HIP

Total hip replacement and hemiarthroplasty in mobile, independent patients with a displaced intracapsular fracture of the femoral neck

A SEVEN- TO TEN-YEAR FOLLOW-UP REPORT OF A PROSPECTIVE RANDOMISED CONTROLLED TRIAL

We reviewed the seven- to ten-year results of our previously reported prospective randomised controlled trial comparing total hip replacement and hemiarthroplasty for the treatment of displaced intracapsular fracture of the femoral neck. Of our original study group of 81 patients, 47 were still alive.

After a mean follow up of nine years (7 to 10) overall mortality was 32.5% and 51.2% after total hip replacement and hemiarthroplasty, respectively (p = 0.09). At 100 months post-operatively a significantly greater proportion of hemiarthroplasty patients had died (p = 0.026). Three hips dislocated following total hip replacement and none after hemiarthroplasty. In both the total hip replacement and hemiarthroplasty groups a deterioration had occurred in walking distance (p = 0.02 and p < 0.001, respectively). One total hip replacement required revision compared with four hemiarthroplasties which were revised to total hip replacements. All surviving patients with a total hip replacement demonstrated wear of the cemented polyethylene component and all hemiarthroplasties had produced acetabular erosion.

There was lower mortality (p = 0.013) and a trend towards superior function in patients with a total hip replacement in the medium term.

Short-term follow-up from three randomised controlled trials (RCTs) has shown that total hip replacement (THR) is superior to hemiarthroplasty for the treatment of mobile independent patients who suffer a displaced intracapsular fracture of the hip.1-3 Two further RCTs show no clinical difference after two-4 and five-year follow-ups.5 One long-term review records lower rates of revision and less pain after THR.6

The major short-term complication of THR is dislocation with reported rates ranging from 2% to 20%1-10 following the treatment of displaced intracapsular femoral neck fracture. In contrast, hemiarthroplasty is associated with acetabular erosion,11,12 particularly in younger patients. This problem has been reported to be more common with unipolar than bipolar prostheses.13

Long-term review is difficult in this population due to high mortality rates. In the series with the longest follow-up, 86% had died by 13 years.6

Our initial report of this prospective RCT reported that THR for displaced intracapsular femoral neck fractures produced better function than hemiarthroplasty after three years1 with better Oxford hip scores14 (OHS) and walking distances. We were interested to see whether this difference persisted after a mean of nine years follow-up.

Patients and Methods

This study was designed to isolate the bearing surface of the acetabulum as the sole variable. The femoral component was standardised and the comparison was made between the articulation of metal on ultra-high-molecular-weight polyethylene in THR and metal on articular cartilage following hemiarthroplasty.

A total of 81 patients living independently who sustained a non-pathological fracture of the hip, with no or minimal osteoarthritis had been studied. They were all > 60 years old, had been able to walk a minimum of half a mile prior to injury and had a normal abbreviated Mini Mental test score.15 They were
prospectively randomised into two groups with 40 patients managed with THR and 41 with a hemiarthroplasty. The mean age of patients at enrolment was 75 years (63 to 86). Their outcome was described in full in our previous report.1 We found no significant differences between the two groups for age, gender, American Society of Anesthesiologists (ASA) score, mental or functional scores.1 Likewise the distribution of procedures between participating hospitals and the level of experience of the surgeons was similar.

A cemented collarless polished tapered (CPT; Zimmer, Warsaw, Indiana) femoral component was implanted in all patients via a translgluteal lateral approach as previously described.1 The THRs were implanted with a 28 mm cobalt chrome femoral head articulating with an all-polyethylene cemented acetabular component without a long posterior wall (ZCA; Zimmer). The hemiarthroplasty group received an appropriately sized Endo Femoral Head (Zimmer). Head size was measured intra-operatively from hemispherical templates and available in 2 mm increments.

Patients who were alive were invited for outpatient review. Their current OHS,14 Short-Form 36 (SF-36)16 and self-reported walking distances were recorded. Anterior-posterior and lateral radiographs of their hips were obtained.

