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Supracondylar fractures of humerus in children extension type management

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Abstract

Supracondylar fractures are most common elbow fractures in children and a most frequent fracture requiring surgery. The peak age for Supracondylar fractures is 5-7 years. Fractures are usually caused by fall onto outstretched hand with the elbow in extension. They reported to be 18% of paediatric fractures. they are also associated with neurovascular injuries and compartment syndrome. Complications like deformity, malunion and stiffness can occur.

This is a retrospective study on displaced supracondylar fractures of the humerus of extension type in 30 children with a mean age of 6 years (5-12 years) who were treated at Sri Lakshmi Narayana Institute of Medical Sciences from 2019 and 2021 with closed reduction and percutaneous fixation with two K-wires from the lateral side. This study included Gartland type II and III fractures. There was a superior occurrence in boys (20 patients) than in girls (10 patients), and injury was further common on the right elbow (19 patients) than on the left elbow (11 patients). This study included 17 patients with Type II fractures and 13 patients had Type III fractures. 6 patients had emergency treatment for their injuries, 18 patients were treated within 24 hours of being injured, and 6 patients were treated between 24 and 48 hours after the fracture took place.

The results were according to Flynn's criteria- excellent in 24 patients, fair in 4 patients, and poor in 2 patients.

Initially, the K-wire position were all from the lateral side, and was convergent in 25, divergent in 3 patients and parallel in 2 patients. K-wires were removed at a mean of 3- 4 weeks. Callus was observed in 25 patients and rehabilitation treatment was indicated. The mean followup was 15-18 weeks.

The reduction was considered sufficient in 25 patients and insufficient in 3 patients. In 2 patients, there was a subsequent loss of reduction, and these 2 patients, another procedure was done using closed remanipulation and fixation with a third K-wire. In one patients, full range of motion was not reached; there was a loss of 5° of flexion and loss of 8° of extension.

Keywords: supracondylar fracture, Gartland, k wire, convergent, divergent, parallel

Introduction

Supracondylar fractures are most common elbow fractures in children and a most frequent fracture requiring surgery. The Supracondylar fractures is more common in 5-7 years. According to Gartland classification system, Type 1 requires non operative treatment whereas other types [2-4] requires surgical intervention. Fractures are usually caused by fall onto outstretched hand with the elbow in extension. They reported to be 18% of paediatric fractures. they are also associated with neurovascular injuries and compartment syndrome. Complications like deformity, malunion and stiffness can occur

These fractures are characterized by deformity, swelling, pain, and functional impairment. Mostly children avoid falling to ground by extending and then hyperextension of elbow occurs. The distal humeral metaphysis is weak and thin and prone to fracture.

This mechanism can differentiate these fractures into extension fractures (most common) and flexion fractures. Gartland classified three types based on displacement: Type I (no displacement), Type II (moderate displacement with the posterior cortex intact), and Type III (complete displacement) which was classified by Wilkins1 regarding distal fragment position as either postero lateral or medial. Brachial artery and median nerve is commonly involved in posterolateral displacement, while radial nerve is damaged in posteromedial displacement.

The concerned limb to be assessed for the consistency of the soft tissue and any neurovascular

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injury. Other injuries should be ruled out. The extremity must be monitored adequately for swelling, which can increase with time, and for neurovascular status, in order to avoid compartmental syndrome.

Treatment is done by percutaneous K- Wire fixation, in order to test the stability of the fixation to be capable to choose if additional fixation is needed and how it can be done. We then re-evaluate our knowledge to establish whether this technique is better to other methods.

Materials and Methods

This study is a retrospective reviewed on displaced supracondylar fractures of the humerus of extension type in 30 children with a mean age of 6 years (5-12 years) who were treated at SRI LAKSHMI NARAYANA INSTITUTE OF MEDICAL SCIENCES from 2019 and 2021

with closed reduction and percutaneous fixation with two K-wires from the lateral side. The fractures were classified as Gartland Types II and III. There was a superior occurrence in boys (20 patients,) than in girls (10 patients), and injury was further common on the right elbow (19 patients) than on the left elbow (11 patients). According to the Gartland classification system, 17 patients had Type II fractures and 13 patients had Type III fractures. 6 patients had emergency treatment for their injuries, 18 patients were treated within 24 hours of being injured, and 6 patients were treated between 24 and 48 hours after the fracture took place.

In this study we find a perfect reduction and adequate fixation of supracondylar fractures of the humerus. Position of the patient to be close to the border of operating slab and traction

of the fractured arm should be perpendicular to the operating table at 90 degrees of abduction with countertraction just about the patient's chest using a sheet. A C-ARM fluoroscopy is positioned at the end of the table consecutively opposite to the operative limb. In the anteroposterior plane, by steady traction and undertaking varus valgus correction reduction is done. Mostly, in extension fractures, elbow is flexed with steady traction on wrist side while maintaining counter traction on anterior side of arm. It is constructive while flexing elbow to give a thrust with the thumb onto the olecranon with traction maintained all through the step. Utmost flexion of the elbow will be required to get a fine reduction. The fragments that also need correction are the internally rotated parts. For that reduction in the form of forearm pronation with utmost flexion of elbow and elbow kept in 90 degrees abduction and externally rotating to 90 degrees. This makes the fracture reduction complete and confirmed under C-ARM guidance.

