Prospective Study Of Managementof Supracondylar Fractures Of Humerus, and It's Complications in Children

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Abstract: Supracondylar fracture of humerus is the commonest injury around elbow which requires hospital admission in children. The supracondylar fracture of humerus demand great respect in treatment because its association with different types of complications We intend to study and evaluate methods of treatment and clinical outcome of fracture supracondylar humerus and evaluation of any shortcomings which causes secondary loss of reduction.

Method : In this study, 45 cases of supra condylar fracture were treated either with closed or open reduction and K-wire pinning. The purpose of this study was to evaluate the result of the surgery with reference to restoration of function and prevention of complications of the fracture.

Results : In our study,43(95.55%) patients had satisfactory results. Of these Patients , 29(64.44%) patients were rated as excellent, 13(28.89%) patients were rated as good & 01(2.22%)patient as fair and 02 (4.44%)patient was rated as poor. 01 patient had developed FFD as he had undergone open reduction and not done good physiotherapy after slab removal, and second patient had myositis ossificans.

Conclusion : Anatomical reduction is the key to obtaining good results, which is possible both through open or closed reduction. The results obtained in this study shows that anatomical reduction (closed/open) with slab/ K-wire fixation is the treatment of choice for supracondylar fractures in children

Keywords : Supracondylar humerus, Carrying angle, Boumann's angle, K-wire, above elbow slab.

Thesis Question: What is incidence of early and late complications & what is the best modality of treating supracondylar humerus fracture in children?

Thesis Answer: Depends upon age, type of fracture, associated neurovascular status of the limb, stability of reduction, and anatomical reduction (closed/ open), immobilised with slab/K-wires and early ROM (range of movement) of elbow to give effective treatment for supracondylar fracture.

THESIS SUMMARY

Introduction

Supracondylar fracture of humerus is the commonest injury around elbow which requires hospital admission in children. It constitutes 3% of all fractures and about 65.4% of all the fractures around the elbow in children. This is the most common fracture requiring re- reduction as it is commonly associated with secondary loss of reduction if no internal fixation is done. So check x-ray after 10 days and immediate re-reduction is

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mandatory.

The occurrence rate increases progressively in the first five years of life to peak between 5 - 7 years of age*. The supracondylar fracture of humerus demand great respect in treatment because supracondylar fractures are more commonly associated with different types of complications as compared to any other fractures in the body such as, compartment syndrome(1%), brachial artery injury(0.5-1%), Volkmann's ischemic contracture(0.5%), elbow stiffness(5-7%),nerve injury(3- 22%), Ipsilateral fracture of extremity(5%), cubitus varus(14% in CR, 3% in percutaneous pinning),myositis ossificans(0.5-1%).

The management of displaced supracondylar fracture of the humerus is one of the most challenging one to prevent complications. It needs accurate anatomical reduction and internal fixation. So no longer is it acceptable to near "not bad for a supracondylar fracture"[3].

There is no controversy in the management of the un-displaced fractures. But various modalities of treatment have been proposed for the treatment of displaced supracondylar fractures of the humerus in children, such as closed reduction and plaster of paris slab application, skin traction, overhead skeletal traction, closed reduction and percutaneous pin fixation and open reduction with internal fixation4,closed reduction and Posterior intrafocal pinning5,closed reduction and Lateral External Fixation [6].

Closed reduction with splint or cast immobilization and treatment with traction has traditionally been recommended for displaced supracondylar fractures, but difficulty in reduction, necessity of repeated manipulations, loss of reduction postoperatively or during follow up leads to malunion and elbow stiffness [7]. Supracondylar fracture of humerus often installs 'sense of apprehension' even in the mind of most experienced surgeon. Even various studies have shown that for displaced supracondylar fractures of humerus, open reduction and internal fixation with K-wires gives more stable fixation, better anatomical reduction with minimal complications. So still close reduction or open reduction and internal fixation with K-wires is the most commonly accepted treatment of displaced (Gartland Type3) supracondylar fractures of the humerus in children.

