THE TREATMENT OF MALUNITED ANTERIOR MONTEGGIA FRACTURES IN CHILDREN

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Anterior Monteggia fractures in children are uncommon. This paper reports six such fractures which were undiagnosed and which became malunited with persistent dislocation of the radial head, restricted flexion and increasing cubitus valgus. This experience underlines the importance of a competent surgeon reviewing all elbow injuries at an early stage, because junior staff have been known to overlook the dislocation of the radial head when there has been a greenstick fracture of the ulna.

Mechanism and pathology—Evans (1949) showed that, in the anterior Monteggia injury, forced hyperpronation first ruptures the capsule and annular ligament, then fractures the shaft of the ulna, and finally rotates the head of the radius so that it lies in front of the capsule. The latter, in the absence of adequate traction and supination, may act as an elastic bar to reduction even in the most skilled hands. I am indebted to Mr F. W. Shea for the details of such an elbow (Figs. 1 and 2) which at operation was found to have this interposed capsule. Figure 3 shows the elbow of a man who sustained this injury thirty-nine years before, and who had had no effective treatment. At the time of examination he had severe cubitus valgus but with neither an ulnar neuritis nor much disability. Interposed capsule having prevented the reduction of the radial head it then acts as a mechanical block to full flexion. Calcification of the interposed capsule was noticed in two elbows in this series (Fig. 4).

Fig. 1
Case 1—Anterior Monteggia fracture of the left arm (Fig. 1). It was irreducible at manipulation. After operation (Fig. 2) reduction has been secured. The arm was immobilised in full supination with the elbow flexed to 90 degrees.

All the fractures of the ulna in this series were greenstick, and it was the apparent mildness of this injury which prevented accurate interpretation of its real severity. In Evans's series most of the fractures were complicated by a triangular fragment. He has also shown that dislocation of the radial head without ulnar fracture may occur from hyperpronation. I am indebted to Mr J. M. Fitton for an example of this injury (Fig. 5) which, at operation, showed an interposed and calcified capsule.
Case 9—Radiographs thirty-nine years after anterior Monteggia fracture which had had no effective treatment.

Case 5—An anterior Monteggia fracture with calcification in the interposed capsule.

Case 7—Anterior dislocation of the radial head without fracture of the ulna, with slight calcification of the interposed capsule.
One elbow in which there was congenital dislocation of the radial head has also been explored; there was no capsular inclusion (Fig. 6) and the capitulum was poorly developed with a convex radial head. Reduction, possible with the arm flexed, was impossible with the arm extended because of an apparent disparity in the length of the radius and ulna. It was reduced in the flexed position and held in place by making a new annular ligament; but this substituted a flexion deformity for the cubitus valgus (Fig. 7).

CLINICAL MATERIAL

In view of the rarity of anterior Monteggia fractures it is unusual to be able to collect in the space of six years one acute irreducible fracture, six malunited fractures, and one anterior dislocation of the radial head without fracture of the ulna. During that time two sisters with bilateral congenital dislocation of the head of the radius were seen. One of these elbows was explored and has been included in this series for comparison (Table I).

All the patients with malunited fractures had a mechanical block to flexion and were developing a valgus deformity. It was for this reason that the first elbow was explored; the successful result encouraged further operations and the various results are recorded here.

TREATMENT

Naylor (1942) pointed out that anterior Monteggia fractures could be reduced by traction and full supination. This may, however, fail (Sayle-Creer 1949), in which case immediate open reduction, as advised by Shea (1962), with reconstitution of the capsule is necessary;
but Wardle (1941) found even this to be inadequate. Reduction must be followed by six weeks' immobilisation with the elbow either flexed or in full extension, but always in full supination.

In malunited fractures the following operation has succeeded in six patients. Using a postero-lateral incision (Boyd 1963) the radial head is defined and the capsular block exposed and removed (Fig. 8). The radial head is then easily reducible without the need to divide the ulna. A new annular ligament is made by turning down a slip of the triceps tendon, leaving it attached to the ulna, and passing it round the neck of the radius from behind forward and securing it through a drill hole in the ulna (Fig. 9). The arm is then immobilised in full extension and full supination for six weeks. Thereafter active mobilisation is allowed. Figure 10 shows a capsular block removed at operation.

**RESULTS**

Figures 11 and 12 show the clinical result in the first patient nearly six years after being treated in the manner described. Table 1 shows the results and the length of follow-up.

