Volume 3, Issue 3, March 2025 ISSN (E): 2938-3765

OUTCOME OF SURGICAL AND CONSERVATIVE MANAGEMENT OF PEDIATRIC SUPRACONDYLAR FRACTUREV OF HUMERUS

Dr. Khudhur Azeez Khudhur
AL– Dour Surgical Hospital Salahaldeen Directorate of Health
M.B.Ch.B, H.D.Ortho
dr.khuder.ortho@gmail.com

Dr.Hassan Mohee Al dean Rasheed
Rania Teaching Hospital Raprain Department
M.B.Ch.B, H.D.Ortho
hasanmohee1985 @ gmail.com

Dr. Asou Ali Baker
Shar Teaching Hospital Sulaymania Directorate of Health
M.B.Ch.B, MRCSI

Abstract

Background: Supracondylar humeral fracture is the second most common pediatric fracture, occur most frequently in child aged (5 – 7) years, and more common in boys than girls. Due to specific anatomical considerations the supracondylar region is at high risk for fracture. This study was undertaken to evaluate the outcome of different types of management according to the severity of the fracture

Materials and methods: This is a prospective case series study, carried out in Sulaymaniyah at Emergency and Shar hospitals. 28 cases were studied between August 2018 to January 2019 including follow up over three months. All patients were treated operatively and conservatively according to the fracture severity. Follow up was done by using Flynn's criteria (cosmetic and functional factors) and the fracture union tested clinically and by X-ray.

Results: Out of 32 cases, 28 were complete the follow up period and included in this study. Age range from (2 – 13) years with (Mean ± SD = 6.4 ± 3.1). The most common frequent fracture type was Gartland type III (42.8%). The outcome according to Flynn's criteria, cosmetically 20 (71.4%) have excellent outcome and 8 (28.6%) have good outcome. Were for function, 15 (53.6%) have excellent outcome, 10 (35.7%) have good outcome and 3 (10.7%) have fair outcome.

Conclusion: Conservative management for types I and IIA have excellent outcome, while anatomical reduction and K-wire fixation is the golden management for types IIB and III. - Aims of the study:

-1- To find the prevalence of the age, gender and side incidence of
-2- To find the outcome of conservative and operative management.
-3- To study the outcome of two types of pinning (medial and lateral).
-4- To evaluate the effect of fracture classification on outcome.

Web of Medicine: Journal of Medicine, Practice and Nursing
webofjournals.com/index.php/5

-5- To evaluate the outcome of two types of reduction (open and closed) with K-wire fixation.

Keywords: Supracondylar humeral fracture, management, outcome, pediatric.

INTRODUCTION

Supracondylar humerous fractures (SCHF) are the most common pediatric humeral fracture and the second most common pediatric fracture overall. Supracondylar humerous fractures occur most frequently in children ages (5 – 7) years [1]. More common in boys than girls [2].

Anatomy of elbow joint: -1

1-1-Articulation: This occurs between the trochlea and capitulum of the humerous and the trochlear notch of the ulna and the head of the radius. The articular surfaces are covered with hyaline cartilage [3] (Figure 1.1).

1-2- Type: Synovial hinge joint.

1-3-Movements: The elbow can bend and straighten. Keep in mind that when the forearm is stretched, its long axis forms an angle with respect to the arm's long axis. Approximately 170° in males and 167° in females make up this lateral opening, which is referred to as the carrying angle. At full elbow flexion, the angle vanishes. 3 .

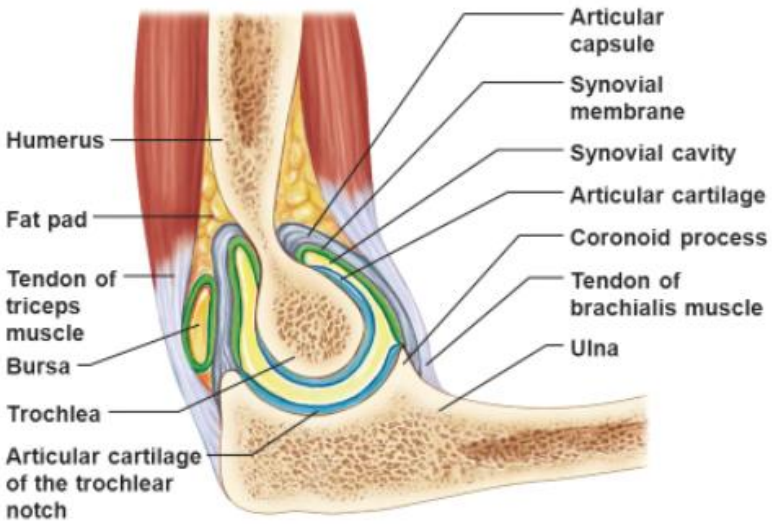


Figure (1.1): Lateral view of the elbow joint.

1-4-Surface anatomy of the cubital fossa:

Anteriorly: Brachialis, tendon of the biceps, median nerve, radial nerve and brachial artery.

Posteriorly: Triceps muscle, a small bursa intervening.

Medially: The ulnar nerve passes behind the medial epicondyle and crosses the medial collateral ligament of the joint (Figure 1.2).

Laterally: Common extensor tendon and the supinator muscle [3]

Web of Medicine: Journal of Medicine, Practice and Nursing
webofjournals.com/index.php/5

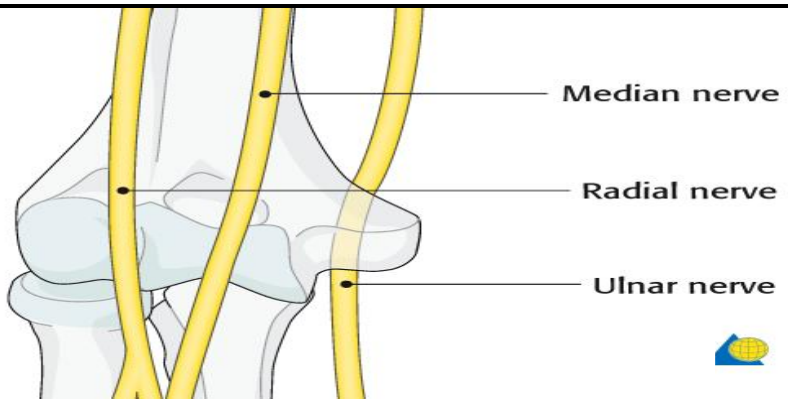


Figure (1.2): Relation of the nerves to the elbow.

1-5- Supracondylar region

In the supracondylar area, the distal metaphyseal part of the humerus is located. In this area, the humerous distal condyles—the medial epicondyle and the trochlea—and the lateral condyle—the capitulum—join the thicker cortical bone of the humeral shaft. The coronoid and radial fossas are located anteriorly, while the olecranon fossa is located posteriorly, hence the cortex is rather thin in this area. Here, the risk of fracture in the supracondylar humerous is relatively considerable. Figure 1.1

1-6- Ossification process: Around the elbow joint, you'll find six ossification centers. At various ages, they develop and join with the neighboring bones. Because ossification centers usually show up in a specific order, and because normal findings can be mistaken for fractures, it's crucial to know the appearance sequence so you can diagnose properly. Ages can vary, but typically occur between two and twelve years old, with ossification centers appearing earlier in females. C-R-I-T-O-E is a mnemonic that specifies the following sequence of appearance: capitellum, radial head, internal or medial epicondyle, trochlea, olecranon, and external or lateral epicondyle. 1.3

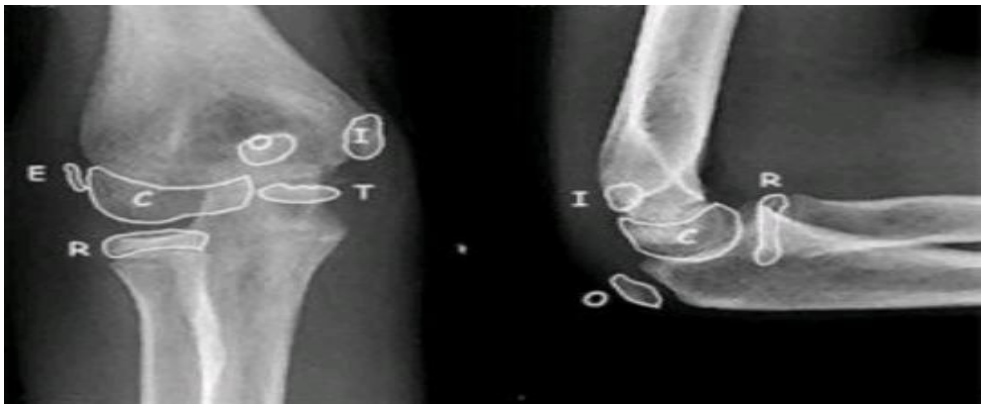


Figure (1.3): X-ray (AP and lateral views) shows ossification centers of pediatric elbow.

Biomechanics and mechanism of injury : 1-Injury mechanism and biomechanics: Due to metaphyseal remodeling, the supracondylar region of bone becomes weaker between the ages of six and seven. On the back side, near the olecranon fossa, and on the front side, near the coronoid fossa, is the thinnest part. The instability of a supracondylar fracture is attributed to the unique distal humeral architecture. 1.

