TOTAL SHOULDER REPLACEMENT IN RHEUMATOID DISEASE
7- TO 13-YEAR FOLLOW-UP OF 37 JOINTS

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We made a prospective study of 58 consecutive Neer II total shoulder replacements in 49 rheumatoid patients. Cemented glenoid and press-fit humeral components had been used. After a mean follow-up of 9.5 years (7 to 13), 11 patients (15 shoulders) had died, one shoulder had been arthrodesed and five patients (five shoulders) had been lost to follow-up.

Of the remaining 37 shoulders 29 were painfree or had only slight discomfort, four had pain on unusual activity, and four had moderate or severe pain. There were satisfactory improvements in the mean range of active elevation (53° to 75°) and external rotation (5° to 38°); satisfactory performance of the activities of daily living had been maintained throughout follow-up. Radiographs showed loosening in ten shoulders of nine glenoid and nine humeral components but of these only three had significant symptoms. Three loose glenoid components and two loose humeral components required revision.

We consider that the Neer total shoulder replacement provides a reasonable medium to long-term outcome in rheumatoid arthritis, but recommend that the humeral component should be routinely cemented.

Received 22 February 1996; Accepted after revision 15 July 1996

Glenohumeral arthroplasty is widely accepted for the treatment of severe rheumatoid disease of the shoulder.1-3 Most surgeons now use relatively unconstrained prostheses; of these, the Neer II implant has become the 'gold standard'.4 There were some early misgivings about the use of an unconstrained replacement in rheumatoid arthritis because of the usual deficiencies of bone stock and soft tissues, but good short-term results have been achieved.5,6 There is, however, continued concern about the incidence of radiolucencies at the cement-bone interface of the glenoid and their effect in the longer term.6,7

We report a prospectively planned study of a group of rheumatoid patients to determine the longer-term clinical and radiological results of the Neer II total shoulder arthroplasty. We have reported our early results in 42 patients.2

PATIENTS AND METHODS

From 1979 to 1985, we performed 58 consecutive Neer II total shoulder arthroplasties in 49 patients with classic seropositive rheumatoid arthritis. All the preoperative radiographs of the glenohumeral joint showed Larsen grade-IV or grade-V changes.8 The indication for surgery was severe pain associated with marked limitation of function.

The operative technique and postoperative management were as described previously.2 No metal-backed glenoid components were used and all were cemented. All the humeral components were inserted without cement. At operation, the state of the deltoid, the rotator-cuff tendons and the glenoid bone was assessed and recorded.

After a mean follow-up of 9.5 years (7 to 13), 11 patients (15 shoulders) had died, one shoulder had been revised to an arthrodesis after a postoperative rotator-cuff tear and five patients (five shoulders) had been lost to follow-up. The remaining 32 patients (37 shoulders) were reviewed by one of the authors (MPMS), who had not been involved in the surgery, in terms of pain relief, active range of movement and the ability to perform five activities of daily living (Table I). There were 28 women and four men and their mean age at operation was 55 years (22 to 71).

Radiographs. Anteroposterior and axillary radiographs of each shoulder were taken postoperatively, at six months, then annually and at the final review. Joint subluxation was assessed by the relationship of the junction of the middle...
and lower thirds of the prosthetic head to the centre of the wire marker on the Neer glenoid component on films obtained with the arm at the side in neutral rotation. We chose this method in preference to measuring the acromio-humeral distance because the latter is very sensitive to changes in radiological projection. Radiological loosening of the humeral stem and the glenoid component was assessed as definite or probable by the criteria shown in Table II.

**Statistical analysis.** We used the chi-squared test with continuity correction to compare independent groups.

### RESULTS

At operation seven of the 37 rotator cuffs appeared to be normal, 25 were thin and five were torn. The glenoid bone was deficient in 21 shoulders and substantially normal in 16. The intra-articular portion of the long head of biceps was always absent.

