

# SUPRACONDYLAR HUMERAL FRACTURE IN CHILDREN: MANAGEMENT BY PERCUTANEOUS LATERAL-ENTRY PIN FIXATION

Shahab-ud-Din<sup>1</sup>, Faseeh Shahab<sup>2</sup>, Khalil ur Rehman<sup>3</sup>, Khadim Hussain<sup>4</sup>

<sup>1-4</sup>Department of Orthopaedics, Lady Reading Hospital, Peshawar - Pakistan.

**Address for correspondence:**  
**Dr. Shahab ud Din**

Professor,  
Department of Orthopaedics,  
Lady Reading Hospital, Peshawar - Pakistan.

E-mail: profdrshahab@hotmail.com

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## ABSTRACT

This case series was conducted at the Department of Orthopaedics and Traumatology, Lady Reading Hospital Peshawar, from January 2007 to June 2008 to assess the outcome of two percutaneous lateral-entry pins in the operative management of supracondylar humeral fractures. The study included management of Type II and III displaced supracondylar humeral fractures according to Wilkins's modification of Gartland's classification system in 193 patients. The fractures were fixed with two percutaneous lateral-entry pins. Seventy-two children had Type II fracture and One Hundred and Sixty-five children presented with Type III fracture according to Wilkins's modification of Gartland's classification system. A comparison of perioperative and final radiographs showed no loss of reduction of any fracture. There was no hyperextension, loss of motion, cubitus varus, iatrogenic nerve palsies and no patient required additional surgery. Six patients had pin tract infection. Follow up rate was 81.5% Results were evaluated by Flynn's Criteria, 93.3% Excellent/good results were obtained. In this case-series, the use of lateral-entry pins was found to give excellent/very good results. It is an effective treatment option for unstable supracondylar fractures of humerus in children. This method provides the greatest skeletal stability and prevents neurovascular complications in children, as in other techniques, hence giving excellent results.

**Key Words:** Supracondylar humeral fracture, Lateral-entry pinning, Children.

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## INTRODUCTION

Supracondylar humeral fractures are the most common fractures around the elbow in children<sup>1</sup>. These fractures are classified according to mechanism of injury into extension and flexion types. Extension type supracondylar humeral fractures are caused by fall onto an out-stretched hand with elbow in full-extension and they are the focus of our study. The flexion-type supracondylar humerus fractures are caused by falls on olecranon with the elbow flexed.

Extension-type fractures account for approximately 96% to 99% of supracondylar humeral fractures<sup>2</sup>. The Extension-type supracondylar humeral fractures are sub classified according to Wilkins's modification of Gartland's classification system based on degree of displacement of the distal fragment<sup>3</sup>.

Type I supracondylar fractures are usually treated by immobilization and they were excluded from our study. There is a disagreement on treatment of Type II supracondylar fractures; as some authors advocate treating with closed reduction and a cast while others prefer

closed reduction and percutaneous Kirschner (K) wire fixation<sup>4, 5</sup>. The management of Type III supracondylar fracture involves closed reduction and percutaneous K-wire fixation but the best pin configuration for the stabilization of the fractures following satisfactory reduction in children is controversial. Lateral-entry pin fixation and crossed pin fixation are mostly used. Lateral-entry pins provide comparable efficacy in terms of stability and duration of bone healing but has far less incidences of iatrogenic nerve injuries as compared to other pin-fixation techniques especially crossed-pin fixation<sup>6</sup>.

The recent area of focus in the management of supracondylar fractures in children is the degree of stability and effectiveness of two lateral-entry pins, in contrast to crossed pins fixation. There are studies available from other countries but there is no published data regarding the use of two lateral-entry pins in local literature. The objective of the study was to assess the efficacy of percutaneous lateral-entry pins in the operative management of supracondylar humeral fractures.

**METHODOLOGY**

A prospective case series was undertaken at Orthopedic and Traumatology Department, Lady Reading Hospital Peshawar, from 1<sup>st</sup> January 2007 to 30<sup>th</sup> July 2008 with follow-up of six months. The study was approved by Institutional Ethics Review Board.

All patients of age between 3 and 12 years with either an open or closed fracture of Gartland Type II or Gartland Type III, who presented to our hospital were included in the study. All patients with Gartland Type I fracture or less than 3 years of age or above 12 years of age were excluded from the study.

All patients were admitted through emergency. On admission, thorough history was taken and detailed examination was performed. The fracture side of all children was placed in posterior splint for temporary stabilization. Capillary refill and distal pulses were monitored closely.