Web of Medicine: Journal of Medicine, Practice and Nursing
webofjournals.com/index.php/5

Most often, a fall onto an extended hand with the elbow fully extended can cause a supracondylar fracture (Figure 1.4). While the elbow hyperextends, the olecranon in its fossa in the distal humerous serves as a fulcrum, and the capsule transfers an extension force to the distal humerus immediately proximal to the physis

When the distal piece moves backward, the anterior periosteum rips away from it because it fails. When the medial or lateral periosteal hinge is intact, the bone remains stable even after a decrease of 1.

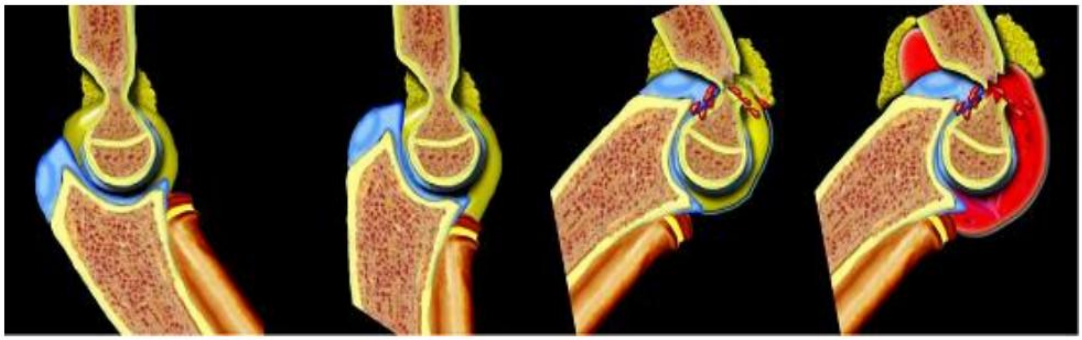


Figure (1.4): Mechanism of injury.

3- Classification of supracondylar humeral fracture

3-1-Extension type: More than 90% of supracondylar fractures occur in extension. These are classified according to the Gartland classification (Figure 1.5) [5]

type I :fractures are non-displaced,

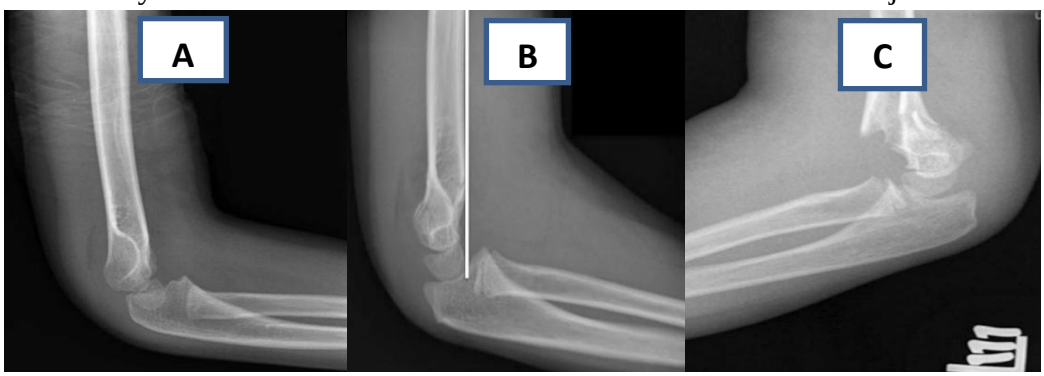
type II: fractures have an intact posterior hinge

– IIA: a less severe injury with the distal fragment merely angulated– IIB: a severe injury; the fragment is both angulated and malrotated

type III: fractures have complete displacement.

type IV: injury has been described in which there is complete loss of the anterior and posterior periosteal hinge, making it unstable in both flexion and extension [6].

3-2-Flexion type: Less than 10% of supracondylar fractures are of the flexion type or are complex intracondylar fractures. There is no formal classification for these injuries [5].



Web of Medicine: Journal of Medicine, Practice and Nursing
webofjournals.com/index.php/5

Figure (1.5): Gartland's classification, (A) type I, (B) type IIA, (C) type IIB, (D) type III, and (E) flexion type.

4-Diagnosis

A full patient history including the location of the pain, if he heard a cracking noise, and if he is able to move the limb by himself. Also in history we asking for previous diseases, if the child is taking any medications, the time of his last meal, the time of the fall/trauma, the mechanism, if there has been any loss of consciousness [4].

Then a full physical examination should be perform (look for any life threatening conditions), which should start with observation of the child as a whole and then reduce to the lesion and look for localized swelling, ecchymosis, deformity, and other skin wounds or abrasions at the fracture site, signs and symptoms of compartment syndrome [4]. Upon palpation, isolation of the approximate painful area should be made. A neurological exam should eliminate any nerve pathology by testing the sensitivity and the motor activity of the hand [4] The palpation of all the pulses, bilaterally, to evaluate their symmetry should be done, specifically the radial pulse and brachial pulse, in order to look for a possible vascular impairment [4].Diagnosis of any fracture should be made through clinical findings and a radiography evaluation is necessary in order to confirm it [4]

5-Radiological finding:

The radiographic study of the injured limb should include proper imaging including anteroposterior (AP) and a lateral view of the elbow and any other sites of deformity, pain, or tenderness. On the AP view, Baumann's angle (Figure 1.6) is commonly used to evaluate fractures as it maintains an estimation of the carrying angle (the varus or valgus attitude of the distal humerus and elbow). This angle is created by the intersection of a line drawn down the axis of the humeral shaft and a line drawn along the growth plate of lateral condyle of the elbow (normally should be less than 80 degree). Varus deviation in relation to the proximal humerus produces an increase in Baumann's angle. Radiographs of the contralateral elbow should be used for comparison, if needed, as Baumann's angle varies among all individuals [7].

Web of Medicine: Journal of Medicine, Practice and Nursing
webofjournals.com/index.php/5

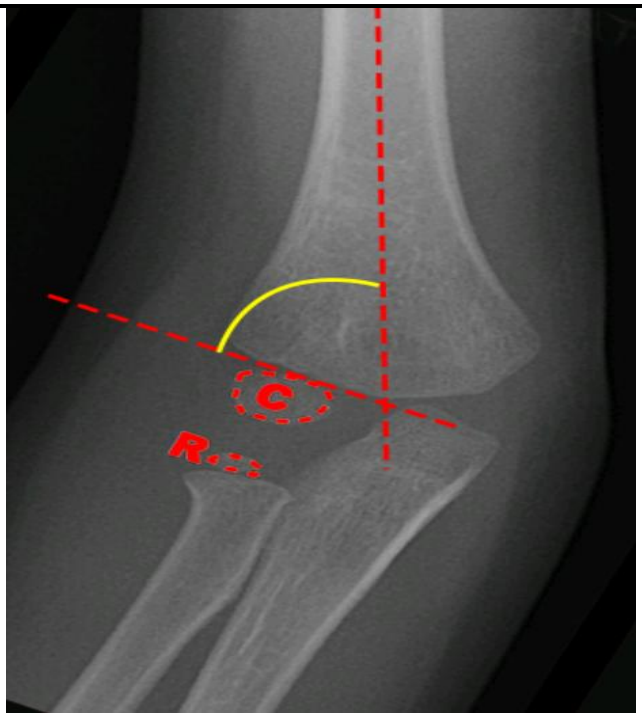


Figure (1.6): X-ray (AP view), Baumann's angle

On the lateral view, the relationship between the anterior humeral line (a line drawn along the anterior aspect of the humerus) and the ossification center of the capitellum should be examined (Figure 1.7). In a normal elbow this line should pass through the capitellum. Additionally, on lateral view one may visualize a posterior ‘‘fat pad’’ sign which indicates an intraarticular effusion [7].

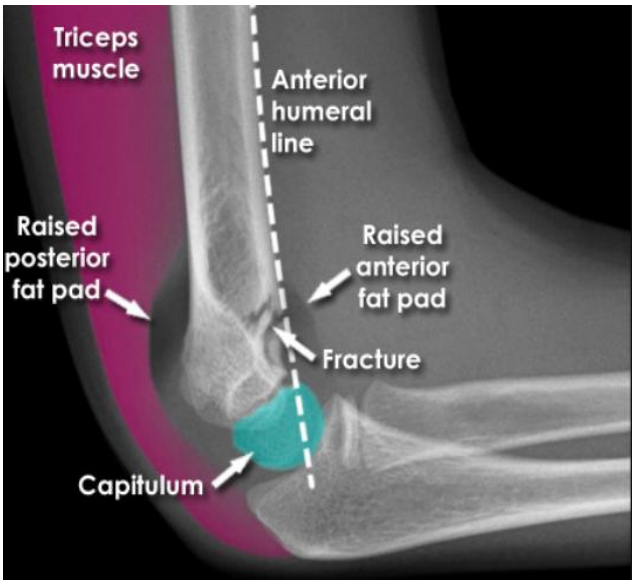


Figure (1.7): X-ray (lateral view),Anterior humeral line and fat pad sign.