The results in terms of pain relief, function and range of movement are shown in Table I. At the time of review, four shoulders had moderate or severe pain. Nearly all had gained a significant functional improvement, but the most striking changes were in the use of the hand at shoulder level and the ability to sleep on the affected side. The range of active elevation had shown a modest improvement at two years to a mean of 88°, but this had deteriorated to a mean of 75° at the latest review. The range of external rotation averaged 38° at both two years and at the latest review.

**Radiography.** The latest radiographs showed radiolucent zones around 23 of the glenoid and 20 of the 37 humeral components. In 14 glenoid and 11 humeral components there had been no progression in the extent or width of the lucency since the two-year review. Defining loosening as progressive radiolucency exceeding 2 mm in width or any definite change in the position of the components, there were nine loose glenoids and nine loose humeral components in ten shoulders (Table III). Five each of the nine loose glenoid and humeral components had shown no radiolucency at the mean two-year follow-up.

There was upward subluxation of over 5 mm in 21 shoulders at the latest review; the other 16 showed no significant superior subluxation. No shoulder showed significant anterior or posterior subluxation.

**Loose components.** All ten patients with definitely or probably loose components were female, and all had a thin or torn rotator cuff at operation (Table IV). Nine of the ten shoulders also had deficient glenoid bone (p < 0.05). All shoulders with loose prostheses also showed significant superior subluxation at the latest review (p < 0.001). Seven of the ten shoulders gave some pain; three shoulders with three loose glenoids and two loose humeral components had enough pain for a recommendation for revision surgery.

### Table I. Clinical results in 32 patients (37 shoulders) at a mean 9.5 years after Neer total shoulder replacement

<table>
<thead>
<tr>
<th></th>
<th>Preoperative</th>
<th>Review</th>
</tr>
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<tbody>
<tr>
<td>Pain (n = 37)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>None or slight</td>
<td>0</td>
<td>29</td>
</tr>
<tr>
<td>With unusual activity</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Moderate or severe</td>
<td>37</td>
<td>4</td>
</tr>
<tr>
<td>Function (n = 37)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perineal care</td>
<td>19</td>
<td>28</td>
</tr>
<tr>
<td>Wash opposite axilla</td>
<td>15</td>
<td>27</td>
</tr>
<tr>
<td>Comb hair</td>
<td>4</td>
<td>18</td>
</tr>
<tr>
<td>Use hand at shoulder level</td>
<td>1</td>
<td>26</td>
</tr>
<tr>
<td>Sleep on affected side</td>
<td>3</td>
<td>23</td>
</tr>
<tr>
<td>Mean range of movement in degrees (n = 37)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Active elevation (range)</td>
<td>53 (10 to 90)</td>
<td>75 (10 to 100)</td>
</tr>
<tr>
<td>External rotation (range)</td>
<td>5 (-30 to 50)</td>
<td>38 (20 to 50)</td>
</tr>
<tr>
<td>Internal rotation (range)</td>
<td>(Greater trochanter to T12)</td>
<td>(Buttock to T7)</td>
</tr>
</tbody>
</table>

### Table II. Radiological criteria for definite and probable loosening of humeral and glenoid components after total shoulder replacement

<table>
<thead>
<tr>
<th>Site</th>
<th>Grade</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glenoid</td>
<td>Definite</td>
<td>Dislocation or other change in position</td>
</tr>
<tr>
<td></td>
<td>Probable</td>
<td>Unchanged position but progressive radiolucencies &gt;2 mm involving all or part of the component; flange/keel/complete</td>
</tr>
<tr>
<td>Humeral</td>
<td>Definite</td>
<td>Subsidence or other change in position</td>
</tr>
<tr>
<td></td>
<td>Probable</td>
<td>Progressive radiolucencies &gt;2 mm involving all or part of the stem. Localised endosteal resorption</td>
</tr>
</tbody>
</table>
Only one of the 13 shoulders with no evidence of loosening was painful.

