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Supracondylar displaced fractures of elbow in children treated with closed reduction and percutaneous K-wire fixation

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Abstract

Objective: The objective of this study was to evaluate results of closed reduction and percutaneous pinning (CRPCP) in pediatric patients with extension-type supracondylar elbow fractures.

Materials and methods: 230 patients with extension type-II and type-III supracondylar fracture of the elbow were included in the study. All patients were treated between January 2008 to December 2016 by closed reduction and percutaneous cross k-wire fixation.

Results: 230 patients were included in the study. There were 160 boys (69%) and 70 girls (31%). Mean age of the patients was 6.0 years (2.5years –12 years). The right side elbow was involved in 74(32%) patients while left side was involved in 156(68%) patients. All the fractures were fixed by two crossed K-wires after close reduction. According to Flynn's criteria, 162(70%) patients had excellent results, 55(24%) patients had good results, 09(04%) patients had fair results and 04(02%) patients had poor results. Pin-tract infections were seen in 16(07%) patients. In 13 patients infection resolved after removal of pins while in 03 patients infection resolved with oral antibiotics. 5 patients had cubitus varus deformity at the end of the treatment. Temporary ulnar nerve deficit occurred in 11(5%) patients who recovered completely in 12 weeks time. Mean range of motion (ROM) of the elbow was 15^0 – 125^0 degrees after one and half month post-operatively. Elbow ROM was equal to that of normal side (0^0 - 140^0 degrees) after 12 weeks of operation. At last follow-up carrying angle of affected elbow was in range of 8^0-10^0 degrees except in 5 patients who had cubitus varus deformity of the elbow.

Conclusion: Closed reduction and percutaneous crossed K-wire fixation is an easy and effective operative treatment in supracondylar extension type II & III fracture of the elbow in pediatric patients, with a low complication rate.

Keywords: Close reduction, internal fixation, supracondylar fracture, percutaneous cross k-wire fixation.

Introduction:

Supra-condylar fractures of the elbow in pediatric patients account for approximately 16-17% of all fractures.[1] These fractures are common in 5-8 years age group patients.[2,3] Supra-condylar fractures of humerus are divided into two types, A)Extension type (98%) and B)Flexion type (2%).[4,5] Extension type sup-racondylar fractures are more common and are usually result of fall on outstretched hand. Flexion type supra-condylar fractures are least common and are caused by direct fall on angle of elbow. Extension type supra-condylar fractures are further classified into 3 types according to the displacement of the fracture.[6] Type-I supra-condylar fractures have no or minimal displacement of the fracture, type-II supra-condylar fracture have some displacement of the fracture having intact posterior cortex while in type-III supra-condylar fracture there is complete displacement of the

fracture with no contact between the proximal and distal fragments. Patients presenting with elbow injury should be managed according to ATLS protocol. Patient should be assessed for other injuries; once other injuries are excluded treatment of the fracture can be planned. Type-1 extension type fractures can be safely managed non operatively with a backslab. Type-II extension type fractures can be managed by different means including closed reduction and back slab application, traction, closed reduction per cutaneous pinning or rarely open reduction and cross K-wire fixation.[7,8] Closed reduction and per-cutaneous pinning is the most advanced technique used for treatment of all types of supra-condylar fractures of humerus.[9,10] Sometimes closed reduction and per-cutaneous pinning is not possible because of instability of the fracture, comminution of fracture or early calus formation. Type-III supra-condylar fractures are highly unstable fractures and even if reduced closely should be further secured with two crossed K wires.[11] In our series we included all type-II and type-III extension supra-condylar fractures of pediatric elbow. Closed reduction and per-cutaneous pinning was done in all these fractures. Outcome measures in this series was fracture healing time, range of motion of elbow, post-operative carrying angle of involved elbow, signs of superficial and deep infection and neurovascular status of the involved limb at the final follow up. The objective of our study was to evaluate results of closed reduction and cross k wires fixation in extension type supra-condylar fractures of elbow (type-II and type-III).

Materials and methods:

This study was done at Department of Orthopedic and Spine Surgery unit HMC (Hayatabad Medical Complex) Peshawar and Department of Orthopedic, Khyber Teaching Hospital, Peshawar from January 2008 to December 2016. 230 patients with closed Gartland type-II and type-III supra-condylar fractures of elbow were included in this study. Children between ages 2.5 to 12 years were included in the study. Exclusion criteria was, patients with age less than 2.5 years or more than 12 years, more than 7 days old fracture, extensive soft tissue swelling, open fractures or patients with neuro-vascular deficit. All admissions were either through accident and emergency department (A&E) or out patient department (OPD). History and complete clinical examination was performed on admission. All patients were placed in elbow back slab for immediate pain relief and stabilization. Patients were monitored closely for signs of compartment syndrome. Patients were prepared for next available surgery list. There were a total 230 patients. There were 160 boys (69%) and 70 girls (31%). Mean age of the patients was 6.0 years (2.5years –12 years). The right side elbow was involved in 74 patients (32%) while left side was involved in 156 patients (68%). All the fractures were fixed by two crossed K-wires after close reduction. They were followed for aminimum of 6 months. Patients were followed post-operatively at regular intervals. X rays were done at 3rd, 6th and 12th week post-operatively and call us formation or any displacement was noted. Post-operative physiotherapy was advised after healing. All these supra-condylar fractures of elbow (type-II and type-III) were managed by closed reduction and fixed with two per-cutaneous crossed K-wires. Image intensifier was used for fracture reduction confirmation and K-wires entry points. K-wires of appropriate size were used according to the age of the patient. One wire from the lateral side and one from the medial side were introduced and opposite cortex engaged. Above elbow back slab was applied to all patients. Post-operatively, operated limb was kept in elevation for at least one day. Back-slabs were removed after 2-3 weeks and pins were removed after another 2-3 weeks. X-rays were taken after pins removal and patients were referred for physiotherapy. Patients were advised to perform flexion and extension exercises. Flynn's criterion (table-1) was applied on all patients at last follow up.

