Complex fractures of the distal humerus in the elderly
THE ROLE OF TOTAL ELBOW REPLACEMENT AS PRIMARY TREATMENT
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Between 1995 and 2000, 19 consecutive patients with fractures of the distal humerus were treated by primary total elbow replacement using the Coonrad-Morrey prosthesis. No patient had inflammatory or degenerative arthritis of the elbow. The mean age at the time of injury was 73 years (61 to 95). According to the AO classification, 11 patients had suffered a C3 injury, two a B3 and two an A3. One fracture was unclassified. Two patients died from unrelated causes and one was unable to be assessed because of concurrent illness.

The mean time to follow-up was three years (1 to 5.5). At follow-up 11 patients (68%) reported no pain, four (25%) had mild pain with activity and one had mild pain at rest. The mean flexion arc was 24° to 125°. The mean supination was 90° (70 to 100) and pronation 70° (50 to 110). No elbow was unstable. The mean Disabilities of the Arm, Shoulder and Hand score was 23 (0.92 to 63.3) and the mean Mayo elbow performance score was 93 (80 to 100). Of the 16 patients, 15 were satisfied with the outcome.

Radiological evaluation revealed only one patient with a radiolucent line at the cement-bone interface. It was between 1 and 2 mm in length, was present on the initial postoperative radiograph and was non-progressive at the time of follow-up.

Primary total elbow arthroplasty is an acceptable option for the management of comminuted fractures of the distal humerus in elderly patients when the configuration of the fracture and the quality of the bone make reconstruction difficult.

Non-operative treatment (immobilisation in a cast, traction, or ‘bag of bones’) often results in either a united fracture with joint stiffness and poor function or nonunion of the fracture with a painful pseudarthrosis.[4,8]

Operative fixation is technically difficult. It usually involves a large exposure, and may require an olecranon osteotomy to fix anterior articular fragments. In addition, if adequate stability is not achieved, nonunion, malunion, post-traumatic arthritis and stiffness of the joint may result. Jupiter and Morrey[9] reviewed 846 procedures from 13 reports of open reduction and internal fixation for fractures of the distal humerus and found that 20% of patients had an unsatisfactory outcome.

In elderly patients, the osteopenic bone and increased comminution compound the difficulties of achieving an anatomical reduction and stable fixation. In 1997, Cobb and Morrey[10] reported their experiences of total elbow arthroplasty (TER) in 20 such patients and concluded that it was an effective alternative treatment. Their study, however, comprised a mixed population, with nine of the patients (ten elbows) suffering from rheumatoid arthritis. If these patients are excluded the mean follow-up of the 11 non-rheumatoid patients with fracture of the distal humerus undergoing TER is only 31.6 months (3 to 60). Also, little information had been recorded for one of the two patients who died at three and ten months, respectively.

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Although fractures of the distal humerus account for only 2% of adult fractures, traditional methods of treatment are associated with a significant number of poor results.[1-3]

Gambirasio et al[18] have recently reported good results in ten patients who underwent TER for complex fractures of the distal humerus. Their conclusions, however, were based upon a mean follow-up of 17.8 months, which they stated could be a deficiency of their study. Indeed, all TERs have been shown to have good short-term results. With longer follow-up the results in some patients have been less satisfactory. Schneeberger et al[17] identified mechanical failures of the prosthesis in post-traumatic patients who had a TER, but noted that none of these occurred within 24 months.

We now report the longest follow-up of the largest
number of TERs for the treatment of complex fractures of the distal humerus in elderly patients with no previous history of inflammatory arthropathy.

Patients and Methods

Between 1995 and 2000, a consecutive series of 19 patients with fractures of the distal humerus was treated by TER. The indications for surgery were fracture comminution and osteopenia in patients over the age of 60 years. Two patients died before any prolonged period of follow-up. One had multi-infarct dementia and hypertonicity affecting her limbs which made assessment impossible. The remaining 16 patients were assessed clinically and radiologically at a mean follow-up of three years (1 to 5.5). The AO classification was used to identify the type of fracture (Fig. 1), all of which were closed injuries. Table I gives the details of the patients. There were four men and 12 women with a mean age of 73 years (61 to 95) at the time of injury. Of the 15 patients who were right-hand dominant, only three (cases 4, 15 and 16) suffered an injury to their dominant side. One was left-hand dominant (case 7) and injured the non-dominant side. According to the AO classification, 11 patients suffered a C3, two a B3, and two an A3 injury. One fracture was unclassified. The mean interval between injury and surgery was eight days (1 to 21). The longest
delay of 21 days was in a patient (case 5) who was referred from another hospital with a C3 fracture.