Aims and Objective

1. To study the etiopathogenesis of fracture patterns of supracondylar fractures in children.
2. To know etiopathogenesis of Early, Immediate and late complications and study its management.
3. To study the importance of secondary loss of reduction in case when no Internal fixation was done, by check x rays after 10 days and at 3 weeks.
4. To study and evaluate methods of treatment and clinical outcome of fracture supracondylar humerus and evaluation of any shortcomings which causes secondary loss of reduction.

Material And Methods

The clinical material for the study, consists of 45 cases of fresh supracondylar fractures of humerus in children of traumatic etiology, meeting inclusion and exclusion criteria, admitted to Government Institute, between year 2012 to 2014

Inclusion Criteria:

1. Age group; 0 to 16 years of both sexes
2. Compound fractures
3. Poly-trauma patients

Exclusion Criteria:

1. Intra articular fractures of lower end humerus.
2. Fracture in children more than 16 years of age.
3. Any pathological fracture.
4. Any pre-existing motor and sensory weakness, such as Cerebral palsy, PPRP.

Method of study:-

As soon as the patient was admitted, a detailed history was taken and a Meticulous examination of the patient was done. Specific attention was given to Neurovascular status of limb distal to fracture site that is w/f any radial, ulnar, Median nerve injury, w/f signs of compartment syndrome, w/f radial pulse, nail bed circulation return. In case of suspected median nerve injury, special attention was given for notifying early compartment syndrome as there is no pain when patient has median nerve injury and has compartment syndrome. The required information was recorded in the proforma prepared. The patients radiograph was taken in antero-posterior and lateral views. The diagnosis was established by clinical and radiological examination. In this study, supracondylar fracture of humerus was classified according to modified Gartland's classification.

Type I : Undisplaced Supracondylar fracture of humerus.

Type II : Displaced Supracondylar fracture with intact posterior cortex.

Type III : Displaced Supracondylar fracture with no cortical contact.

a) Postero-medial

b) Postero-lateral.

Type IV : Fractures with considerable displacement without contact fragments, which displaces in to flexion and extension during manipulation under IITV control.

Temporary closed reduction was done on admission and above elbow Posterior pop slab was applied in 90° of flexion at elbow. The limb was elevated to reduce swelling of the elbow. All patients were taken for elective surgery as soon as possible after necessary blood, urine and radiographic pre-operative work-up.

Patients' attendants were explained about the nature of injury and its possible complications. Patient's attendant were also explained about the need for the surgery and complications of surgery.

Written and informed consent was obtained from the parents of children before surgery.

All patients with grade III fractures were started on prophylactic antibiotic therapy. Intravenous Cephalosporin was used. It was administered according to body weight of the children, prior to induction of anaesthesia and continued at 12 hourly intervals post-operatively for 3 days in closed reduction and k-wire casesand for 5 days in open reduction cases. In closed reduction and k-wire casesantibiotics were withdrawn after 3 days while in open reduction cases after I.V.

antibiotic for 5 days, oral antibiotics were given till suture removal.

Operative Technique

Anaesthesia:

All patients were taken up for surgery under general anaesthesia.

Patient Positioning:

Patient was positioned supine with ipsi-lateral shoulder at the edge of the table.

Painting and Draping:

Affected elbow, arm a forearm was scrubbed, painted and draped leaving the elbow, lower third of arm and upper third of forearm exposed.

Technique of closed reduction:

1. Longitudinal traction with elbow in extension and supination was given. At the same time counter traction was given by an assistant by holding proximal portion of arm.
2. Continuing traction and counter traction, medial or lateral displacement were corrected by valgus or varus force respectively at fracture site.
3. After that, posterior displacement and angulation was corrected by flexing the elbow and simultaneously applying posteriorly directed force from anterior aspect of proximal fragment and anteriorly directed force from posterior aspect of distal fragment over olecranon while maintaining traction.
4. If an adequate reduction is obtained the elbow should be capable of smooth and almost full flexion. Radial artery pulsation checked, if pulsations disappear, degree of flexion is reduced by progressive10-20degrees till pulsation returns.
5. Confirm the adequacy of reduction under image intensifier in two views.