After the reduction, k wire fixation with percutaneous technique done. It is preferable to use smooth K-wires of mostly 1.8mm and 2.0mm diameters. It is fixed with arm flexed, pronated and in external rotation. Place the K-wire from the lateral aspect of the distal humerus under the C-ARM guidance in view that it is in line with diaphysis in lateral view. Also, the k-wire are directed obliquely toward the medial aspect of humerus (fig 1). Both the K-wires should be parallel or divergent. Then the shoulder brought to neutral and under C-ARM guidance (fig 2), Anteroposterior view is confirmed.

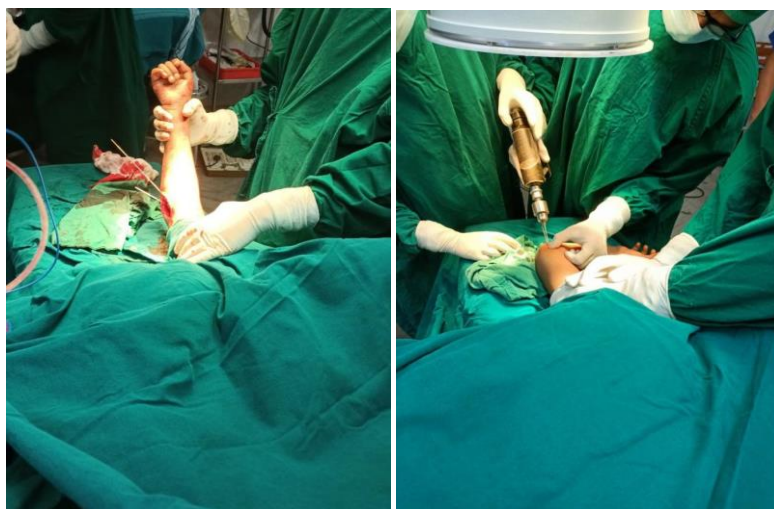


Fig 1: Intraoperative pictures showing k wire fixation directed obliquely toward the medial aspect of humerus

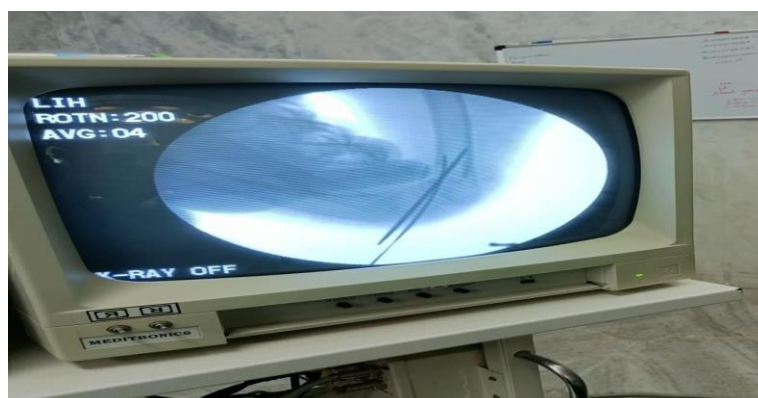


Fig 2: C- arm fluoroscopy showing lateral view of k wire fixation

If fixation is not ideal or the reduction not satisfactory, it is fine to take out the K-wires and begin again. For checking the fixation stability, internal rotation should be done to get a lateral view of elbow, with cautious watch for fragment rotation. The fracture margins can be found different with one section in lateral view and the other in oblique view. To reduce the fracture take the arm into 90 degrees of external

rotation again and fix it with another K-wire. The third K-wire fixation (fig4) if done through medial side should avoid the injury to ulnar nerve. K-wire insertion from medial side, to avoid hyperflexion and push the thumb over the epitrochlea to move forwards the edema distant. Then relocate the thumb to posterior aspect and insert the K-wire by hand with a T-handle.



Fig 3: Clinical picture of supracondylar fracture of elbow & Anteroposterior view of elbow showing extension type of supracondylar fracture of Gartland classification Type III



Fig 4: Post op Xray of Type III Gartland classification of supracondylar fracture of elbow with 3 k wire fixation.

Wires are curved and are out nudged through the patient’s skin to make easy removal afterwards and the elbow is immobilized with a above elbow plaster cast. There is a definite danger of infection that can be prohibited with preoperative and postoperative antibiotic treatment The cast is removed after one week postoperatively and the K-wire sites are assessed. The cast after that is applied for three more weeks. The cast and the K-wires are removed after 3 weeks and rehabilitation is followed.