6-**Treatment**

Treatment of supracondylar humeral fractures is based on the Gartland type. Type I fractures are treated with long arm cast immobilization for 3 weeks followed by a brief period of protected

activity. Patients with the presence of a posterior fat pad on radiographs should be presumed to have a type I fracture and treated in this fashion [6].

Treatment of type II injuries is somewhat controversial, type IIA fractures being stable and type IIB fractures having some degree of rotation or translation making them unstable. Closed reduction and casting can be used in patients with type IIA injuries. Closed reduction and percutaneous pinning typically with two or three lateral or medial pins has become the main form of treatment for type IIB injuries and for those in which the stability is in doubt [6].

Type III fractures are treated with closed reduction and pinning , sometimes treated by open reduction and pinning. The indications for open reduction, which occurs approximately 10% of the time, include irreducible fractures, open fractures, and those with suspected or confirmed neurovascular injuries [6].

7-Complications

7-1-1-Vascular injury: The brachial artery is the most vulnerable area in a SCHF patient. Forearm edema and developing compartment syndrome are more typical complications of the injury. When there is excessive discomfort along with one positive symptom, such as pain when passively extending the fingers, a tight and sensitive forearm, no pulse, a dulling sensation, or diminished capillary return when squeezing the pulp of the finger, immediate intervention is required. 2. Nerve damage (7-1-2): Ullar, radial, or median nerve injuries are possible, with a focus on the anterior interosseous branch. When a nerve that was previously recorded as intact is discovered to be impaired following manipulation, it raises concerns about potential entrapment in the fracture and necessitates prompt examination. 2. Inadequate pin placement might cause injury to the ulnar nerve. Before inserting the smooth K-wire, it is best to do a mini-open approach on the elbow's medial side to locate the nerve. 2. 7-2 is late.

Malunion frequency is 7-2-1. Elbow deformities caused by backward or sideways shifts are typically not noticeable since they are corrected gradually by modeling during growth. Although limited flexion or extension may result from forward or backward angulation, the impairment is minimal2. Varus (or, less commonly, valgus) elbow deformity, which is permanent and does not improve with growth, can result from untreated sideways angulation and rotation, which are far more essential. Both cubitus varus and cubitus valgus can lead to disfiguring cubitus and late ulnar nerve palsy, respectively. Once a kid reaches skeletal maturity, a supracondylar osteotomy may be necessary to rectify a severe abnormality.

2. 7-2-2-Heterotopic ossification and elbow stiffness: Elbow injuries always carry the risk of stiffness. The patient and their parents should be informed that it may take months for their extension to return, and that while some loss of extension is usual, it is unlikely to impact their ability to function. It is recommended to refrain from passively stretching the elbow since it can lead to increased stiffness and the extremely rare complication of heterotopic ossification. 2.

MATERIALS AND METHODS

This is a prospective study (observational – case series study) carried in Sulaymaniyah at emergency hospital and Shar hospital from the first of August 2018 to the 31st of January 2019.

Web of Medicine: Journal of Medicine, Practice and Nursing
webofjournals.com/index.php/5

A total number of 32 patient presented with SCHF of both sex , aged (2 -13) years. Follow up was lose for four patients and the study continued with complete follow up for 28 patients. Detailed history was taken from the family and sometimes from the patient, then full examination and plain radiography. An above elbow back-slab was applied for all patient to immobilize without compromising vascularity and limb was elevated to reduce oedema.

All patients whom need operation received intravenous antibiotic as preoperative prophylaxis and Acetaminophen bottle 10mg/kg infusion as analgesia, and send for routinely laboratory investigations (complete blood count, viral screen, renal function test, and random blood sugar).

1-Inclusion criteria:

Aged between (2 – 13) years -
Both sex -
Closed fracture -
Unilateral fracture -
Associated neurovascular injury -

2-Exlusion criteria:

Age below 2 years and above 13 years -
Bilateral fractures -
Fracture with elbow dislocation -
Open fracture -
Pathological fracture -

3-Treatment techniques:

Patients with Gartland type I treated by above elbow back-slab (extended from just below axilla and behind the elbow to the metacarpal shaft with the forearm in pronation and elbow flexed in 90 degree) for 3-4 weeks

3-1-Manipulation

Manipulation was done under general anesthesia for Gartland type II and III. The child is placed supine with an arm table. Ensure adequate AP and lateral images can be obtained by C-arm without the arm being moved. An upper arm tourniquet is applied but not inflated unless converting to open reduction (Figure 2.1):

1. Traction: With an assistant securing the proximal humerus, gentle but steady and continuous traction was applied to the extended arm for 2 minutes. An AP view with the image intensifier at this point will show restoration of length and demonstrate any medial, lateral or rotational displacement of the distal fragment.
2. Medial/lateral correction: Medial or lateral translational displacement seen on the AP view now be addressed with direct manipulation while maintaining longitudinal traction.
3. Reduction of the extension: Wrist of the patient kept in one hand while placing other hand around the patient's elbow with the thumb on the olecranon. The patient's elbow is then flexed gently while the thumb maintains pressure on the olecranon. The elbow then flexed to 100°. If it does not, this may indicate entrapment of tissues within the fracture. In this situation, the arm brought back out into extension and the antecubital fossa re-inspected. If there is puckering, or a bone spike is palpable under the skin, an attempt made to 'milk' this gently to free up the soft tissues before repeating the reduction process from step 1. A lateral view is achieved by rotating

Web of Medicine: Journal of Medicine, Practice and Nursing
webofjournals.com/index.php/5

the image intensifier (not the limb) through 90°. If this is unsatisfactory, then return to step 1. After that applying an above elbow back-slab (in the same way for treatment of type I) and when swelling subsided change to a full P.O.P cast for (3 - 4 weeks).

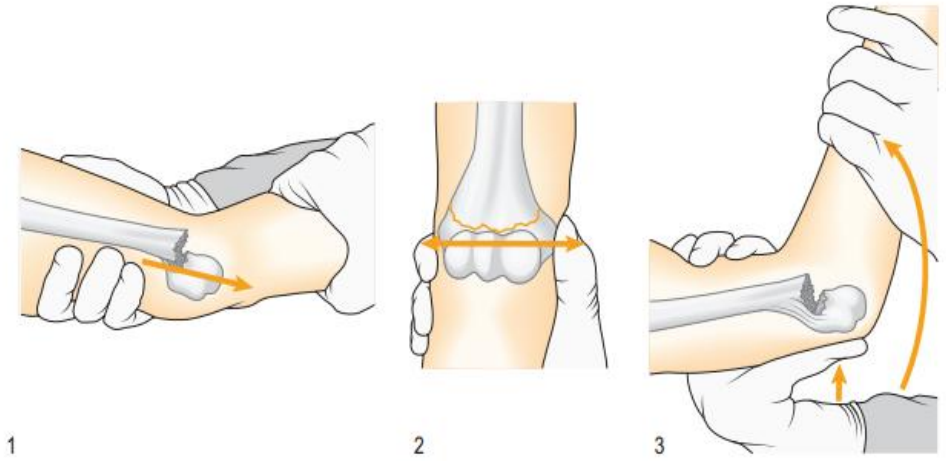


Figure (2.1): Closed reduction of an extension-type supracondylar fracture.

3-2-Pinning:

Pinning following reduction is performed for Gartland type IIB and III with the elbow supported in flexion. The fracture is held with two crossed medial and lateral k-wires, or with two or three laterally based wires. The stability is increased by maximal separation of the pin at the fracture site and also where they cross the fracture site (Figure 2.2) .

• Lateral wires were passed percutaneously through a stab incision to avoid dragging epithelial tissue into the wire tract.

• Medial wire was placed via an open approach to avoid iatrogenic injury to the ulnar nerve. This is performed using an incision that is adequate for visualizing the medial epicondyle to ensure that the k-wire is placed directly on to bone. Soft tissue retraction must be used to prevent the rotating wire from wrapping adjacent structures around the wire and thus causing tension or entrapment of the ulnar nerve. All wires were passed at low revolutions to reduce the risk of thermal damage.

Once wires are seated, the fracture was stressed gently in sagittal and coronal planes to check stability. If the fracture remains unstable, a third wire was passed and/ or the other wires repositioned. Post procedure, an above elbow back-slab was applied with the arm in 90° of flexion, ensuring that good circulation in the fingers is maintained.

