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Management of displaced supracondylar fracture of humerus in children by closed reduction and k wire fixation

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Abstract

Supracondylar fracture of humerus is a common pediatric elbow injury contributing 60-70% of all elbow injuries. The management of displaced supracondylar fracture of the humerus is one of the most difficult of the many fractures seen in children. Displaced fractures are inherently unstable. Conservative treatment often results in malunion. Open reduction and internal fixation is more invasive and recovery is prolonged. Closed reduction and percutaneous pinning is the preferred method of treatment for displaced type 3 supracondylar fractures in children. This study was done to know the age, sex, side of involvement, mode and mechanism of injury, anatomical and functional results of treatment of this type 3 fractures by closed reduction and percutaneous pinning and also the complications of this procedure. 30 cases of displaced supracondylar fractures of humerus in children who attended in first 24 hours of injury were managed by closed reduction and percutaneous k wire fixation under image intensifier with in 8hours were studied. Out of 30 cases 24 cases had excellent results, 6 cases have good results, according to modified Flynn's criteria. One patient developed ulnar nerve palsy which was iatrogenic, and improved completely after wire removal. Another was brachial artery injury which was explored and recovered completely. This concludes closed reduction and percutaneous k wire fixation is a safe and reliable technique for obtaining and maintaining an excellent reduction in this difficult fracture.

Keywords: Closed reduction, percutaneous pinning, supracondylar fracture

1. Introduction

Supracondylar fractures of the humerus contribute 13% to 16.6% of all pediatric fractures and account for around 60-80% of all elbow injuries. The rate of occurrence increases steadily in the first five years of life to peak at 5-7 years of age. The main cause for this fracture is fall on outstretched hand and indirect injury to the elbow. This fracture involves the lower end of the humerus usually involving the thin portion of humerus through olecranon fossa, or just above the fossa or through metaphysis.

Supracondylar humerus fractures in children are associated with considerable morbidity; including malunion, neurovascular complications, compartment syndrome, and elbow stiffness. The management of displaced supracondylar fracture of the humerus is one of the most difficult of the many fractures seen in children. Management of un-displaced fracture is plaster of Paris immobilization. Displaced fractures can be managed by closed reduction and immobilization, traction by various modalities, closed reduction and K wire fixation, open reduction and K wire fixation. Closed reduction with splint or cast immobilization for displaced supracondylar fractures are associated with loss of reduction and malunion producing varus or valgus deformity of elbow and elbow stiffness. Surgical treatment of these fractures offers the advantages of reduced hospitalization, more stable fixation, fewer sequelae and far better anatomical and functional results. Closed reduction and percutaneous pinning promises to be the best method at present but closed reduction is not always achievable because of intense soft tissue swelling and intrinsically unstable nature of the fracture. In these cases open reduction becomes mandatory. The goal in treating these fractures is to reestablish the anatomy of distal humerus perfectly with least complications and with enough stability to permit early painless functional elbow motion.

The objective of this study is to restore the anatomy of the distal end of the humerus with closed reduction and fixation with K-wires, preoperative recording of sex, side of involvement, mode of injury of supracondylar fracture of humerus, to study anatomical and functional results of treatment of supracondylar fractures of humerus with closed reduction and percutaneous 'K' wire fixation, to note intra-operative and postoperative complications of the procedure, to follow up the patients till union and return of function.

2. Material and methods

Thirty children in the age group of 4 to 12 years who were admitted in first 24 hours of injury having type 3 supracondylar fracture humerus were included in this study. All the children were given resting splint. They underwent radiographs and required investigations and taken for surgery under general anaesthesia within 8 hours presenting to us, because we have an in house anaesthesiologist. Parents consent was taken both for closed and open reduction. Patient was positioned supine with ipsilateral shoulder at the edge of the table. Affected elbow, arm and forearm was scrubbed, painted and draped leaving the elbow, lower third of arm and upper third of forearm exposed. Traction along the longitudinal axis with elbow in extension and supination were given. At the same time counter traction was given by an assistant by holding proximal portion of arm. Medial or lateral displacements were corrected by valgus or varus forces respectively. After that, posterior displacement and angulation was corrected by flexing the elbow and applying posteriorly directed force from anterior aspect of proximal fragment and anteriorly directed force from posterior aspect of distal fragment while maintaining traction in the axis of forearm. Almost all in postero medial displaced fractures elbow was fully flexed and fully pronated to lock the fractures and prevents displacement while passing the wires. Reduction was confirmed under image intensifier in two views; Stainless steel k wires of about 1.2mm to 2.0mm were used. We used to hold the reduced fracture with two K wires from lateral epicondyle in divergent manner. Both pins were placed percutaneously. There was 6 cases with postero medial comminution and for those patients also only divergent lateral pins used. After the pins were placed, the elbow was extended and the carrying angle was compared with that on the non-affected side. The adequacy and stability of the reduction was checked under image intensification. The pins were bent to prevent migration and cut off outside the skin to allow removal in the outpatient clinic without anaesthesia. Pop slab was applied in elbow 90 degrees of flexion by keeping eye on radial pulse. Patient was encouraged to move fingers. A careful observation for any neurovascular deficit was observed at regular intervals. Appropriate antibiotics and analgesics were used. Check x rays in AP & lateral views were taken. Patients were discharged on 1st post-operative day with pop slab. Weekly once child comes for pin tract dressings. At four weeks following surgery the Plaster of Paris slab was removed. Clinical evaluation was done to rule out distal neurological deficit. Check X-ray was taken to see whether union had taken place or not. Most of the patients had union at about four weeks. The K-wires were removed in the out-patient department. The Plaster of Paris slab was discarded and sling was given for one week. Patients were advised active elbow movements after demonstrating it to the patient. They were advised to come once in four weeks to assess the range of the elbow movements. They were then called at three months following surgery. X-rays were taken the range of elbow movements and carrying angle was

