

**“EVALUATION AND COMPARISON OF SURGICAL
MANAGEMENT OF DISPLACED SUPRACONDYLAR
FRACTURE OF HUMERUS IN CHILDREN -
CLOSED REDUCTION & PINNING
VERSUS
OPEN REDUCTION & INTERNAL FIXATION”**



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M. Ch (Orthopaedic Surgery)**

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DISSERTATION

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INTRODUCTION

INTRODUCTION

Supracondylar fractures of humerus is the most common elbow injury in children and makes up approximately 60% of all elbow injuries. It becomes progressively more uncommon as the child approaches adolescence the average age group of patients being 7 1/2 years.

Age is a key factor in the incidence of supracondylar (Elison EL. Dressing for S.C. fractures of the humerus. JAMA 1934; 82). Falhey has observed that older children have a greater displacement with their supracondylar fracture. (Falhey JJ. Fracture of elbow in children. American Academy of Orthopaedic Surgeons, Inst Course Lect 1960; 17: 13 - 46). This was also referred in Nenrikson's series of over 800-supracondylar fractures. (Henrickson B. S.C. fractures in children. Acta Chir Scand 1966; 369).

Considering the number of patients injured and the severity of the initial injury that occurs, great deligence is required to secure an excellent result and to avoid or minimise the crippling complications, such as Volkmann's ischaemic contracture, mysositis ossification, stiffness, permanent nerve injuries and malunion.

Injuries of elbow demand respect because for their vascular damage and nerve injury they cause than any other injuries in the body. (Hanlon CR., Ester WL. Fractures in Children: A Statistical Analysis. Am J Surg 1954; 87: 312-23).

Poor bone to bone contact because of low cross sectional area makes correct alignment of these fractures difficult to achieve and impossible to maintain by closed methods. The error of rotational malalignment therefore of ten persists despite prolonged and forceful conservative management.

Closed reduction with the help of image intensifier followed by k wire fixation for type III supracondylar fracture of humerus has given new window of management which is excellent method.

Open reduction of supracondylar fractures, visualisation of the traumatic anatomy, restoration of the pillars and the fossa and maintenance of pillar heights by cross k wire fixation ensure a predictable good cosmetic and a functional result. (Hammond G. The management of S.C. fractures of the humerus in children. *Surgical Clinics of N.A.* 1952; 32(2): 747). (Lars Dineission, Holger Peterson. Open reduction and pin fixation of severely displaced S.C. fractures of the humerus in children. *Acta Orthop Scand* 1980; 54: 249).

AIMS & OBJECTIVES

AIMS

The aim of the study was to compare results of Supracondylar fractures Type III in children treated by 02 methods as follows.

- 1) Closed reduction & pinning with K-wires under Image Intensifier.**
- 2) Open reduction and internal fixation with K-Wires.**

Study was performed in view of

Postoperative a) ROM

b) Carrying Angle

c) Deformities

d) Stiffness and Pain

Basically assessing functional outcome

OBJECTIVES

To study the comparison of Closed Reduction and Pinning versus Open reduction internal fixation of Supracondylar # Humerus Type III in view of

- a) Functional Outcome**
- b) Cosmetic Deformity**
- c) Cost of hospitalization and stay period**
- d) Complications**
- e) Time for surgery**

MATERIALS
&
METHODS

The Study was conducted in Ortho Unit of 02 centers

- a) Rakshak Hospital in Pune, Kharadi, Chandan Nagar (Secondary Trauma Centre)
- b) Rakshak Hospital in Shikrapur, Pune Nagar Highway, Pune. (Primary Trauma Centre – Peripheral Centre)

We selected 20 patients who fitted our criterion for the study. Out of which 10 patient were studied and operated in Rakshak Hospital, Kharadi, Chandan Nagar (Secondary Trauma Centre) Where facility of C-Arm / Image intensifier was available and remaining 10 patients were studied at Rakshak Hospital in Shikrapur, Pune Nagar Highway, Pune. (Primary Trauma Centre – Peripheral Centre) where C-Arm / Image intensifier was NOT available.

Study Place:-

- a) Rakshak Hospital in Pune, Kharadi, Chandan Nagar (Secondary Trauma Centre)
- b) Rakshak Hospital in Shikrapur, Pune Nagar Highway, Pune. (Primary Trauma Centre – Peripheral Centre)

Study Period:-

March 2005 – December 2011

Inclusion Criterion:-

- a) Age : 4 to 13 years
- b) Fracture : Type III Supracondylar fracture Humerus

Exclusion Criterion:-

- a) Age : Less than 4 or more than 13 years.
- b) # Age : Fractures Older than 02 weeks.
- c) Other : Anesthetically unfit patients.
- d) Other : Association with other serious injuries or
Combined medical illness.
- e) Other : Any History of massaging.
- f) Other : Any DNVD.

Preoperative Assessment:-

- Detailed history of mode of injury was obtained from the parents, as well as the patients.
- Out of 20 Cases – 12 due to fall while playing
 - 6 due to fall due to other causes / vehicles
 - 2 due to RTA (Road Traffic Accident)
- All patients presented with pain, swelling, “S” Shaped deformity of lower arm and inability to move the affected elbow.

- **On Examination**

All patients had diffuse swelling all around the elbow and puckering of the skin at the site of fracture. All patients had shortening of the arm as compared to the normal side.

Average period from Injury to presentation was 10 hours.

The Mean age was 7.8 years.

There were 16 boys and 04 girls.

14 patient presented Left. sided # & 06 presented with Right side.

X-Ray

Anteroposterior

(Elbow in full extension and forearm in full supination) and

Lateral View taken

- **Type**

Only cases (20) with Gartland's Grade III type of Supracondylar fracture were included in series. They were further grouped into fracture with

Extension Type

1) Posteromedial	:	06
2) Posterolateral	:	11
3) Posterior displacement	:	02

Flexion Type

1) Anterior displacement	:	01
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PHOTOGRAPHS

“TYPE III SUPRACONDYLAR FRACTURE HUMERUS”



AP VIEW



Lateral view

“TYPE III SUPRACONDYLAR FRACTURE HUMERUS”



Lateral view

- Preoperative Plan

10 cases were operated by the method Closed pinning under General Anesthesia in Secondary trauma centre where image intensifier was available and 10 cases were operated by ORIF open reduction and internal fixation method in primary centre where image intensifier was not available.

