SILASTIC REPLACEMENT OF THE HEAD OF THE RADIUS IN TRAUMA

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Eighteen patients with marginal depressed or comminuted fractures of the head of the radius, nine of whom had an associated posterior dislocation of the elbow, had a Silastic replacement carried out shortly after injury. After an average follow-up of twenty-six months satisfactory clinical results were observed in seventeen cases; three prostheses broke. The prosthesis has been particularly effective in the group with an associated posterior dislocation of the elbow.

In current practice many marginal depressed fractures and most comminuted fractures of the head of the radius are treated by excision of the fragments of the radial head. The benefits of operation within twenty-four hours have been established by Wilson (1933) and by Gaston, Smith and Baab (1949). Although many results are satisfactory, a number of well-known problems can ensue. These include chronic pain in the elbow, forearm or wrist, restricted movement of the elbow, cubitus valgus, anterior subluxation of the proximal end of the radius, and new bone formation at the site of excision. In addition, McDougall and White (1957) and Taylor and O'Connor (1964) have indicated a high incidence of late subluxation of the inferior radio-ulnar joint.

Prosthetic replacement of the radial head after excision offers theoretical advantages in the prevention of these problems. Speed (1941) and Carr and Howard (1951) used Vitallium caps while Cherry (1953) advocated the use of an acrylic prosthesis. Neither type of prosthesis has proved popular although Carr (1971) reported long-term satisfactory results with a Vitallium cap in the treatment of eleven fresh fractures of the radial head. The flexible Silastic radial head prosthesis designed by Swanson and manufactured by the Dow Corning Corporation has been available since 1969. Since that time only scattered reports of its use in injury have appeared. Martinelli (1975) briefly described its satisfactory use in ten patients. Dossa, Brabet and Pelou (1972) reported on two patients four months and eighteen months after replacement of a freshly fractured radial head. A further report from the same centre (Sommelet et al. 1974) strongly recommended the use of a radial head prosthesis particularly in the young adult. This was based on eight cases where the prosthesis had been made of Vitallium and another eight where the Silastic prosthesis had been used.

This paper describes our experience over a five-year period with replacement of the radial head after marginal depressed or comminuted fractures and radial head fractures associated with dislocation of the elbow.

**Classification.** We have used the radiological classification of Johnston (1962): Type I—fissure fracture or marginal sector fracture; Type II—displaced marginal fracture; Type III—comminuted fracture involving the whole of the radial head; Type IV—fracture of the radial head with associated dislocation of the elbow. See Figure 1.

In this series there was one case of Type II, eight cases of Type III and nine in the Type IV category.

**CLINICAL MATERIAL**

Eighteen patients with fractures of the radial head treated by replacement with a Silastic prosthesis have been reviewed. The period of study extended from 1973 to 1978. There were twelve men and six women. The age

<table>
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<tr>
<th>Time</th>
<th>Number of patients</th>
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<tr>
<td>0–6 hours</td>
<td>5</td>
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<tr>
<td>6–12 hours</td>
<td>5</td>
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<tr>
<td>12–24 hours</td>
<td>3</td>
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<td>6–17 days</td>
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| Table 1. Time from injury to operation |

494 THE JOURNAL OF BONE AND JOINT SURGERY

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range was between twenty-one and sixty-eight years with a mean of forty-four years. The duration of follow-up was five months to five years with a mean of twenty-six months. The time from injury to operation is indicated in Table I.

Each patient was reviewed by the authors and the results were assessed clinically and radiologically. A subjective assessment was also obtained using a questionnaire. The operation was carried out via a posterior approach in nine cases and via a lateral approach in the other nine cases.

RESULTS

Subjective assessments
Elbow pain. Seven patients were entirely free of pain in the elbow. Of the remainder, nine had mild pain and in two patients moderate pain was felt only after heavy work. No patient had pain at rest or at night. In each case it was poorly localized over the lateral aspect of the elbow.

Wrist pain. Twelve patients were free of pain in the wrist; six patients had mild discomfort on heavy use. In none were the symptoms sufficient to restrict their activities.

Each patient was questioned regarding everyday function of their arm: in attending to their toilet, dressing, combing the hair, and using a key or a screwdriver. None had any complaint of pain in these respects although six patients had a vague feeling of impending instability of the elbow during heavy effort. This, however, did not appear to restrict their activities.

