous K – wire fixation of 1.6 to 2 mm will be done under C – arm fluoroscopy. K-wires can be introduced from lateral side or one from the lateral and another one from medial side. The medial side K-wire will be inserted with the elbow in 20-30^0 flexion and protecting the ulnar nerve by haemostat or it will be inserted by a mini open skin incision of 0.5 to 1cm and retracting the ulnar nerve with haemostat in order to avoid injury to ulnar nerve. The pins will be bent and left and cut outside the skin so that pin removal could be done 3 weeks post operatively. Then the pin sites will be covered with betadine soaked guage pieces and above elbow slab

will be applied in 90^0 of flexion for 2 weeks. Patient will be discharged from the hospital within 24 to 48 hours after operation .Patients will be followed up regularly at 2 wks, 6 wks and 12 wks post operatively and each time will be assessed radio logically for reduction and union, and clinically for movement and carrying angle by using Flynn's grading[13]. Baumann's angle is useful in assessing the alignment of the elbow in children with supracondylar fractures and it remains almost same in children of age group 2-13 years and does not change significantly whether its a boy or girl[14]. Skagg's criteria based on Baumann's angle is used for evaluation maintenance of reduction and or malalignment[15]. Chi-square test was used for comparison.

RESULTS

Group A contained 27 patients. The median age had been 5.4 years. There were 21 male patients, and 6 female patients. 14 patients were injured as a result of falling from some height, 11 children were injured during playing and one injury was caused by road side accident. 12children had right side and 15 left side fractures.3 children had pulse less, functional hands, one had median nerve paralysis and another had radial nerve paralysis. First aid treatment and support was given in crammer splint and ice compression and elevation in most patients (86 per cent). In twenty cases, the displacement was postero medial, four got postero lateral and three got direct posterior displacement. For this population there was no intraoperative ulnar nerve damage. In Group A, the mean Baumann loss of angle, Capito humeral loss of angle and carrying loss of angle were 5.4, 6.2 and 3.7 degrees, respectively and maximum movement was 129 degrees. Excellent results in 23 patients, good in 3 and fair in 1 patient in Group A were shown by Flynn's grading. Skagg's criteria were adequate in Group A in 25 patients. Group B contained 28 patients. The median age had been 6.3 years. There were 17 male patients, and 11 female patients. 18 children were injured as a result of falling from some height, 10 children were injured during playing. 14children had right side and another 14 left side fractures. 2 children had pulse less, functional hands, one had median nerve paralysis and another had radial nerve paralysis. First aid treatment and support was given in crammer splint and ice compression and elevation in most patients (90 per cent). In nineteen cases, the displacement was postero medial, two got postero lateral and seven got direct posterior displacement. For this population there was 4 cases of iatrogenic ulnar nerve damage. In Group B, the mean Baumann loss of angle, Capito humeral loss of angle and carrying loss of angle were 5.8, 6.4 and 3.57 degrees, respectively and maximum movement was 127 degrees. Excellent results in 21 patients, good in 5 patients and fair in 2 in Group B patients were shown by the Flynn's grading. Skagg's criteria were adequate in Group B in 24 patients. Two patients had an infection in the superficial pin tract. Two patients required urgent re-exploration, one of whom had an ulnar nerve compression due to k-wire position and one had constriction of the cubital tunnel although no direct pressure was observed over the nerve. 26 patients eventually return to work and only two had slight restriction. The two groups were compared as shown in table no. I. We found no substantial differences ($p>0.05$) in all of these variables between groups except that there were four cases of iatrogenic ulnar nerve palsy requiring reoperation.