- Anesthesia

Type

All Surgeries were done under General Anesthesia

In Closed pinning case

Out of 10 cases : 09 were given short GA and
01 was given GA + Intubation

Time

For Average Time of Surgery and type Anesthesia please refer the chart enclosed

- **Operative Procedure**

1st group

Closed pinning of Grade III Suprcondyular # Humerus

Anesthesia Type : GA

09 case with Short GA

01 case with GA + Intubation

Operative Time:

For Average time for procedure please refer the chart enclosed along with.

Position:

All 10 patients were operated in supine position.

Tourniquet:

No tourniquet was applied in all 10 patients.

Technique:

Under Short GA patient's fracture was reduced closed with guidance of image intensifier with traction in extension followed by flexion with thumb pressure on olecranon of the patient.

Anteroposterio correction was obtained under image intensifier.

Followed by Medio/lateral correction was done.

Followed rotational deformity was waited for.

As the reduction was confirmed in both AP + Lat views then K-Wire of 2.5mm to 3 mm was passed by first passing medial condyle by guarding the ulnar nerve with thumb, palpating medial epicondyle.

Followed by passing K-wire in lateral view under image intensifier guidance. After passing the K-wire position and reduction were rechecked.

2nd K-wire passed from lateral side in the same method.

2 cross K-wires position confirmed in AP and Lat views under Image Intensifiers. Elbow was checked by doing Flexion and Extension.

Radial Artery pulsation checked, carrying angle checked. Followed by - Both the K-wire were cut and tips were buried in the skin. Then Above Elbow slab was given post operatively.

2nd Group

ORIF Open Reduction Internal fixation with 02 K-wires

Anesthesia Type:

All the cases were operated under GA with Intubation

Operative Time:

For Average time for procedure please refer the chart enclosed along with.

Position:

Lateral position was given to all 10 patients and tourniquet was applied. Affected arm was placed on a support along with 90 degree of elbow flexion.

Technique:

Midline posterior incision was performed. It was continued up to 2 cm distal to olecrenon tip. Fascia overlying the triceps brachia were identified and split in midline and elevated with the skin and subcutaneous tissue creating two fasciocutenous flaps. Dissection was continued to the lateral and medial triceps borders.

Posterolateral humerus shaft was approached by elevating the triceps muscle from posterior perostern and retracting it medially. Medially Ulnar Nerve was identified and exposed proximally in posterior compartment.

Fracture was identified and reduction was achieved with traction with the help of reduction clamps. At the distal humerus periosteum if detached is carefully seen to avoid soft tissue interposition. Reduction is achieved after adjustment in external flexion positioning with traction. Reduction is confirmed medially and laterally. 2mm to 2.5mm K-wire used from lateral and medial side of distal end of humerus. Post K-wire fixation movements checked in flexion and extension K-wire were cut approximately. Intra-operative stability,, angle correction checked. Wound was closed in layers, no drain was kept. Then Above Elbow slab was given post operatively.

Postoperative

Patient was asked to do pendulum exercises of shoulder and active exercised of the finger. Stitched were removed 14 days postoperative. Slab was removed after 4 weeks and K-wire removal after 5 weeks, Gentle active movements of elbow were encouraged. X-Rays was done AP and Lateral every month for first 3 months and every 3 months thereafter. Follow up for 1 year was kept.

Follow-up Assessments

Follow-up of both groups ranged from 05 months to 12 months.

OBSERVATIONS & OUTCOME

“Michel and Adam (1961) have proposed the criteria for evaluation of the end results of supracondylar fractures.

Good:

Change in angle less than 5 degree

OR

Limitation of elbow motion less than 10 degree.

Fair:

Change in carrying angle from 5 to 15 degrees

OR

Limitation of elbow motion 10 to 20 degree.

Poor:

Change in carrying angle more than 20 degrees

OR

Limitation of elbow motion more than 20 degrees.

Results in Our Series:

Results	Closed Pinning	ORIF
Good	8	6
Fair	1	1
Poor	1	3

Failures

a) Closed Pinning

One case in closed pinning had poor result which are considered as failures. Which resulted due to limitation of Elbow movements more than 20 degrees and due to comminution of fracture and excessive callus formation.

b) ORIF

03 cases had poor results due to stiffness and flexion restricted more than 20 %

One case resulted in varus deformity due to severe medial comminution and loosening of k wires, superficial infection

PLEASE REFER STATISTICAL ANALYSIS CHARTS BELOW

GROUP I: CLOSED REDUCTION & PINNING

Pt. No.	Age (yrs)	Sex	Side of Arm	Injury	Injury to Surgery Interval	Type of Anes.	Surgery Time-Min	Duration of Stay	Carrying Angle Pre Op Normal Hand	Carrying Angle Post Op.	Flexion	Extension	Complication
01.	07	M	Lt.	SCIII	06 hrs	SGA	12	24 hrs	12 deg	10 deg	130 deg	0	None
02.	10	M	Rt.	SCIII	08 hrs	SGA	20	24 hrs	10 deg	12 deg	130 deg	0	None
03.	05	F	Lt.	SCIII	12 hrs	SGA	25	24 hrs	12 deg	10 deg	125 deg	0	None
04.	06	M	Lt.	SCIII	06 hrs	SGA	15	24 hrs	11 deg	14 deg	115 deg	0	Pin track Inf.
05.	09	M	Lt.	SCIII	06 hrs	SGA	10	24 hrs	12 deg	12 deg	130 deg	0	None
06.	07	F	Lt.	SCIII	08 hrs	SGA	12	24 hrs	10 deg	12 deg	135 deg	0	None
07.	13	M	Rt.	SCIII	08 hrs	SGA	20	24 hrs	16 deg	15 deg	130 deg	0	None
08.	04	M	Lt.	SCIII	04 hrs	SGA	25	24 hrs	13 deg	12 deg	135 deg	0	None
09.	05	M	Lt.	SCIII	02 hrs	SGA	15	24 hrs	15 deg	16 deg	125 deg	0	None
10.	06	M	Lt.	SCIII	06 hrs	GA+I	30	48 hrs	12 deg	08 deg	110 deg	0	Sup. Inf.