A) Antero-posterior view or Jone's view.

B) Lateral view by externally rotating the arm.

6. After getting satisfactory alignment reduction, and if reduction is stable then POP slab with elbow flexion more than 90 Degrees was given .If reduction is unstable then reduction was maintained by percutaneous K-wire fixation.

After experiencing failure to obtain a satisfactory reduction after two or three manipulations we considered open reduction.

Technique of open reduction:

Triceps Splitting Approach:

Under GA, in lateral position, in IITV control.

Standard posterior approach

1. Midline central incision taken over posterior aspect of lower third arm and elbow.
2. Incision deepened in layers and triceps splitted in centre with sharp dissection.
3. Reduction is done- by removing any buttonholing of distal spike of proximal fragment or any periosteum getting entrapped at fracture site, after holding the proximal fragment with bone holding forceps.
4. Following reduction, two crossed K-wires were put percutaneously as in Closed reduction technique. Cut pins were bent and kept outside the skin for removal later.
5. Wound was washed and closed in layers.
6. Sterile dressing was put and above elbow posterior POP splint was applied in 90°of elbow flexion and midprone position.

Introduction of K-wires:

Stainless steel Kirschner's wires of about 1.2mm to 2.0mm were used. We used two crises-cross pins, one from medial epicondyle and one from lateral condyle. After achieving satisfactory reduction either closer or by open technique, K-wires were introduced with the help of a power drill under image intensifier control.

Selection of first pin placement was done according to initial fracture displacement. In cases of postero medial displacement we preferred to put medial pin first while in cases of postero lateral displacement lateral pin was put first. Medial pin entry was from tip of the medial epicondyle and lateral pin was entered at the centre of the lateral condyle. Both pins were directed 40° to the humeral shaft in sagittal plane and 10° posteriorly. K-wire placement was checked in image intensifier in antero-posterior and lateral views. If reduction was unstable after 2 cross k wires, then additional k wire passed either medially or laterally. K-wires were bent and kept at least 1 cm outside the skin. Sterile dressing was applied. Above elbow posterior pop splint in 90° elbow flexion and midprone position of forearm applied.

Treatment for flexion type of injury:

1. Reduction is done by longitudinal traction to the forearm with supination and elbow in extension and counter traction is given to arm by assistant.
2. After correcting the overriding, the distal fragment is pushed posteriorly by direct pressure, and simultaneously the proximal fragment i.e. shaft is pushed anteriorly.
3. Reduction is achieved and checked under C-arm control in AP and Lateral views.
4. The extremity is mobilised with POP AE slab with elbow in extension, as flexion of the elbow is again causing redisplacement of distal fragment anteriorly.
5. The POP slab is continued for 3 weeks and the routine physiotherapy advised.

NOTE:

We Did Not Require Skin Traction (Dunlop Traction) Or Overhead Skeletal Traction Or Posterior Intrafocal Pinning Or

Lateral External Fixator Modality For Any Of The Fracture Treatment In Our Series.

Post – Operative management:-

Post-operatively, operated limb was elevated on a drip-stand and patient was encouraged to move fingers. First 24 hours, patient was closely monitored for signs and symptoms of early compartment syndrome i.e. w/f stretch pain, nail bed return, pulse ox meter oxygen (O2) saturation. At 3rd post-operative day, check dressing was done and condition of the operative wound or pin site were noted. Following dressing, check x-ray in AP & lateral views were done. Patients in whom closed reduction was done were discharged on 3rd Or 4th post-operative day. Patients in who open reduction was done, were discharged after 5 days with oral antibiotics. These patients were reviewed on 12th postoperative day on O.P.D. basis for suture removal.