Table 1. Analysis of the two groups based on different parameters

Data	Group- A	Group-B	P value
No of patients	27	28	0.478
Age in years	5.4±2.8	6.3±1.4	
Sex			
Male children	21	17	0.322
Female children	6	11	
Hand Status			
Pulseless functional hand	3	2	0.91
Median nerve paralysis	1	1	
Radial nerve paralysis	1	1	
Displacements			
Posteromedial	20	19	0.223
Posterolateral	4	2	
Direct Posterior	3	7	
Iatrogenic Ulnar nerve paralysis	0	4	0.044
Bauman loss of angle in degrees	5.40±4.0	5.80±4.8	0.484
Humero-capitellar loss of angle in degrees	6.2±4.7	6.4±4.9	0.485
Carrying loss of angle in degrees	3.70±3.96	3.57±3.98	0.49

Range of motion (ROM) in degrees			
Total motion	129	127	0.41
Flynn grading			
Excellent	23	21	0.676
Good	3	5	
Fair	1	2	
Poor	0	0	
Skagg's criteria			
Satisfactory	25	24	0.585
Unsatisfactory	2	4	
Infection if any	1	2	0.464
Need for Re-surgery	0	2	0.153
Return to function			
Full	26	26	0.765
Minor restriction	1	2	
Major restriction	0	0	

DISCUSSION

Paediatric type III supracondylar displaced extension fracture of humerus treated by closed reduction with percutaneous k-wire fixation has repeatedly yielded adequate results. However there is ongoing debate about the appropriate technique of k-wire fixation, contrasting lateral k-wire fixation method to medial and lateral k-wire fixation method. In this study we find either constructs or methods of fixation, lateral k-wire and cross k-wire were comparable to each other in terms of results but there is evidence of intrao perative ulnar nerve damage (7%) in the medial and lateral k-wire fixation method.

While intro perative ulnar injury can occur with this procedure, the method of lateral and medial k-wire fixation was expected to have the upper hand in terms of better fracture stability. In comparison, lateral k-wire entry has the advantage of preventing ulnar nerve damage however this form seems to be less robust compositionally.

A analysis of the corpses recorded by Lee SS et. Al and Ziouts et.al indicated that cross k-wire fixation have greater torsional stiffness than lateral fixation[16,17]. The total strength of this kind of structure is linked to k-wire postion and mainly to k-wire divergence in different columns and number of k wires inserted. The higher strength seen with the divergent k-wire fixation was due to the position of the contact between the two k-wires and because of the fact that the greater separation or divergence between the two k wires permitted certain purchase in both the medial as well as the lateral column[18,14].Bloom et al. claimed that the cross pin fixation was equivalent to three divergent lateral pins, and all of these combinations were greater than two divergent lateral pins[19].

The prevalence of cross-medial and lateral k wire-related iatrogenic ulnar nerve injury has been estimated from 0% to 6%[10,20,21,22,23,24]. Some have suggested quite often such lesions occur[24,25]. In 1977 Arino et al. proposed 2 lateral k-wires to prevent ulnar nerve damage[26].A latest systematic analysis of thirty-five studies comparing lateral k-wire fixation method with cross k-wire fixation method found that introperative ulnar nerve damage occurred in forty percent of 1171 cross k-wire fixation category[27]. While ulnar nerve damage has recovered in many cases but still in some cases reports of permanent ulnar nerve damage have been documented[10,22,28]. Skaggs et al. stated that even making incision over the medial epicondyle in attempt to ensure that the ulnar nerve is not damage cannot ensure nerve protection[29]. In an early-operation analysis by Rasool MN, six iatrogenic ulnar nerve injuries revealed 2 ulnar nerve penetrating injury and 3 had compression of the cubital tunnel, and in 1 case the ulnar nerve was in front of the medial epicondyle.[30]

Even though damage to the ulnar nerve is prevented, positioning the k-wire just adjacent to the nerve above the medial epicondyle will cause constriction of the cubital tunnel. Therefore, one simple and inevitable assumption is that if medial k-wire is used, the lateral k-wire will be first placed and then the medial k-wire fixation to be done with the elbow in a slight extension.

CONCLUSION

Through this clinical study we conclude that both constructs or methods of fixation, lateral k-wire and cross k-wire were comparable to each other in terms of results. But the medial and lateral k-wire fixation group indicates four (7 percent) cases of intra operative ulnar nerve damage that several other studies indicate as well. Consequently, the lateral k-wire fixation procedure for the treatment of type III paediatric supracondylar fracture is a consistently safe method for avoiding intra operative ulnar nerve damage which also provides sufficient stability if correct k-wire fixation guidelines are used.

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