

# Displaced supracondylar fracture of the humerus in children : a modified technique of closed reduction

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**Background:** Reduction of supracondylar fracture in children is technically difficult and therefore numerous methods have been described in the past .

**Method:** We present a modified technique of reduction of grade three extension type supracondylar fracture of the humerus in children . All fracture except one were stabilized with two crossed pins after reduction under image intensifier. Early mobilization at 3 to 4 weeks with the pins in situ and pin removal at 4-5 weeks produced good results .

**Results:** Only three out of 38 patients treated by this method had poor results. No neurovascular complications were found in the patients treated by this technique, and indeed we found that this method worked well even in those cases who presented late or had a gross swelling over the elbow at the time of presentation. At the end of three weeks, Baumann's angle was found to range between 72-84 degrees.

**Conclusion:** The authors found this method to be effective and without any complications in the treatment of the displaced extension type supracondylar fractures of the humerus .

**Key-words:** Supracondylar fracture of the humerus; Two crossed pins.

Various methods have been described for the reduction of the fracture, such as reduction of the fracture by manipulation in flexion<sup>1</sup>, milking maneuver to disengage the proximal fragment from the soft tissue<sup>2,3</sup>, and manipulation reduction immobilization and fixation using a U-shaped slab with elbow in full extension<sup>4</sup>. The most popular method of reduction is longitudinal traction with elbow in extension and forearm in supination<sup>5</sup>. Two crossed Kirschner wires, the tips of which cross to the opposite cortices, provide an adequately rigid biomechanical construct than lateral Kirschner wires for maintaining the reduction<sup>6,7</sup>.

## Method and Material

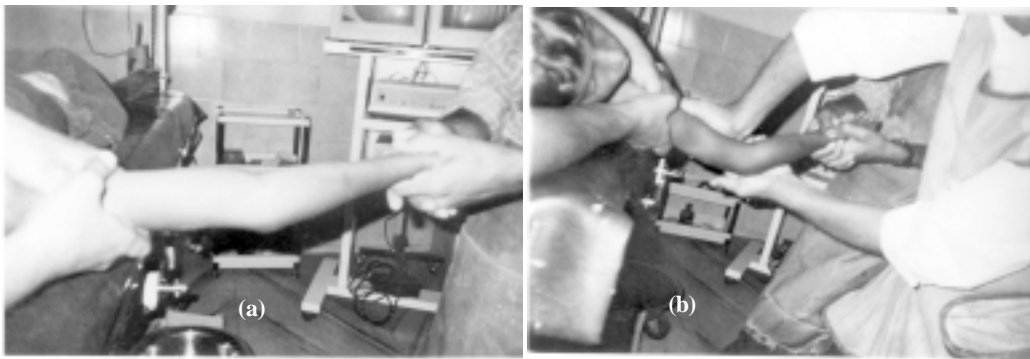
From March 2002 to September 2002 we treated 38 patients with Gartland and Wilkins type three closed, extension type of supracondylar fractures of the humerus. All patients were treated by the same surgeon on an out patient basis immediately following presentation. There were 29 male and 9 female patients. The mean age was 7.2 years and range 2-14 years. The time of presentation varied from a few hours to 5 days after injury. Out of the 38 patients, 22 presented within 12 hours after injury, and 16 between 1 to 5 days, with the average being 2.6 days. Manipulation had been tried elsewhere in one patient and a history of massaging of the extremity was given by 5 patients. In 3 patients peripheral pulses were absent but none of the patients had a compromised distal circulation when checked by nail bed circulation and colour of the hand. One patient had a radial nerve palsy before manipulation which recovered completely within 3 months post reduction .

**Method:** Dissociative anesthesia (Diazepam and Ketamine) was used in all the patients and the image intensifier was positioned at the head end of the patient. Continuous traction was applied to the forearm against a counter traction on the arm, by the assistant for 2-3 minutes, with the elbow in full extension and forearm supinated such that the palm is held facing the ceiling (Fig. 1). This caused disimpaction of the fragments and

## Introduction

Supracondylar fractures of the humerus in children are difficult to treat. Closed reduction is both difficult to achieve and maintain, because of the thinness of bone at the distal third between the coronoid and olecranon, where most supracondylar fractures tend to occur.

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**Fig. 1.** (a) Step one of reduction, traction and counter traction in extension of the elbow with fore arm supine and arm in neutral rotation; (b) Step two of reduction, anterior - posterior movement is done at the fracture site keeping the traction and counter traction on.

aligns the fragments in the normal anatomical position with respect to varus and valgus angulations. Then with the traction on, one hand was kept anteriorly over the proximal fragment and another was kept posteriorly over the distal fragment and gentle antero-posterior movement was carried out several times. During this movement one feels the click of reduction. After that the elbow was flexed and the alignment of reduction was checked under image intensifier. Lateral view was obtained by turning the image intensifier without rotating the arm with the elbow in flexion. If satisfactory alignment cannot be achieved the whole procedure is repeated till adequate reduction is achieved. The authors had tried this maneuver to a maximum of six times for a five day old injury. Medial and lateral displacement can be corrected by pushing the distal fragment medially or laterally, while lateral opening is corrected by pronating the forearm.

