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OUTCOME STUDY OF FRACTURES OF SUPRA-CONDYLAR HUMERUS IN CHILDREN TREATED BY CROSS PINNING AND FOLLOWING A SPECIFIC POST-OPERATIVE REGIME

Orthopaedics

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ABSTRACT

Aim: The aim of this study was to study the outcome of fractures of the supra-condylar humerus in children treated by cross pinning and following a specific post-operative protocol.

Methodology: Forty children with displaced unilateral fracture of the supra-condylar humerus were treated surgically using cross-pinning. Elbow movements were started within the first post-operative week and pins were removed on appearance of callus. Patients were followed for six months.

Results: Union was achieved in all patients. Thirty seven patients had satisfactory outcome on follow-up. No patient showed loss of reduction, signs of myositis, neurological deficit, compartment syndrome or fixed elbow stiffness.

Conclusion: Post-operative care until the expected recovery, directly under the supervision of the operating surgeon, is essential for a good functional and cosmetic outcome. Not just the participation of a physiotherapist, but a clear-cut regime for post-operative care definitely adds to the increasing numbers of outstanding results of the operating surgeon.

KEYWORDS:

Supra-condylar humerus, Post-operative protocol, Elbow movements, Pin removal.

INTRODUCTION:

Supra-condylar humerus fracure is a common elbow injury in children accounting for sixteen percent of all pediatric fractures and two-thirds of all hospitalizations for pediatric elbow injuries.[1] The incidence reaches a peak about the age of eight years.[2] Typically the fracture occurs due to a fall on an outstretched hand with hyperextension of the elbow joint. The distal fragment displaces posteriorly in more than ninety five percent of fractures.[2] Taking into account the potential complications like varus and valgus deformities, excessive impinging callus and rarely elbow arthritis, supra-condylar humerus fractures become an important subject of research.[3] An aggressive approach for accurate reduction and stabilization of these fractures is justified keeping in view the long-term deformity and neurological complications. Functional and cosmetic complications related to this type of fracture make treatment urgent and essential.[4,5] After a closed reduction, per-cutaneous pinning maintains fracture reduction without the need for immobilizing the elbow in significant flexion.[1] Although closed reduction and per-cutaneous pinning is accepted as the treatment of choice for displaced supra-condylar fracture of the humerus, there are some debates on the pinning techniques, period of immobilization, elbow range of motion (ROM) exercise, and perceptions on the restoration of elbow ROM.[6]

In spite of the vast research in to the treatment of this fracture, there has been paucity of information on the post-operative regime and rehabilitation of these injuries. Post-operative protocol varies from surgeon to surgeon.[1,6] Literature shows evidence of pin removal at different points of time in the post-operative period. Also institution of elbow movements; both active and assisted have not been clearly defined. Effectiveness of physiotherapy after operative treatment of fractures of supra-condylar humerus in children has been negated by some authors.[7] To address this issue we have been following a defined post-operative regime at our hospital.

The aim of the study was to analyze the clinical and functional outcome of supra-condylar humerus fractures in children treated by closed reduction and per-cutaneous pinning and following this specific post-operative regime.

METHODOLOGY:

We present a study of 40 (M=24, F=16) children (Age: 4 to 13 years) with closed supra-condylar humerus fracture of Gartland type II and type III, not more than 72 hours old, treated by closed reduction and per-cutaneous pinning during the period between November 2014 to September 2015 in a tertiary care hospital.

All patients were clinically evaluated for identification of fracture, neurovascular deficit, deformity and associated injuries. After clinical assessment, x-ray was done for confirmation and classification of fracture. No specific exclusion criteria were used.

All patients were operated on the same day as presentation. Under anesthesia closed reduction and per-cutaneous kirschner wire fixation was done under C-arm guidance. Two wires were put in a cross fashion, one from each epicondyle. The direction of displacement in coronal plane decided which pin to put first. For varus displacements lateral pin was put first and for valgus medial pin was initially put. The ulnar nerve was not explored in any patient. Additional pins were placed as dictated by fracture pattern for maximum stability and reduction.

Post–operative care included immediate splinting and elevation as per swelling and active-assisted finger movements. Assisted elbow movements were encouraged after 72 hours but not later than the first week as per compliance and pain tolerability. Active movements were more favoured than passive movements. However full range of movement was instituted only after early callus was seen on both x-rays in orthogonal views. The limb was kept in a removable splint till this time. All patients were encouraged to visit the physiotherapist at least twice weekly for the first month.

