BONY ANKYLOSIS OF THE ELBOW AFTER BURNS

M. K. SETH. J. K. KHURANA

From the Department of Orthopaedics, Armed Forces Medical College, Pune, India

Ten patients with 13 ankylosed elbows after burns are described. Six elbows, fixed in nearly full extension, had almost total functional disability; the other seven had varying amounts of deformity. In five of the 13 elbows there was a continuous bony mass with loss of the joint space; these were treated by a modified excision arthroplasty which restored good movement and useful function, though there was some lateral laxity. Six elbows had a posterior bony block; this was excised, which restored a useful arc of movement. The literature on bony ankylosis after burns is reviewed and the management of these cases in a developing country is described.

Heterotopic ossification around the elbow after trauma is well known and is also seen occasionally as a complication of neural lesions. It is sometimes found in chronic infections or other systemic diseases (Noble 1924) and has been noted even in healthy individuals with no history of trauma (Samuelson and Coleman 1976). Relatively little, however, has been written on the aetiology and treatment of ankylosis after burns.

We present 13 elbows of 10 patients who developed ankylosis of the elbow after severe burns, and the results of surgical treatment in 11 of these elbows.

CLINICAL MATERIAL

The age of the patients ranged from 14 to 32 years with an average of 23.5 years. Nine of the 10 patients were females who had been accidentally burnt in their kitchens while cooking; the tenth was a man who was burnt when a petrol tank caught fire. Three cases were bilateral; of the remaining seven, the right elbow was involved in four cases and the left in three. In one elbow there was no local evidence of burns, but in all the others there was evidence of extensive burns of the limb. In those cases with local evidence of burns, the skin around the elbow was depigmented and atrophic, with loss of the subcutaneous fat; in some areas the skin was adherent to the underlying bone. The muscles of the arm and forearm were wasted.

Every patient had a palpable bony mass around the elbow. In all but two patients, there was virtually no movement at the elbow joint; the radio-ulnar joint, however, was mobile in all but one case. Ten elbows were fixed in almost full extension with total functional disability of the limb; three patients with bilateral involvement were unable to look after themselves and had to depend on others for feeding, cleaning and dressing. Two elbows were fixed at a right angle, and one at 40°.

Pre-operative radiographs showed posterior calcification at the tip of the elbow in two cases, while a continuous bony block extending from the tip of the olecranon to the humerus was seen in four elbows (Figs 1 and 2). In all these six elbows the joint space was preserved. But in five other elbows the joint space was largely or completely obliterated (Figs 3 and 4) and in one there was also radio-ulnar synostosis. The biochemical parameters of all the patients were within normal limits.

In six elbows surgical excision of the bony masses was performed, once the bone seemed mature radiologically. In the five elbows where the joint space was obliterated, a modified excision arthroplasty was done. The radio-ulnar synostosis present in one case was excised.
and no operation was performed on the two elbows which were fixed in functional position. The period between burns and operation ranged from 18 to 52 months with an average of 34.1 months.

**Surgical technique.** A posterior approach was used; the patient, under general anaesthesia, was placed prone with the arm over an armboard. A longitudinal incision was made on the posteromedial aspect and the ulnar nerve isolated. The triceps tendon and muscle were split to expose the bone.

Where only a bony block was present, this was excised and the wound was closed with a suction drain. Where a modified excision arthroplasty was planned, the distal end of the humerus was freed subperiosteally; the bridging bone was then cut, and the radial head and the tip of the olecranon were excised with a saw.

![Case 5. Figures 3 and 4—The joint is virtually obliterated. Figures 5 and 6—After operation full movement has been restored.](image)

A new joint was fashioned by excising the condyles transversely at the level of epicondyles, and rounding off the distal end of the humerus with a rasp. The articular surface of the trochlear notch had been preserved in all cases and it was not disturbed. The tourniquet was released and bleeding vessels ligated; the raw bleeding bone ends were cauterised and Gelfoam was used to cover the re-fashioned distal end of the humerus (Rockwell 1963; Shahriaree, Sajadi and Silver 1979). The elbow was reduced and fixed temporarily with two crossed K-wires in 90° of flexion and with the forearm midplane. The wound was then closed with suction drainage.

Postoperatively the limb was immobilised in a long arm cast. Two weeks later the plaster and any K-wires were removed, the sutures were taken out and movements (active and passive) were begun. In elbows treated by excision arthroplasty, a sling was worn for a further four weeks before more vigorous physiotherapy was begun; this was continued for six months. The patients were followed up for a period of 23 to 42 months with an average of 32.4 months.