Web of Medicine: Journal of Medicine, Practice and Nursing
webofjournals.com/index.php/5

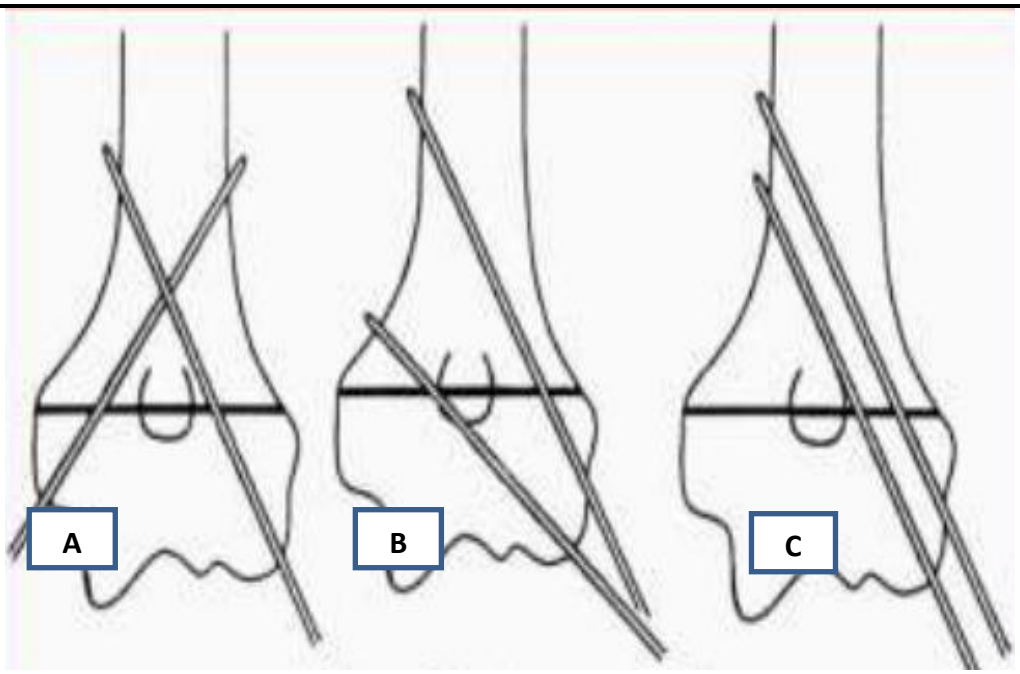


Figure (2.2): (A) cross K-wires, (B) lateral divergent K-wires, (C) lateral parallel K-wires

3-3-Open reduction

Open reduction technique We placed the patient under general anesthesia and positioned them on their side. We then dangled the afflicted limb over the sandbag with the elbow bent. We applied a tourniquet after raising the limb for five minutes. Figure 2.3 shows the results of using Campbell's posterior technique. The first step involved locating and safeguarding the ulnar nerve. Following that, extensor triceps The ends of the fracture were detected and reduced under vision using an aponeurosis tongue flap and triceps splitting procedure. The lateral K-wire always engages the medial cortex proximally after being introduced from the lateral epicondyle and crosses the physis. To avoid injuring the ulnar nerve or engaging the opposite cortex, a medial pin was placed through the medial epicondyle. We bent and severed wires. We released the tourniquet, layered the wound closure, and, if necessary, kept the suction drain in place. We applied the slab with the elbow bent backwards. The X-ray was examined, and the degree of reduction was determined using Baumann's angle.

Web of Medicine: Journal of Medicine, Practice and Nursing
webofjournals.com/index.php/5

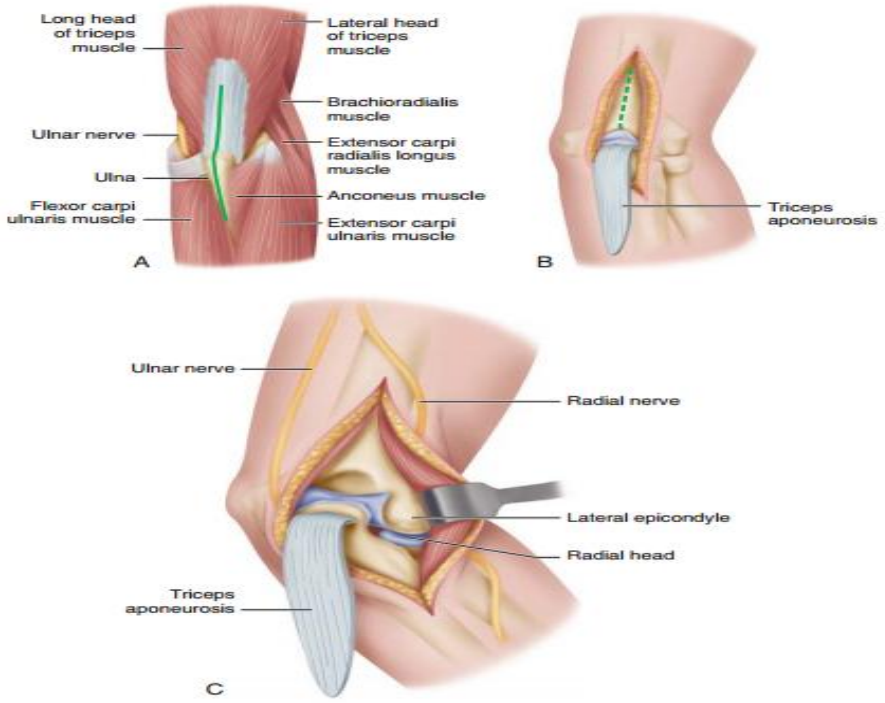


Figure (2.3): Posterior approach to the elbow

4-Follow up

All patients were admitted to the hospital for observation and discharged as per the agreement. On day zero, one week, three to four weeks, six weeks, and three months later, all patients underwent clinical examinations and X-rays as part of their follow-up. We removed the cast for kinds I and IIA after three to four weeks. For types IIB and III, the K-wires were removed with the back-slab after four, five, or six weeks, depending on the signs of union. Passive mobilization and massaging were discouraged by patients and their relatives. According to Flynn's criteria 8, the range of motion and carrying angle of the elbow were recorded during the follow-up appointment

. 5-Analytical statistics We used Microsoft Excel 2010 and computerized statistical software (SPSS) version 25 to input data for all patients. The p-value for all statistical analyses was set at less than 0.05 using the Chi-square test.

RESULTS

Out of 32 children presented with SCHF, 28 (87.5%) complete there follow up over three months and 4 (12.5%) lost after one week of follow up (all are type I).

From the 28 patients (which involved in the study), 17 (60.7%) were males and 11 (39.3%) were females. Elbow in the left side was involved in 15 (53.6%) and the right side involved in 13 (46.4%). The dominant side in 13 (46.4%) and non-dominant side in 15 (53.6%). Age range from two to thirteen years (Mean ± SD = 6.4 ± 3.1) with maximum patients received between 5-7 years 11 (39.3%) followed by 2-4 years 9 (32.1%) then 8-10 years 5 (17.9%) and 11-13 years 3 (10.7%).

According to the mechanism of injury ,22 (78.6%) were caused by full on outstretched hand and the rest 6 (21.4%) were caused by direct trauma.

The fracture was classified according to Gartland's classification, were 8 (28.6%) patients of type I, 4 (14.3%) patients of type IIA, 4 (14.3%) patients of type IIB, and 12 (42.8%) patients of type III, no patients with type IV or flexion type.

Eight patients (28.6%) were treated with back-slab, 4 (14.3%) patients need MUA and back-slab, 11 (39.3%) treated with percutaneous K-wire fixation, and 5 (17.8%) patients treated with open reduction and K-wire fixation. From the 16 (57.1%) patients treated with K-wire fixation, 8 (50%) with lateral type of fixation and the other halve with cross type of fixation. And two pins used in 13 (81.25%) while 3 pins used in 3 (18.7%).

The K-wire was removed after four weeks in 9 (56.25%) patients, five weeks in 5 (31.25%) patients and after six weeks in 2 (12.5%) patients.

Surgical fixation was indicated for neurovascular compression in 7 (43.75%) patients , unstable fracture in 6 (37.5%) patients and unreduceable fracture in 3 (18.75%) patients.

Twenty patient were taken to operation (71.4%), 15 of them (75%) within 12 hours, 5 (25%) more than 12 hours. Preoperatively there was no complications except one patient (3.6%) with radial nerve palsy (observed until full recovery within three months) .After one week follow up there was no complications and after 3-4 weeks there was one patient (3.6%) with pin tract infection (treated by daily dressing and oral antibiotic).

According to Flynn's criteria, cosmetically 20 (71.4%) have excellent outcome and 8 (28.6%) have good outcome. Were for function, 15 (53.6%) have excellent outcome, 10 (35.7%) have good outcome and 3 (10.7%) have fair outcome Figure (3.1).

