IPSILATERAL HUMERAL AND FOREARM FRACTURES IN CHILDREN. TECHNICAL CONSIDERATIONS

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ABSTRACT
A retrospective study was undertaken regarding 20 patients with ipsilateral humeral and forearm fractures over a 3-year period. The existing controversies in the management of such a complex injury and associated problems are outlined. A pertinent literature review is also included. Non-operative management was the choice of treatment in 12 patients, consisting in closed reduction and casting, with good results.

Key words: fracture, ipsilateral, floating elbow, Volkmann contracture

Humeral and forearm fractures are the most frequent skeletal lesions in childhood [1]. The treatment of each of these lesions is well established, varying from closed reduction and cast fixation to percutaneous fixation or open reduction and internal fixation (ORIF).

The ipsilateral lesions include a supracondylar fracture of the humerus, a lateral condyle fracture, a medial epicondyle fracture and a fracture of radius and ulna on the same limb. This is a rare and serious injury, with a frequency of 3-13% [2]. The most severe situation is that of so called “floating elbow”, when a supracondylar fracture is associated with a fracture of both forearm bones.

The recommended management is difficult to define, because of fractures’ instability and higher frequency of compartment syndrome.

The aim of this work is to present our experience in dealing with ipsilateral fractures of the upper limb.

Materials and methods
In this retrospective study, all the cases of ipsilateral injuries of the upper limb treated between 2006 and 2008 were included. There were 20 patients, 16 boys and 4 girls. The left upper limb was involved in 15 cases and the right one in 5. One patient had also a supracondylar fracture of the contralateral humerus. In 18 cases (90%), the cause of injury was a fall from a certain height and in 2 cases (10%) the cause was traffic accident. The specific associations of lesions were as follows:

- 8 3 cases (15%) with lateral condyle fracture and olecranon fracture;
- 8 2 cases (10%) with medial epicondyle fracture and radial neck fracture;
- 8 one case (5%) with fracture of the upper extremity of the humerus combined with a fracture of the distal radial metaphysis;
- 8 3 cases (15%) with fracture of the humeral shaft and distal metaphyseal fracture of both forearm bones;
- 8 11 cases (55%) combining humeral supracondylar fracture with fractures of the middle third of the forearm bones (Fig. 1).

In 12 cases, the proximal (humeral) fracture was treated conservatively, with closed reduction and casting. In two cases there was lack of interfragmentary stability and closed reduction was reinitiated.

In 6 cases, the proximal fractures were operated on. Two patients had lateral condyle fractures, two, medial epicondyle fracture, one a fracture of humeral shaft and one case had a supracondylar fracture.

The treatment of fractures of the forearm was non-operative in 17 cases.

In three cases the fractures at both levels were treated surgically from the beginning (table 1).

The upper limb was placed in cast with the elbow at 90 degrees of flexion and with forearm in supination; a lesser angle of elbow flexion would impaire the blood flow through brachial artery, increasing the risk of ischemic contracture. The limb was immobilized for a period of 4-6 weeks. Although closed reduction and casting are associated with an increased risk of compartment syndrome, in this series there was not such a complication.
The patients were followed up for a period ranging between 3 and 12 months. At the final check-up, the results were quantified following the criteria of Flynn.

**Results**

All the patients were examined, observing the active movements of the elbow (flexion-extension), measuring loss of motion, and the carrying angle loss (cosmetic factor). There were documented also fracture healing time and scar complications. Following Flynn criteria [10], there were good results in 11 cases (55%), fair results in 7 cases (35%) and poor results in 3 cases (15%). There were no cases of cubitus varus/valgus. One patient with a Garlind III supracondylar fracture developed a hypertrophic callus with limited elbow flexion at 100 degrees (Table 1).

**Discussion**

The humeral and forearm fractures in the same extremity are rare in children, resulting from severe trauma. The combined supracondylar and both bones forearm fractures were coined by ... (table 1). Stanitski with the term "floating elbow" [2,13]. The upper segment injury may include supracondylar, intercondylar, lateral condyle, medial epicondyle fractures. The lower segment fractures may be also at different locations: olecranon, radial neck, Monteggia lesions, various levels of the bone shaft [1,2,3].

The incidence of compartment syndrome is higher in these injuries [4], so, the management is sometimes challenging. There have been many opinions regarding treatment, varying from conservative to more aggressive, surgical approach. Although there were reported good results after conservative treatment [5], many authors consider pinning of the superior fracture the best choice. In 6th decade, closed reduction and casting with or without continuous transolecranian traction was recommended [6]. Afterwards this attitude was dropped, due to increased frequency of cubitus varus, of up to 25% of cases [1,6]. Today is preferred closed reduction and percutaneous pinning of upper fracture [2,5,6]. Other consider percutaneous pinning of both proximal and distal fractures to be the best treatment [3].

In this series the most frequent association was between humeral supracondylar fracture and fracture of both radius and ulna. Reed and all [11], in a series of 15 patients treated conservatively, reported good functional outcome [11]. Williamson et al [12] consider that traction and percutaneous pinning has greater efficiency [12].

Stanitski recommends early closed reduction and pinning of superior fracture and closed reduction of inferior fracture and casting [1,2,13].

<table>
<thead>
<tr>
<th>Age</th>
<th>Type or fracture</th>
<th>Treatment</th>
<th>Follow-up</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 years</td>
<td>Lateral condyle</td>
<td>Open reduction + pinning with 2 K-wires</td>
<td>6 months</td>
<td>good</td>
</tr>
<tr>
<td></td>
<td>Olecranon</td>
<td>Open reduction + screw fixation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 years</td>
<td>Medial epicondyle</td>
<td>Open reduction + pinning w/ h K-wires</td>
<td>4,5 months</td>
<td>good</td>
</tr>
<tr>
<td></td>
<td>Radial neck</td>
<td>Conservative</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17 years</td>
<td>Medial epicondyle</td>
<td>Open reduction + pinning w/ h K-wires</td>
<td>3 months</td>
<td>good</td>
</tr>
<tr>
<td></td>
<td>Radial neck</td>
<td>Conservative</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 years</td>
<td>Lateral condyle</td>
<td>Open reduction + pinning with one K-wire</td>
<td>12 months</td>
<td>good</td>
</tr>
<tr>
<td></td>
<td>Forearm</td>
<td>Conservative</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14 years</td>
<td>Humeral shaft</td>
<td>Open reduction + plate and 4 screws</td>
<td>8 months</td>
<td>fair</td>
</tr>
<tr>
<td></td>
<td>Forearm</td>
<td>Conservative</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 years</td>
<td>Supracondylar</td>
<td>Open reduction + pinning with 2 K-wires</td>
<td>11 months</td>
<td>fair</td>
</tr>
<tr>
<td></td>
<td>Forearm</td>
<td>Conservative</td>
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</tbody>
</table>

Table 1. Summary of cases according to age, site of fracture, method of treatment, follow-up and end results
In 1976 Pierce and Hodorski [7] reported a series of 21 cases of ipsilateral fractures, three of them being located at shaft level of humerus, radius and ulna. The treatment varied from conservative to surgical. The authors concluded that nervous lesions are a predictive factor for poor results [7].

Conclusions

In this series the good results obtained after conservative treatment allow us to state that a surgical approach represents a new trauma to a already injured limb, the results after surgery not being always as expected.

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