Results:

230 patients were included in the study. There were 160 boys (69%) and 70 girls (31%). Mean age of the patients was 6.0 years (2.5years –12 years). The right side elbow was involved in 74

Table-1: Flynn criteria

Results	Loss of carrying angle(degrees)	Loss of motion(degrees)
Excellent	0-5	0-5
Good	6-10	6-10
Fair	11-15	11-15
Poor	>15	>15

Table-2: Results according to Flynn criteria

	Number	Percentage
Excellent	162	70%
Good	55	24%
Fair	09	04%
Poor	04	02%

patients (32%) while left side was involved in 156 patients (68%). All the fractures were fixed by two crossed K-wires after close reduction. According to Flynn's criteria, table-1, 162 patients (70%) had excellent results, 55 patients (24%) had good results, 09 patients (04%) had fair results and 04 patients (02%) had poor results as shown in table-2. Pin-tract infections were seen in 16 patients (07%). In 13 patients infection resolved after removal of pins while in 03 patients infection resolved with oral antibiotics. 5 patients had cubitus varus deformity at the end of the treatment. Temporary ulnar nerve deficit occurred in 11(5%) patients who recovered completely in 12 weeks time. Mean range of motion (ROM) of the elbow was 15^0 – 125^0 degrees after one and half month post-operatively. Elbow ROM was equal to that of normal side (0^0 - 140^0 degrees) after 12 weeks of operation. At last follow-up carrying angle of affected elbow was in range of 8^0-10^0 degrees except in five patients who had cubitus varus deformity of the elbow.

Discussion:

Supra-condylar fracture of the elbow is very common injury in pediatric patients.[12] Type-III supra-condylar fractures are highly unstable fractures and are managed surgically.[13,14] Closed reduction and K-wire fixation is the accepted treatment of type-II & type-III supra-condylar fractures of the elbow.[15] In the present study, using Flynn's score[16] 94% of the patients achieved excellent or good outcome and 13 patients (06%) achieved fair or poor results. A similar series from Kallio et al[17] achieved 90% excellent or good cosmetic results; and 10% were rated as poor. Another similar series from Eberhardt et al[15] achieved 93% good to excellent functional results. Their cosmetic results were 93% excellent and 7% good, with no poor results. All our patients at six month post-op follow up had full range of motion. In the 20 cases of Shannon et al[18] all children had a full range of elbow motion compared with their normal side. 16 patients in our series had pin tract infection which is slightly higher than other series.[19,20] In a series with lateral cross-pinning with proud wires, the pin tract infection rate was 30%.[18] 05(02%) of our patients had cubitus varus deformity. In a similar series from El-Adl et al[21] cubitus varus deformity was noted in six patients (8.6%). They related it to unsatisfactory reduction of the fracture before pinning. In agreement with other studies[22] all fractures in the present study were immobilized with a long arm splint for 4 weeks before mobilization was permitted. There was no secondary displacement of the fracture after per-cutaneous pinning with this protocol. Stability studies by Zionts et al[23] had demonstrated that crossed pins provided the best stability. More recently, Lee et al[24] using a saw-bone model, found that two 'divergent' lateral pins were comparable to cross-wires in extension, varus and valgus loading, but were inferior in axial rotation testing.[11] patients (5%) in our series had signs of transient ulnar nerve deficit post-operatively; this is a well-known complication with a reported incidence of 2 to 8%.[25]

Conclusion:

Closed reduction and per-cutaneous crossed K-wire fixation is an easy and effective operative treatment in supra-condylar extension type-II & III fracture of the elbow in pediatric patients, with a low complication rate.

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Role and contribution of authors:

Dr Awal Hakeem, idea, operating surgeon and wrote the initial write up.

Dr Sanaullah, did data and references collected.

Dr Syed Hamad Ali Shah Banori, did bibliography.

Dr Israr Ahmed, work for statistics.

Dr Mohammad Arif Khan, critically analysis and did the necessary changes.

Dr Abid Ali, did followup of the patient and helped in data and referenes collection.

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