SUPRACONDYLAR FRACTURES OF THE HUMERUS IN CHILDREN

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Two types of supracondylar extension fractures of the humerus are seen in children. About one-third have little or no displacement and present no serious problem. The rest are grossly displaced and may be difficult to treat. This paper deals only with this latter type.

Three conditions must exist to secure a good result: an exact reduction, a safe fixation, and careful and prolonged after-care. Remodelling of the humerus (newly debated by Attenborough 1953) may give better movements than originally expected but does not correct the grave varus deformities (such as that shown in Attenborough's Figure 14). The author is of the opinion that all means should be used and eventually new methods devised to obtain satisfactory reduction and safe fixation.

Many surgeons have advised open reduction, Holmberg (1942) representing Scandinavia in this respect, but it is usually admitted that open reduction may be difficult and is frequently followed by a decreased range of movement.

An important problem is rotational displacement of the lower fragment resulting in bad contact, secondary displacements and varus deformity.

Böhler (1938) advised reduction under pronation but this is not sufficient in all cases. Philippides (1937) advised reduction by means of mechanical traction and this proved to be of great value. Persson (1938) constructed a handy frame for this purpose. Certain difficulties were experienced, however, even with this method. The author presented (1939) the results of treatment with mechanical traction combined with strong lateral rotation of the arm and followed by fixation, including the shoulder. The results were definitely improved by this method.

Fixation with a plaster cylinder from the fingers to the upper part of the arm does not prevent rotation, and secondary displacement will frequently occur in the plaster. The forearm rests on the abdomen in medial rotation. This directly invites a new rotational displacement. The author considers it necessary to include the shoulder in the plaster. The old rule still holds good: the joints on both sides of a fracture must be immobilised when using plaster-of-Paris for fixation.

Fig. 1
Attachment for applying traction.

Fig. 2
Position of limb in plaster.
DETAILS OF TREATMENT

Reduction—All means must be available and used individually as need arises. These include: 1) mechanical traction; 2) lateral rotation during the traction; 3) varying pronation and flexion of the elbow; and 4) direct manipulation.

An easy way of applying traction is to use a bundle of knitting wool as a sling around the base of each finger and to tie them to a simple bow. Perssons (1938) frame is not effective in some cases which demand extreme rotation. The author (1939) prefers an extension apparatus that permits traction by means of weights in all degrees of rotation (Fig. 1). Very often the arm has to be maximally rotated in such a way that the hand is behind the frontal plane ("hurrah position").

Like many surgeons (Windfield 1948) the author avoids extreme flexion of the elbow because of the danger of producing ischaemia of the forearm and hand. For this reason reduction and fixation are carried out with the elbow at 135 degrees or sometimes flexed to 90 degrees. Using the 135 degrees position, it is possible to simplify the traction: it is only necessary to pull on the hand and to put counter-traction on the arm just above the elbow (Fig. 1). The patient is fixed to the table. When the traction has been working for a little while reduction is carried out by manipulation. If check radiographs show rotational
displacement the arm is rotated laterally while the traction is continued. This is important because without the traction the lower fragment may catch the upper one and reduction does not take place. The degree of lateral rotation is varied according to the radiographs. Fluoroscopy makes this procedure easier. There are times when the pronation of the forearm or the flexion of the elbow must be altered. In one case reduction was obtained only when lateral rotation was used with the elbow in full extension and the hand in pronation.

If patience and great care are used, these methods will result in satisfying positions in at least 90 per cent of all cases and in the remaining 10 per cent there will be only an occasional bad result.

**Fixation**—A plaster shoulder spica is applied while traction is maintained and with the arm in lateral rotation (Fig. 2). The holes caused by the traction materials may be filled afterwards. If severe swelling exists or if the child has eaten shortly before the accident and it is unwise to give anaesthesia, a preliminary reduction may be carried out, an arm plaster put on and the arm suspended above the head of the child in the bed in such a way that the arm is kept safely in lateral rotation. The final reduction is carried out one week later, and a plaster spica applied as described.