The Coonrad-Morrey TER (Zimmer) was used in all patients. This is a linked device with 7° valgus/varus laxity and provides stability even in the absence of the humeral condyles and is therefore in our opinion the prosthesis of choice for patients with comminuted fractures of the distal humerus.

A previously described posterior approach was used and the implant fixed with Palacos cement. Bone graft was inserted between the anterior flange of the humeral component and the anterior cortex. After operation, a compression dressing and plaster back-slab were retained for 48 hours. The wound was then inspected and elbow mobilisation commenced under supervision of a physiotherapist.

An independent researcher (RM) undertook the follow-up assessment. The patients’ daily activities and postoperative quality of life were evaluated using the Disabilities of the Arm, Shoulder and Hand (DASH) questionnaire. The patients were also assessed by the Mayo elbow performance score.

Anteroposterior (AP) and lateral radiographs were taken at follow-up and compared with the immediate postoperative radiographs for evidence of failure of the implant and aseptic loosening.

Results

The mean follow-up was three years (1 to 5.5). At follow-up, 11 patients (68%) reported no pain, four (25%) had mild pain with activity and one patient had mild pain at rest. The mean flexion arc was 24° to 125°. The mean supination was 90° (70 to 100) and pronation 70° (50 to 110). Pronation and supination were measured as rotation of the hand with the elbow flexed and stabilised at 90°. No elbow was unstable. The mean DASH score was 23 (0.92 to 63.3); 0 reflects no disability and 100 reflects the most severe disability. The mean Mayo elbow performance score (Table II) was 93 (80 to 100). A Mayo elbow performance score of between 90 to 100 is excellent, and good if between 75 and 89. A total of 15 patients (94%) was satisfied with the outcome. The patient who was not satisfied (case 9) had loss of extension (60°) secondary to heterotopic ossification. The patient with the longest delay between injury and surgery (case 5) had an excellent result 5.5 years after the arthroplasty.

The only perioperative complications were one myocardial infarct (case 11) and one superficial wound infection (case 12) which responded to antibiotics. There was one case of neurapraxia (case 15), which was present after the injury and before surgery.

Radiographs showed that 15 implants were well fixed with no evidence of loosening (Fig. 2). In one patient (case 16) there was a radiolucent line of between 1 and 2 mm long on the initial postoperative radiograph. This had not progressed at follow-up. The patient had no pain and satisfactory elbow function. One patient (case 9) had severe heterotopic ossification. No predisposing factors could be identified for the heterotopic ossification.

Discussion

As the elderly population increases, the number of fractures in patients over the age of 60 years with significant osteopenia will increase. Palvanen et al published a retrospective study of Finnish women over the age of 60 years who were admitted to hospital between 1970 and 1995 for treatment of their first osteoporotic fracture of the distal humerus. They reported an age-adjusted increase in the

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<th>Table II. The Mayo elbow performance score</th>
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<tr>
<td>Function</td>
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<tr>
<td>Pain (maximum 45 points)</td>
</tr>
<tr>
<td>None (45)</td>
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<tr>
<td>Mild (30)</td>
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<tr>
<td>Moderate (15)</td>
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<tr>
<td>Severe (0)</td>
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<tr>
<td>Range of movement (maximum 20 points)</td>
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<tr>
<td>Arc &gt; 100° (20)</td>
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<tr>
<td>Arc 50 to 100° (15)</td>
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<tr>
<td>Arc &lt; 50° (5)</td>
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<tr>
<td>Stability (maximum 10 points)</td>
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<tr>
<td>Stable (10)</td>
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<tr>
<td>Moderately unstable (5)</td>
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<tr>
<td>Grossly unstable (0)</td>
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<tr>
<td>Function (maximum 25 points)</td>
</tr>
<tr>
<td>Able to comb hair (5)</td>
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<tr>
<td>Able to feed oneself (5)</td>
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<td>Able to undertake personal hygiene tasks (5)</td>
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<td>Able to put on shirt (5)</td>
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<td>Able to put on shoes (5)</td>
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<td>Mean total (maximum 100)</td>
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incidence of such fractures resulting from moderate or minimal trauma from 12 in 100 000 women in 1970 to 28 in 100 000 in 1995. They concluded that if this trend continued, it would result in an almost threefold increase in the number of fractures of the distal humerus in women by the year 2030. A difficult orthopaedic problem may become increasingly common.

