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

DISSENYATION SUBMITTED TO UNIVERSITY OF SEYCHELLES AMERICAN INSTITUTE OF MEDICINE

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE M. Ch (Orthopaedic Surgery)

By

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A STUDY DONE AT DEPARTMENT OF ORTHOPAEDICS RAKSHAK HOSPITAL, KHARADI, PUNE (TRAUMA CENTRE)

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, myositis ossification, stiffness, permanent nerve injuries and malunion.

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.

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**
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
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. Anteroposterior 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.
2\textsuperscript{nd} 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 olecranon tip. Fascia overlying the triceps brachia were identified and split in midline and elevated with the skin and subcutaneous tissue creating two fasciocutaneous 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:**

<table>
<thead>
<tr>
<th>Results</th>
<th>Closed Pinning</th>
<th>ORIF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>Fair</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Poor</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>01.</td>
<td>07</td>
<td>M</td>
<td>Lt.</td>
<td>SCIII</td>
<td>06 hrs</td>
<td>SGA</td>
<td>12</td>
<td>24 hrs</td>
<td>12 deg</td>
<td>10 deg</td>
<td>130 deg</td>
<td>0</td>
<td>None</td>
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<tr>
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<td>10</td>
<td>M</td>
<td>Rt.</td>
<td>SCIII</td>
<td>08 hrs</td>
<td>SGA</td>
<td>20</td>
<td>24 hrs</td>
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<td>SGA</td>
<td>25</td>
<td>24 hrs</td>
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<td>SGA</td>
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<td>SGA</td>
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<td>24 hrs</td>
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<td>12 deg</td>
<td>130 deg</td>
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<td>SGA</td>
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<td>24 hrs</td>
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<td>12 deg</td>
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<td>SGA</td>
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<td>24 hrs</td>
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<td>SGA</td>
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<td>15 deg</td>
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<td>10.</td>
<td>06</td>
<td>M</td>
<td>Lt.</td>
<td>SCIII</td>
<td>06 hrs</td>
<td>GA+I</td>
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<td>48 hrs</td>
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<td>08 deg</td>
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<td>Sup. Inf.</td>
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## GROUP II: OPEN REDUCTION & INTERNAL FIXATION

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<td>Lt.</td>
<td>SCIII</td>
<td>04 hrs</td>
<td>GA+I</td>
<td>90</td>
<td>05</td>
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<td>10 deg</td>
<td>130 deg</td>
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<td>02.</td>
<td>04</td>
<td>M</td>
<td>Lt.</td>
<td>SCIII</td>
<td>08 hrs</td>
<td>GA+I</td>
<td>80</td>
<td>03</td>
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<td>GA+I</td>
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<td>03</td>
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<td>06 hrs</td>
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<td>GA+I</td>
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<td>GA+I</td>
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<td>GA+I</td>
<td>80</td>
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<td>M</td>
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<td>GA+I</td>
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<td>GA+I</td>
<td>60</td>
<td>05</td>
<td>15 deg</td>
<td>12 deg</td>
<td>130 deg</td>
<td>0</td>
<td>None</td>
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**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

Volkmann’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 a of extension type # ~ 95%

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

③ Mean age of injury was 7 years

No Volkmann’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 <24hrs] 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 at 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 Supracondyler 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 Group 1 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**

<table>
<thead>
<tr>
<th>Group</th>
<th>Good result</th>
<th>Fair result</th>
<th>Poor result</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>8 (80%)</td>
<td>1 (10%)</td>
<td>1 (10%)</td>
</tr>
<tr>
<td>II</td>
<td>6 (60%)</td>
<td>1 (10%)</td>
<td>3 (30%)</td>
</tr>
<tr>
<td>Total</td>
<td>14</td>
<td>2</td>
<td>4</td>
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</table>

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 9 hours 40 min mean
Comparison between two groups