Following this, results were evaluated using Flynn’s criteria which divides the results according to loss of motion and loss of carrying angle for functional outcomes into 4 categories. Statistical processing of data was done with SPSS Pack (SPSS Inc., Chicago, IL) using Fisher’s exact test for normal values and chi square and using Mann-Whitney analysis for nonparametric values.

Flynn’s Criteria [2]

Result	Rating	Cosmetic factor: Cubitus angle loss	Functional factor: Motion loss
Satisfactory	Excellent	0-5	0-5
	Good	6-10	6-10
	Fair	11-15	11-15
Unsatisfactory	Poor	Over 15 or cubitus varus	Over 15

Fig 5: Flynn’s criteria

Results

The results showed excellent in 24 patients and fair in 4 patients, and poor in 2 patients. Initially, the K-wire position were all from the lateral side, and was convergent in 25, divergent in 3 patients and parallel in 2 patients. K-wires were removed at a mean of 3- 4 weeks. Callus was observed in 25 patients and rehabilitation treatment was indicated. The mean followup was 15-18 weeks.

The reduction was considered sufficient in 25 patients and insufficient in 3 patients. In 2 patients, there was a subsequent loss of reduction, and these 2 patients, another procedure was done using closed remanipulation and fixation with a third K-wire. In one patients, full range of motion was not reached; there was a loss of 5° of flexion and loss of 8° of extension.

There were no cases of nerve injury or compartmental syndrome, although two patients had a loss of pulse in their arms at the initial examination that was recovered once the fracture was reduced. In 2 patients, infection developed in the K-wire tract. Postoperatively, prophylactic antibiotics was not taken accordingly in these patients. After discharge patients were advised antibiotics for a 10 day period. The infections were treated by removing the K-wires in one patient and with intravenous antibiotics. The infections all were Staphylococcus aureus. There also was a residual cubitus varus in one patient.

When evaluating the delayed displacement according to fracture type and the position of the K-wires, displacement in Type III fractures was found more often. Displacement was found fewer normally when the wires were divergent. No variation was found connecting the patients getting emergency treatment and those patients treated within 24/ 24-48 hours after their injuries.

Discussion

In supracondylar fractures of humerus where complete reduction fails outcomes are difficult. By using the closed reduction it is good to get good results. Remodelling of bone in children especially in elbow fractures are not of good potential and is not easy to get better results always3. If there are secondary displacements noted after initial reduction there are chances of myositis ossificans if we consider secondary reduction.

There are various choices concerning the fixation types to apply and mainly on the subject of K wire position whether to

be convergent, divergent or parallel [4]. The most established outlook is acquired either from lateral or from both sides (lateral and medial) application of k wires. The medial side application has a risk of ulnar nerve damage. In case of hyperflexion ulnar nerve injury is more prone to risk. Most commonly ulnar nerve damages in case of cross fixation method of k wire fixation [5, 6]. Mostly type III fractures it is sensible to use different options. In this study we fix two k wires from lateral side and check the rotation of fragments and if unstable a third k wire can be fixed from medial or lateral side. In this study the third k wire fixation was done in two patients which had good results. Vascular lesions are not included in this study and so open reduction and fixation is avoided, but in case of proper reduction open reduction can be done [9]. There are rotation of fragments in case of converging k wire fixation, so either divergent or parallel k wire fixation is suggested [6].

There can be a delayed treatment option for supracondylar fractures, to treat soon with appropriate orthopaedic team even though the outcomes are equivalent. In case of doubtful vascular injury or when crucial to identify the status, open reduction is considered. When there is pink pulseless hand i.e., distal perfusion is preserved it is likely to pull through the pulse by fracture reduction. Volkman's ischemia is one the complications of this fracture which didn't happen in this study. The most common nerve involved in supracondylar fracture is anterior interosseous nerve which is a branch of median nerve can be identified by the patient inability to do okay sign. Radial nerve is also injured and common. They heal with time on their own and there were no nerve lesions in this study.

Antibiotics are to taken before and after surgery in order to avoid infection. Few surgeons fix the k wires subcutaneously to steer clear of danger. Antibiotics like cefixime for 5- 7 days was used in this study. After treatment, range of movements are not easy to make progress, but physiotherapy helps a lot after fixation. Ideally 3 weeks of immobilization is needed following which rehabilitation can be started. In case of Type II fractures this has good stability. In some cases callus formation might not be seen even at 3 weeks of immobilization and it can be prolonged.

In this study we concluded that closed reduction and percutaneous fixation of supracondylar fracture of humerus in children, fixed with two k wires from the lateral side with either parallel or divergent type. Proper antibiotics were given and sterile dressing and theatre were used. The advantages of fixing k wires from lateral side low occurrence of nerve injury, better stability, and good range of movements. It is mandatory to confirm stability of fixation after fixing two k wires and if needed to fix it with a third k wire, that can be fixed either from medial or lateral side. The additional k wire is fixed to provide a sufficient fixation, since they can easily go for re displacement.

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