Figure (3.1): Outcome according to Flynn's criteria

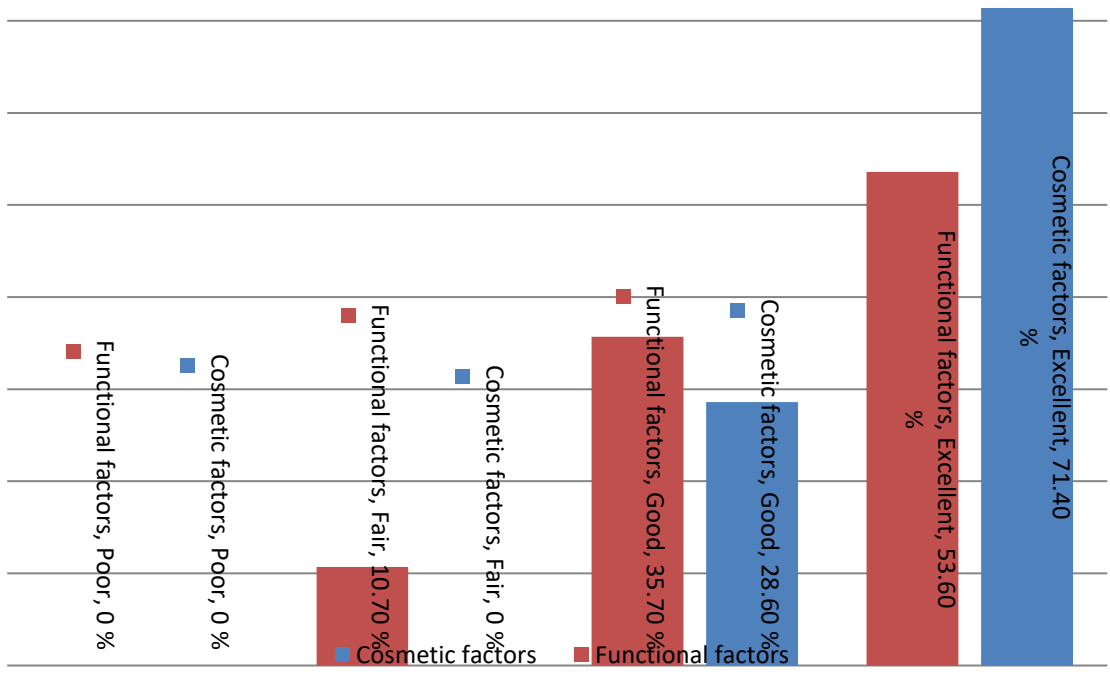


Table (3.1): Outcome according to gender

Gender	Total cases	Cosmetic factor		Functional factor		
		Excellent	Good	Excellent	Good	Fair
Male	17	12 (70.6 %)	5 (29.4 %)	10 (58.8 %)	5 (29.4 %)	2 (11.8%)
Female	11	8 (72.7 %)	3 (27.3 %)	5 (45.45%)	5 (45.45%)	1 (9.1%)

In the study the cosmetic outcome in both sex is nearly equal (P value = 0.28 / not significant) ,out of 17 male (70.6 %) have excellent outcome and (29.4 %) have good outcome and out of 11 female (72.7 %) (27.3 %) have excellent and good outcome respectively.
while functionally the outcome in males is slightly better than females, as shown in table (3.1), in males; excellent(58.8 %) good(29.4 %) fair (11.8 %), and in females; excellent (45.45 %) good (45.45 %) fair (9.1 %)

Table (3.2): Outcome according to the age group

Age group	Total cases	Cosmetic factor		Functional factor		
		Excellent	Good	Excellent	Good	Fair
2 - 4 years	9	7 (77.8%)	2 (22.2%)	4 (44.4%)	5 (55.6%)	0
5 – 7 years	11	8 (72.7%)	3 (27.3%)	6 (54.5%)	3 (27.3%)	2 (18.2%)
8 – 10 years	5	2 (40%)	3 (60%)	2 (40 %)	2 (40%)	1 (20 %)
11 – 13 years	3	3 (100%)	0	3 (100%)	0	0

From table (3.2) seen that the better outcome is in the age group (11 – 13 years) with (100 %) of both cosmetic and functional factors. Followed by the age group (2 – 4 years) then (5 – 7 years) and finally (8 – 10 years). The P value in this distribution is (0.32) which not significant.

Web of Medicine: Journal of Medicine, Practice and Nursing
webofjournals.com/index.php/5

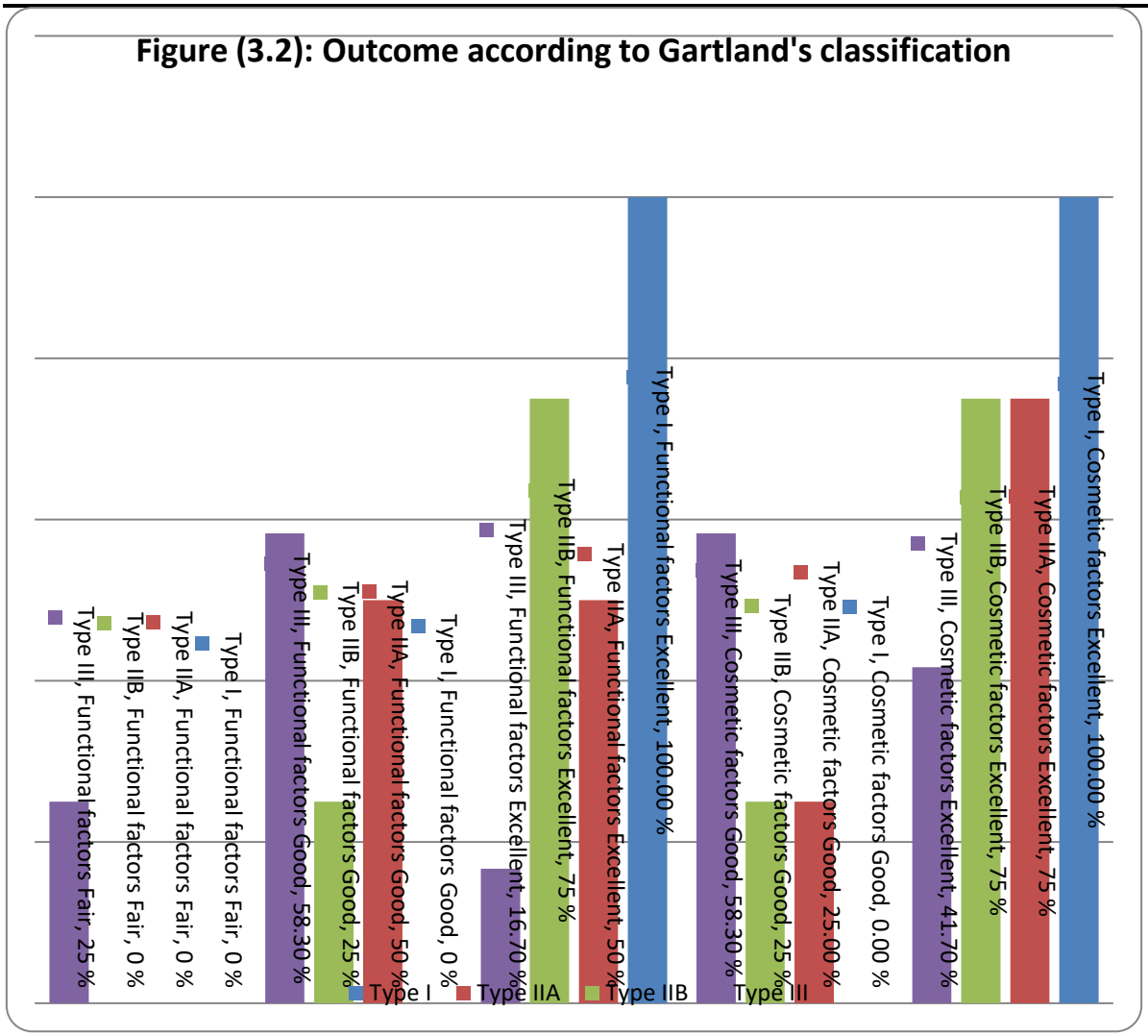


Figure (3.2): Outcome according to Gartland's classification

For Gartland's classification Figure (3.2) the P value (= 0.02 / highly significant). In type I the outcome is (100%) cosmetically and functionally, while types IIA and IIB have the same cosmetic outcome and functionally type IIB have better outcome than type IIA. Type III have good outcome better than excellent both cosmetically and functionally.