assessed. Patients who were having neurological involvement were followed up every week following surgery. Later follow-ups were made at end of six months. The range of movements and presence of deformities were measured by using a goniometer at these intervals. The functional results were graded based on Flynn's *et al* grading.

3. Results

In thirty cases of type 3 supracondylar fracture of humerus treated with closed percutaneous K wire fixation the age of the patients was ranges from 4 to 12 years. The mean age was 8.03 years. Out of 30 patients 21 were male 70% and 9 were female patients. Twenty three, 76.7% left elbow were involved. All of them injured while plying either at home or school. Among thirty patients in the study, only two patients had flexion type of supracondylar fracture, remaining all twenty eight patients 93.3% had extension type of fracture. In extension variety all were type 3 fractures. 21 patients 75% had postero-medial displacement and seven patients had postero-lateral displacement. One patient had ulnar nerve injury and 1 patient had brachial artery injury. Both were noticed post operatively. On first post operative day wire was removed nerve function improved by 6-8 weeks. Loss of brachial pulse was noticed on table and 2D colour Doppler was done which showed complete block. Within 6 hours exploration was done, clot was evacuated; total pulse was regained without any disability. All cases included in this study group were fresh fractures and attended to our hospital within 6 hours of time and they underwent surgery around 8 hours after admission to hospital. All the patients were discharged on first postoperative day and followed regularly every week for k wire dressings. In one case while passing a k wire from lateral condyle there was a split of distal fragment and appears as lateral condyle fracture. This fragment was also fixed with additional k wire which was subsequently healed. In present series one case of mild superficial pin tract infection was noted and was treated with appropriate antibiotics. There was no case of k-wire out word or in word migration. In 80% of the cases we used two k wires; in 29 cases we did lateral divergent pinning. One case we did crossed pinning which developed ulnar nerve palsy. The results were graded based on Flynn's *et al* criteria, excellent in 24 cases 80%, good in 6 cases 20%.

4. Discussion

Supracondylar fractures of the humerus in children are common injuries and complete displacement of the fragments occurs in many of the cases. Vascular complication is preventable to a great extent. However, cubitus varus deformity seems to be the most common complication with any of the methods of treatment. As its management poses a number of problems like VIC, Nerve palsies, myositis ossificans or cubitus varus or valgus deformity, it has to be managed with minimal manipulation, anatomical reduction and decompression of elbow to obtain excellent results. Some displaced fractures are stable after reduction and may be managed satisfactorily after closed reduction by cuff and collar or by plaster slab immobilization. However many of these fractures are unstable after reduction except in acutely flexed position. If considerable swelling is present this acutely flexed position may compromise circulation and predisposes to Volkmann's ischemic contractures. The main force stabilizing the fracture results from flexion of the elbow rather than pronation or supination of the forearm. Too much flexion may occlude the circulation, but too little flexion may allow fracture to become displaced, so called "Supracondylar

dilemma”, is unique to conservative treatment. Alignment of distal humeral fragment can be achieved without flexion either by static means such as K- wire fixation or dynamically by traction.

Displaced supracondylar fractures are managed with various methods; closed reduction with plaster, traction, closed reduction and percutaneous pinning, open reduction and k wire fixation, lateral divergent pins or crossed pins. Traction is still an effective method of treatment but has many drawbacks. First, it is expensive due to increased hospital stay. Second, when the extremity is swollen, it is very risky to attempt skin traction. Third, when skeletal traction is attempted, it poses some problems and prolongs the hospitalization period [1]. Primary open reduction and internal fixation is an alternative method of treatment. There are several different surgical approaches to the fracture site. The most commonly used is the posterior approach which may cause loss of elbow movement, and infection. Because of these problems, the major indications for a primary open reduction include an open fracture, failure to achieve an adequate closed reduction or neurovascular compromise that worsens especially with the manipulative technique [2]. Open reduction and internal fixation is used only after many unsuccessful attempts at closed reduction, or after a trial of traction for a time, when the skin and soft tissues are devitalized, a poor result is to be expected.