**After-treatment**—The only treatment has been by active movements within the limits of pain, the children being carefully instructed and the movements supervised. The author has seen some very bad results (stiff elbows) after passive movements and massage (Watson-Jones 1943).

**RESULTS**

Thirty fractures with gross displacement have been treated according to the description and followed up for three to eight years. Most of them have been examined more than six years after the injury. The children were aged between two and eleven years. Illustrative radiographs are shown in Figures 3 to 8.

**Anatomical results**—The accuracy of the reduction as determined by radiographic examination is shown in Table 1.

Only one result, with 25 degrees' varus, was considered bad. This case was one of Y-fracture, comminuted and involving the joint, and it might have been discarded from this material of supracondylar fractures.

**Clinical results**—Functionally twenty-four of the thirty children had ideal results with a normal range of movements, normal appearance and no complaints. Four children had a
normal range of movement but a varus deformity measured on the arm to 5, 8, 9 and 15 degrees. One of these was admitted to the hospital with a radial paralysis. Neurolysis was performed and full recovery followed. One child had a flexion defect of 10 degrees and a varus angulation of 7 degrees. One had 35 degrees lack of extension and 25 degrees of varus (intra-articular Y-fracture).

**TABLE I**

**ANATOMICAL RESULTS IN THIRTY CASES OF SUPRACONDYLAR FRACTURE OF THE HUMERUS**

<table>
<thead>
<tr>
<th>Displacement</th>
<th>Number of cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Displacement less than 2 millimetres</td>
<td>22</td>
</tr>
<tr>
<td>Ulnar displacement (8 millimetres)</td>
<td>1</td>
</tr>
<tr>
<td>Radial displacement</td>
<td>2</td>
</tr>
<tr>
<td>Dorsal displacement</td>
<td>1</td>
</tr>
<tr>
<td>Varus angulation</td>
<td>4</td>
</tr>
<tr>
<td>Rotational displacement</td>
<td>0</td>
</tr>
</tbody>
</table>

I have compared these results with a series of supracondylar fractures treated by manipulative reduction and arm plaster (Jensenius 1948) and a series treated with open reduction and arm plaster (Holmberg 1942). This comparison is seen in Table II.

**TABLE II**

**COMPARISON OF RESULTS OF THREE METHODS OF TREATMENT**

<table>
<thead>
<tr>
<th>Cases . . .</th>
<th>Manipulative reduction and arm plaster (Jensenius)</th>
<th>Open reduction and arm plaster (Holmberg)</th>
<th>Traction in lateral rotation and shoulder spica (Madsen)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Results* (per cent)</td>
<td>75</td>
<td>54</td>
<td>30</td>
</tr>
<tr>
<td>Good . . .</td>
<td>43</td>
<td>61</td>
<td>83</td>
</tr>
<tr>
<td>Fair . . .</td>
<td>40</td>
<td>22</td>
<td>10</td>
</tr>
<tr>
<td>Bad . . .</td>
<td>17</td>
<td>17</td>
<td>7</td>
</tr>
</tbody>
</table>

*Good = full movement, varus not exceeding 5 degrees  
Fair = loss of movements by up to 10 degrees, varus 5–10 degrees  
Bad = loss of movement by more than 10 degrees, or varus exceeding 10 degrees

**COMMENT**

The importance of varus deformity—I agree with Windfeld (1948) and other surgeons who consider rotational displacement as an important cause of varus deformity. Ulnar displacement and angulation may give the same result. In two cases an increase of a very slight varus deformity has been observed from disturbance of growth at the epiphysial line. A disturbance of this nature has not occurred in any case with perfect reduction. This observation is considered to encourage the attempt to obtain perfect reduction.
SUMMARY

1. Reduction of supracondylar fractures in children by lateral rotation of the arm combined with mechanical traction and manipulations is described. Fixation in a plaster shoulder spica is recommended.
2. The results are presented and seem to be satisfactory.

REFERENCES