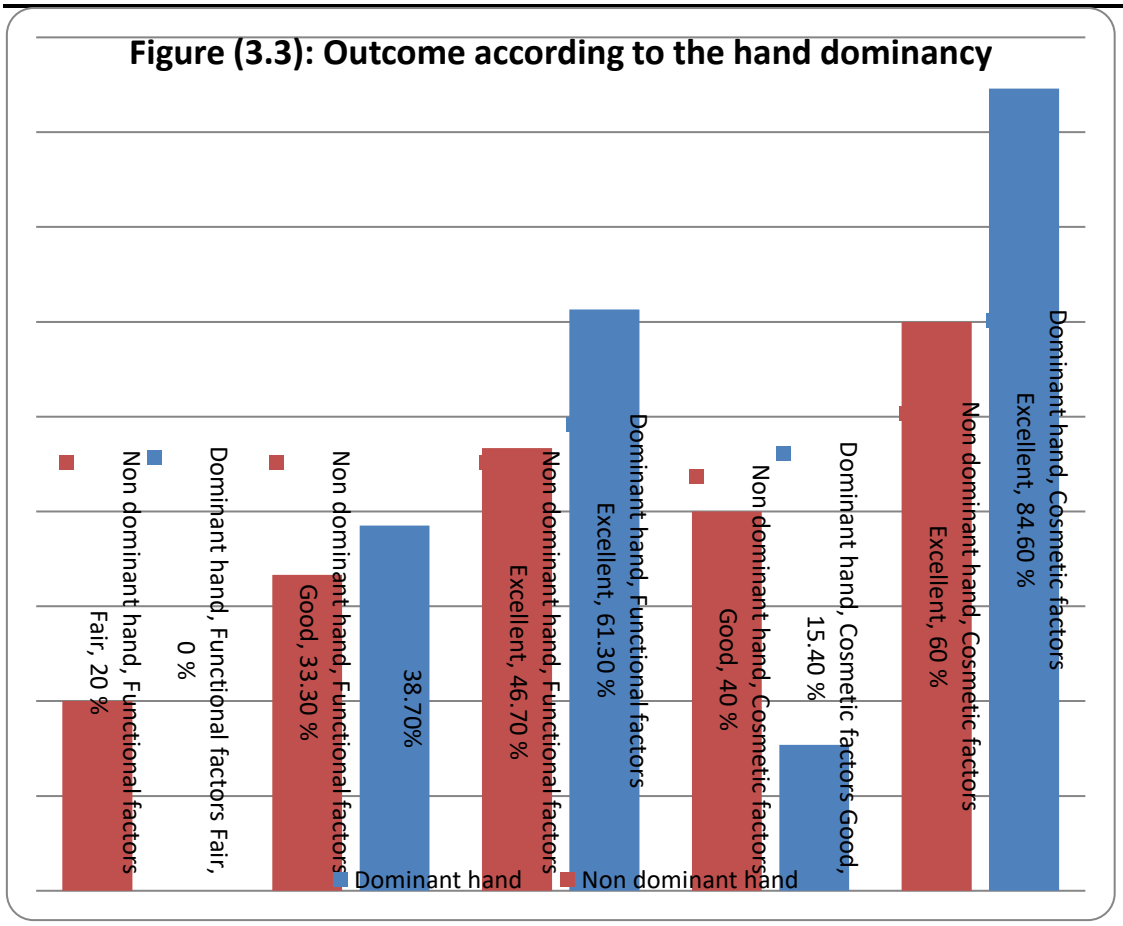


Figure (3.3) shows that outcome of the dominant hand is excellent more than good (whatever the dominant hand be right or left), and for non-dominant hand the outcome is good more than excellent. The P value in the association (= 0.2) which mean not significant association

Table (3.3): Association of the fracture type and vascular injury

Classification	Total cases	Capillary refilling		Distal pulses		
		< 2 sec.	>2 sec.	Good	Weak	Absent
Type I	8	8 (100 %)	0	8 (100 %)	0	0
Type IIA	4	4 (100 %)	0	4 (100 %)	0	0
Type IIB	4	3 (75 %)	1 (25 %)	4 (100 %)	0	0
Type III	12	8 (66.7 %)	4 (33.3 %)	6 (50 %)	5 (41.7%)	1 (8.3 %)

A significant P value (0.04) indicate that there was a good association between severity of fracture and vascular embarrassment as shown by table (3.3). Types I and IIA are not associated

Web of Medicine: Journal of Medicine, Practice and Nursing
webofjournals.com/index.php/5

with any vascular embarrassment (no changes in capillary refilling or distal pulse volume). But in type IIB , 1 (25 %) have increase in capillary refilling time and in type III have 4 (33.3 %) with the same changes, while 5 (41.7 %) have weak distal pulse and 1 (8.3 %) have absent distal pulse.

All the patient's vascular embarrassment return to normal after manipulation.

Table (3.4): Outcome according to the delay of surgery

Time of surgery	Total cases	Cosmetic factor		Functional factor		
		Excellent	Good	Excellent	Good	Fair
Less than 12 hours	15	9 (60 %)	6 (40 %)	6 (40 %)	7 (46.7%)	2 (13.3%)
More than 12 hours	5	3 (60 %)	2 (40 %)	2 (40 %)	2 (40 %)	1 (20 %)

The study show as in table (3.4) that there is no difference in the cosmetic outcome in relation to delay the surgery time, while there is a little difference of no significance in the functional outcome (P value = 0.2).

Table (3.5): Outcome according to the type of surgery (open or closed)

Type of surgery	Total cases	Cosmetic factor		Functional factor		
		Excellent	Good	Excellent	Good	Fair
Closed	11	6 (54.5 %)	5 (45.5 %)	3 (27.3 %)	5 (45.4%)	3 (27.3%)
Open	5	2 (40 %)	3 (60 %)	2 (40 %)	3 (60 %)	0

Patients who treated by close reduction and K-wire fixation have best cosmetic outcome (P value = 0.013), while those who treated by open reduction and K-wire fixation have best functional outcome (P value = 0.03) as shown in Table (3.5)

Web of Medicine: Journal of Medicine, Practice and Nursing
webofjournals.com/index.php/5

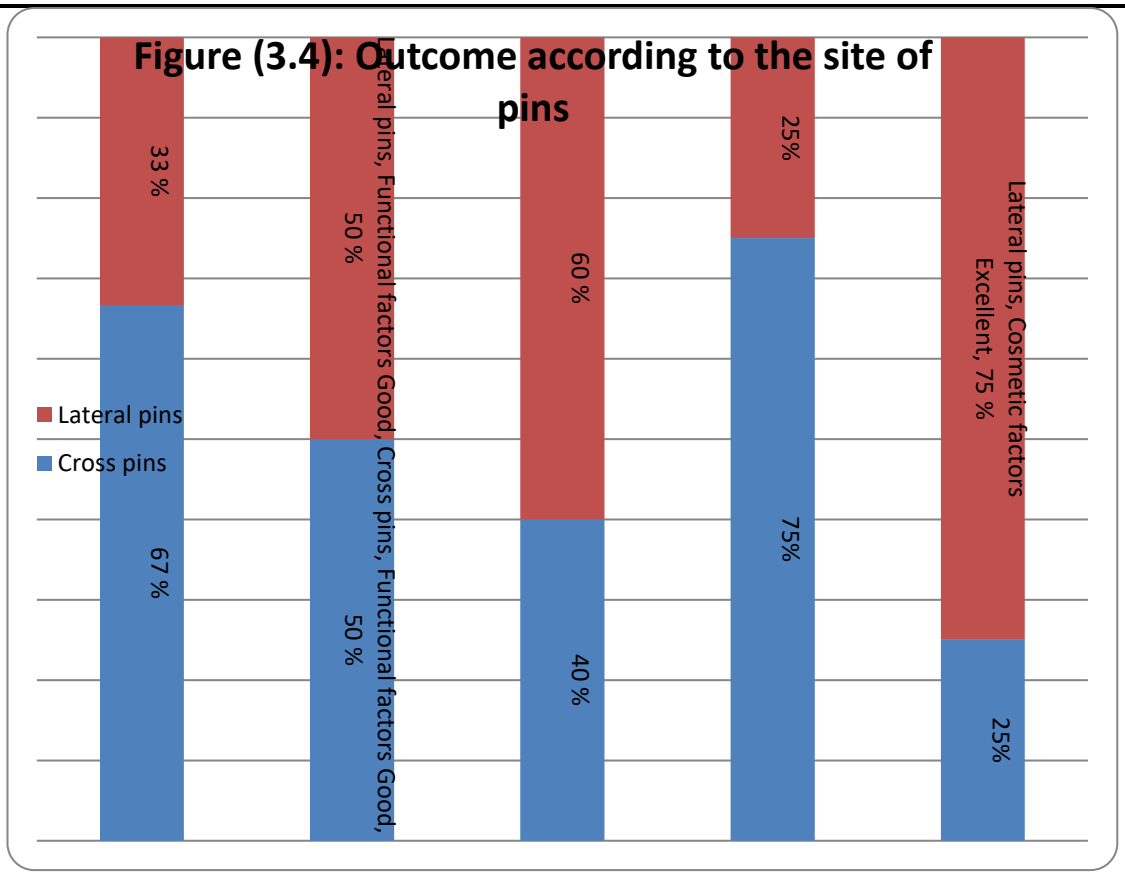


Figure (3.4) clearly shows that the lateral pins site have better outcome (functionally and cosmetically) than the cross pins (P value = 0.05)

Table (3.6): Outcome according to the time of K-wire removal.

Time of K-wire removal	Total cases	Cosmetic factor		Functional factor		
		Excellent	Good	Excellent	Good	Fair
4th week	9	7 (77.8%)	2 (22.2%)	5 (55.6%)	3 (33.3%)	1 (11.1%)
5th week	5	1 (20%)	4 (80%)	0	4 (80%)	1 (20%)
6th week	2	0	2 (100%)	0	1 (50%)	1 (50%)

The study observed that patient with early removal of K-wires (4th week) have better outcome than those with delay of K-wire removal to the 5th week , which already better than those at 6th week (P value = 0.025) which is highly significant.

DISCUSSION

Supracondylar fractures of humerus is a common fractures seen in children. The important goals of the treatment are full recovery of elbow function, achieving normal cosmetic view of elbow, protecting the patient from neurovascular complications that may occur [9].

Supracondylar fractures of humerus are common in boys compared to girls. In our series, (60.7 %) were boys and (39.3 %) were girls. These results are consistent with other literatures (Charlotte J,

Web of Medicine: Journal of Medicine, Practice and Nursing
webofjournals.com/index.php/5

Fredrik M, Nilesh J) [4,7,9]. The mean age is (6.4) years with the peak incidence between age (5 – 7) years (Rajmohan G, Biruk et al, Faseeh S) [10,11,12].

