ORIGINAL ARTICLE

Union in Neglected Humeral Lateral Condylar Fractures in Children after Open Reduction and Internal Fixation

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ABSTRACT

Background: Humeral lateral condylar fractures are the second most common distal humeral fractures, after supracondylar humeral fractures and comprises of 12-20% of all distal humeral pediatric fractures. Usual age of occurance is 6 years. Sometimes patients presented late due to many reasons. These patients have non-union if not treated properly. Cubitus valgus, tardy ulnar nerve pain and lateral instability of elbow are late complications. No local study is available when neglected humeral lateral condylar fractures in children are treated by open reduction and internal fixation.

Aim: To determine union in neglected humeral lateral condylar fractures in children after open reduction and internal fixation.

Methods: In this study, 65 children with neglected humeral lateral condylar fractures were enrolled from accident and emergency department of The Children's Hospital and the Institute of Child Health, Lahore during six months (from September 2017 to February 2018). These fractures were treated by open reduction through lateral approach and then internal fixation and union was analysed at 12th week both clinically and radiologically. Bridging callus on antero-posterior and lateral views at 12th postoperative week and no pain at fracture site was acceptable criteria for union.

Results: In our study population 65 patients were included with mean age of 7.83 ± 3.029 ranged from 3 to 14 years of age. 46 patients (70.8%) were male and remaining 19 patients (29.2%) were female. 57 patients (87.7%) showed union. There was no effect of age, gender, malnutrition, body mass index on outcome.

Conclusion: It is concluded that union (87.7%) is acceptable in neglected humeral lateral condylar fractures in children after open reduction and internal fixation.

Keywords: Open reduction, Internal fixation, Humeral lateral condyle, Fracture, Union.

INTRODUCTION

Humeral lateral condylar fractures are the second most common distal humeral fractures, after supracondylar humeral fractures and comprises of 12-20% of all distal humeral pediatric fractures[1]. Usual age of occurrence is 6 years[2].Elbow anteroposterior, lateral, and sometimes internal oblique (20°) views of radiographs should be obtained in patients with elbow trauma having suspicion of lateral condyle fracture. Sometimes contra-lateral elbow radiographs may be required for confirmation of diagnosis[3].

Humeral lateral condylar fractures are classified by Milch into two types.Milch type I is defined as fracture line passes lateral to the capitulutrochlear groove while Milch type II is defined as fracture line passes through the capitulutrochlear groove. Mirsky et al defined a third type when fracture is extended medially and exited through the physis on medial side[4]. Yet another classification developed by Jakob which is more practical regarding operative decision.Jakob classification consists of three types.In Jakob type I fracture is undisplaced (< 2 mm), in Jakob type II fracture is displaced (>2 mm) but without rotation, and in Jakob type III fracture is completely displaced with rotation[5].

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Above elbow cast immobilization is treatment of choice for undisplaced fractures, fractures with ≤2 mm displacement on anteroposterior, lateral, and internal oblique(20°)views of elbow radiographs and fractures with displacement but an intact cartilage hinge. Radiographic assessment is recommended every 3 to 7 days for the first 3 weeks of immobilization to monitor for loss of reduction. Closed reduction and percutaneous pinning or open reduction and internal fixation is treatment for displaced fractures.

Neglected humeral lateral condylar fracture is a challenge for surgeon regarding surgery and finally union.Union was assessed in a retrospective study of 22 patients with neglected humeral lateral condylar fractures done by Flynn et al.20 patients out of 22 had union. Two patients had complications, one with malunion and other with resorption of condyle due to postoperative infection and avascular necrosis of lateral condyle[6].

The rationale of my study is to determine union in neglected humeral lateral condylar fractures after open reduction and internal fixation. The result of this study will allow us to change our previous concepts regarding management of neglected humeral lateral condylar fractures.

MATERIALS AND METHODS

After approval from the ethical review committee of our hospital, this descriptive case series study was done. Our sampling technique was non-probability, consecutive type.65 patients who came in outpatient department of pediatric orthopedics of the Children Hospital and the

Institute of Child Health, Lahore and fulfill the inclusion criteria were enrolled in the study. Our selection criteria were patients aged 3-14 years presented after 8 weeks after initial trauma, both male and females. All patients with open fractures on clinical examination (skin wound) and neurovascular injury on clinical examination (absent pulses and sensations distally) were excluded from the study. Informed consent and demographic profile (name, age, sex, and contact) was obtained. The procedure details, benefits and complications explained to parents. The fracture was approached via Kocher's incision. The humeral metaphyseal area was nibbled to create space for realignment of the fragment. Two or three multidirectional Kirschner wires were used for fixation following reduction. In cases where exact anatomical reduction was not possible, most acceptable reduction was fixed. The wires were retained for a minimum of 6 weeks and the limb protected in above elbow cast till fracture union. Union was assessed radiologically. Elbow physiotherapy was started as soon as there was radiological evidence of union. A single surgical team carried out all procedures uniformly to reduce bias. All data was collected on single proforma. Data was analyzed in SPSS 17.0. Quantitative variables like age were presented as mean and standard deviation while qualitative variables like gender and union were presented as frequency and percentage. Chi square was applied for post-stratification for age, malnutrition and gender .P value ≤0.05 was considered significant.

RESULTS

Sixty five patients with mean age of 7.83±3.029 ranged from 3 to 14 years of age were included in our study. Regarding age, 18 patients (27.7%) were below 5 years, 29 (44.6%) were between 5 to 9 years whereas rest of 18 patients (27.7%) were either 10 years or more in age. Regarding gender 46 patients (70.8%) were male and remaining 19 patients (29.2%) were female.