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

The age group comparison with other series

<table>
<thead>
<tr>
<th>authors</th>
<th>Average age (in years)</th>
<th>Common age groups (in years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Andrew J.W(1978)</td>
<td>6.6</td>
<td>2-13</td>
</tr>
<tr>
<td>D.Ambrosia (1972)</td>
<td>7</td>
<td>4-10</td>
</tr>
<tr>
<td>Fowles &amp; Kassab (1974)</td>
<td>7.2</td>
<td>5-10</td>
</tr>
<tr>
<td>Kurer &amp; regan(1990)</td>
<td>8.0</td>
<td>5-12</td>
</tr>
<tr>
<td>Present series</td>
<td>7.8</td>
<td>4-13</td>
</tr>
</tbody>
</table>
**Sex incidence as compared with other series**

<table>
<thead>
<tr>
<th>Authors</th>
<th>Male%</th>
<th>Female%</th>
</tr>
</thead>
<tbody>
<tr>
<td>D Ambrosia</td>
<td>69</td>
<td>31</td>
</tr>
<tr>
<td>Edward (1978)</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Fowles (1974)</td>
<td>81</td>
<td>19</td>
</tr>
<tr>
<td>Present series (grpI+grpII)</td>
<td>80</td>
<td>20</td>
</tr>
</tbody>
</table>

**sex ratio in SC # of humerus**
Showing sides involved

<table>
<thead>
<tr>
<th></th>
<th>LEFT</th>
<th>RIGHT</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>14</td>
<td>6</td>
<td>20</td>
</tr>
</tbody>
</table>

Pie chart showing side involvement with 14 on the left and 6 on the right, totaling 20.

Legend:
- RIGHT
- LEFT
### Type of displaced fractures

<table>
<thead>
<tr>
<th></th>
<th>Extension type</th>
<th>Flexion type</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>19</td>
<td>1</td>
<td>20</td>
</tr>
</tbody>
</table>

### Type of fractures as compared to other series

<table>
<thead>
<tr>
<th>Authors</th>
<th>Extension type type %</th>
<th>Flexion type %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fowles &amp; Kasaab</td>
<td>90</td>
<td>10</td>
</tr>
<tr>
<td>(1974)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watson &amp; Jones</td>
<td>96</td>
<td>04</td>
</tr>
<tr>
<td>(1955)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gere (1974)</td>
<td>95</td>
<td>05</td>
</tr>
<tr>
<td>Present series</td>
<td>95</td>
<td>05</td>
</tr>
</tbody>
</table>
### Comparison of results of present series with other series

<table>
<thead>
<tr>
<th>Authors</th>
<th>Good %</th>
<th>Fair %</th>
<th>Poor %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sharkawi &amp; Fattah</td>
<td>72.4</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>Holmberg</td>
<td>56</td>
<td>28</td>
<td>16</td>
</tr>
<tr>
<td>Gruber &amp; Hudson</td>
<td>65.3</td>
<td>13</td>
<td>16</td>
</tr>
<tr>
<td>Kurer &amp; Regan</td>
<td>62.9</td>
<td>13</td>
<td>21.7</td>
</tr>
<tr>
<td>Present series</td>
<td>80</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td><strong>Group I</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Present series</td>
<td>60</td>
<td>10</td>
<td>30</td>
</tr>
<tr>
<td><strong>Group II</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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 neur ovascular 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.

Postoperative 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 postoperatively.

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


CLINICAL PHOTOGRAPHS
POST OP EXTENTION

POST OP FLEXION
CLINICAL 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

    Unlar

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:


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) 1<sup>st</sup> X-ray  
b) 3<sup>rd</sup> week  
c) 6<sup>th</sup> week  
d) 12<sup>th</sup> week  
e) 6<sup>th</sup> month

**Removal of 'K' wires:**

**Mobilization:**
### Clinical Follow-Up Assessment

<table>
<thead>
<tr>
<th>R.O.M.in</th>
<th>Flexion</th>
<th>3 weeks</th>
<th>6 weeks</th>
<th>3-6 months</th>
<th>1 year &amp;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degrees</td>
<td>Extension</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pain</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tenderness</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pin Tract Infection</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deformity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nerve Involvement</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

**Assessment of Results**

**Range of Movements**

**Malunion**

Results: 1) Good 2) Fair 3) Poor

Remarks
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In consideration of the review by the examination board towards submission for the M.Ch (Orth) and/or editing by The Journal of the M.Ch (Orth) of the material submitted for publication entitled:

“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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Name: Dr. Sagar Anant Khadilkar

Date: 7 June 2012