Pins were removed at a minimum of one week after full movements were permitted. Follow up of patients was done weekly for the first month and then monthly for assessing complete union, functional outcome and cosmetic appearance for a period of six months. Final assessment with regards to cosmetic and functional results was done as per Flynn's criteria.[8]

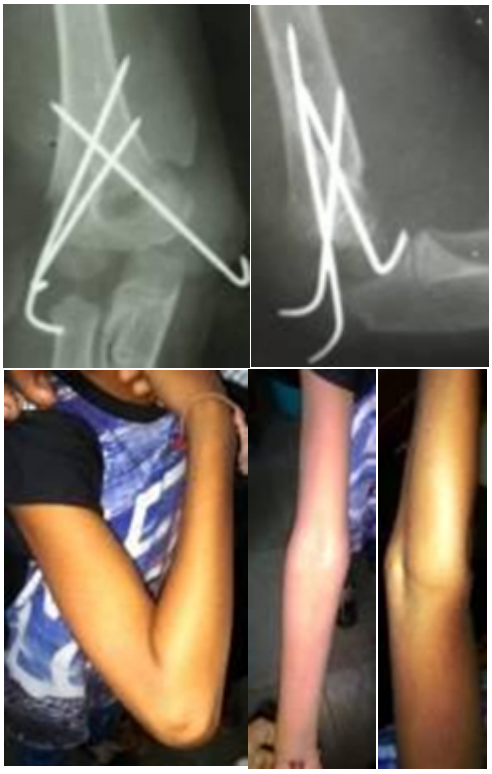
OBSERVATIONS AND RESULTS:

We had 40 children (M=24, F=16) in the age group 4-13 years (Mean=7 years) with unilateral supra-condylar humerus fracture.

Majority of children had trauma while playing (80%), 10% had trauma due to fall from tree, 10% had history of domestic fall. Dominant side was involved in 23 patients. Two boys had associated fracture of lower end radius on the same side. None of our patients had clinically identifiable post traumatic nerve palsy.

Twenty four children had Gartland Type III and rest had Type II fracture. Four patients had some intra-articular comminution.

In all patients reduction with k wires was maintained for a minimum of three weeks after surgery. One patient developed superficial skin infection at k wire insertion site which was cured with antibiotics. Callus in both views was seen in 33 patients on follow-up at completion of one month after surgery. No patient was left out without signs of union at the next follow-up at 2 months.



Figures showing excellent outcome

At the final assessment on completing six months (Table 1) three patients had post operative restricted elbow movements amounting to be rated as poor functional outcome. All of them had a Type III Gartland fracture with articular comminution. Mean loss of flexion-extension arc of movement as compared to normal side in the entire study was 15%. Clinically 37 patients showed no varus/valgus deformity at elbow at end of follow up though over all radiologically there was a mean loss of humerus-ulnar angle of 7 degrees (Range 0-23 degrees). No patient showed loss of reduction, signs of myositis, neurological deficit, compartment syndrome or fixed elbow stiffness during the follow up period.

Majority of our patients achieved near full range of elbow movement (92.5%) and were able to perform their routine activities as before trauma at final follow up. According to Flynn's criteria, 32 patients had excellent outcome and 5 had a good one on cosmetic factor and 37 patients had a satisfactory rating on functional factor. The difference in arm and forearm girth as compared to the opposite limb was statistically insignificant.

Gartland Type	n	Av time at pin removal	Av loss Of ROM(%)	Flynn criteria(Cosmetic & Functional)			
				Excellent	Good	Fair	Poor
II	16	4.6 wks	5	16	0	0	0
III	24	6.2 wks	25	16	5	0	3
Total	40	5.4 wks	15	32	5	0	3

Table 1. Results of study

DISCUSSION:

Displaced supra-condylar humerus fracture is a common fracture seen in the pediatric population. Anatomical reduction and its maintenance is essential for obtaining good cosmetic results and functional recovery.[9] Primary closed reduction and per-cutaneous pinning with 2 or 3 K-wires is the preferred treatment for all displaced supra-condylar humerus fractures in children.[2] Cross-pinning as well as two pins from lateral condyle are accepted methods of fixation of such fractures. We used crossed pinning technique in all patients.

While the post-operative protocols vary from surgeon to surgeon, a typical regime calls for splintage to control elbow motion and forearm rotations.[1] The removable splint can be used to serve the purpose of both splintage and intermittent mobilization.

The apprehension in initiation of elbow movements within the first post-operative week should be discouraged. With a proper fixation; pain and swelling tend to exponentially decrease in the first 72 hours following surgery. In addition to the routine advantages like aiding in joint nutrition, inhibiting pain via stimulation of joint mechanorec eptors and promoting ligament and capsular remodeling, active exercises help in increasing proprioceptive input and improving coordination with muscle control. However we were of the opinion that full range of movement requires considerable muscle force that could alter the reduction in subtle unstable fractures even after fixation. Hence we delayed full range of movements till callus was seen on x-ray.

The timing of pin removal has been quite varying without any justification in literature. We delayed pin removal until a week after seeing callus. Our reasoning is that once callus is seen, pins become increasingly insignificant in providing stability to the fracture. Also as callus is vascular, there are increased chances of per-cutaneous pins inviting infection if kept for longer time, due to its proximity to the pins.

After a satisfying operative fixation, orthopaedic surgeons, by and large, tend to limit their attention and responsibilities towards patients only until the immediate post-operative period. We have been of the opinion that post-operative care until the expected recovery, directly under the supervision of the operating surgeon, is essential for a good functional and cosmetic outcome. Not just the participation of a physiotherapist, but a clear-cut regime for post-operative care definitely adds to the increasing numbers of outstanding results of the operating surgeon. However this study does not compare between any other post-operative protocols being followed world-wide for these fractures.

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