Union was achieved in 57 patients (87.7%) out of 65 patients. Remaining 8 patients needed further intervention for union.3 patients showed malnutrition. When we cross tabulated gender with union and applied fisher exact test, results came up statistically non-significant (p=0.683). 41 male and 16 female patients showed positive results for union. When we cross tabulated malnutrition with union and applied fisher exact test, results came up statistically non-significant (p=1.000). All of 3 patients that were suffering with malnutrition also showed positive results for union.

When we cross tabulated BMI>24.9kg/m2 with union and applied fisher exact test, results came up statistically non-significant (p=0.716).it showed equal distribution among sampled population. When we cross tabulated age group with union and applied fisher exact test results came up significant (p=0.571). Among different age groups, union showed equal distribution.

DISCUSSION

Humeral lateral condylar fractures are the second most common distal humeral fractures,after supracondylar humeral fractures and comprises of 12-20% of all distal humeral pediatric fractures[1]. Usual age of occurrence is 6 years[2].

Some causes of neglected lateral condyle fracture are: health facilities are not widespread: sometimes radiological or operational facilities are not available in developing countries: even sometimes lateral condyle fractures are not diagnosed initially; and more worse is situation when cultural, religious and financial issues of parents prevent them to adopt proper treatment. Under such circumstances, these fractures are managed by local bone settler or inappropriately at primary centers by conservative means or even do not take treatment[7, 8].

The main reasons for avoidance of surgery for neglected lateral condyle fractures are due to many problems during surgery: 1. Completely distorted anatomy with articular surface of the fragment facing the humeral metaphyseal area, 2.Condylar fragment size enlarges making it difficult to fit in original bony bed, 3.Condylar fragment losses its shape to become irregular and surrounded on all sides by cartilage ,4.Humeral metaphyseal fragment also enlarges and becomes misshapen and5.Soft tissue contraction, fibrosis and callus makes are other technical demanding problems.

If neglected humeral lateral condylar fracture is not treated, then there are late complications like cubitus valgus, tardy ulnar nerve palsy,elbow pain and lateral intability of elbow. There are 25% of cases of tardy ulnar nerve palsy due to no treatment of neglected humeral lateral condylar fractures reported by Gay and Love[9]. Painful elbow in athletes is also due to neglected humeral lateral condylar fractures reported by Flynn et al[10] .Masada et al showed that adults often present with pain or lateral instability of elbow with neglected humeral lateral condylar fractures[11].

Neglected humeral lateral condylar fracture has propensity for nonunion due to its intra-articular nature and synovial fluid bathing the fractured fragments. Common extensor muscles origin from lateral condyle and hence their continuous pull after lateral condyle fracture is another cause of nonunion.

There are many options available for treatment of neglected humeral lateral condylar fractures in literature with different results. Some of these options are:In-situ fixation[14],fixation in malreduced position after limited reduction[8], reduction with minimal displacement in selected cases [15,16] and lengthening of the aponeurotic part of common extensor muscle origin to achieve anatomical reduction[6].

There are many complications after open reduction and internal fixation of neglected humeral lateral condylar fractures. Avascular necrosis of lateral condyle, infection, elbow stiffness and pain are some of these complications. Most problematic complication is avascular necrosis of lateral condyle and this is iatrogenic. This is due to disturbance of blood supply of lateral condyle when posterior dissection is done during open reduction and internal fixation because main blood supply of the lateral condyle of humerus comes from posterior side of lateral condyle via common extensor muscle[12] and vessel plexus in the olecranon fossa[13].

Following precaution should be adopted when performing open reduction and internal fixation to avoid avascular

necrosis: If anatomic reduction of distal fragment is not possible, then this fragments should be fixed in that position which gives maximum range of motion and nearly normal carrying angle inspite of maximum posterior stripping of the lateral condyle. There are many studies which are beneficial in this regard. Flynn *et al.* is advising against surgery when condylar fragment was in a poor position and would probably have required major dissection due to this reason[17]. In one study multiple incisions were given in the common extensor aponeurosis for easier reduction by Gaur *et al*. [18].Roye *et al*. advised functional reduction of lateral condylar fragment in such a position that yields maximum elbow motion[19]. Bohler avoided extensive soft tissue dissection by transolecranon approach[20].

Various results obtained in literature following open reduction and internal fixation of neglected humeral lateral condylar fractures in children. Dhillon *et al* study conducted on 16 patients showed good elbow function in 5 patients, fair in 7 patients and poor in 4 patients based on their devised indigenous clinical score[21].Toh *et al*. study of 20 patients showed excellent results in 7 patients and good results in 13 patients based on Broberg and Morrey score[22]. Agarwal et al study of 16 patients showed excellent to good results in 6 patients, fair results in 6 patients and poor results in 4 patients[23,24].

The rationale for managing neglected humeral lateral condylar fracture is to obtain union and in this way prevent late complications like cubitus valgus, tardy ulnar nerve palsy, pain, and instability.

CONCLUSION

There is high rate of union and satisfactory elbow function in neglected humeral lateral condylar fractures in children after open reduction and internal fixation. The central point of our study is careful mobilization of the rotated distal condylar fragment by careful dissection of soft tissues and use of a simpler implant such as Kirschner wire. Moreover,there is poor correlation between age of patient, time of injury to presentation in outdoor, milch types and final elbow function in our study.

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