ORIGINAL ARTICLE

Outcome of open reduction internal fixation with cross K-wires for supracondylar fracture of humerus in terms of Flynn's criteria in children

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Abstract

Objectives: To determine the outcome of open reduction and internal fixation of supracondylar fracture of humerus in children using Flynn's criteria.

Methods: The quasi-experimentalstudy was conducted at Punjab Medical College/Allied Hospital, Faisalabad, Pakistan from July 2012 to June 2014and comprised children aged between 5 and 12 years with supracondylar fracture of humerus presenting within one week of the fracture. Post-surgery follow-up included clinical assessment and measurement of carrying angle on radiographs. Outcome was assessed using Flynn's criteria. SPSS 17 was used for statistical analysis.

Results: Out of 79 cases, 50(63.3 %) were boys and 29(36.7%) girls. Overall mean age was 7.36±1.68 years. Excellent results were obtained in 58(73.4%), good in 14(17.7%), fair in 5(6.4%) and poor in 2(2.5%) patients in terms of functional and cosmetic outcome.

Conclusion: Open reduction and internal fixation of supracondylar fracture was found to be a better choice of treatment with good functional results.

Keywords: Supracondylar fracture, Open reduction internal fixation, Humerus, Children. (JPMA 65: S-186 (Suppl. 3); 2015)

Introduction

Supracondylar fracture of the humerus is the second most common fracture in children (16.6%).[1] These comprise 55% to 75% of all elbow fractures.[2] This fracture is common in the first decade of life due to various anatomical factors, mainly the ligament laxity and anatomical structure of humerus (shaft) to flat transformation at the lower end of humerus. Supracondylar humerus fractures are most commonly caused by fall on an outstretched hand, and are divided into two types;extension type and flexion type.[3] Extension type is more common (97.7%) than flexion type (2.3%). Extension type is further divided by Gartland according to the degree of displacement of the distal fragment. Type I is undisplaced fracture, Type II is displaced with intact posterior cortex, and type III is completely displaced with no contact between the fragments.[4]

Treatment of elbow fractures in children has remained a great challenge for the surgeons since Hippocrates.[5] Supracondylar fractures can be one of the most difficult fractures to treat.[6] Depending upon the type of fracture, displacement, swelling and associated injuries, there are various treatment modalities for this fracture. Numerous techniques include closed reduction and application of a cast, traction (both skin and skeletal), closed reduction and percutaneous pinning, and open reduction and internal fixation (ORIF).[7] Indication for ORIF includes open fractures, fractures complicated by vascular injury and unsatisfactory closed reduction. Common complications include loss of carrying angle, decreased range of motion (ROM), infection,non-union and neurovascular injuries. Outcome is most commonly evaluated using Flynn's criteria. Excellent results were obtained in 58-77.3%, Good results 12-16.0%, Fair 3-4% and Poor 2-2.7% (Mean: 2.35%).[4] Due to increase in road traffic accidents (RTAs) and changing human habitat, the number of trauma patients is increasing day by day. Supracondylar humeral fracture is a common fracture presenting to the orthopaedic emergency.

The current study was planned to determine the outcome of ORIF procedure of supracondylar fracture of humerus in children using Flynn's criteria.

Patients and Methods

The quasi-experimental study was conducted at Punjab Medical College/Allied Hospital, Faisalabad, Pakistan from July 2012 to June 2014 and comprised children aged between 5 and 12 years with supracondylar fracture of humerus presenting within one week of the fracture. The patients had Gartland type III fractures which were diagnosed by X-rays. Those excluded were patients with Gartland type I undisplaced fracture, Gartland type II

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displaced fracture, or those with previous deformity of the affected limb.

The sample size was calculated throughthe World Health Organisation (WHO) calculator with P = 2.35% (Range 2-2.7%); Absolute precision = 2%; and Confidence level = 95%.[4]

After permission from the institutional ethics committee, patients were selected using non-probability consecutive sampling technique from among patients admitted through emergency department and evaluated for life-threatening conditions as per the Advance Trauma Life Support (ATLS) protocol.[5]

All demographic details of the patients were noted on a proforma. The fractures were splinted to relieve pain and prevent further soft tissue trauma. Analgesics, tetanus prophylaxis and intravenous (IV) antibiotics (3rd generation cephalosporin) were administered by the emergency medical officer. Patients were prepared for general anaesthesia and informed consent was obtained from their parents guardians.