K-wires were removed at 3 weeks post-operatively after X – Ray confirmation of satisfactory callus formation. Pop splint was discarded at the same time and patient was encouraged to do active elbow flexion extension and supination – pronation exercises. Patients were advised not to lift heavy weight till 12 weeks postoperatively.

Follow up was done on O.P.D. basis at 3rd 6th & 12th week postoperatively.

The follow up was done by clinical and radiological evaluation, and results were assessed based on:

1. Pain.
2. Swelling.
3. Tenderness at fracture site.
4. Movements of the elbow.
5. Carrying angle of the elbow compared with normal elbow.
6. Union of the fracture.
7. Baumann's angle.

Post-OP Complications

Immediate And Delayed Post Op. Complications.

Immediate Complications

1 Nerve injury-median/radial/ulnar.
2 Vascular injuries (brachial artery).
3 Compartment syndrome.
4 Secondary loss of reduction.

Delayed:

1 Iatrogenic nerve palsy
2 Superficial pin tract infection
3 Migration of k -wires
4 Restriction of movements
5 Operative wound infection
6 Volkmann's ischemic contracture
7 Cubitus varus / valgus

Follow – Up:

All the cases were followed-up at 3rd week, 6th week and 12th week. During the follow-up the patients were assessed with respect to the following parameters and the findings were recorded in the proforma:

1. Pain – Presence of pain around the elbow is noted and severity of pain is mentioned as severe (+++), moderate (++), mild (+) or nil (O).
2. Tenderness – Presence of tenderness at fracture site is noted as Present (P) or not presents (NP).
3. Swelling – Presence of swelling around the elbow joint is noted as present (P) or not present (NP).
4. Movements – Movements of the elbow joint are recorded and noted as the range of motion present in degrees.

Post – Operative management:-

Post-operatively, operated limb was elevated on a drip-stand and Patient was encouraged to move fingers. First 24 hours, patient was closely monitored for signs and symptoms of early compartment syndrome i.e. w/f stretch pain, nail bed return, pulse ox meter oxygen O2 saturation. At 3rd post-operative day, check dressing was done and condition of the operative wound or pin site were noted. Following dressing, check x-ray in AP & lateral views were done. Patients in whom closed reduction was done were discharged on 3rd or 4th post-operative day, with oral antibiotics. Patients in who open reduction was done, were discharged after 5 days with oral antibiotics. These patients were reviewed on 12th postoperative day on O.P.D. basis for suture removal. K-wires were removed at 3 weeks post-operatively after X - Ray confirmation of satisfactory callus formation. Pop splint was discarded at the same time and patient was encouraged to do active elbow flexion extension and supination – pronation exercises. Patients were advised not to lift heavy weight till 12 weeks post-operatively.

Results

The final results were evaluated by Flynn's criteria. The results were graded as excellent, good, fair and poor according to loss of range of motion and loss of carrying angle. In our study, 43(95.55%) patients had satisfactory results. Of these Patients , 29(64.44%) patients were rated as excellent, 13(28.89%) patients were rated as good & 01(2.22%)patient as fair and 02 (4.44%)patient was rated as poor. 01 patient had developed FFD as he had undergone open reduction and not done good physiotherapy after slab removal, and second patient had myositis ossificans.

Conclusion

- Supracondylar fracture of humerus is one of the commonest fractures seen in children.
- Incidence is higher in boys.
- Left sided injury is more common than right side.
- Due to the frequent occurrence of complications, a detailed neurovascular examination is a must in all cases.
- Anatomical reduction is the key to obtaining good results, which is possible both through open or closed reduction.
- Rigid fixation can be achieved either closed reduction and slab /through criss-cross K wire or 2 lateral pins.
- By the aforementioned surgical methods, early mobilization of the elbow with good range of movement and fewer complications were achieved.
- The results obtained in this study shows that anatomical reduction (closed/open) with slab/ K-wire fixation is the treatment of choice for supracondylar fractures in children.

Clinical Message

Anatomical reduction (closed/open) with slab/ K-wire fixation is the treatment of choice for supracondylar fractures.

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