GROUP II: OPEN REDUCTION & INTERNAL FIXATION

Pt. No.	Age (yrs)	Sex	Side of Arm	Injury	Injury to Surgery Interval	Type of Anes	Surgery Time-Min	Duration of Stay in days	Carrying Angle Pre Op Normal Hand	Carrying Angle Post Op.	Flexion	Extension	Complication
01.	06	F	Lt.	SCIII	04 hrs	GA+I	90	05	11 deg	10 deg	130 deg	0	None
02.	04	M	Lt.	SCIII	08 hrs	GA+I	80	03	10 deg	-5 deg	110 deg	0	Varus
03.	10	M	Rt.	SCIII	12 hrs	GA+I	60	03	12 deg	10 deg	135 deg	0	None
04.	09	M	Lt.	SCIII	06 hrs	GA+I	50	05	15 deg	14 deg	130 deg	0	None
05.	07	M	Lt.	SCIII	24 hrs	GA+I	70	05	14 deg	5 deg	120 deg	0	ROM
06.	06	M	Rt.	SCIII	12 hrs	GA+I	90	03	11 deg	10 deg	100 deg	0	ROM
07.	12	F	Rt.	SCIII	10 hrs	GA+I	60	04	10 deg	12 deg	130 deg	0	None
08.	11	M	Rt.	SCIII	12 hrs	GA+I	80	05	12 deg	09 deg	125 deg	0	None
09.	12	M	Lt.	SCIII	10 hrs	GA+I	60	05	12 deg	10 deg	110 deg	0	ROM
10.	06	M	Lt.	SCIII	24 hrs	GA+I	60	05	15 deg	12 deg	130 deg	0	None

DISCUSSION

Discussion

Supracondylar fractures of humerus are common injuries and complete displacement Occurs in Many of the cases

Wilkins reviewing 4520 fractures in 31 Major series made several pertinent observations 97.7% of the fractures were of extension type

2.2% were flexion type

Most occurred in boys especially between 5 to 8 years

Volkman's contracture Occurred in 0.5% of all fractures. The radial median and ulnar nerve in order of frequency

In our particular series of 20 patients

① 19 fractures found to be of extension type # ~ 95%

② 01 fracture was found to be flexion type # ~ 5%

③ Mean age of injury was 7 years

No Volkman's contracture was found in any of the Cases

Gupta et al. Mehlman et al and Leet et al. all reported no difference in emergency treatment [<8 hours] and urgent treatment [>8 hours but <24 hrs] concerning need for open reduction longer hospital Stay unsatisfactory results or perioperative complication (Compartment Syndrome, iatrogenic nerve injury, Pin track infection). They all agree however that gross Malalignment needs to be temporarily reduced as an emergency with definitive treatment being done in less than 24hrs

In our series of 20 cases average time of injury and surgery was 9 hrs

Swenson, Casiano and Flynn et al. used two crossed pins Grave and Beaty reported good results in 61 of 64 Cases (95%) type III Supracondylar fractures with closed reduction and percutaneous pinning. Transient and permanent damage of ulnar nerve is rare in all reports

Royce et al. reported neurological Complication in 4 of 143 children (2.7%) after Kirshner Wire fixation of Supracondylar fractures. Late Neuropraxia occurred in two patients nerve injury was caused by insertion of K wires

Skaggs et al noted an incidence of 4% Ulnar Nerve palsy when medial Pin was inserted 15% when elbow was acutely flexed while passing the medial pin
In our series of 20 patients' Group 1 and Group 2 none of the patients suffered from any kind of neurological deficit.

17 patients were treated with 2 cross k wires and 3 with 2 lateral k wires in all.

Aronson & Prager evaluated the quality of reduction by measuring the Boumann's angle after reduction. They accepted the reduction if Boumann's angle of the fractured extremity was within 4 degrees of the normal extremity.

In our series of both groups Boumann angle was measured from unaffected arm preoperatively and compared with affected elbow post operatively after completion of the treatment in Group1 treated with CR with pinning 9 cases have shown good results with restoration of bowman angle within 4 degrees. 1 case fair result with 12 degrees of change .

In group 2 out of 10 cases 9 cases boumanns angle was maintained up to 4 degrees. But in one case results were poor due to residual cubitus varus.

Open reduction and internal fixation for grade iii supracondylar fractures of humerus in children was indicated when

1. attempts of closed reduction failed (1 to 2 attempts)
2. in case of open fractures
3. in cases with vascular injuries
4. neurological compromise
5. late presented fractures
6. Centers where no image intensifier or intra-op X-ray facility is available also in some cases had completely detached periosteum or the fracture fragment puckering or even piercing the skin, there was no cortical contact, CR may be impossible, thus if the fragments can not be reduced or held with wires open reduction and fixation is indicated.

In our series of group II all cases were result of

- attempts of closed reduction failed (1 to 2 attempts)
- in case of open fractures
- Centers where no image intensifier or intra-op X-ray facility is available

Complications

Complications of closed reduction and pinning can be

- Improper reduction
- Infection
- Malalignment causing cubitus varus
- Neurological damage (Ulnar median radial)
- Vascular damage
- Loss of movements

In our series of group 1

- no vascular or neurological damage was seen.
- One case was having superficial infection which was treated with antibiotics.
- 2 cases with decreased ROM due to excessive callus formation.
- One case change of carrying angle was 12 degree.
- ✓ Rest of the cases carrying angle was within normal range.

Complications in open reduction and internal fixation can be

- improper reduction
- infection
- Malalignment causing cubitus varus
- Neurological damage (ulnar median radial)
- Vascular damage
- Loss of movements
- Myositis ossificans
- Excessive callus formation with residual stiffness causing decreased range of motion

In our series of group II treated with ORIF

- No vascular or neurological damage was seen
- No incidence of Myositis ossificans was noted
- 2 cases had excessive callus formation causing residual stiffness and decreased ROM
- Cubitus varus seen in one patient
- Change in carrying angle in 3 cases
- Superficial infection in 2 cases
- Loosening of pin in 1 case.