Data was recorded on Microsoft Excel Worksheet. Results were recorded as frequencies, means ± standard deviations (SD).

The surgical technique was same for all patients (minor adjustments according to patients need were done). The surgical technique used was same as reported by Skaggs et al<sup>5</sup>.

The splint was removed after 3 weeks, pins were removed after 5 weeks (depending on the fracture healing) and follow-up was done monthly for six months.

All patients were assessed at follow-up according to criteria of Flynn et al<sup>7</sup> (Table 1)

**RESULTS**

A total of 237 patients were recruited in the study. Seventy-two patients (31.3%) had closed Type II Supracondylar humerus fractures while 165 patients (68.7%) had Type III fractures according to Wilkins’s modification of Gartland’s classification system<sup>3</sup>. There were 150

boys (63.5%) and 87 girls (36.5%). The mean age at the start of treatment was 6.3 years (±1.1 years) (Range: 3years –12 years). The left side humerus was involved in 172 patients (72.5%) while right side was involved in 65 patients (27.5%).

Two lateral-entry pins were used for all fractures.

One hundred and ninety-three patients (81.5%) had completed follow-up of six months while 44 patients (18.5%) did not complete their six months of follow-up.

According to criteria, 95 patients (49%) had excellent results, 85 patients (44%) had good results, and 13 patients (7%) had poor results (Table 2). All 13 patients with poor results had Gartland Type III fractures which were fixed after 72 hrs.

Twenty-two fractures were open at the time of injury. In 182 patients (76.7%) surgery was performed within 24 hours from the time of injury and in 55 patients (23.2%) surgery was delayed up to 72 hours because of their delayed reporting to the hospital. The radial pulse was monitored preoperatively and postoperatively. Two hundred and thirty-one had a palpable pulse before surgery while 6 children (2%) had absent radial pulse. But the distal pulse returned after reduction and fixation. Thirty-five children (14.7%) had neurological complications, 23 patients (9.7%) had median nerve palsy, 10 patients (4.2%) had radial nerve palsy, 2 patients (<1%) had ulnar nerve palsy, all of which resolved within eight weeks of treatment. There were no iatrogenic nerve injuries and vascular injuries. No patient in the series suffered from compartment syndrome. None of the patient had Volkmann’s ischemic contracture. Seven patients (2.9%) presented with pin-tract infections. In 3 patients, infection resolved with oral antibiotics and in 4 patients infection resolved after removal of K-wires.

No patient had a clinically evident cubitus varus deformity, elbow hyperextension, or loss of motion at the time of the last clinical visit. No patient underwent additional surgery related to the supracondylar fracture.

Radiographs of a 7 year old boy with Gartland type III supracondylar fracture of humerus are show in Figure 1.

**Table 1: Flynn’s Criteria**

RESULTS		Loss of Motion (°)	Loss of Carrying Angle (°)
Satisfactory	Excellent	0-5	0-5
	Good	6-10	6-10
	Fair	11-15	11-15
Unsatisfactory	Poor	>15	>15

**Table 2: Result according to type of fracture**

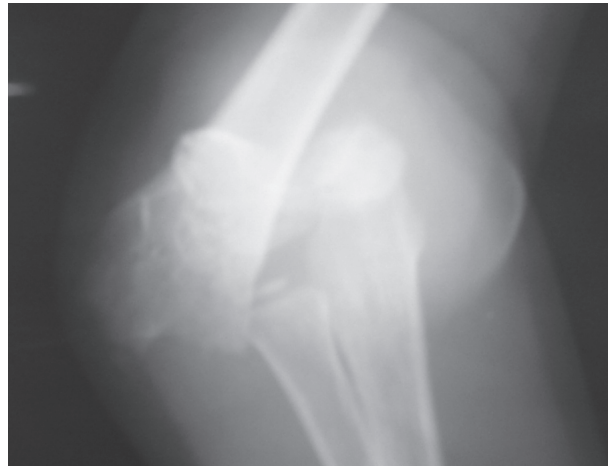
RESULT	TYPE II FRACTURE (n=56)	TYPE III FRACTURE (n=137)
EXCELLENT	43 (77%)	40 (29.7%)
GOOD	13 (23%)	84 (61.4%)
POOR	0	13 (8.9%)