After reduction pinning of the fracture was done under image intensifier control. The lateral pin was introduced first, keeping the level of lateral pin in mind under image intensifier guide the medial pin was introduced avoiding the ulnar nerve. The author noted that the entry point of the medial pin was either at the same level or 1 to 2 mm posterior to the lateral pin.

At the end of three weeks the plaster of Paris slab was removed, a check X-ray obtained and active physiotherapy started. By the fourth to fifth weeks post

reduction the Kirschner wires were removed and follow up was maintained until 12 weeks. Baumann's angle and anterior humeral line were studied in all the patients at the end of three weeks.

The elbow was kept in a posterior slab at 120 degree flexion for three weeks, followed by removal of the support and radiographic evaluation.

### Results

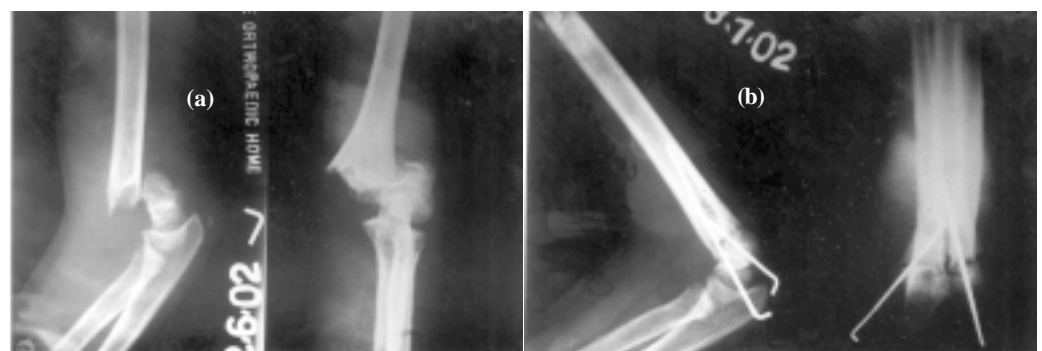
Results were classified on the basis of radiographic findings into three groups good, satisfactory and poor.

*Good:* Perfect alignment of the fracture fragments.

*Satisfactory:* Reduction with translation of distal fragments up to two millimeter in sagittal or coronal plane or few degrees of valgus angulation, but those with rotation, varus, or anterior angulation were not accepted.

*Poor:* Rotation or varus angulation, Baumann's angle outside the range of 70-84 degrees, anterior humeral line passing anterior to the capitellum fell in this group.

Out of 38 patients, 26 had good results (Fig. 2). Five patients out of nine from the satisfactory group presented 12 hours after injury and three patients were from the poor category. There was no iatrogenic injury to the ulnar nerve during percutaneous pinning of medial column, but one patient had a radial nerve palsy before reduction was attempted. Myositis ossificans was not found in any case.



**Fig. 2.** (a) Displaced supracondylar fracture of the humerus; (b) three weeks post reduction and fixation with kirschner wires.

No deep pin tract infection was noted in any of the cases. The average range of motion at the end of 8 weeks was 52 to 126 degrees and all the patients had a full range of movement by the 12th week. The range of Baumann's angle was 72-84 degrees, the average being 78.6 degrees.

## Discussion

Boyd et al<sup>8</sup> prefer two crossed medial and lateral Kirschner wires put percutaneously for unstable fracture. In their series, 70 of 71 patients had satisfactory results and only two cases had iatrogenic ulnar nerve palsies. Two crossed Kirschner wire fixation is the most popular technique for stabilization of displaced supracondylar fractures of the humerus, but reduction of fracture to the correct alignment is often technically difficult<sup>9</sup>.

We have modified the technique advocated by Wilkins<sup>5</sup> where reduction was achieved only by longitudinal traction. In this method along with longitudinal traction gentle antero-posterior movement was done at the fracture site, which helped the fracture fragments to align in proper position. The important key to reduction by this method is the continuous traction and counter traction for 2-3 minutes with shoulder in neutral rotation and forearm supinated so that the palm is facing anteriorly. We found that this method was effective and safe for management of displaced supracondylar fracture of the humerus in children. The frequency of ulnar nerve injury during insertion of medial pins percutaneously ranges from 0 - 5 % in various studies<sup>10,11</sup>. For that a small incision and identification of the ulnar nerve has been advised<sup>9</sup>, if the entry point of the medial pin is kept at the same level as that of lateral pin, injury to the ulnar nerve can be avoided. Rotating the image intensifier rather than the arm for the antero-posterior and lateral view prevents the displacement of reduction. Baumann's angle<sup>12,13</sup>, anterior humeral line<sup>14</sup>, rotational malalignment and varus angulation were considered in the assessment of the reduction. The authors found this method to be effective and without any complications in the treatment of the displaced extension type supracondylar fractures of the humerus.

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