Ten-year life expectancy after primary total hip replacement

We determined the ten-year life expectancy of 5831 patients who had undergone 6653 elective primary total hip replacements at a regional orthopaedic centre between April 1993 and October 2004. Using hospital, general practitioner and the local health authority records, we recorded the dates of death for those who died following surgery.

The mean age at operation was 67 years (13 to 96) with a male:female ratio of 2:3. Of 1154 patients with a ten-year follow-up 340 (29.5%) had died a mean of 5.6 years (0 to 10) after surgery. Using Kaplan-Meier curves, the ten-year survival was 89% in patients under 65 years at surgery, 75% in patients aged between 65 and 74 years, and 51% in patients over 75.

The standardised mortality rates were considerably higher for patients under 45 years, 20% higher for those between 45 and 64 years, and steadily reduced in patients aged 65 and over.

The survival of cemented hip replacement derived from the Swedish Hip Arthroplasty Register Annual Report 2004 exceeds the life expectancy of patients over the age of 60 in our area, suggesting that cemented hip replacement is the procedure of choice in this population.

More than 50 000 primary total hip replacements (THRs) are carried out in the United Kingdom every year.1 Although life expectancy after THR has been studied in Scandinavia2-4 and in the USA,5,6 only short-term data are available on this subject for the United Kingdom.7,8 Knowledge of the patient’s life expectancy helps the surgeon obtain informed consent prior to THR and to decide which type of prosthesis and bearing surface would be most suited to the patient’s needs in the face of limited healthcare budgets.

Patients and Methods

Between 21 April 1993 and 26 October 2004, 5831 consecutive patients underwent 6653 primary THRs at a regional orthopaedic centre. The date of surgery, gender, date of birth, name of the general practitioner (GP) and date of death were recorded. Patients entered the study on the date of operation. In patients who had the contralateral hip replaced at a second operation, the first THR was used as the starting point in the study. No patients underwent bilateral THR at the same operation, and none was lost to follow-up. All patients were censored at the date of death or when they had survived ten years post-operatively. Date of death was verified using a combination of hospital and GP records cross-referenced with the Regional Health Authority records. Kaplan-Meier survival rates for life expectancy were then measured. In order to calculate standard mortality ratios, the ten-year Kaplan-Meier survival was compared with United Kingdom national statistics9 for the same period. Patient age groups were designated as under 45, 45 to 54, 55 to 64, 65 to 74, 75 to 84, and over 85 years, matching the national statistics database subsets, thereby allowing calculation of standardised mortality rates for each age group. This rate is the ratio of the number of observed deaths in a study population to the number of expected deaths for the general population during the same period within the same age groups. It is expressed as a percentage and the standard is set at 100. Any value below 100 implies that the study population has a lower mortality (better survival) than the general population, and values over 100 imply that the study population has a higher mortality (worse survival) than the general population.

The age groups were then re-ranked into under 50, 50 to 59, 60 to 74, and 75 years and over. This made it possible to make a direct
comparison of patient survival in our study with the survival of prostheses from the Swedish Hip Arthroplasty Register results contained in the 2004 annual report.10 The survival of prostheses in our unit was not calculated.

**Results**

The mean age at surgery was 67 years (13 to 96). A total of 3869 patients (66.3%) who underwent THR were 65 years of age or older (Fig. 1, Table I). The male:female ratio was 2:3. There were 38 surgical teams involved in performing the 6653 operations, with four surgeons accounting for 3097 (46.5%) THRs.

A full ten-year follow-up could only be obtained for the 1154 patients whose THRs were performed between 21 April 1993 and 31 March 1995. Of these, 340 (29.5%) had died by 31 March 2005, with 321 (94.4%) of these being aged 60 or over at operation. Of those with ten-year follow-up, 771 patients (67%) were 65 or older at the time of surgery.

The early mortalities of the 5831 patients undergoing their first THR were at seven days in 11 patients (0.2%), at 28 days in 26 patients (0.4%) and at 90 days in 53 patients (0.9%), whereas the mortalities of the 822 patients undergoing their second THR were one (0.1%) at seven days and 28 days, and three (0.4%) at 90 days.

Age-specific Kaplan-Meier survival curves showed that life expectancy at ten years decreased with increasing age but remained constant at approximately 90% under the age of 65 (Figs 2 and 3, Table II). Females lived longer than males. Of those with a full ten-year follow-up, 325 patients aged 65 or over (42%), 189 aged 75 or over (56%), and 20 aged 85 years or over (77%) at the time of surgery had died within ten years of the procedure.

Correlating these interval data with those from the National Death Statistics for the same period to calculate standardised mortality rates for the same age groups revealed that there was a significant increase in mortality, as reflected by the high mortality rates in patients under 65 years. The standardised mortality rate was increased 15-fold in females under 45 years. These data suggest that having a THR above the age of 75 years is associated with a much higher survival than in the average population for both men and women (Table III).

**Discussion**

**Total hip replacement.** Quality of life is improved after THR11 and it is a highly cost-effective procedure.12-14 The majority of procedures are performed in elderly patients,
and most hip replacements should outlive the patients into whom they are implanted.

