COMPARISON OF PERCUTANEOUS PINNING WITH CASTING IN SUPRACONDYLAR HUMERAL FRACTURES IN CHILDREN

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Background: In Children Supracondylar fracture of humerus is one of the most common fractures in first decade of life. There are various treatment modalities for this fracture i.e. Close reduction and casting, open reduction and internal fixation, skeletal traction and Percutaneous Pinning. This study was conducted to know the outcome of Percutaneous Pinning in the management of displaced supracondylar humeral fracture in children and to compare the results with close reduction and castings and published literature. **Methods:** This descriptive study was conducted in Orthopaedic department of Ayub Teaching Hospital Abbottabad and Lady Reading Hospital, Peshawar from January 2002 till December 2003 on 40 children. Patients included were of either gender with age range from 3 to 12 years with displaced supracondylar fracture presenting within 72 hours of injury. Two treatment modalities were studied for comparison. Cross k-wires fixation through each humeral condyle was done after closed reduction of fracture under image intensifier in general anesthesia. Casting/Backslab was applied after reduction of fracture without image intensifier under anesthesia or analgesia. Out come measures were according to Flynn criteria that are functional and cosmetic factor which is based on loss of elbow motion and carrying angle in degrees respectively. **Results**: Cross percutaneous pinning gave excellent results in 13 (65%), good outcome in 4(20%) and poor outcome in 3(15 %) patients. While patients treated with close reduction and casting showed excellent results in 4 patients (20%), good in 8 patients (40%), fair in 2 patients (10%) and poor in 6 patients (30%). **Conclusion:** Closed reduction and cross percutaneous pinning for displaced supracondylar humerus fractures in children is safe, cost and time effective method and gives stable fixation with excellent outcome as compared to close reduction and casting.

Keywords: Percutaneous Pinning, Supracondylar fracture, Humerus fractures, close reduction

INTRODUCTION

Supracondylar fracture of humerus is the most common fracture in the 1st decade of life[1,2] due to various causes mainly ligament laxity and anatomical structure of humerus tube to flat transformation at the lower end of humerus. Its incidence decreases with age.[3,4]

Elbow fractures treatment in children remained a great challenge for surgeons since Hippocrates. Proper training is needed to adopt recent advances by young surgeons to deal with these challenges.[5]

There are two types of supracondylar fractures of humerus in children according to direction of distal fragment i.e. Extension type (97 %) and Flexion type (03%).[6] Gartland[7] classified this fracture into three types as shown in table-1. Mechanism of injury is hyperextension, abduction or adduction of elbow during fall on dorsiflexed hand and flexed elbow[8]

There are various treatment modalities for the management of supracondylar fracture of humerus in children i.e. closed reduction and casting, open reduction and internal fixation (ORIF), skeletal traction and Percutaneous pinning (PCP). Supracondylar fractures in children should be handled properly to prevent complications like elbow stiffness, varus or valgus deformities, compartment syndrome[9] neurovascular compromise and myositis ossificans.

Table-1: Gartland classification of supracondylar fracture of humerus in children[7]

Type I – Undisplaced

Type II - Displaced with intact posteriorcortex

TypeIII - Completely displaced with no contact between the fragments

Displaced supracondylar fractures should be treated with percutaneous pinning under image intensifier during day time when trained orthopedic surgeon, assistant, OT and image intensifier technician are available and should not be attempted during night hours due to lack of facilities because one night delay in treatment does not harm the results[10]. Percutaneous pinning can be done in emergency theatre under image intensifier preferably within 1st 8 - 12 hours of injury[11]. Percutaneous pinning in unstable or irreducible supracondylar fracture is the treatment of choice with elbow in 90° flexion to reduce chances of vascular compromise[12]

Rationale of the study is to compare the results of casting with cross percutaneous pinning with objective to know the best treatment modality for displaced supracondylar fracture of humerus in children.

MATERIAL AND METHODS

This study was conducted in the Orthopedics unit of Ayub Teaching Hospital Abbottabad and Lady Reading Hospital, Peshawar on forty patients from January 2002 to December 2003. Patients were admitted through casualty and OPD.

Patients included were children from 3 to 12 years age, closed displaced fractures and presented within 72 hours after injury. Patients with vascular injury and open fracture were excluded from the study.