Comparison between group I and II result

<u>Group</u>	<u>Good result</u>	<u>Fair result</u>	<u>Poor result</u>
<i>I</i>	8 80%	1 10%	1 10%
<i>II</i>	6 60%	1 10%	3 30%
<u>Total =20</u>	14	2	4

In group I treated with closed reduction and pinning results were encouraging(80% good and 10% fair) as compared to group II treated with open reduction and fixation

(60% good and 10 % fair)

Interval between injury and time of intervention was 9hours 40 min mean

Comparison between two groups

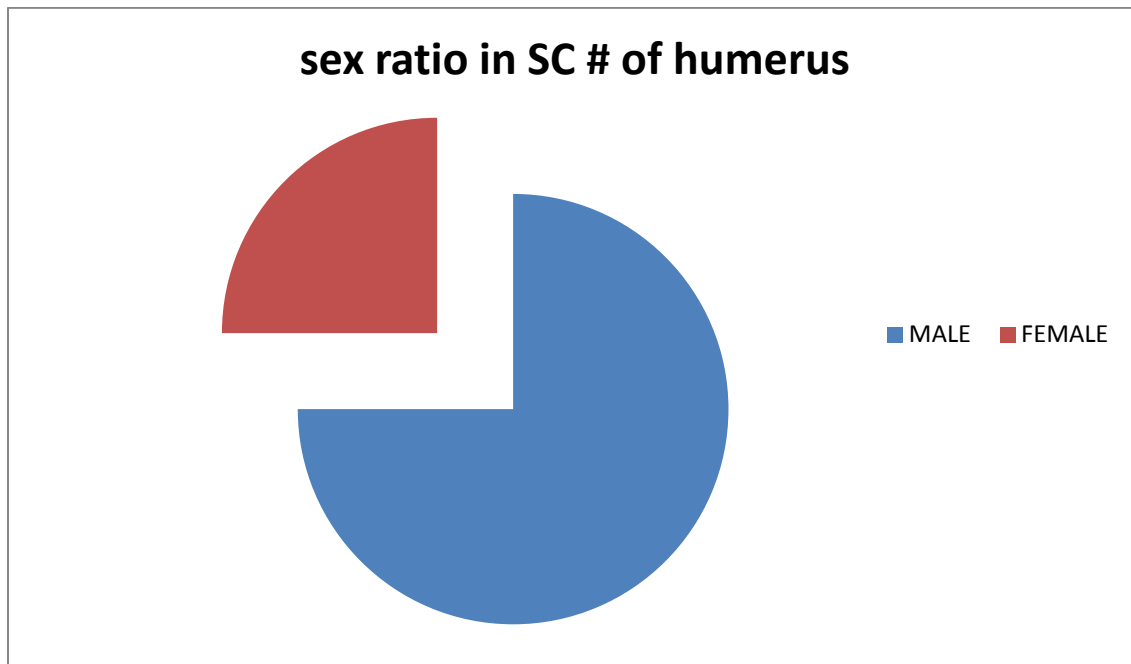
<u>Criteria</u>	<u>Group I</u> <u>CR + Pinning</u>	<u>Group II</u> <u>ORIF</u>
Age mean all 10 cases	7yr	8 yr
Sex male : female	7:3	8:2
Side of arm RT:LT	2:8	4:6
Injury – surgery time interval	9hrs 40 min	9 hrs 40 min
Time for procedure and Anesthesia	19 min	1 hr 10 min
Stay in hospital	1 day	4 days

The age group comparison with other series

<u>authors</u>	<u>Average age</u> <u>(in years)</u>	<u>Common age groups</u> <u>(in years)</u>
Andrew J.W(1978)	6.6	2-13
D.Ambrosia (1972)	7	4-10
Fowles & Kassab (1974)	7.2	5-10
Kurer & regan(1990)	8.0	5-12
Present series	7.8	4-13

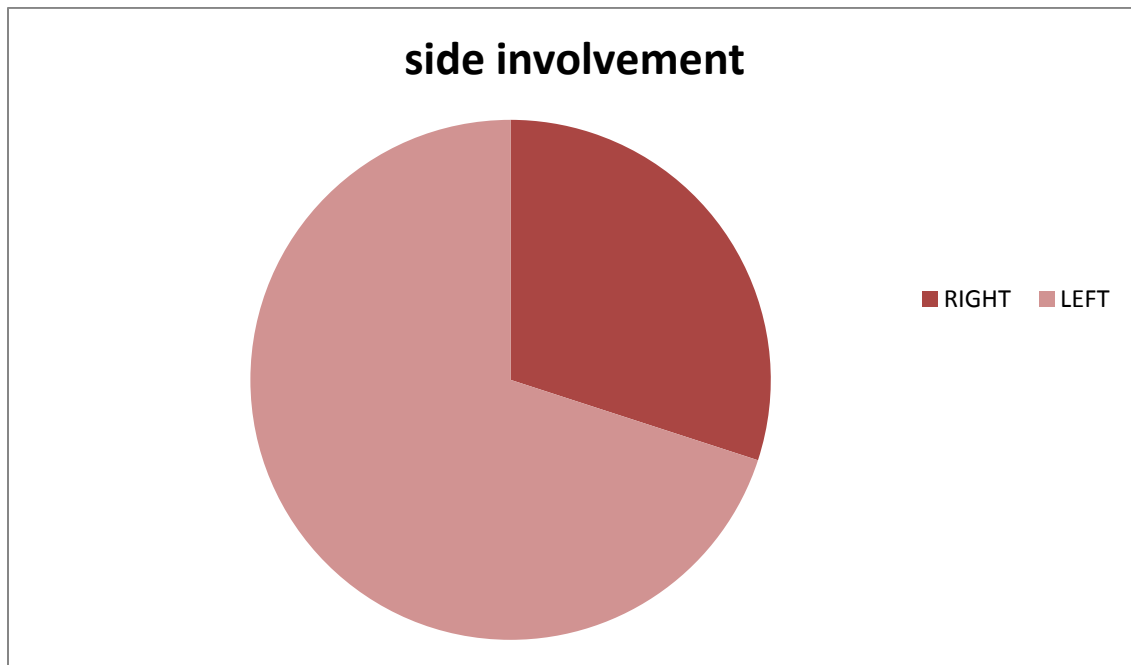
Sex incidence as compared with other series

<u>Authors</u>	<u>Male%</u>	<u>Female%</u>
D Ambrosia	69	31
Edward(1978)	50	50
Fowles (1974)	81	19
Present series(grpI+grpII)	80	20



Showing sides involved

<u>LEFT</u>	<u>RIGHT</u>	<u>TOTAL</u>
14	6	20



Type of displaced fractures

<u>Extension type</u>	<u>Flexion type</u>	<u>Total</u>
19	1	20

Type of fractures as compared to other series

<u>Authors</u>	<u>Extension type %</u>	<u>Flexion type %</u>
Fowles & Kasaab (1974)	90	10
Watson & Jones (1955)	96	04
Gere (1974)	95	05
Present series	95	05

Comparison of results of present series
with other series

<u><i>Authors</i></u>	<u><i>Good %</i></u>	<u><i>Fair %</i></u>	<u><i>Poor %</i></u>
<i>Sharkawi & Fattah</i>	72.4	14	14
<i>Holmberg</i>	56	28	16
<i>Gruber & Hudson</i>	65.3	13	16
<i>Kurer & Regan</i>	62.9	13	21.7
<i>Present series Group I</i>	80	10	10
<i>Present series Group II</i>	60	10	30

Percutaneous fixation after closed reduction has advantage of providing excellent stability of supracondylar type III fractures of humerus fractures in children. It is based on principles of restoring anatomical restoration , Stable internal fixation and early mobilization.