**RESULTS**

The results were evaluated using the criteria advocated by Shahriaree et al. (1979); that is, pain, range of movement, stability and function were assessed. Eight patients were pain-free at follow-up; two had mild pain and one felt pain during heavy work.

In those patients who had a bony block excised, the range of movement was from 80° to 115° with an average of 97.5° (Table 1). In those who had a modified excision arthroplasty movements were at first full; they often had radiographic evidence of patchy heterotopic ossification, but this did not compromise the range of movement (Figs 5 and 6). Pronation and supination were normal, or nearly normal, in all cases except the elbow which had had a radio-ulnar synostosis, where there was very little.

At follow-up, however, none of our patients had maintained a full range of movement. Despite this, there was no evidence of recurrence of the ossification. The patients treated by modified arthroplasty had lateral instability of the elbow but this did not hinder their day-to-day activities. All the patients were able to look after themselves and to carry out their daily tasks.

There was no serious complication in this series, although wound healing was delayed in one case.

**DISCUSSION**

Heterotopic ossification around the elbow joint is seen after a severe injury where there has been damage to the soft tissues, a haematoma and stripping of the periosteum. Widespread periarticular ossification is occasionally seen with neurological lesions such as paraplegia (Miller and O’Neill 1949), hemiplegia (Irving and Le Brun 1954) and after poliomyelitis (Costello and Brown 1951). Frequent passive stretching exercises are thought to be a causal factor in such cases.

Evans and Smith (1959) reported 20 cases of bone and joint involvement after burns. Of these, 11 had heterotopic periarticular ossification. They noted that
TABLE I. Details of the 10 patients with 13 elbows involved

<table>
<thead>
<tr>
<th>Case</th>
<th>Age (years)</th>
<th>Sex</th>
<th>Period between burn and operation (months)</th>
<th>Pre-operative range of movement</th>
<th>Procedure</th>
<th>Follow-up (months)</th>
<th>Postoperative range of movement</th>
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<tbody>
<tr>
<td>1</td>
<td>21</td>
<td>F</td>
<td>36</td>
<td>5 (R)</td>
<td>EA</td>
<td>42</td>
<td>Full</td>
</tr>
<tr>
<td>2</td>
<td>32</td>
<td>F</td>
<td>39</td>
<td>10 (L)</td>
<td>EB</td>
<td>38</td>
<td>90</td>
</tr>
<tr>
<td>3</td>
<td>23</td>
<td>F</td>
<td>90</td>
<td>90 (L)</td>
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<td>4</td>
<td>14</td>
<td>F</td>
<td>48</td>
<td>10 (R)</td>
<td>EA</td>
<td>37</td>
<td>Full</td>
</tr>
<tr>
<td>5</td>
<td>31</td>
<td>M</td>
<td>37</td>
<td>20 (R)</td>
<td>EA</td>
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<td>Full</td>
</tr>
<tr>
<td>6</td>
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<td>F</td>
<td>18</td>
<td>25 (R)</td>
<td>EB</td>
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<td>110</td>
</tr>
<tr>
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<td>F</td>
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<td>EA</td>
<td>28</td>
<td>Full</td>
</tr>
<tr>
<td>8</td>
<td>17</td>
<td>F</td>
<td>33</td>
<td>10 (L)</td>
<td>EB</td>
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<td>9</td>
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<td>10</td>
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<td>26</td>
<td>10 (L)</td>
<td>EA</td>
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</tbody>
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EA, excision arthroplasty
EB, excision of bony block

"the proximity of the involved joint to the area of the burn is not consistently a factor in the production of heterotopic bone". They also thought that the severely burnt patient was "constitutionally susceptible to trauma" and that the repeated trauma of routine handling or changing dressings might contribute to heterotopic bone formation. Johnson (1957) reported four cases of localised periarticular ossification where gross trauma was not a factor; three of these had severe burns. All our cases except one had evidence of severe burns around the elbow with loss of subcutaneous fat, gross wasting of muscles and skin which was sometimes adherent to the bone. We feel that ossification after burns is triggered by fluid exudate and by necrosis of muscles. Stretching of the capsule, ligaments and muscles under heavy sedation and by physiotherapy may be an added factor.

We have used a posteromedial incision rather than the more common posterolateral one, since it avoids damage to a possibly adherent ulnar nerve. We feel that our procedure is safe and simple; it is particularly suitable for developing countries where the facilities for total joint replacement are not readily available.

REFERENCES