As a standard procedure for percutaneous pinning patient was put supine on operating table and general anesthesia was given. Patient's involved elbow was cleaned and draped. Fracture was closely reduced under image intensifier and elbow was flexed maximally and stabilized with sterile roll gauze. First pin was passed in displaced fragment. For medial and lateral pinning upper extremity was rotated externally and internally respectively. 2 cross K-wires were passed while crossing with each other at 30 degrees angle and engaged the opposite cortex of humerus. K-wires were left protruded through skin up to 4 mm for easy removal later on even in the office or OPD. Our fracture fixation was stable by checking the flexion and extension of the elbow per operatively.

Two cross K-wires give more stability as compared to lateral K-wires[13]. K-Wire was of 1.6 mm thickness[14]. No external support was applied.

Procedure for casting was done under analgesia/anesthesia in operation theatre. Fractures were closely reduced and stabilized with back slab/cast and elbow flexed beyond 90 degree with forearm in pronation or supination according to postero-medial or postero-lateral displacement of distal fragment respectively in order to prevent loss of fracture reduction and compartment syndrome[4]. Back slab was removed after 04 weeks.

Follow up in both procedures was done up to one year and were assessed according to Flynn criteria[15] (table 02) i.e. functional and cosmetic factors.

First follow up visit for PCP was conducted at two weeks for stitches removal. Second visit was asked for at one month after operation for K - wire removal in the OPD or clinic where patients were advised for elbow exercises. Remaining follow up visits for assessment of carrying angle and range of motion of elbow was done clinically at monthly intervals with X-rays AP / Lateral views of the elbow which is sufficient to assess outcome of the procedure adopted[9]. Final visit was at one year after surgery. Complications like Volkmann's Ischemic Contracture (VIC), nerve injury elements and infection were also looked for.

Follow up for closed reduction and casting were arranged on weekly basis for one month with X ray elbow AP/Lateral. After a period of one month back slab was removed and outcome was assessed clinically and radiologically. Patients were advised for elbow, hand and shoulder exercises. Remaining visits were conducted on monthly basis for assessment of carrying angle and range of elbow motion . Final examination was done after one year of casting.

Table-2: Criteria for fracture assessment

Results	Cosmetic factor – loss of carying angle (degree)	Functional factor – loss of motion (degree)
Excellent	0 – 5	0 – 5
Good	6 – 10	6 – 10
Fair	11 – 15	11 – 15
Poor	> 15	> 15

RESULTS

Of the total 40 patients 20(50%) patients treated with PCP including 14 male (70%) and 6 female (30%). Nineteen (95%) patients presented with extension type of supracondylar fracture while 01 patient (05 %) with flexion type Elbow on left side was involved in 15 (75%) patients and right side in 5 (25%) patients. Among 19 extension type fractures Gartland type II were 7 (36.8 %) and Gartland type III were 12 (63.1 %).

13 (65%) patients after getting treated by closed reduction and percutaneous pinning were found to have excellent outcome (i.e. both loss of elbow motion and loss of carrying angle =0-5 degree).

4 (20%) patients turned out with good outcome (i.e. both loss of elbow motion and loss of carrying angle = 6-10 degree). 3 (15 %) patients turned out with poor outcome (i.e. both loss of elbow motion and loss of carrying angle = >15 degree. None of the 20 patients turned out with fair results (i.e. both loss of elbow motion and loss of carrying angle = 11 - 15 degree). Three patients were observed with poor results according to Flynn criteria i.e. >15 degree change in carrying angle and elbow motion. Of these three patients two developed cubitus varus while one developed elbow stiffness. Two patients developed pin tract infection that resolved after K-wire removal after a period of 04 weeks. One patient developed transient Ulnar nerve palsy (neuropraxia) that resolved after six-weeks time.

20 patients were treated with close reduction and casting. They were 16 male (80%) and 04 female (20%). 2 (10%) patients had flexion type of fracture while 18 (90%) patients had the extension type. Among 18 extension type of fractures Gartland type II fracture were 8 (44.44%) and type III were 12 (66.66%). Left elbow was involved in 14 patients (70%) and right was involved in 06 patients (30%). Six patients had cubitus varus, 2 patients (10%) developed elbow stiffness. Outcome of procedure was excellent in 04 patients (20%), good in 08 patients (40%) fair in 02 patients (10%) and poor in 06 patients (30%). Comparative results are shown in table-3.