Group I with CR & percutaneous pinning has shown excellent results as compared to group II with ORIF. However ORIF is good method and is effective in patient whom attempts of closed reduction have failed and cases with Open wounds or neurovascular damage.

The results presented by us compare well with the results observed by other authors in literature. The results with closed reduction and pinning are better than ORIF method both for the change of carrying angle is concerned as well as the motion of elbow is concerned.

CONCLUSION

Conclusion

Twenty patients between age 4-13 years of age were selected in two equal groups. Group I was having 10 patients treated with closed reduction and pinning. Group II was having 10 patients treated with open reduction and internal fixation

In all out of 20 patients 15 were males 5 were females

Mean age was 7.8 years

Preoperative carrying angle was measured from unaffected elbow and compared with carrying angle postoperatively with affected elbow.

There were no intraoperative complications in any of the case.

Post operative protocol was 3 weeks of pop slab (above elbow)

Followed by active elbow mobilization were started.

All the cases were followed every week for 8 weeks later every 2 weeks for 2 months ,followed by monthly check ups

K wires were removed after confirmation of union clinically & radiologically, 4-6 weeks post operatively.

These patients were called in physiotherapy dept. on daily basis for 4-6 weeks till acceptable uncomplicated range of motion was regained. Every fortnight there after.

The results were graded according to pre-operative carrying angle of unaffected side and post operative carrying angle, movements of flexion and extension. and they were statistically evaluated.

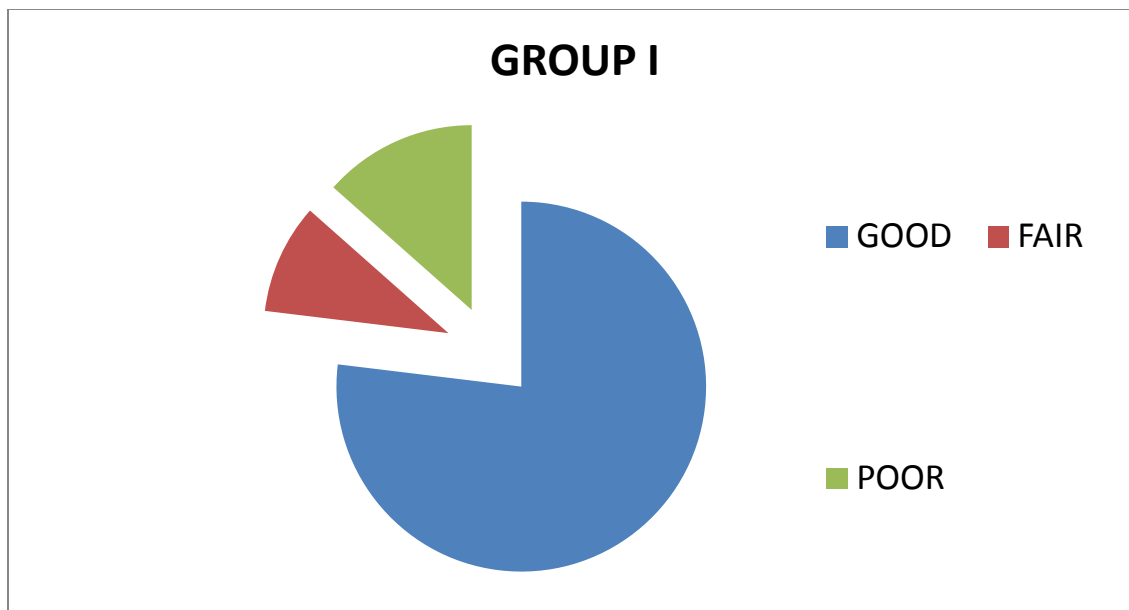
Out of 20 cases 18 were Closed fractures and 2 were Open type.

Out of 20 cases 19 were extension type and one was flexion type.

16 cases are males and 4 females.

14 were left sided 6 right sided

Time interval between injury and surgical intervention was within 24 hours as per our hospitals protocol.



In group I with closed reduction and pinning 80% good results 10% fair results 10% poor results were found as compared to 60% good results 10 % fair, 30 % poor results were seen.

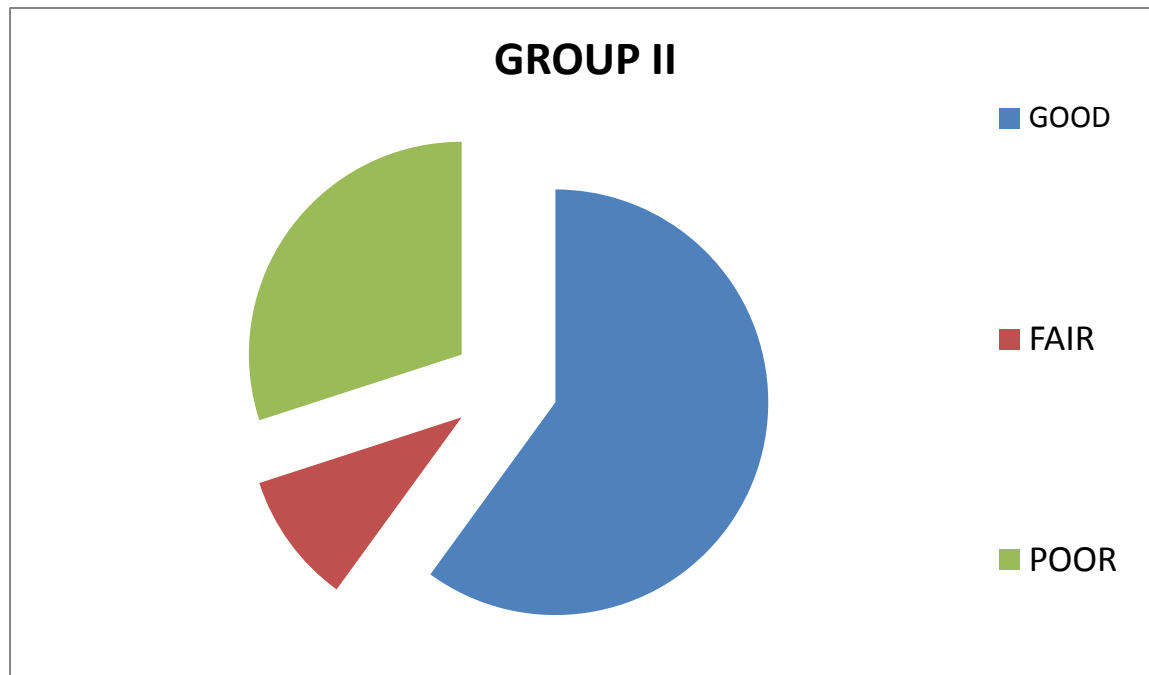
Group I has shown excellent results (80+10=90% between good and fair) . In group I poor result was due to loss of range of movements in one case which was due to formation of excessive callus.