Femoral osteolysis was recorded in the zones described by Gruen, McNeice and Amstutz17 and Johnston et al18 and acetabular lysis in the zones described by DeLee and Charnley.19 After THR, linear polyethylene wear of the acetabular component was measured by the method of Dorr and Wan20 and after hemiarthroplasty acetabular erosion was recorded by two authors (PPA, GCB) using the four grades we described previously.1 Acetabular erosion was graded on the basis of its radiographic appearance as grade 0 (no erosion), grade 1 (narrowing of articular cartilage, no bone erosion), grade 2 (acetabular bone erosion and early migration), and grade 3 (protrusio acetabuli).

Several patients who had moved out of the area completed the questionnaires by post and the main carers of four other patients with impaired memory were interviewed by telephone.

Statistical analysis. Data were analysed using SPSS for Windows (SPSS Inc., Chicago, Illinois) by a statistician. The Mann-Whitney U test was used to compare the OHS and SF-36 scores. Walking distance comparison required logarithmic transformation followed by the Student’s t-test. The Wilcoxon-rank test was used to compare old and new OHS. Analysis of variance (ANOVA) was used to compare old1 and new walking distances after logarithmic transformation. Z-scores were used to analyse mortality rates and Fisher’s exact test to compare revision rates. Kaplan-Meier analysis with 95% confidence intervals was used to compare survival using the Breslow (generalised Wilcoxon) test for significance. The level of significance was set at a p-value < 0.05.

Results
The mean follow-up was nine years (7.2 to 10.3).

After THR, there were no immediate post-operative deaths, but 13 of the original 40 (32.5%) patients had died leaving 27 available for follow-up. None of the deaths were directly attributable to the THR. The mean survival in patients who died was 3.3 years (1.3 to 9.1). There were four men and 23 women alive with a mean age of 80 years (72 to 88).

After hemiarthroplasty there were two immediate deaths from pulmonary embolism, one intra-operatively and one within a week from surgery. A further 19 patients died, leaving 20 of the original 41 patients available for follow-up. None of these additional deaths were directly attributable to the operation. This represents an overall mortality rate of 51.2%. The mean survival of patients who died was 3.8 years (0.003 to 7.5). A total of 19 women and one man were alive with a mean age of 84 years (78 to 91).

At 100 months post-operatively, a significantly greater proportion of the hemiarthroplasty patients had died (Z-test, p = 0.026).

Of the 27 surviving THRs, two declined to attend follow-up or to answer any questionnaires and one answered all questions apart from the SF-36. A further three had developed dementia and so only data on walking distances could be collected. This left 21 patients with a full data set.

Of the 20 surviving hemiarthroplasty patients, three declined to answer any questionnaires or to attend follow-up although two were able to give their walking distance. The National Health Service Spine Portal indicated that a further three patients were alive but they could not be contacted. One of the survivors had developed dementia and could provide data only on walking distance. This left 13 patients with a full data set. There was a significant increase in survival after THR (p = 0.013) (Fig. 1).
The mean follow-up after THR was 8.83 years (7.2 to 10.3) and after hemiarthroplasty 8.6 years (7.2 to 10). The overall loss to follow-up was 4% (3 of 81).

After THR, one patient (2.5%) required revision because of massive femoral stem subsidence (18 mm).

A total of four (9.8%) hemiarthroplasties were subsequently revised to a THR. Of these, only one patient was still alive at final follow-up but could not be contacted. Three were revised for acetabular erosion and one for a peri-prosthetic fracture. There was no significant difference in revision rates between the two groups (p = 0.201, Fisher’s exact test).

There had been no new dislocations since the last review with three THRs and no hemiarthroplasties dislocating during the whole study. After a mean of three years, three patients with hemiarthroplasties had pain associated with acetabular erosion. In the intervening time period only one was revised; the other two died without further revision.

The seven- to ten-year results of this study indicate longer survival of patients treated by THR. There was also a trend towards better function, less pain and fewer re-operations in this group.