Table-3: Comparative results of PCP and close reduction and casting according to Flynn criteria (n = 40)

Results	PCP (n = 20)	Close Reduction and Casting (n = 20)
Excellent	13 (65%)*	04 (20%)
Good	04 (20%)	08 (40%)
Fair	0%	02 (10%)
Poor	03 (15%)	06 (30%)

**: P value <.05*

PCP

Male to female ratio was 2.3:1. Mean age of the patients was 6.8 year. Duration of hospital stay was 24-48 hours with median stay period of 36 hours. Ratio of left to right side fracture was 3:1 (i.e. 15 versus 5 patients). Age range was from 03 - 12 years with maximum patients received between 06 - 08 years (n :14).

Close reduction and casting

Male to Female ratio was 4:1. Duration of hospital stay was 12 to 48 hours with median stay period of 30 hours. Age range was from 3 to 12 years with maximum patients between 6 to 8 years (n=12). Left to right side ratio was 3:2. Mean age for casting group was 7.05.

DISCUSSION

Percutaneous pinning is a good treatment modality for displaced supracondylar fracture of humerus in children. It has the advantages that it is safe as compared to closed reduction and casting with minimal chances of compartment syndrome and loss of fracture reduction. This procedure is time effective and cheap as compared to open reduction and internal fixation in which there is more trauma to soft tissue, increase surgery time, increase hospital stay (3 to 4 days) and suture material is used.

PCP disadvantages are pin tract infection, ulnar nerve damage and sometime secondary procedure for k-wire removal. In our study we removed all the K-wire in the OPD without any analgesia or anesthesia.

Our study on 20 patients treated with percutaneous pinning reveals extension type of fracture in 19 (95 %) and flexion type in 01 (5 %) patients, comparable with study conducted by CeKanauska et al[16], in which 90 (96.7%) were extension type and 03 (3.3 %) were flexion type. Gartland type II in our study out of 19 extension fractures were 07 (36.8 %) and type III 12 (63.1 %), closely resembling the observation made by CeKanauska et al[16] on 90 extension type fractures in which Gartland type II were 23 (25.5 %), type III were 63(70 %) while type I were in 4 children (4.5%). Sex incidence in our study was 14 male (70%) and 06 female (30%) comparable with the study of Celiker[17] which shows 73.3% male and 26.7% female patients.

We had excellent and good results in 17(85%) patients which is compatible with the results of Ababneh et al[18] and Umer et al[19] who recorded 87 and 100% results with excellent prognosis respectively. Similarly the rate of poor prognosis of 03 patients (15%) is comparable with the 08 % recorded by Ababneh et al.[18]

In another study[20] on 71 patients boys were 47 (66.2%) and girls were 24 (33.8%) with left elbow involvement in 49 (69.1%) and right side in 22 patients (30.9%) and having good and excellent results in 91.8% which is comparable to our study.

In our study patients treated with closed reduction and casting were 20 with flexion type 02 (10%) and extension type 18 (90%) resembling the study conducted by Celiker et al[17] revealing 79.5% extension and 20.5% flexion type. Sex incidence in study by Celiker et al[17] was 73.3% male and 26.7% female, almost the same as that of our study revealing 80% males and 20% females. We evaluated our results according to Flynn criteria[15] and obtained excellent results in 4 patients (20%), good in 8 patients (40%), fair in 2 patients (10%) and poor in 6 patients (30%), supporting the work of Diri B et al [21] that also showed 28% poor results. Close reduction and casting has the advantages that it can be done under analgesia with no metal (k-wire) needed which may cause pin tract infection and secondary procedure for removal. Its disadvantages are loss of reduction, more chances of malunion (cubitus varus) and compartment syndrome if elbow flexion is more than 100 degrees.

By comparing our results of percutaneous pinning with casting, PCP has excellent results in 65%, good in 20% and poor in 15%, while closed reduction and casting has excellent results in 20%, good 40%, fair 10% and poor 30%. This shows that PCP is the better treatment modality for treating displaced supracondylar fracture of humerus in children as compared to closed reduction and casting as proven by p value $0.025 < p\ 0.05$.

CONCLUSION

Closed reduction and cross percutaneous pinning for displaced supracondylar humerus fractures in children is safe, cost and time effective method and gives stable fixation with excellent outcome as compare to close reduction and casting.

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