In group II 60 % good results 10 % fair results and 30 % poor result were seen. Poor results were due to loss of range of motion and residual cubitus varus deformity and superficial infection.

Loss of range of motion due to excessive callus formation, lack of physiotherapy in 3 cases. Also poor follow up and superficial infections were seen in 2 cases. Loosening of pin seen in 1 case.

Severe comminution of medial pillar was seen in one case causing inadequate reduction and also had superficial infection and pin loosening

with the end result of varus deformity in one case in group II. This deformity was corrected after one year with valgus osteotomy after one year post first surgery which resulted into acceptable carrying angle.



Superficial infection was seen in two cases which was treated with debridement wash and use of antibiotics intravenously .

None of the case had deep infection.

None of the cases had myositis ossificans in this series.

Overall results of group II treated with ORIF were satisfactory. With 60 % good and 10 % fair results which are comparable to series with other authors.

None of the patients had neuro -vascular complications, none of the patients suffered from Volkmann's ischemic contractures.

ORIF is method of choice in cases with open fractures or cases in which attempts of closed reduction were failed.

I conclude that closed reduction and pinning with k wires for fixation of type III Gartland's fractures in children has excellent results and less complication rate with less surgical time. It also requires less hospital stay and hence less hospital expenditure as compared to open reduction and internal fixation. However ORIF has shown good results and are comparable to other Authors.

ORIF is choice in cases where attempts of closed reduction fails or K wires are not holding the reduction .

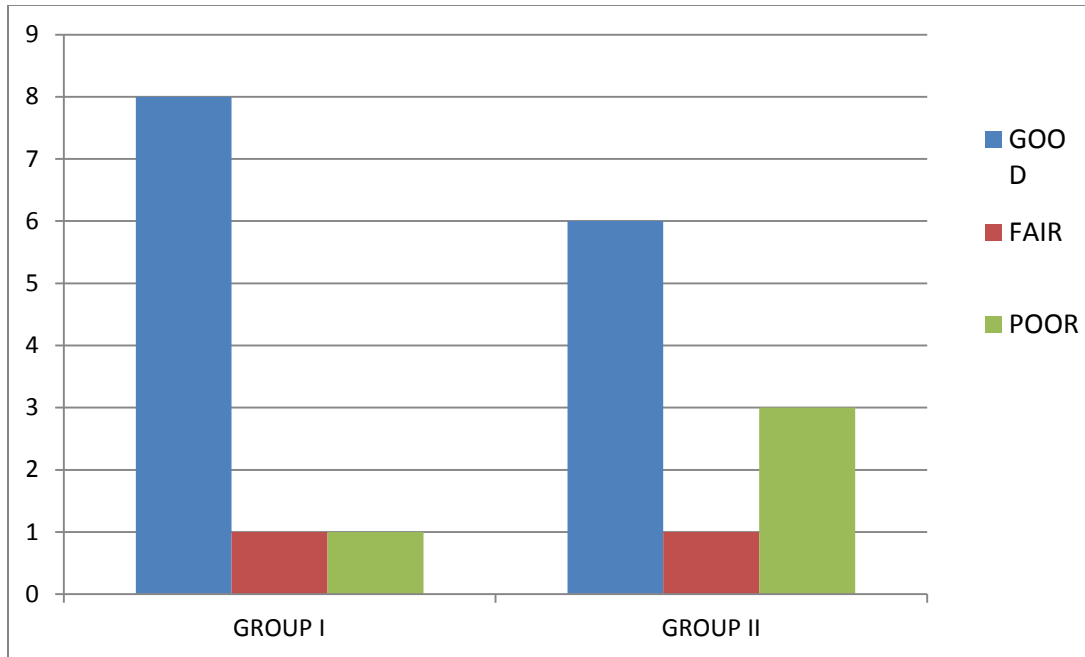
Lack of range of motion could have been corrected with better follow up and physiotherapy.

Results of the cases depended on comminution, intraarticular fractures and contamination in open cases.

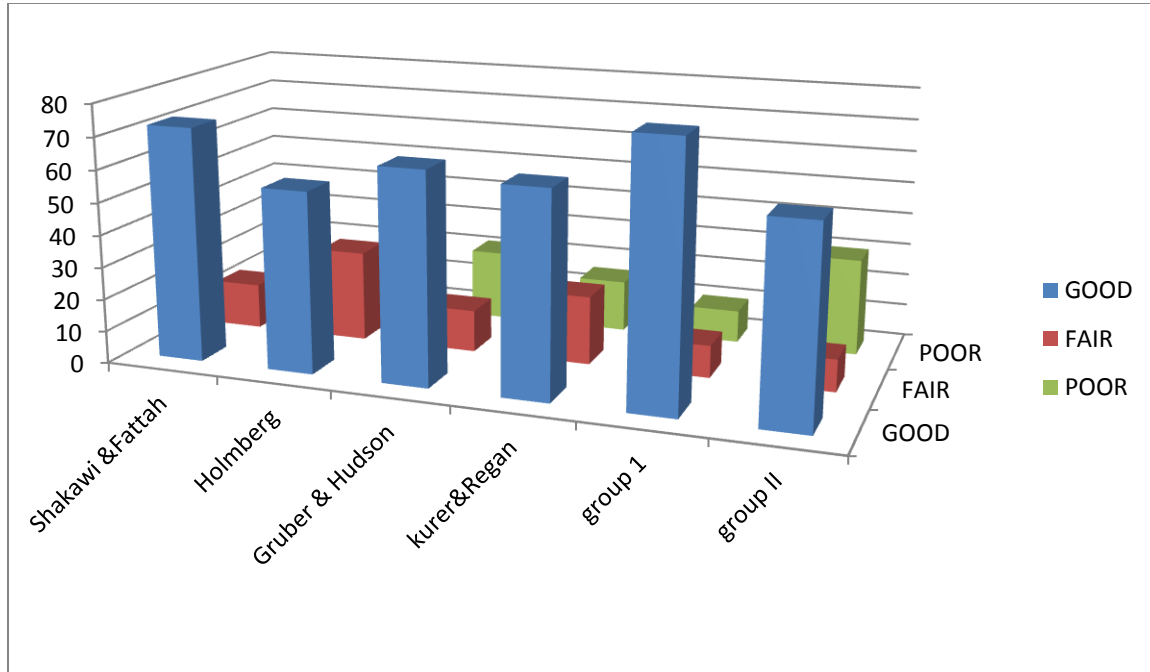
One case with varus deformity was corrected with valgus osteotomy later .