Objective assessment
No patient had an obvious clinical deformity either at the elbow or at the wrist. There was no significant tenderness over the implant although painless crepitus was present in almost all cases.

Extension and flexion. Six patients lost less than 10 degrees of extension, five lost 10 to 20 degrees and seven lost 20 to 30 degrees. The average loss of extension was 10 degrees in Type III and 21 degrees in the Type IV injury. Sixteen patients had lost less than 5 degrees of flexion, one patient had lost 15 degrees, while the remaining patient, who also had an associated fracture of the coronoid process of the ulna, had lost 50 degrees of flexion.

Rotation. Pronation and supination were measured using a Patrick goniometer with the elbow flexed to 90 degrees and held firmly against the side. The normal and abnormal elbows were compared. Ten patients had symmetrical pronation, four had lost up to 15 degrees and one had lost 40 degrees of pronation. This last patient had also sustained a fracture of the coronoid process. Three patients had, respectively, an apparent gain in pronation of 5, 10 and 15 degrees relative to the other side. Ten patients had symmetrical supination, three had lost up to 15 degrees of supination and in a further two the deficit was 15 and 30 degrees respectively. In each of three cases there was an apparent gain in supination of 10, 10 and 15 degrees respectively.

The apparent gains in pronation and supination were a change in the arc of rotation. The average loss of this arc of rotation was 11 degrees in the Type III group and 6 degrees in Type IV. The Type III group included the patient with an associated fracture of the coronoid process, who had lost 70 degrees of rotation.

Carrying angle. In the six patients where there was less than 10 degrees of loss of extension the carrying angle was found to be symmetrical. An accurate measurement of the carrying angle in the other twelve patients could not be made because of the greater degree of flexion deformity.

Overall clinical assessment of joint function
The results were graded into three groups: excellent if there was no pain in the elbow or wrist on maximal exertion, less than 20 degrees loss of movement in any direction and full muscle power at the elbow; good if there was mild pain in the elbow or wrist on exertion, less than 30 degrees loss of movement in any direction and good muscle power at the elbow; poor if there was severe pain on effort, pain at rest or loss of movement greater than 30 degrees in any direction with severe reduction of motor power.

It is recognized that limited movement of the elbow is consistent with a good result (Radin and Risenborough 1966). This classification is similar to that of Radin and Risenborough but puts greater emphasis on the functional aspect. On this basis seven cases had an excellent result, ten had a good result and one had a poor result.

Return to work. Eleven of the twelve men were manual workers and all were able to return to their previous employment or to similar work. The average period of absence was sixteen weeks, the earliest return being at five weeks.

Distal radio-ulnar joint. Four patients had up to 4 millimetres of subluxation of the distal radio-ulnar joint. However, only one of the four had pain and tenderness overlying the joint whereas a further five patients had symptoms about the wrist on heavy work without any abnormal features on their radiographs.

Radiographs. The overall contour of the head of the prosthesis remained unchanged over the maximal follow-up period of five years. The prosthesis broke at the junction of the stem and the head in two cases but neither patient, one of whom did heavy manual work, noticed any difference in the function of the elbow; in both these cases the prosthesis had not been fully seated into the radial neck. Another patient developed an oblique fracture in the head of the prosthesis two years after its insertion; this caused no symptoms. Minor tilting of the prosthesis was apparent in one-third of the
cases: the capitellum became osteoporotic three months after operation, the osteoporosis increasing progressively for up to one year and thereafter remaining static. This contrasts with the sclerotic line frequently seen around the stem of the prosthesis (Figs. 2 and 3). In six cases there was a minor degree of new bone formation in relation to the proximal end of the lateral collateral ligament and in three cases in relation to the proximal end of the medial collateral ligament. There was no case of myositis ossificans.

Complications. The smallest of the Silastic prostheses had been inserted in one patient; this prosthesis later subluxed and seven months after operation it was replaced by a large one with a satisfactory result. There were no neurological problems, either temporary or permanent, after any of the operations. There were no cases of infection.

DISCUSSION

Conservative management of the Type I undisplaced fracture of the radial head gives good results and there is rarely any need for operative intervention.