The population over the age of 64 undergoing THR seems to self-select as being at the fitter end of the spectrum, with standardised mortality rates that decrease with advancing years. In Norway, survival eight years after THR was 69% in patients aged between 70 and 79, and 43% in those over 80. The standardised mortality rate, however, was still higher than in the general population, and in a Medicare population after six years, the mortality rate after six years was 6% higher in patients with rheumatoid arthritis than with osteoarthritis.

As 66.3% of the THRs in our series were carried out in a population with a lower standardised mortality rate than their peer group, and as life expectancy declines with advancing years, this interaction requires consideration on how it may affect the choice of prosthesis. Although younger patients have a high standardised mortality rate they may generally live longer than the older population, and it is in those patients under the age of 50 that THRs have the highest failure rate.

In the Swedish arthroplasty survey, the nine-year survival of cemented hip replacements with metal heads and high-density polyethylene acetabular components was 96.6% (95% confidence interval (CI) 96.2 to 97.0) in patients aged 55 or over. However, in patients under 55 with the same prosthetic fixation it was 89.9% (95% CI 85.2 to 93.4), 95.2% (95% CI 93.2 to 97.2) with uncemented implants, and 93.0% (95% CI 88.6 to 97.4) with hybrid hip replacements. These prostheses all comprised metal on high-density polyethylene bearings.

Our published ten-year survival rates for cemented CPT stems (Zimmer, Swindon, United Kingdom) and polyethylene acetabular components was 95.6%, whereas in hybrid hip replacement this fell to 92.6%. In younger patients with a mean age of 50 years, 8% of the series had been revised within 6.6 years and 12% had radiologically identifiable polyethylene wear with peri-prosthetic osteolysis.

As the longer life expectancy of patients under 55 after ten years is associated with prosthetic failure, there may be some benefits from using harder bearing surfaces, such as ceramic-on-ceramic or metal-on-metal, in this age range, or uncemented devices. However, in the age group of 60 years and over (Table IV), the survival data derived from the Swedish Hip Arthroplasty register annual report (2004) for hip replacement with cemented metal stems and high-density polyethylene acetabular components, exceeds the life expectancy of the United Kingdom patient population by 18% and 15% in males and females, respectively.

Direct comparison of these two data sets must be performed with some caution as different cemented designs have been used between 1993 and 2004. In Sweden the most commonly used femoral components were the Lubinus SPI (Waldemar Link GmbH, Hamburg, Germany) (40.4%), Exeter (Stryker UK Ltd, Newbury, United Kingdom) (19.2%) and Charnley (DePuy International Ltd, Leeds, United Kingdom) (13.2%). In the same period we used mainly collarless, polished, tapered stems, either Exeter or CPT. The most frequently-used acetabular components in Sweden were the Lubinus all-polyethylene component (33.5%) and the Charnley component (16.2%), whereas we used the Elite acetabular component (DePuy, Leeds, United Kingdom). These components are among the through their hospital. A study from Sweden noted that mortality after six years was 6% higher in patients with rheumatoid arthritis than with osteoarthritis.

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| Table II. Ten-year survival (95% confidence intervals) after elective total hip replacement |
|-----------------|-----------------|-----------------|
| Age (yrs)       | Ten-year patient survival (%) |               |
|                 | Males            | Females         |
| < 45            | 91.0 (75.3 to 97.0) | 96.0 (90.5 to 98.4) |
| 45 to 54        | 80.7 (83.2 to 84.9) | 90.0 (84.3 to 94.7) |
| 55 to 64        | 86.9 (82.5 to 90.3) | 88.1 (84.4 to 91.0) |
| 65 to 74        | 68.2 (62.4 to 73.2) | 78.1 (74.6 to 81.2) |
| 75 to 84        | 41.3 (33.4 to 49.1) | 57.0 (52.4 to 61.3) |
| > 85*           |                  | 35.3 (23.4 to 47.5) |

* the number of males > 85 yrs was too small for valid analysis after six years

| Table III. Standardised mortality ratios after elective primary total hip replacement according to age group and gender |
|-----------------|-----------------|-----------------|
| Age (yrs)       | Standardised mortality ratio |               |
|                 | Males            | Females         |
| < 45            | 400              | 1498            |
| 45 to 64        | 156              | 248             |
| 65 to 74        | 85               | 98              |
| 75 to 84        | 67               | 67              |
| ≥ 85            | 44               | 45              |
better-performing implants in the Swedish National Hip Arthroplasty Register. In our unit, the ten-year survival for the Exeter hip replacement was 98%,20 and for the CPT was 95.6%.

We acknowledge that the only outcome measure with the Swedish Hip Arthroplasty Register is revision, for which the threshold is applied variably between patients and surgeons. There is no assessment of the functional outcome of patients who have not undergone revision, nevertheless, prosthetic revision is the least equivocal measure that we have.

Uncemented THRs are generally more expensive than cemented implants. The ten-year life expectancy in a United Kingdom population after primary THR is comparable for patients of all ages up to 64 years, but the standardised mortality rate is at least four times higher in patients under 45 years of age. Our findings, used in conjunction with results from the Swedish Arthroplasty Register, where retention of the implant has been used as the end-point, suggest that cemented THR is the most cost-effective option in patients over the age of 60 years.

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