We strongly advocate closed reduction and pinning with K wires for fixation of type III supracondylar fractures of humerus in children. however open reduction internal fixation is required with judicious indications giving good results.

“GRAPHICAL COMPARISON IN RESULTS OF
GROUP I AND GROUP II”



“GRAPHICAL COMPARISON IN RESULTS OF
GROUP I AND GROUP II WITH OTHER AUTHORS”



REFERENCES

1. Boyed HB ,Attenberg AR. fractures about the elbow in children.Ar ch.surg 1944;49,213.
2. Hanlon CR.,Ester WL. Fractures in children;a statistical analysis.Am j Surg 1954;87:312-23
3. Sandgard E. fractures of lower end of humerus in children treatmnt and end results.Acta Chir scand.(suppi)1944; 89-106.
4. Holmberg L. fractures in children. 1945;103
5. Swenson AL. treatment of S.C.fractures of humerus in children by k wire transfixation. JBJS 1948;30A:993
6. Attenborough CG, remodeling of humerus after fractures in childhood . JBJS 1960;35B: 386-95.
7. Smith L. Deformity following S.C.fractures of humerus in children.JB JS 1960;42A:245.
8. Gruber and HudsonOC S.C.fractures of humerus in children: END res ult study of open reduction.
9. Spinner M,Schreiber SN. Anterior interosseous nerve paralysis as a co mplication of S.C.fractures of humerus in children.JBJS 1969;51 A:15 84
- 10.Haddad RH,Riordan DC.percutaneous pinning of displaced S.C.fractur es of humerus in children.Clin orthop1970; 71:112.
- 11.Ambrosia D. S.C.fractures of humerus –prevention of varus deformati y.JBJS 1972; 54-A:60
- 12.Ramsey RH, Griz J Immediate open reduction and internal fixation of severly displaced S.C.fractures of humerus in children. CLIN Orthop 1973; 90:130.
- 13.Nassar.Open reduction Kirschner wire fixation for humerus in childre n.JBJS 1976; 58-B: 135.

14. Andrew J Wetland, Baltimore SM, Liestal Vernon TT. Surgical treatment of displaced S.C.fractures of humerus in children.JBJS 1978; 60A: 657
15. La Belle H. cubitus varus deformity following S.C.fractures of humerus in children.J.Pediatr orthop Scand 1982;2 : 539 – 46.
16. Colpans RW ,Osterman AL. neurological complications associated with S.C.fractures of humerus in children.JBJS 1990; 72A:1211-14
17. Krurer MW. Completely displaced S.C.fractures of humerus in children.Clin orthop 1990;256:205 -14.
18. Lal GM, Bhan S delayed open reduction of S.C.fractures of humerus. Int Orthop, 1991;15:189.
19. Badhe NP, Howard PW (1998) Olecranon screw traction for displaced supracondylar fractures of the humerus in children. Injury 29:457–60. [[PubMed](#)]
20. Battaglia TC, Armstrong DG, Schwend RM (2002) Factors affecting forearm compartment pressures in children with supracondylar fractures of the humerus. J Pediatr Orthop 22:431–439.
21. Campbell CC, Waters PM, Emans JB, Kasser JR, Millis MB (1995) Neurovascular injury and displacement in type III supracondylar humerus fractures. J Pediatr Orthop 15:47–52.
22. Chen RS, Liu CB, Lin XS, Feng XM, Zhu JM, Ye FQ (2001) Supracondylar extension fracture of the humerus in children. Manipulative reduction, immobilization and fixation using a U-shaped plaster slab with elbow in full extension. J Bone Joint Surg Br 83B:883–887.
23. Cheng JC, Ng BK, Ying SY, Lam PK (1999) A 10-year study of the changes in the pattern and treatment of 6,493 fractures. J Pediatr Orthop 19:344–50.
24. Devnani AS (2000) Gradual reduction of supracondylar fracture of the humerus in children reporting late with a swollen elbow. Singapore Med J 41:423–424.
25. Dormans JP, Squillante R, Sharf H (1995) Acute neurovascular complications with supracondylar humerus fractures in children. J Hand Surg Am 20:1–4.
26. Dunlop J (1939) Transcondylar fracture of humerus in childhood. J Bone Joint Surg Am 21A:59–73 .

- 27.. Furrer M, Mark G, Ruedi T (1991) Management of displaced supracondylar fractures of the humerus in children. *Injury* 22:259–262.
28. Gartland JJ (1959) Management of supracondylar fracture of humerus in children. *Surg Gynecol Obstet* 109:145–154.
29. Gurkan I, Bayrakci K, Tasbas B, Dagler B, Gunel U, Ucaner A (2002) Posterior instability of the shoulder after supracondylar fractures recovered with cubitus varus deformity. *J Pediatr Orthop* 22:198–202 .
30. Houshian S, Mehdi B, Larsen MS (2001) The epidemiology of elbow fracture in children: analysis of 355 fractures, with special reference to supracondylar humeral fractures. *J Orthop Sci* 6:312–315. [[PubMed](#)]
31. Jefferiss CD (1997) Straight lateral traction’ in selected supracondylar fractures of the humerus in children. *Injury* 8:213–219.
32. Mazda K, Boggione C, Fitoussi F, Pennicot GF (2001) Systematic pinning of displaced extension – type supracondylar fractures of the humerus in children. A prospective study of 116 consecutive patients. *J Bone Joint Surg Br* 83B:888–893.

