Treatment of flexion-type supracondylar humeral fracture in children

B Garg, A Pankaj, R Malhotra, S Bhan
Department of Orthopaedics, All India Institute of Medical Sciences, New Delhi, India

ABSTRACT

Purpose. To assess the results of treatment for flexion-type supracondylar humeral fracture in children.

Methods. The treatment of 14 children with flexion-type supracondylar humeral fracture was reviewed. Severity was classified according to the Gartland system for extension-type fractures. Type-I fractures were treated with immobilisation in an extension cast. For type-II and -III fractures, closed reduction was first attempted followed by percutaneous pinning. If closed reduction failed, open reduction and internal fixation was performed.

Results. Patients were followed up for at least one year (range, 14–36 months). Treatment results were excellent in 7 patients, good in 4, fair in 3, and poor in none. Patients were pain-free and satisfied and none suffered any activity restriction.

Conclusion. Closed reduction and percutaneous pinning is a good treatment option for type-II and -III flexion-type supracondylar humeral fractures.

Key words: bone wires; humeral fractures; ulnar neuropathies

INTRODUCTION

Supracondylar humeral fractures are the most common fractures around the elbow in children. Flexion-type fractures are rare and account for only 2.5% of all supracondylar fractures, with only a few having been reported. The injury results from a fall directly onto the elbow rather than the outstretched hand (as in extension-type fractures). The distal fragment is displaced anteriorly and may migrate proximally in a completely displaced fracture. The ulnar nerve is vulnerable and may be entrapped in the fracture or in the healing callus.

Various treatment options have been described, including: manipulation and casting in flexion, manipulation and casting in extension, traction, closed reduction and percutaneous pinning by Kirschner wires, and open reduction and internal fixation. The inherent instability, difficulty in achieving reduction, and potential for loss of range of movement by keeping the elbow in extension for a long time—makes surgical treatment imperative.

MATERIALS AND METHODS

The mean age of the 10 boys and 4 girls was 6.4
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(range, 4–10) years. All injuries were due to falls; 8 fell directly on the elbow, one landed on the outstretched hand, 5 were not sure of the circumstances. Nine injured the left and 5 the right side. No patient had any other associated fracture. Only one had an ulnar nerve palsy at presentation, from which the patient had recovered within 12 days of reduction.

Fracture severity was classified according to the Gartland system for extension-type fractures: type I, minimally displaced; type II, displaced, with some integrity of the anterior cortex; type III, displaced, with no cortical contact; A, anteromedial displacement; B, anterolateral displacement. Three patients were classified as type I, 5 as type II, 2 as type IIIA, and 4 as type IIIB.

Patients with type-I fractures were treated with immobilisation in an extension cast for 3 weeks followed by early active movement. Those with type-II and -III fractures were treated with closed reduction and percutaneous pinning under general anaesthesia (Fig.). Gentle traction was applied with the elbow in extension and the distal fragment reduced by direct anterior pressure using an image intensifier. Rotation was checked and percutaneous crossed pinning was undertaken with the elbow extended, allowing some degree of elbow flexion. The elbow was immobilised in a plaster slab in 30° flexion for 4 to 6 weeks; then early range of movement exercises were initiated.

In 4 patients with failed closed reduction (1 type II, 1 type IIIA, 2 type IIIB), open reduction and internal fixation was performed through an anteromedial approach. A transverse incision was made across the antecubital fossa, curving proximally and medially. To expose the fracture site, the neurovascular bundle was retracted medially while the brachialis and biceps tendons were retracted laterally. Reduction and crossed pinning was performed under visualisation. Stability was checked and the wound closed with interrupted nylon sutures. For the patient with the ulnar nerve palsy, the ulnar nerve was released and transposed anteriorly and an above-elbow slab applied in 30° flexion; the wire and cast were removed at 4 and 6 weeks respectively and early range of movement exercises initiated. Patients were followed up weekly for the first 3 weeks and then monthly for at least one year (range, 14–36 months).

RESULTS

Treatment results were assessed according to Flynn criteria (Table 1); outcome was deemed excellent in 7 patients, good in 4, fair in 3, and poor in none (Table 2). Three patients had superficial pin tract infections that resolved after wire removal. All the patients were pain-free and satisfied and none endured any permanent activity restriction.

DISCUSSION

Flexion-type supracondylar humeral fractures are rare, accounting for 4 to 10% of all such fractures. The type of injury may not be recognised until reduction is attempted. In flexion-type injuries, the fracture is unstable, whereas in extension types it is stable in

<table>
<thead>
<tr>
<th>Grading</th>
<th>Loss of functional movement</th>
<th>Change in carrying angle (varus or valgus)</th>
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<tbody>
<tr>
<td>Excellent</td>
<td>$0°–5°$</td>
<td>$0°–5°$</td>
</tr>
<tr>
<td>Good</td>
<td>$6°–10°$</td>
<td>$6°–10°$</td>
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<tr>
<td>Fair</td>
<td>$11°–15°$</td>
<td>$11°–15°$</td>
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<tr>
<td>Poor</td>
<td>$&gt;15°$</td>
<td>$&gt;15°$</td>
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Figure (a) Preoperative, (b) immediate postoperative, and (c) one-year follow-up radiographs of a patient with type-III A flexion-type supracondylar humeral fracture treated with closed reduction and percutaneous crossed pinning.
hyperflexion. A laterally displaced supracondylar
fracture may actually be a flexion-type injury.  

Ulnar nerve injury is more common in flexion-
than extension-type fractures. The ulnar nerve is
carried anteriorly with distal fragment and may be
sharply angulated over the fracture margin of the
shaft as it projects posteriorly. This is even more likely
when the distal fragment is displaced radially, as the
ulnar nerve is also pulled laterally. The vessels and
median nerve on the anterior aspect of elbow are
carried forward and upward away from the shaft and
therefore become less vulnerable.

The management of flexion-type supracondylar
humeral fractures has been controversial. Fracture type
largely determines its treatment. Type-III fractures
are most challenging, because maintaining adequate
reduction is difficult. Closed reduction in flexion by
direct pressuring on the small condylar mass is often
unsuccessful. When reduction is achieved, the elbow
is usually in extension, making stabilisation of the
distal fragment with pins difficult. This is because
anatomic landmarks for entry of Kirschner wires are
more difficult to identify when the elbow is extended
than flexed. The pins should be well-placed in lateral
and medial columns to attain optimum stability.

The overall excellent to good results in 79% of
our patients demonstrates the superiority of closed
reduction and percutaneous pinning. However,
in type-III fractures, open reduction should be
performed if 2 or 3 closed reduction attempts fail.
Open reduction is best performed through an
anteromedial, rather than an anterior approach (as
used in extension-type fractures). In flexion-type
fractures, the brachialis remains intact and must be
retracted to expose the fracture, necessitating a medial
extension to the anterior approach. Exploration or at
least identification of the ulnar nerve is advisable.
Reduction should always be performed under
visualisation and both medial and lateral pins should
be used to stabilise the fracture fragments, since
precise reduction and stability are required to avoid
secondary displacement or late deformity.

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