In all these elbows reduction was achieved easily in all positions of the forearm once the capsular block had been removed. In the one elbow in which there was a congenital dislocation of the radial head and which was explored, reduction could not be held with the arm extended much beyond a right angle, but after being held in this position it has remained stable with a range of movement from 40 degrees of extension to 135 degrees of flexion for eighteen months. In the patient with the dislocated radial head without fracture the triceps tendon was very

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**Fig. 10**

A specimen of an excised capsule. The central hole has been worn away by the rim of the radial head.

**Fig. 11**

Case 2—Result five and a half years after operation upon the left elbow.

**Fig. 12**

Case 2—Result five and a half years after operation upon the left elbow.
short and thick and a not very satisfactory slip had to be used. Redislocation occurred after a slight injury, but subsequently there has been considerable improvement. This indicates that a strong annular ligamentous reconstruction must be done. If the triceps tendon is unsuitable, then a free tendon graft, as recommended by Watson-Jones (1955), should be used.

**TABLE 1**

**CLINICAL SUMMARY AND RESULTS**

<table>
<thead>
<tr>
<th>Case number</th>
<th>Sex</th>
<th>Age in years</th>
<th>Date of injury</th>
<th>Date of operation</th>
<th>Length of follow-up in years</th>
<th>Range of elbow movement Flexion and extension</th>
<th>Pronation and supination</th>
<th>Remarks</th>
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<tbody>
<tr>
<td>1</td>
<td>Male</td>
<td>7</td>
<td>September 1961</td>
<td>September 1961</td>
<td>1</td>
<td>Full</td>
<td>Full</td>
<td>An acute injury in which manipulation failed</td>
</tr>
<tr>
<td>2</td>
<td>Female</td>
<td>7</td>
<td>September 1955</td>
<td>June 1957</td>
<td>5½</td>
<td>Full</td>
<td>Full</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Female</td>
<td>8</td>
<td>October 1957</td>
<td>January 1959</td>
<td>1</td>
<td>Full</td>
<td>Slight restriction of pronation</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Male</td>
<td>10</td>
<td>October 1957</td>
<td>August 1960</td>
<td>2½</td>
<td>Full</td>
<td>Some restriction of pronation</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Female</td>
<td>7</td>
<td>June 1960</td>
<td>December 1960</td>
<td>2½</td>
<td>Full extension. Flexion to 115 degrees</td>
<td>Full</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Female</td>
<td>4½</td>
<td>November 1962</td>
<td>March 1963</td>
<td>1</td>
<td>Full</td>
<td>Loss of pronation</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Female</td>
<td>6</td>
<td>September 1961</td>
<td>February 1962</td>
<td>1</td>
<td>Full extension. Flexion to 100 degrees</td>
<td>Full</td>
<td>Dislocation of the radial head. No fracture</td>
</tr>
<tr>
<td>8</td>
<td>Female</td>
<td>7</td>
<td>—</td>
<td>September 1961</td>
<td>1½</td>
<td>Extension to 40 degrees. Flexion to 135 degrees</td>
<td>—</td>
<td>Congenital dislocation of the radial head</td>
</tr>
<tr>
<td>9</td>
<td>Male</td>
<td>44</td>
<td>1925</td>
<td>—</td>
<td>39</td>
<td>Full</td>
<td>Full</td>
<td>Severe cubitus valgus. No ulnar nerve lesion</td>
</tr>
</tbody>
</table>

The follow-up period has varied from five and a half years to one year and in no case has there been evidence of extra-articular ossification.

**DISCUSSION**

When manipulative reduction of a recent anterior Monteggia fracture in a child has failed, open reduction must be done at once. Probably simple reconstruction of the capsule and orbicular ligament followed by adequate immobilisation in supination is all that is needed.

In malunited fractures open reduction to restore full flexion at the elbow and prevent cubitus valgus is a useful procedure. Part of the triceps tendon is most suitable for making a new annular ligament, although occasionally a free tendon graft has to be used. After excision of the capsule it is essential that the repair is strong. Immobilising the arm in full supination and extension allows rapid healing of the triceps muscle, and the gradual and unforceful recovery of flexion prevents calcification around the joint.
SUMMARY

1. Six cases of malunited anterior Monteggia fracture have been treated, five of them successfully, by open reduction and reconstruction of the orbicular ligament by turning down a slip from the triceps tendon.
2. One relapse occurred after a slight injury; this was because of an unsuitable triceps tendon.
3. A slip from the triceps tendon has retained reduction of the head of the radius in a patient with congenital dislocation of the radial head.

I am indebted to Mr F. W. Shea and to Mr J. M. Fitton of St James's Hospital, Leeds, for sending me two patients; and to Miss M. Brown for the drawings.

REFERENCES