Complications. One shoulder developed late deep sepsis after 3.5 years which settled with antibiotic treatment alone. There were two intraoperative fractures, one of the glenoid and one of the humerus, neither of which developed loosening. The glenoid fracture was managed by fixation with a Kirschner wire but the humeral fracture was incomplete and only detected postoperatively. No intervention was required.

DISCUSSION

There are many early and mid-term reports of total shoulder replacement in rheumatoid disease but few long-term reviews. Our earlier paper indicated short-term success but expressed concern about the high incidence of glenoid lucency. At a mean of 9.5 years we have found radiolucencies in 23 of 37 glenoid components. The total number was not unexpected, but the incidence of progressive change was high at 24%. A more surprising and unexpected finding was the progressive nature of a similar proportion of humeral lucencies; these involved mainly the lateral and distal aspects of the press-fitted stems (Fig. 1). In all but one case the loose humeral components were associated with loose glenoid components.

We found superior subluxation of the humeral component in 21 shoulders (57%); in 20 of these a thin or torn rotator cuff had been recorded at operation. Continuing subluxation is probably the result of progressive thinning and rupture of the rotator cuff due to progression of rheu-
matoid disease. There was definite superior subluxation in all ten loose arthroplasties (Fig. 2). Barrett et al\textsuperscript{1} suggested that subluxation leads to eccentric loading on the glenoid face which produces a rocking movement of this component within the bony glenoid fossa, and this is the most likely reason for glenoid loosening in our patients. We also consider that eccentric loads on the humeral head, from the glenoid rim or from impingement beneath the acromion, may produce a toggle effect on the humeral stem which eventually produces the pattern of humeral radiolucencies which we report.

Despite the high incidence of progressive lucencies around both the glenoid and humeral components (25%), only five loose components in three shoulders gave symptoms severe enough to require revision. This may reflect the limited demands placed on the shoulder by some rheumatoid patients and the ‘protective’ effects of ipsilateral involvement of the elbow, wrist and hand.

Lucencies around the glenoid and humeral components did not inevitably result in early loosening; of the 23 glenoid components and 20 humeral components with lucencies at a mean two-year follow-up, only four of each became loose by 9.5 years. Five other apparently satisfactory glenoid and humeral components at 2.5 years developed loosening after this, and therefore the long-term clinical outcome could not have been predicted on the basis of the earlier review.

All but one of the loose glenoids were in bone which was described as deficient at operation. Attempts to improve fixation of the glenoid component have included metal backing,\textsuperscript{12} but Sledge et al\textsuperscript{3} have reported a high incidence of early loosening in rheumatoid patients with the metal-backed Neer glenoid component. Other implant designs have not been in use for long enough for proper assessment. It has been suggested that glenoid loosening would be reduced if rheumatoid shoulders had arthroplasties at an earlier stage, but shoulder pain associated with Larsen grade-III and grade-IV joints is not always derived from the glenohumeral joints themselves.\textsuperscript{13} Early glenohumeral arthroplasty may not be appropriate for these patients. Another approach to this problem is to avoid the use of a glenoid component; we have found comparable medium-term results for hemiarthroplasty of the humeral head and total shoulder replacement in rheumatoid patients, although glenoid erosion may be a problem.\textsuperscript{14}

Progressive loosening of the humeral component would probably be reduced by the routine use of cement in rheumatoid patients, as recommended by Neer.\textsuperscript{7} Some of the newer designs of arthroplasty provide a much larger range of stem sizes than the Neer prosthesis and have been designed for cementless fixation. Only longer-term review will show whether better filling of the humeral medullary cavity with metal will affect the long-term cementless fixation.

The Neer II total shoulder replacement for rheumatoid disease appears to provide reasonably reliable long-term pain relief, with associated improvements in the range of movement and function. In common with other total joint replacements, radiological loosening of the components becomes more frequent with time, but in rheumatoid patients after shoulder arthroplasty the need for revision is infrequent.

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


