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Research Article

A Comparative Study of Outcome of Percutaneous Lateral and Crossed Pinning in the Treatment of Type III Supracondylar Fractures of Humerus in Children

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Abstract: The aim of present study was to evaluate the two different methods of percutaneous pinning in the management of type III supra condylar fractures in children. The study was conducted at a tertiary care medical college hospital at Mangalore, Karnataka, India between Jan 2002 and 2005 in randomly selected 45 children with type III supracondylar fractures in the age group of 2 to 12 years. Excluded from the present study were type I and type II supracondylar fractures and those treated by open reduction. Results were analyzed with regard to ulnar nerve injury, carrying angle and range of movements in 17 children with lateral pinning and 28 children with crossed pinning. Functional outcome was graded as per Mitchell and Adams criteria. There was no significant difference in the functional outcome between lateral pinning and the crossed pinning group.
Keywords: Supracondylar fractures, Crossed pinning, Lateral pinning.

INTRODUCTION

The routine non-operative management of type III supracondylar fracture of humerus with plaster cast after closed reduction has reportedly been associated with a greater incidence of failure to obtain and maintain the fracture reduction and subsequent complication of malunion. The high rate of complications associated with non-operative treatment led to the evolution of current techniques of percutaneous pinning. Two K-wires are routinely passed from both medial and lateral side or both the wires are passed from lateral side alone. The advantages of percutaneous pinning methods include easier management of extensively swollen elbows, better maintenance of reduction and decreased risks of associated complications.

The aim of present study is an attempt towards assessing and comparing the results of two methods of pinning – crossed pinning and lateral pinning in type III supracondylar fractures of humerus in children.

MATERIAL AND METHODS

This study was done at Father Muller's Medical College, Mangalore, between January 2002 and January 2005. 45 children with type III supracondylar fractures of humerus in children of either side in either sex, between the age group of 2-12 years were included in the study. Excluded from the present study were type I and type II supracondylar fractures and those treated by open reduction.

The cases were treated on an emergency basis with closed reduction and percutaneous pinning, under the guidance of C-arm image intensifier. General anesthesia was employed for all cases. Assessment of reduction was done clinically by assessing the carrying angle and radiologically by taking x-rays in anteroposterior (Jone's), lateral Views. Maintenance of reduction was achieved by passing two crossed K-wires from both the medial and the lateral epicondyles or by passing two K-wires from the lateral condyle in a parallel or crossed fashion. The choice of crossed or lateral pin fixation was made according to the operating surgeon's personal preference.

When crossed pinning was employed, the lateral pin was inserted first so that the medial pin can be placed with the elbow in less flexion to avoid ulnar nerve injury. All the elbows were immobilized using a well padded posterior above elbow slab with elbow flexed to 90 degrees or less as tolerated. The 'K' wires were removed at three to four weeks' time as an outpatient procedure. The slab was continued till the removal of pins. Follow – up was done regularly at 6 weeks, 3 months, 6 months and then once in six months. During the follow-up period, pain, restriction of motion, satisfaction with appearance of elbow as well as x-ray examination was done. Carrying angle and the range of

flexion and extension of both the injured and the normal elbow was measured and recorded. A neurological examination was performed to note recovery in case of a neural deficit being noted previously.

Finally, the functional outcome was assessed on the basis of Mitchell and Adams[5] criteria. The outcome was considered excellent, when the elbow had normal shape and movement of the elbow with a change in carrying angle of less than 5 degrees and limitation of elbow movement of less than 10 degrees. Results were graded as good, when the change in the carrying angle was between 5-15 degrees and limitation of movement between 10-20 degrees. When the change in carrying angle was more than 15 degrees and limitation of movements more than 20 degrees, the results were considered poor.

Statistical analysis was done by Chi-square test, t test and Fischer's exact test.

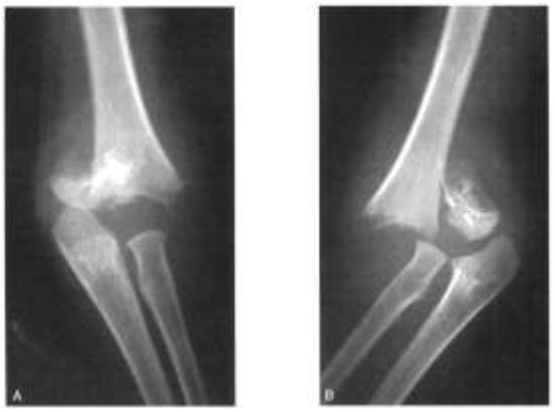
OBSERVATION AND RESULTS

The mean age of patients was 6.75 years with a peak incidence in the age group of 5 – 8 years. There were 71% male children in this study. The left side was involved in 69% of cases. 77% of cases had posteromedial displacement of the distal fragment. The incidence of pre-operative nerve injuries was 8.8% with radial and median nerve being involved equally with no ulnar nerve injury. In our series 28 patients were treated with crossed pinning and 17 patients with lateral pinning. Mean duration of follow up was 19.53 months in our study. Pin tract infection (3 cases) and ulnar nerve palsy (2 cases) occurred as complications.

Post pinning ulnar nerve injury was seen in 2 cases (7%) in the crossed pinning group. The average loss of range of movement was 8.4 degrees in the lateral pinning group and 7.2 degrees in the crossed pinning group. The difference was not statistically significant.

The average change in carrying angle was 2.5 degrees for crossed pinning and 3.1 degrees for the lateral pinning group. The difference between the two groups was not statistically significant.

There were 82% excellent and 18% good results in crossed pinning group and 71% excellent and 29% good results in lateral pinning group. The difference in functional outcome between the two groups was not statistically significant.