All the patients were operated upon by consultant orthopaedic surgeons. All fractures were approached through medial incision. Ulnar nerve was identified and preserved. Fracture fragments were reduced under vision and fixed with Kirshner's wires in crossing pattern. Haemostasis was secured and the wound was closed in layers. Above-elbow cast was applied.

First follow-up was after 10 days when stitches were removed. On second follow up at 4th week, we removed the Kirishner's wires. Patients were called for further follow-up at 16 weeks to see ROM and impairment of the carrying angle. Follow-up was assured by taking the telephone numbers of the patients. At each visit, impairment of extension and flexion was noted with clinical assessment, and the carrying angle was measured on radiographs.

Outcome was assessed using Flynn's criteria.5SPSS 17 was used for statistical analysis.

Results

Out of 79 cases, 50(63.3 %) were boys and 29(36.7%) girls (Figure-1). Overall mean age was 7.36±1.68 years (range: 5-12 years) (Table-1). The most common age was 7 years

Table-1: Age of Patients.

	N	Minimum	Maximum	Mean	Std. Deviation
Age	79	5	12	7.36	1.688

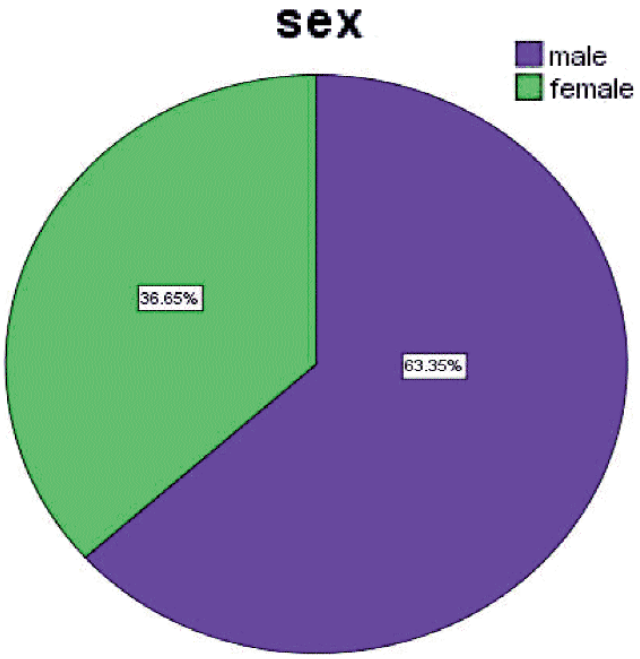

Figure-1: Distribution of gender.

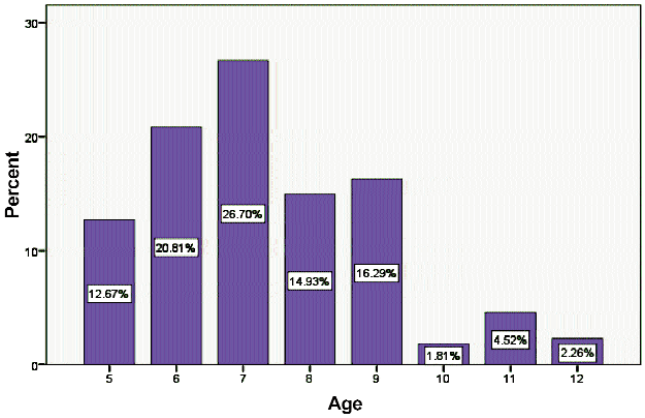

Figure-2: Distribution of percentage of age of patients.

Table-2: Distribution of affected side.

Side	Frequency	Percent
Right	33	41.7
Left	46	58.3
Total	79	100.0

in 21(26.70%) (Figure-2).

The right arm was involved in 33(41.7 %) patients and left arm in 46(58.3 %) (Table-2).

In terms of ROM outcome, Excellent results were obtained

Table-3: Distribution of impairment of range of motion.

Outcome	Frequency	Percent
Excellent	58	73.4
Good	14	17.7
Fair	05	6.4
Poor	02	2.5

Table-4: Distribution of impairment of carrying angle.

Outcome	Frequency	Percent
Excellent	58	73.4
Good	14	17.7
Fair	05	6.4
Poor	02	2.5

in 58(73.4%), Good in 14(17.7%), Fair in 5(6.4%) and Poor in 2(2.5%) patients (Table-3), and the same was true for the carrying angle (Table-4).