In the presence of osteopenia, internal fixation which is sufficiently stable to allow early mobilisation is often difficult. The complexity of the fractures also makes anatomical reduction and stable internal fixation challenging. John et al\textsuperscript{23} reported the results of surgical stabilisation of 49 patients with supracondylar fractures of the humerus whose mean age was 80 years (75 to 90); 41 (84\%) were complete articular-type fractures as classified by the Müller system, and 39 were reviewed at a mean follow-up of 18 months. A very good result was reported for 31\% of patients, a good result for 49\%, and a fair or poor result for 20\%. Only 5\% had constant pain. They concluded that in elderly patients surgical stabilisation of these fractures was not associated with a higher incidence of failure of the implant or pseudarthrosis and thus internal fixation was not contraindicated in this age group.

Pereles et al\textsuperscript{24} carried out a retrospective review of fractures of the distal humerus in 18 patients over the age of 60 years. All were objectively evaluated using a standardised clinical evaluation and the SF-36 Health Survey. They reported that at a minimum follow-up of one year, 12 patients had a good clinical outcome. Five (28\%), however, complained of moderate pain during activity for which medication was required.

Caja et al\textsuperscript{25} found that in their group of 22 patients with bicondylar fractures of the distal humerus the range of movement and functional outcome were most dependent on the age of the patient. They noted that even if early mobilisation was achieved the results were worse in older patients.

It is in the light of these studies that the outcome of TER must be assessed. Cobb and Morrey\textsuperscript{10} retrospectively evaluated their series of TERs for fracture of the distal humerus. They reviewed 20 consecutive patients (21 elbows) with a mean age of 72 years (48 to 92) at a mean follow-up of 3.3 years (0.25 to 10.5). Assessment using the Mayo elbow performance score identified 15 elbows with an excellent result and five with a good result. There were no fair or poor results. In one elbow the data were inadequate. The mean flexion arc was 25° to 130°. There was no evidence of loosening on the radiographs. Postoperative complications included fracture of the ulnar component in one patient, ulnar neurapraxia in three, and reflex sympathetic dystrophy in one. They suggested that TER could be suc-
cessfully used for severely comminuted fractures of the distal humerus in older patients. This study, however, comprised a mixed population of patients. There were nine patients (ten elbows) who suffered from rheumatoid arthritis (45% of the group). TER is most commonly undertaken in rheumatoid patients and the inclusion of this group of patients with a fracture with a group of non-rheumatoid patients may introduce bias with respect to outcome. Exclusion of rheumatoid patients leaves 11 patients (11 elbows) with a mean follow-up of 31.6 months.

A smaller study by Ray et al. reported seven patients who had TER as primary treatment for fracture of the distal humerus. They had a mean age of 81.7 years and all had good results at a follow-up between two and four years. Again, however, nearly half of these patients (3 of 7) had rheumatoid arthritis.

Gambirasio et al. recently reported ten patients with a mean age of 84.6 years who suffered a complex fracture of the distal humerus. Their primary surgical intervention was a Coonrad-Morrey arthroplasty. The mean Mayo Score at follow-up was 94, which indicates a functional pain-free range of movement. The mean follow-up was only 17.8 months, with seven patients having been reviewed at only 12 to 14 months after surgery. They acknowledge that the short follow-up could be considered a deficiency of the study. We would agree with this, since the study of TER in patients with post-traumatic arthritis by Schneebberger et al. showed that failure of the implant may occur after more than two years.

Our study involves the largest reported group of non-rheumatoid patients undergoing TER for fractures of the distal humerus with a mean follow-up of three years. Such patients can be expected to have greater functional demands than similarly aged rheumatoid patients. They may more closely resemble osteoarthritic or post-traumatic patients who undergo TER. Reports after TER in these patients show poorer functional outcomes and survival of the prosthesis because of increased demands imposed by strenuous activity. Mechanical failures such as fracture of the prosthesis and worn bushings occurred after more than two years. We therefore feel that our follow-up is the minimum required to detect early failures.

In our study 93% of patients had no pain or only mild pain with activity. The mean DASH score of 23 (0.92 to 63.3) is indicative of good or excellent results. In addition, the mean Mayo performance score of 93 represents an excellent functional outcome. No patient had a fair or poor result. These results confirm the conclusion of previous studies that primary TER is an acceptable option for the management of comminuted fractures of the distal humerus in the elderly and advances the postoperative period of time for which good results can be anticipated.

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

References


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