In our study, the fractures are common on left side (53.6 %) than the right side (46.4 %) as observed, these results were also more common in previous studies (Nilesh J, Birak et al, Faseeh S) [9,11,12], and the non-dominant side affected in (53.6 %) (Rajmohan G, Rashid et al) [10,13] . The left limb was reported to be non-dominant in (90 %) of worldwide population and self-protection, when injury occurs, is limited which leads the left limb to be dominantly injured (Bayisenga et al) [14].

Full on the outstretched hand is the commonest cause (78.6 %), this result was consistent with the previous studies (Nilesh J, Rashid et al, Vineet et al) [9,13,15]

Regarding distribution of patient according to Gartland's classification were near other articles (Saad S, Justin et al) [16,17], the highest incidence with type III then followed by type I , IIA and IIB respectively.

According to Flynn's criteria, most of the patient have excellent cosmetic and functional outcome and no patient have poor results, these results were shown by many other studies (Rajmohan G, Vito et al, Vibhute et al, Muzahim et al) [10,18,19,20].

There is no other studied shows the relation between gender and the outcome, we found that there was no difference between boys and girls in cosmetic outcome and there was better outcome in boys according to functional factors.

In our study we found that the best outcome in relation to age group was between (11 – 13 years) and that was different from what found by Rajmohan G.A.[10] which found the best result was between (3 – 5 years).

The outcome of SCHF in relation to Gartland's classification as shown in Figure (3.2), there was strong relation as the outcome decrease with increase in the fracture severity, this is the same result found by Saad s. AL-Nasir [16]. While Justin E et al [17] find that there is no difference in outcome in relation to fracture severity.

The dominant hand have better outcome than non-dominant hand that may be related to the use of the dominant hand by playing after removal of cast. There is no study focused on this point.

Vascular embarrassment is associated with SCHF type IIB and III, this result similar to that shown by Vineet et al [15], which find that involvement of brachial artery is most commonly associated with type II and III SCHF.

There is no difference in the outcome between early (less than 12 hours) or delay (more than 12 hours) operation time, this result was identical to other studies (Fredrik M, Bayisenge et al, Vibhute et al, Gabrielle et al) [6,14,19,21].

Close reduction and percutaneous K-wire fixation is the preferred treatment of most displaced SCHF, this result was find by Vibhute N. et al [19], Mozahem A. et al [20]and Andrew H. et al [22] have some differences from our result which find that the cosmetic outcome in percutaneous pinning was better than open reduction, while the functional outcome was better with open reduction and this was the same result that found by Nilesh J. et al [9].

We found that the lateral pinning have better outcome than cross pinning, and this result was supported by other studies (Rajesh et al, Vito et al) [23,19]. But Andrew H. et al[22] find that there is no statistical significant difference between lateral and medial pins. While Mushtaq T. [24] find that

Web of Medicine: Journal of Medicine, Practice and Nursing
webofjournals.com/index.php/5

cross pinning is the treatment of choice for SCHF with extra precautions during medial wire insertion.

Early removal of pins (within 4 weeks) have better outcome, and this was the same result found by Andrew H. et al [22].

Limitations of this study:

It is not a comparative study. .1

Small population data. .2

Short period of follow up. .3

CONCLUSIONS

The incidence of SCHF is higher in boys, and most common age group affected is (5 – 7 years). -1

Left side injury is more common than right side, and the non-dominant side is more commonly injured. -2

Conservative management for types I and IIA have excellent outcome, while anatomical reduction and K-wire fixation is the golden management for types IIB and III. -3

The severity of fracture have a negative effect on the SCHF outcome. -4

The results obtained in this study shows that lateral K-wire fixation have a better outcome than cross K-wire fixation. -5

Cosmetically the close reduction and percutaneous pinning have excellent outcome , while open reduction and K-wire fixation have excellent functional outcome. -6

Early removal of K-wires (within 4 weeks) have a better outcome. -7

RECOMMENDATIONS

1. Good clinical and radiological evaluation of SCHF because it guide the line of treatment.
2. We recommend for removal of K-wires within (3 – 4 weeks) for better outcome.
3. For safety and excellent outcome, we recommend to use two lateral pins for fixation.
4. We suggest for more studies to predict the outcome in relation to various methods of surgical treatment.
5. Excellent experience in maneuvers of manipulation and good facilities helping in reduce for need to open reduction.

REFERENCES

1. Joshua M, Martin J, Scott K , 2018, Pediatric elbow fracture, 1st ed, Springer International Publishing, page 38 – 61.
2. Ashley B, David W, Michael R, 2018, Apley and Solomon's system of orthopaedics and trauma, 10th ed, CRC press Tylor and Francis group, page 781 – 784.
3. Lawerence E, 2019, Snell's clinical anatomy by regions, 10th ed, Wolters Klumer, page 272 – 274.
4. Charlotte J, 2014, supracondylar humeral fracture in the pediatreic population: role of the physiotherapy, University of Zagreb.
5. Timothy O, Samuel P, Alasdair J, 2016, McRae's orthopaedic trauma and emergency fracture management, 3rd ed, Elsevier, page 569 – 575.

Web of Medicine: Journal of Medicine, Practice and Nursing
webofjournals.com/index.php/5

.6 Frederick M, James H, Terry S, 2017, Campbell's operative orthopaedics, 13th ed, Elsevier, page 1433 – 1440.

.7 Jacob W, Seth D, 2008, pediatric supracondylar fracture of the distal humerus, Curr Rev Musculoskeletal Med, vol. 1, page 190 – 196.

.8 Umile G, Francesco F, Mattia L, Nicola M, Vincenzo D, 2008, Rating system for evaluating of the elbow, British Medical Bulletin, vol. 87, page 131 – 161.

.9 Nilesh J, Abhijit B, Binoti A, Ashok K, 2016, Comparative analysis of surgical outcome of treatment of supracondylar fractures Gartland type III by using close reduction and K-wire fixation versus open reduction and K-wire fixation method, International Journal of Research of Orthpaedics, vol. 2, page 271 – 277.

.10 Rajmohan G, 2008, management of Gartland type III supracondylar fracture of humerus in children by open reduction and internal fixation using cross K-wires : a short term follow up study, the Tamilnadu University.

.11 Biruk L, Admassie D, Banchiamlak A, 2008, fractures around child's elbow – radiological patterns, east and central African journal of surgery, vol. 13, page 23 – 28.

.12 Faseeh S, Shahabuddin D, 2015, supracondylar humeral fracture in children: management by percutaneous lateral – entry pin fixation, jornal of postgraduate medical institute, vol. 28, page 103 – 106.

.13 Rashid A, Vivek S, Ramesh J, Tarun P, Narender R, 2017, epidemiologic pattern of pediatric supracondylar fracture of humerus in a teaching hospital of rural India: a prospective study of 263 cases, Chinese journal of traumatology, vol. 20, page 158 – 160.

.14 Bayisenga J, Ssebuufu R, Mugenzi D, 2013, early outcomeof delay management of supracondylar humeral fracture in children in Rwanda, east and central African journal of surgery, vol. 18, page 94 – 102.

.15 Vineet K, Ajai S, 2016, fracture supracondylar humerus : a review, journal of clinical and diagnostic research, vol. 10, page 47 – 52.

.16 Saad S, 2015, supracondylar fracture of humerus in children a follow up study of sixty eight cases, Karbala J. Med, vol. 2, page 2191 – 2196.

.17 Justin E, Christine H, Robert L, 2017, fracture classification does not predict functional outcome in supracondylar humeral fracture : a prospective study, journal of pediatric orthopaedics, vol. 37, page 233 – 237.

.18 VitoP, Maria R, Gianluca T, Sergio A, 2016, surgical treatment of displaced supracondylar pediatric humeral fractures: comparison of two pinning technique, journal of functional morphology and kinesiology, vol. 1, page 39 – 47.

.19 Vibhute N, Roney T, Tony K, 2017, a clinical study of functional outcome after management of supracondylar fracture humerus in a child, journal of medical thesis, vol. 5, page 27- 31.

.20 Muzahim A, Laith S, Salwan A, 2017, open versus percutaneous cross K-wire fixation for displaced supracondylar fracture of humerus in children, Iraqi medical journal, vol. 63, page 147 – 157.