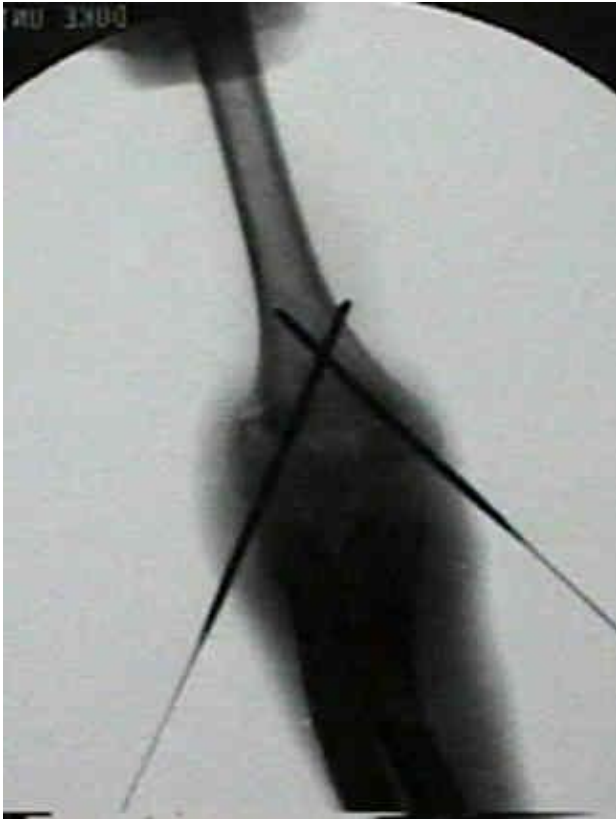
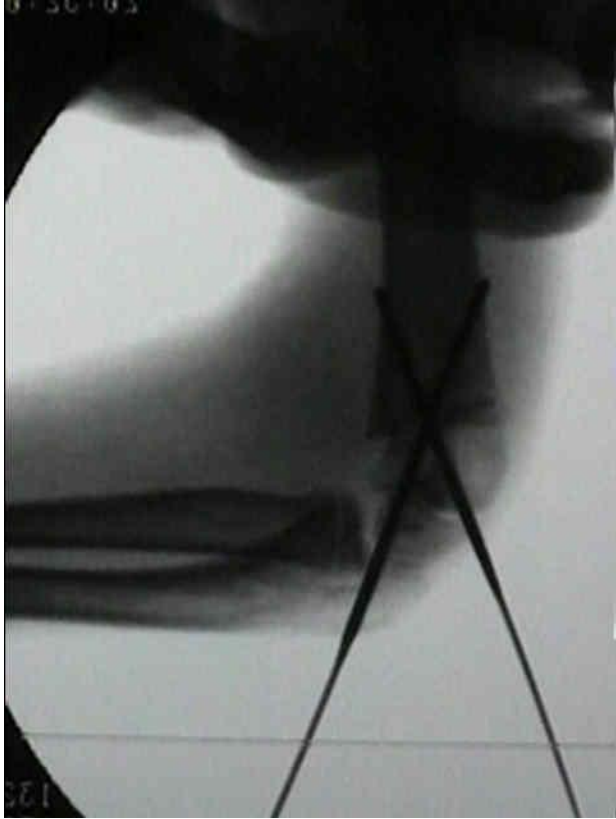
33. Mills MB, Singer IJ, Hall JE (1984) Supracondylar fracture of humerus in children: further experience with a study in orthopaedic decision making. *Clinic Orthop* 188:90–97 .
34. Mohammed S, Rymaszewski LA (1995) Supracondylar fractures of the distal humerus in children. *Injury* 26:487–489.
35. O’ Hara LJ, Barlow JW, Clarke NMP (2000) Displaced supracondylar fractures of the humerus in children. Audit changes practice. *J Bone Joint Surg Br* 82B:204–210 .
36. Palmer E, Niemann KMW, Vesely D, Armstrong JH (1978) Supracondylar fracture of the humerus in children. *J Bone Joint Surg Am* 60A:653–656.
37. Piggot J, Graham HK, McCoy GF (1986) Supracondylar fractures of the humerus in children. Treatment by straight lateral traction. *J Bone Joint Surg Br* 68B:577–583.

CLINICAL PHOTOGRAPHS













POST OP EXTENTION



POST OP FLEXION



CLINICAL PROFORMA

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PROFORMA

**“EVALUATION AND COMPARISON OF SURGICAL MANAGEMENT OF
DISPLACED SUPRACONDYLAR FRACTURE OF HUMERUS IN CHILDREN -
CLOSED REDUCTION & PINNING
VERSUS
OPEN REDUCTION & INTERNAL FIXATION”**

Name :

Age: Sex: IP No:

Address :

Complaints :

History :

(1) Fall (2) Accident (3) Previous Treatment (4) Native Treatment

(5) Duration (hours)

Mechanism of Injury:

1) Direct Trauma (2) Indirect Trauma

Time & Date of Injury:

First Aid given:

Time & Date when seen in the Hospital:

On Examination:

(1) Attitude of the Limp:

(2) Open or Closed:

If Open Type:

Radial

(3) Neurological Deficit: Anterior interosseous

Ulnar

4. Vascular Deficit: Radial Plus: Good / Feeble

Capillary Filling: Good /Sluggish

5. Passive Stretch Sign:

6. Associated Other Bony Injuries:

6. Associated Diseases:

FINAL DIAGNOSIS

GENERAL PHYSICAL EXAMINATION

(1) C.V.S.: (2) Respiratory System: (3) Abdomen:

Investigations: Hb%

Blood Group & Typing Urine (R) **Treatment Given:** Prior Closed

Reduction Done or Not:

Time of Surgery: Emergency: Anaesthesia - G.A.

Elective: Position of Patient: Prone

Whether Traction given: Yes / No No.of Days:

Open Reduction & Internal Fixation with 'K' wires: Post

Operative Complications

Immediate

- Loss of Reduction
- Vascular (Ischaemia)
- Nerve injures
- Wound infection

Delayed

- Pin Tract Infection
- Mal union
- Stiffness
- VIC
- Myositis Ossificans
- Late Nerve Complications - Tardy Ulnar Palsy

X-ray Report: Elbow - A.P. / Lateral

Injury X-ray

Post Traction Injury X-ray

Post-Operative X-ray a) 1st X-ray b) 3rd week c) 6th week
d) 12th week e) 6th month

Removal of 'K' wires:

Mobilization:

Clinical Follow-Up Assessment

R.O.M.in	Flexion	3 weeks	6 weeks	3-6 months	1 year &
Degrees	Extension				
Pain					
Tenderness					
Pin Tract Infection					
Deformity					
Nerve Involvement					

Assessment of Results

Range of Movements

Malunion

Results: 1) Good

2)

3) Poor

Fair

Remarks



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