Initial x-rays

Follow up

Fig. 1: Crossed pinning

Initial x-rays

Follow up
Fig. 2: Lateral pinning

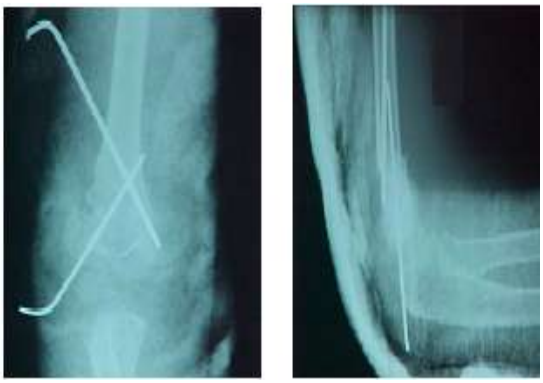


Fig. 3: Lateral crossed pinning

DISCUSSION

In this study, 45 children with type III supracondylar fractures of humerus who were treated with closed reduction and percutaneous crossed pinning (medial-lateral) or lateral pinning methods were evaluated both retrospectively and prospectively.

In our series, there was 77% incidence of posteromedial displacements and 23% postero-lateral displacements. The other series also showed higher rate of postero-medial displacement: Wilkins [1] (75%), Aronson and Prager [2] (75%) and Mostafavi and Spero [3] (82%).

The incidence of pre-operative nerve injuries was 8.8% (6 cases), which is comparable to that in Wilkins[1] series of 7.7%. Radial and median nerves were equally involved with no ulnar nerve involvement. Neurological recovery was complete in all cases by 3 to 4 months.

Pin tract infection with pin loosening, necessitated earlier removal of 'K' wires (at 2 weeks). The infection was treated with appropriate antibiotics and regular wound dressing. The above elbow slab was continued in these patients. Infection was fully eradicated in all 3 patients with the above measures. The loss of both the range of motion and the carrying angle were greater in these 3 patients, compared to those without infection.

There were 2 cases of post pinning ulnar nerve palsy following medial pinning (7%). In one case, there was only paresthesia along the ulnar nerve distribution, which subsided spontaneously in one week. In another case of nerve palsy, there were both motor and sensory deficits, but complete neurological recovery occurred by the end of 4 months.

There was no post pinning nerve injuries following lateral pinning.

The incidence of ulnar nerve injury with medial pinning in other series was – 8% in the series by Skaggs *et al*. [4] and 5% in the series by Solak *et al*. [5]. Iatrogenic nerve injury almost always involves the ulnar nerve following the placement of the medial pin for crossed pinning. The incidence of ulnar nerve injury was reduced in our series by taking precautions such as inserting the lateral pin first and avoiding hyper flexion of elbow during medial pin placement.

All patients achieved radiological union at an average of 7.6 weeks. This compared favorably with the series by Mostafavi[3] where union occurred at an average of 7.2 weeks.

The correlation between the type of pinning and functional outcome was made on the basis of change in the carrying angle and range of motion as compared to the normal side. In our series, the average change in carrying angle for cases treated with lateral pinning was 3.1 degrees (range: 0-8 degrees) with 5 patients having change of carrying angle between 5-8°. In the series by Aronson and Prager [2], this was 2.2 degrees (range 0-8 degrees).

The average change in carrying angle in cases treated by crossed pinning was 2.5 degrees with range of 0-7 degrees. 5 patients had loss of carrying angle between 5-7° in this group. The difference in the carrying angle between the two groups was not statistically significant ($p = 0.345$).

However, there was no cubitus varus deformity in either group in our series and patients were satisfied with the cosmetic appearance of their elbows. In the series by Davis *et al*. [6] there was, as a whole, 13% incidence of cubitus varus.

The slightly higher change of carrying angle in lateral pinning cases may be related to a comparatively less stable construct with two lateral pins compared to two crossed pins. Biomechanical studies by Zionts [7] have demonstrated that crossed pinning is more stable than lateral pinning in rotational testing as well as varus and valgus loading. However, a series by Skaggs *et al*. [4] demonstrated no clinical difference in stability between crossed and lateral pins. In our series, the average losses of range of movement were 7.2 degrees (range 0-16degrees) for cases with crossed pinning. This compared favorably with series by Nacht *et al*. [8] (7.8 degrees).

For cases with lateral pinning, the average loss of range of movement was 8.4 degrees (range 0-14 degrees) which compares favorably with the series by Aronson and Prager [2] which demonstrated a loss of range of movement of 10 degrees. The difference with regard to loss of range of movement between the two groups was not statistically significant (p=0.204) with both groups showing excellent or good range of movements. In our series, no significant improvement in range of motion was observed between the sixth month exam and the final follow-up exam. It is therefore inferred that no significant improvement in the range of motion could be obtained after the first six months following surgery.

Functional outcome following two types of pinning was evaluated according to Mitchell and Adams [9] criteria. In our series, the functional outcome following crossed medial – lateral pinning was excellent in 82% and good in 18% of cases. There were no poor results. This compared favorably with the series by Mostafavi and Spero [3] with 88% excellent results. In our series cases treated with lateral pinning showed 71% excellent and 29% good results with no poor results. In the series by Aronson and Prager2 excellent results were found in 88% and good results in 12%.

The difference in functional outcome between two groups was not statistically significant ($x2 = 0.817$ P =.366).

CONCLUSION

The above study clearly shows that lateral pinning is as effective as crossed pinning in the treatment of type III supracondylar fractures and especially favorable in such cases with grossly swollen elbows in which the medial epicondyle in barely palpable. Both the methods offer consistently satisfactory functional and cosmetic results.

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