Discussion

Supracondylar fracture of the humerus is one of the commonest fracturesin children.[8] These comprise 55% to 75% of all elbow fractures.[2] Gartland's classification is the most commonly used for supracondylar fractures. Gartland extention type I and II supracondylar fracture can be managed by closed reduction followed by plaster immobilisation, but treatment of Gartland Extention type III fractures is controversial. It may cause problems when managed by closed reduction and plaster immobilisation even after acceptable initial reduction.

In the treatment of type III fractures the main difficulty of closed reduction and casting is the need to hyperflex the elbow beyond 120o to maintain reduction, which is not always possible due to the loss of radial pulse on hyperflexion.[4] Failure to do so increases the risk of losing reduction, due to loss of supporting effect of the triceps muscle.[9] Due to this reason, Gartlandtype III supracondylar fractures in children should be managed by surgical option. The aim of surgical treatment is to focus on the accurate, stable reduction and fixation of fracture to prevent any axial rotation and coronal or sagittal tilt and, hence, avoid postoperative deformity like loss of carrying angle and loss of ROM.

Closed reduction and percutaneous pinning under fluoroscopic guidance is now the accepted standard treatment for displaced supracondylar fractures of the humerus.[10] Many surgeons advocate closed reduction of type III fractures under image intensifier and percutaneous pinning with wires.[11] But in majority of hospitals in Pakistan, there is non-availability of image intensifier and that is why supracondylar fractures are managed by other methods like side arm traction and ORIF with wires. Sidearm traction requires prolonged stay in hospital as well as keeping the child in lying down position in bed, which is a difficult task for parents and hospital personnel.[12] The side arm traction also has disadvantage of pin-tract infection, loosening of pin and ulnar nerve injury during pin insertion.

In massive swelling and delayed cases closed reduction and percutaneous pinning is difficult to achieve anatomical reduction and stable fixation.[13] In such condition, ORIF of supracondylar fracture with cross Kwire is a batter treatment of choice. However, other indications for open reduction include a fracture irreducible by closed reduction, vascular compromise not improved with closed reduction, and non-acceptable reduction.[14] The incidence of the need for open reduction varies in different series between 2% and 25%.[15]

There are different approaches used for internal fixation of supracondylar fractures. A lateral, medial, anterior or even posterior approach can be used.[16] But we used medial approach basically because in this approach ulnar nerve can be exposed easily before insertion of pins to fix the fracture. Hence, chances of ulnar nerve injury can be minimised through this approach.

In this study functional outcome of supracondylar fracture in children was measured in terms of Flynn's criteria. There were 63% male and 37% female cases. These findings are in accordance with a study by Najiullah Khan et al. where 62.7% male and 37.3% female patients were included.[4]

In this study Excellent results were obtained in 58 (73.4%), Good in 14 (17.7%), Fair in 5 (6.4%) and Poor in 02 (2.5%) cases. Najiullah khan et al. described Excellent results in 58-77.3%, Good results 12-16.0%, Fair 3-4% and Poor 2-2.7%4. These results are comparable to our study. Ay et al. described the results in 61 patients treated with a transverse anterior cubital approach for open reduction and pinning; the results were Excellent in 72.2% and Good in 27.8% cases.[17] Nouman et al. found Excellent outcome in 21(60%) patients, Good in 9(25.71%), Fair in 4(11.43%) and Poor in 1(2.86%).[8] Devkota et al. described 70.8% Excellent, 22.7% Good, 3.8% Fair and 2.5% Poor results at eight-week follow-up 18. According to Manandhar et al., 20(80%) patients were found to have Excellent and 5(20%) Good results.[16] These results are also comparable. On the other hand, Reitman et al. found excellent results for only 55% of elbows.[19] Aktekin et al. found that patients treated with closed reduction and pinning had better function

and a greater ROM of the elbow.[20] This is due to early presentation of patients, availability of improved healthcare system and provision of good facilities in their hospitals.

ORIF by K wire is an excellent method of management of supracondylar fractures of humerus in children when the fracture is open or when good reduction cannot be achieved by closed means.[21] Obtaining an adequate anatomical reduction favours Excellent to Good functional and cosmetic outcomes as well as fewer complications.[6] However, Kirschner wire fixation has its own disadvantages, including wire extrusion, pin-tract infection and heterotropic ossification.[13] These complications can be reduced by appropriate surgical technique and strict follow-up.

Conclusion

ORIF by K wire is an excellent method of management of supracondylar fractures of humerus in children when the fracture is open or when good reduction cannot be achieved by closed means. Functional outcome can be very poor with late presentation of patient and delayed treatment. Obtaining an adequate anatomical open reduction favours excellent to good functional and cosmetic outcomes as well as fewer complications.

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