Importantly, however, the statistically significant functional benefit afforded by THR over hemiarthroplasty at three years was no longer present at seven to ten years, but we suspect the small numbers of patients involved contributed to this finding. We believe this was probably the effect of increasing comorbidities in this ageing population rather than any deterioration of the THRs because at follow-up none of these patients described any significant problems related to their hips. In contrast, three patients with hemiarthroplasties were revised to THR for acetabular erosion and five experienced sufficient pain to warrant revision. Thus, eight hemiarthroplasties (20%) were revised or merited revision for pain compared with one THR (2.5%) (p = 0.015). Greater revision rates for hemiarthroplasty have been reported in other studies.

Patients with hemiarthroplasties complained of more pain than those with a THR at final follow-up, this is consistent with the only other RCT with long term review.

There was only one failure on the femoral side in each group, which indicates that the cemented collarless polished tapered stem is suitable for either procedure.

The strength of this trial is that the bearing surface of the acetabulum was the sole treatment variable. However, the weakness is the loss to follow-up through mortality, morbidity and with insufficient data for adequately powered statistical analysis. This study and others highlight the difficulty in retaining sufficient subjects for long-term studies of femoral neck fractures in the elderly. With an overall mortality of 42% and despite only 4% loss to follow-up, a

<table>
<thead>
<tr>
<th>Outcome measure</th>
<th>Total hip replacement</th>
<th>Hemiarthroplasty</th>
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<tbody>
<tr>
<td></td>
<td>Three year follow-up</td>
<td>Final follow-up</td>
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<tr>
<td>(n = 36)</td>
<td>(n = 21)</td>
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<tr>
<td>OHS</td>
<td>18.8 (12 to 47)</td>
<td>23.1 (12 to 45)</td>
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<tr>
<td>SF-36 physical function</td>
<td>40.5 (16 to 56.5)</td>
<td>37.0 (12.2 to 55.8)</td>
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<tr>
<td>SF-36 mental function</td>
<td>52.0 (24.2 to 68.4)</td>
<td>54.4 (28.1 to 64.8)</td>
</tr>
<tr>
<td>Walking distance (miles)</td>
<td>2.23 (0 to 25)</td>
<td>0.72 (0 to 3)</td>
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<tr>
<td></td>
<td>Final follow-up</td>
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<tr>
<td>(n = 13)</td>
<td>(n = 21)</td>
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</tr>
<tr>
<td>OHS</td>
<td>22.3 (12 to 48)</td>
<td>25.5 (12 to 38)</td>
</tr>
<tr>
<td>SF-36 physical function</td>
<td>38.1 (16.0 to 59.8)</td>
<td>31.1 (18.2 to 51.3)</td>
</tr>
<tr>
<td>SF-36 mental function</td>
<td>55.3 (39.0 to 66.6)</td>
<td>53.6 (39.6 to 61.6)</td>
</tr>
<tr>
<td>Walking distance (miles)</td>
<td>1.17 (0 to 4)</td>
<td>0.59 (0.01 to 3)</td>
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40% difference in outcome between the two groups would have been required to demonstrate significance. Using a power of 80% and p-value of 0.05, each treatment arm would have required 180 patients to demonstrate significance of the difference in overall mortality. Such numbers pose logistical difficulties in trials of this nature as demonstrated by our recruitment process, which took more than three years to complete. Other authors describe similar problems recruiting the large numbers required in their multi-centre RCTs and involving several centres which give rise to problems in compliance with scientifically rigid protocols.

In randomised controlled trials, the results of THR for displaced intracapsular femoral neck fractures are superior to hemiarthroplasty in the short term but not after five years in independent patients over the age of 70. Dislocation remains the major complication of THR but the use of larger femoral heads may reduce this incidence.

After seven to ten years, THR is associated with lower mortality and less morbidity than hemiarthroplasty in mobile independent patients with displaced intracapsular femoral neck fractures.

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References