However, considerable controversy exists regarding conservative or operative treatment of Type II fractures. The advice of Mason (1954)—"if in doubt, resect"—contrasts with that of Johnson (1962)—"if in doubt, conserve". No directly comparable series have been published. Radin and Riseborough (1966) advised early total excision of the head of the radius in Type II fractures if more than two-thirds of the radial head was involved, but considered that the result would be only fair. Our single case in this category has had an excellent subjective and objective result and the patient is able to work as a furniture remover.

In contrast to the Type II injuries there is widespread agreement that early total excision of the radial head gives the best results in Type III fractures. Gaston et al. (1949) reported satisfactory results in twenty-three patients treated by early total excision of the radial head. Mason (1954) published good functional results in seventeen of his eighteen patients who had had the radial head excised, although he also noted an average of 25 degrees loss of extension and 30 degrees loss of rotation. Johnston (1962), however, found that all six of his patients treated by excision of the radial head had pain in the elbow, four also had pain in the wrist but rotation was fully maintained. Radin and Riseborough (1966) had six good results out of twenty-six patients similarly treated by early total excision of the radial head.

Of the eight Type III fractures in our series, four had an excellent result, three had a good result and one a poor result. The average loss of extension of 10 degrees and loss of rotation of 11 degrees compares favourably with the figures published by Mason (1954). The poor result was in a patient who had, in addition, a fracture of the coronoid process of the ulna and was operated on eight days after injury.

The Type IV fracture-dislocation has the worst prognosis, reflecting the additional involvement of soft tissue. Gaston et al. (1949) reported twelve such cases treated by total excision of the radial head within twelve hours of injury via a transverse approach across the antecubital fossa. There was average loss of extension of 45 degrees and six of their patients had considerable new bone formation at the site of excision. There were no cases of myositis ossificans and this they attributed to early operation. Johnston (1962) had five cases of this
type of injury, four had immediate reduction of the dislocation carried out followed by excision of the radial head two to three weeks later. These patients had an average of 25 degrees loss of extension, 10 degrees loss of flexion and 20 degrees loss of rotation. All had pain in the elbow, four had myositis ossificans and three had pain in the wrist. These poor results were attributed to the combination of severely injured soft tissue and late operation. Seven of our nine Type IV cases had good results and two had excellent results. Four patients had no pain and five had minimal pain on heavy work. The average loss of extension of 20 degrees is considerably less than in the series of Gaston et al. (1949) but is similar to that reported by Johnston (1962). However, the symptomatic sequelae were less severe in our group.

Progressive osteoporosis of the capitellum for one year after insertion of the prosthesis has been consistent in our series. It is evident on most published radiographs although it has not attracted particular attention. The articular surface of the capitellum is known to be damaged to a varying degree in the initial injury (Mason 1954) but this is not commonly associated with any radiological changes. The Silastic prosthesis is compressible and may not produce enough contact to stimulate the formation of healthy bone in the capitellum. There were no cases of myositis ossificans, and this we consider mainly due to early operation as indicated by Gaston et al. (1949). The occurrence of heterotopic calcification at the origin of the medial and lateral collateral ligaments in one-third of the cases is no more frequent than might be expected after simple dislocation of the elbow.

McDouggall and White (1957) and Taylor and O’Connor (1964) drew attention to late dislocation or subluxation of the distal radio-ulnar joint after excision of the radial head. Before this, only scattered individual reports of this complication had appeared; Gaston et al. (1949) did not consider this problem to exist in any of their 113 cases. Curr and Coe (1946) described a single case of dislocation of the distal radio-ulnar joint occurring at the time of fracture of the radial head and a further two cases were reported by Essex-Lopresti (1951). There was no correlation between the radiological appearances of subluxation and symptoms. In our series, six of the eighteen cases had discomfort in the wrist on heavy work. This is disappointing if a function of the radial head prosthesis is to prevent symptoms in the distal radio-ulnar joint. However, it may indicate that some ligamentous damage to the distal radio-ulnar joint occurred in the original injury, thus making the condition described by Curr and Coe (1946) a much commoner injury than has previously been considered.

Early insertion of the Silastic prosthesis has given satisfactory results in the treatment of comminuted fracture of the radial head. We consider that it has been particularly effective in the group where there has been an associated posterior dislocation of the elbow, a group which has been hitherto associated with a moderate or poor result.

REFERENCES