**Figure 1: Radiographs of 7 year old boy with Gartland type III supracondylar fracture of humerus**

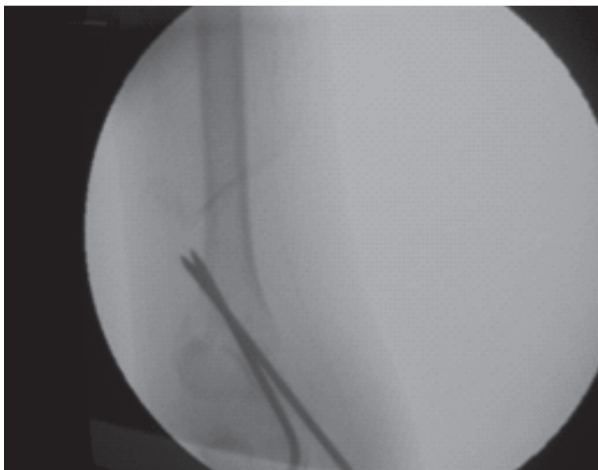
**A: Anteromedial view**



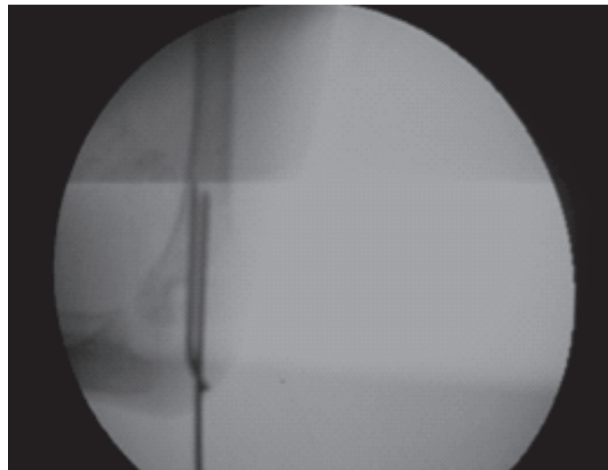
**B: Lateral view**



**C: Anteroposterior view of image intensifier, perioperatively**



**D: Lateral view of image intensifier, perioperatively**



## DISCUSSION

The supracondylar humeral fractures in children are common and challenging injuries. The aim of treatment is to gain a functional and cosmetically acceptable upper limb with normal range of movement. Ideally, this should be achieved by one definitive procedure. A number of surgical and conservative procedures due to loss of reduction can be psychologically traumatic to the child and may result in parental anxiety; often associated with an increased risk of poor outcome<sup>7</sup>. In the beginning we started with 237 patients. We tried our best to keep in touch with the patients during follow-up. Despite efforts of locating these patients, follow-up was limited to 193 patients only. It was better than a similar study conducted previously, because of a shorter follow up duration in that study<sup>8</sup>.

In our study, six patients (2.8%) presented with pin-tract infection, 2 resolved with oral antibiotics while 4 resolved after pin-removal. The reported rate of pin tract infection in association with supracondylar humeral fracture ranges from <1% to 6.6%<sup>9, 10</sup>. Gupta et al reported one pin track infection in a series of 150 fractures; which resolved with oral antibiotic and pin removal<sup>9</sup>. Mehlman et al identified five pin track infection (2.5%), which were treated with oral antibiotics and resolved without sequelae<sup>10</sup>.

In our study, 13 patients (6.7%) had poor results. All these fractures were classified as Gartland Type III fractures which were fixed 72 hours after injury. The analysis of the fractures with loss of reduction revealed several apparently important technical points for effective fixation with lateral-entry pins. The aim should be to place the lateral parallel to metaphyseal flare of lateral

cortex and second diverging pin should cross the fracture site at medial edge of coronoid fossa, as described by Hamdi et al<sup>11</sup>.

The lateral-pin also has an added advantage that it can be removed easily. In our study, the pins were removed after five weeks, two weeks after removal of the cast. It was found that it takes (on average) one month for complete range of movement (ROM) at elbow to return to pre-fracture range of movement. Our finding was comparable to that of Wang et al. who concluded from his study that it takes about 5 weeks after removal of cast, to restore original range of movement at the elbow joint<sup>12</sup>.

## CONCLUSION

The use of lateral-entry pins is effective for most unstable supracondylar fractures of humerus. This method provides the greatest skeletal stability and prevents neuro-vascular complications in children compared to other techniques, hence giving excellent results.

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## CONTRIBUTORS

SD conceived the idea, planned and wrote the manuscript of the study. FS, KR and KH helped in the data analysis and write up of the manuscript. All the authors contributed significantly to the research that resulted in the submitted manuscript.