Web of Medicine: Journal of Medicine, Practice and Nursing
webofjournals.com/index.php/5

Gabrielle M, Kali R, John S, Julius A, 2018, pediatric supracondylar humerus fracture: does after hours treatment influence outcome, journal of orthopaedic trauma, vol. 32, page 215 – 220. .21

Andrew H, et al, 2012, the treatment of pediatric supracondylar humerus fractures, journal of the American Academy of Orthopaedic Surgeon, vol. 20, page 320 – 327. .22

Rajesh G, Ramkumar G,Saravanan K, Fawas T, Rajeev K, 2016, cross pinning versus lateral pinning in type III supracondylar fracture: a retrospective analysis, International Journal of Research in Orthpaedics, vol. 2, page 138 – 142. .23

Mushtaq T, 2016, comparative study between tow patterns of percutaneous K-wire fixation of supracondylar fracture of the humerus in children, Mustansiriya medical journal, vol. 15, page 14 – 19. .24

APPENDICES

Flynn's criteria

Results	Cosmetic factor- loss of carrying angle(degree)	Functional factor-loss of motion (degree)
Excellent	0-5	0-5
Good	6-10	6-10
Fair	11-15	11-15
Poor	>15	>15

Web of Medicine: Journal of Medicine, Practice and Nursing
webofjournals.com/index.php/5

Questionnaire

OUTCOME OF SURGICAL AND CONSERVATIVE MANAGEMENT OF PEDIATRIC SUPRACONDYLAR FRACTUREV OF HUMERUS

Form No.: ( ) , Hospital: S.T.H ☐ Shar ☐

Name: , Age: ,Gender: male ☐ ,female ☐

Mechanism of injury: trauma → direct ☐ , full on outstretched hand ☐
Others ☐

Arm affected: left ☐ , Rt ☐ , dominant hand ☐

Signs:

Peripheral pulse → good volume ☐ , weak ☐ ,absent ☐

Capillary refilling → less than 2 sec. ☐ ,more than 2sec. ☐

Neurological deficit → ulnar ☐ ,radial ☐ ,median ☐

Gartland classification: I ☐ ,IIa ☐ ,IIb ☐ ,III ☐ ,IV ☐

Reduction: no reduction ☐ ,MUA ☐

Holding methods: back slab and cast ☐

Percutaneous pinning → cross ☐ , lateral ☐ , pins No. ☐

ORIF ☐ → pins No. ☐

Post-operative:

Fracture stability: stable ☐ , unstable ☐

Peripheral pulse → good ☐ , weak ☐ ,absent ☐

Capillary refilling → less than 2 sec. ☐ ,more than 2sec. ☐

Neurological deficit → ulnar ☐ ,radial ☐ ,median ☐

Indication of operation:

Unreduceable ☐ , neurovascular compression ☐, unstable ☐

Time of operation:

Within 12 hrs ☐ , More than 12 hrs ☐

Follow up after 1week:

Reduction → stabile ☐ ,unstable ☐

Infection → pin tract ☐ ,wound ☐

Follow up after 3-4 weeks:

Infection → pin tract ☐ ,wound ☐

Deformity → valgus ☐ ,varus ☐

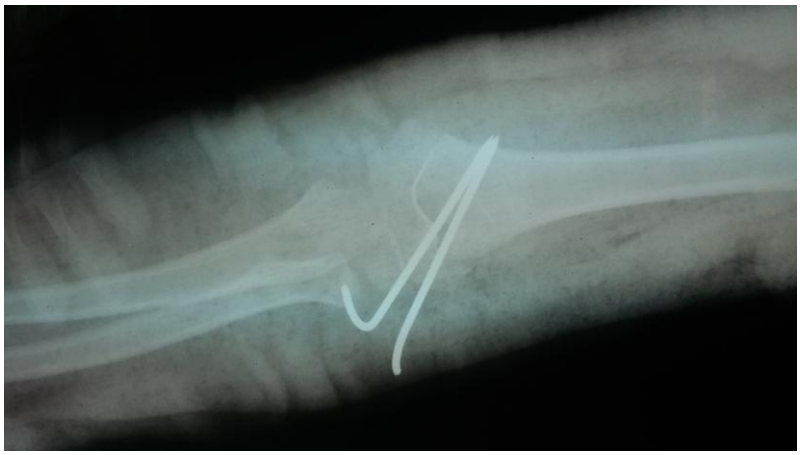
Follow up after 3 months:

Loss of carrying angle ☐ degree, loss of movement ☐ degree

Removal of K-wires: 4th week ☐, 5th week ☐ , 6th week ☐

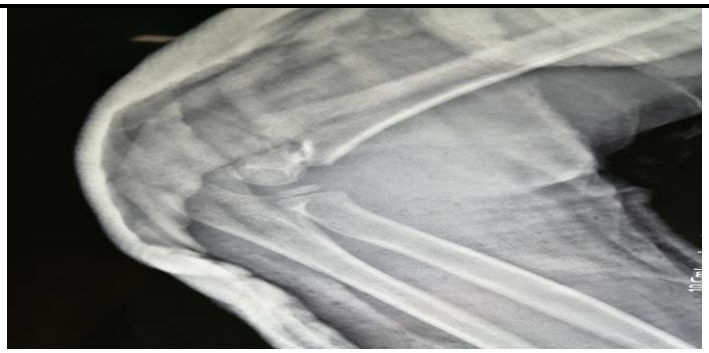
Web of Medicine: Journal of Medicine, Practice and Nursing
webofjournals.com/index.php/5

X- Rays

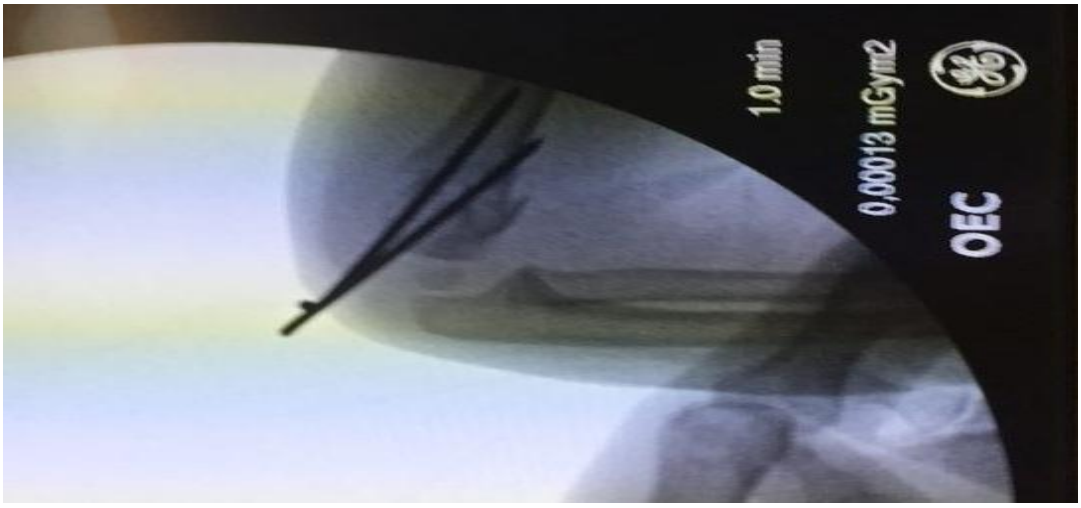


Type III fracture treated by close reduction and percutaneous k-wire fixation

Web of Medicine: Journal of Medicine, Practice and Nursing
webofjournals.com/index.php/5



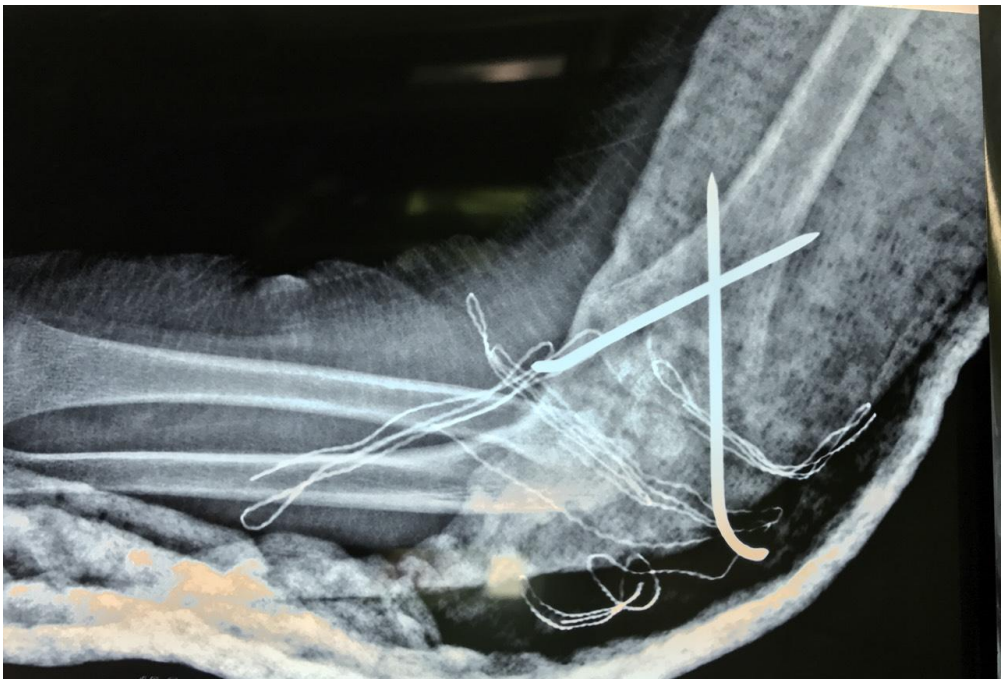
Type I fracture treated by above elbow backslap



Type IIB fracture treated by close reduction and K-wire fixation

Web of Medicine: Journal of Medicine, Practice and Nursing
webofjournals.com/index.php/5

Web of Medicine: Journal of Medicine, Practice and Nursing
webofjournals.com/index.php/5



Web of Medicine: Journal of Medicine, Practice and Nursing
webofjournals.com/index.php/5