The present study was conducted to assess the results of closed reduction and percutaneous fixation with k wires for displaced supracondylar fractures of the humerus in children. Percutaneous Kirschner's wire fixation for supracondylar fracture of humerus in children offers simple, safe and affordable treatment option. Supracondylar fracture should be reduced accurately and stabilized. Acceptance of poor reduction in a displaced position leads to imperfect results like limited movement of elbow joint like limited flexion, varus & valgus deformities. Perfect anatomic reduction is the key factor in the management of displaced supracondylar fracture of humerus. Initial treatment as well as definitive treatment of this fracture is of utmost importance.

This is quite often complicated in developing countries like India due to lack of awareness, poverty and presence of traditional bone setters. In this series our aim was to avoidance of complications and achievement of excellent functional and cosmetic results, which should be goal in the treatment of all fractures.

Age is the key factor in supracondylar fracture. This is almost exclusively fracture of immature skeleton often in first decade. In the present study most of the patients were of the age 4 - 8 years and average age was 8.03 years. Results of the present study are comparable with other studies reported in past literature. Fowles JV. *et al.* [3], in their study, reported that the majority of the patients were from 5-10 years age group. This fracture is more common in males because males are supposed to be more active and prone to sustain this injury. In present series 70% patients were males. Present study results were comparable with other series and most of them have shown male predominance. Fowles *et al.* [3] (1974) in their study reported 81% males and 19 % females. In supracondylar fractures of humerus the non-dominant side fracture is more commonly involved probably because it is frequently used in protective reflex to support the body. Present study in 73% patients fracture occurred on left side and 27% on right side. Aronson DD. *et al.* [4], reported 13 (65%) fractures on the left side and 7 (35%) on the right side in their study of 20 cases. Fowles *et al.* [3] reported 43% of fractures occurred on right

side and remaining 57% occurred on left side. The major cause of fracture in present study was fall while playing. Fransworth *et al.* [5] in their study fall from a height was the major cause of injury in 70% of the cases. Posteromedial displacement is more common probably due to secondary pull of the triceps, which originates medially and also biceps lie medial to the shaft which would increase contribution. In present study posteromedial displacement account for 75% of Cases and posterolateral displacement account for 25%. The average interval between the patient attended to the hospital and surgery was about 8 hours in present study. Average interval between fracture and surgery was 1.4 days in the study done by Skaggs DL *et al.* [6]. We could able to manage to do surgery in 8 hours due to availability of in house anaesthesiologist, and due to earlier taken up for surgery, all the fractures were reduced by closed reduction. In the present study, among thirty patients, one (3.33%) patients had ulnar nerve palsy and one (3.33%) patient had brachial artery injury. Brachial artery was explored due to total block within 6 hours of closed reduction and patient was fully recovered with no disability. On the first post-operative day we could able to notice iatrogenic ulnar palsy because of medial wire, which was removed patient was recovered fully in 6 weeks. One patient also developed superficial k wire infection which was controlled by antibiotics. In one case while passing a k wire from lateral condyle there was a split of distal fragment and appears as lateral condyle fracture. This fragment was also fixed with additional k wire which was subsequently healed. The results were graded based on Flynn's *et al.* criteria, excellent in 24 cases 80%, good in 6 cases 20% comparable to other authors.

5. Conclusion

In the management of displaced supracondylar fracture of humerus, closed reduction and application of a cast is inappropriate, as either the initial or the subsequent method of treatment, this method is potentially hazardous to the circulation and makes it difficult to control the reduction, resulting in loss of the carrying angle and in cubitus varus or valgus deformity. Anatomical reduction is the key for obtaining good results. As the incidence of malunion is high anatomical reduction must be achieved before K wire fixation. Rigid fixation can be achieved through divergent 2 lateral K wires.

This method is simple, safe and effective. The period of hospital stay is short, which makes this method very economical. With this technique, consistently satisfactory results can be obtained both cosmetically and functionally. By this method, we have achieved early mobilization of the elbow with good range of elbow movement with fewer complications. With the fracture stabilized by pins, an elbow with severe swelling can be extended beyond 90°, thus vascular compromise is avoided. Closed reduction and percutaneous pin fixation for displaced supracondylar fractures of the humerus in children gives excellent functional and cosmetic results. The most common complication, cubitus varus, can be avoided if surgery is taken up as early as possible and with minimal efforts of reduction.

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