Outcome after primary and secondary replacement for subcapital fracture of the hip in 10 264 patients

Between 1999 and 2005, 10 264 patients who had undergone total hip replacement (THR) for subcapital fracture of the hip were compared with 76 520 in whom THR had been performed for other reasons. All the cases were identified through the Swedish Hip Arthroplasty Register. The THRs performed as primary treatment for fracture were also compared with those done after failure of internal fixation.

After seven years the rate of revision was higher in THR after fracture (4.4% vs 2.9%). Dislocation and periprosthetic fracture were the most common causes of revision. The risk was higher in men than in women. The type of femoral component and the surgical approach influenced the risk. After correction for gender, type of component and the surgical approach the revision rates were similar in the primary and secondary fracture THR groups.

Total hip replacement is therefore a safe method for both the primary and secondary management of fracture of the hip.

By tradition internal fixation has been the method of choice in Scandinavia for displaced subcapital fractures of the femoral neck. The poor results recorded in an early study in the 1970s1 led to the questioning of total hip replacement (THR) as a method of treatment. The development of superior implants and improvements in technique have produced better results and during the past ten years in Sweden THR has become increasingly common as primary treatment for these fractures.2 A number of randomised trials have shown that THR results in better function and improvement in health-related quality of life (HRQoL) and has a lower failure rate than internal fixation.3-8 The major problems with internal fixation are the need for revision because of avascular necrosis, displacement of the fracture and non-union, with poor functional outcomes even after uneventful healing. When revision is needed after internal fixation, arthroplasty is often the treatment of choice. However, there is a risk of deteriorating hip function and HRQoL in the period before revision.9 Nilsson, Stromqvist and Thorngren10 noted that 50% of such patients were confined to a wheelchair at the time of revision.

Studies on the choice between THR and hemiarthroplasty for different groups of patients with a hip fracture have recently been initiated within the Swedish Hip Arthroplasty Register.11 Our study addresses THR after fracture. We have compared the revision rates of THR after fracture with that performed for other reasons. We have also assessed THR chosen as a primary procedure after fracture of the hip with that as a salvage procedure after failed internal fixation using the same endpoint of revision. We wished to determine whether the revision rate of THR after a fracture was higher than that undertaken for other reasons and if THR after failed internal fixation was associated with an increased risk of revision compared with that used as the primary treatment for fracture.

Materials and Methods

Since 1979 THRs performed in Sweden have been registered in the Swedish Hip Arthroplasty Register.11 From 1992 registrations of primary arthroplasties have been linked to the patient using the unique ten-digit identity number given to all Swedish citizens. Clinical details and information about the surgical technique and the type of prosthetic components inserted are registered. Endpoints in the register are any further operation on the hip and revision, which is defined as exchange or removal of any of the components or of the entire replacement. All units performing THR in Sweden participate in the Register. The total number of THRs carried out in Sweden each
year is approximately 14 000, 11% of which are due to fracture. This group includes both those performed as a primary procedure and those undertaken after failed internal fixation.

We assessed all THRs performed subsequent to a fracture between 1999 and 2005. After the exclusion of patients with pathological fractures or idiopathic avascular necrosis there were 10 264 recorded procedures. The median follow-up was 55 months (12 to 96). Special attention was paid to the coding of the salvage procedures and manual validation of the entries was undertaken.

These were compared with the 76 520 THRs in the Register which had been performed for other reasons during the same period in order to evaluate the frequency of revisions. We also compared the revision rate in patients who received THR as a primary treatment of their fracture with that in those who later received a THR as a secondary procedure because of failure of internal fixation.

Revision was defined as exchange or removal of any part of the prosthesis. Consequently, an exchange of liner or of a head was considered to be a revision. The types of femoral component which were analysed included Lubinus SII (Waldemar Link, GMH & Co, Hamburg, Germany), Exeter Polished (Stryker, Kalamazoo, Michigan), Spectron EF Primary (Smith & Nephew Orthopaedics Inc., Memphis, Tennessee), Charnley (DePuy, Warsaw, Indiana), Stanmore mod (Biomet Ltd, Bridgend, Wales), ScanHip II Collar (Biomet Ltd) and Cenator (Corin Group PLC, Cirencester, United Kingdom). The Charnley and Charnley Elite Plus components were analysed as one unit.

Statistical analysis. The statistical calculations were made using the SPSS version 16.0 (SPSS Inc., Chicago, Illinois). We used the Kaplan-Meier method with 95% confidence intervals (CI) and Cox regression for the fracture group. Significance was set at p ≤ 0.05. The Cox regression analysis comprised gender, age, a primary or secondary procedure, an anterior or posterior surgical approach and the type of femoral component. All subgroups in the Cox regression analysis were individually compared with the rest of the fracture group.

Results
The ICD-10 coding\textsuperscript{12} was incorrect in 12% of the validated cases. After correction 4577 (45%) of the THRs for fracture were classified as primary and 5687 (55%) as secondary. Between 1999 and 2005, there was a considerable relative increase in primary procedures from 24% to 57%.

Of the patients, 7716 (75%) were women (Table I) and 5375 (52%) of the operations were on the left side. The mean age at the time of surgery in the primary and secondary groups was the same (75 years, SD 8.4 and 10.7, respectively). Those who had THR for other reasons (control group) had a mean age of 68 years (SD 10.9). In the fracture-related group 63 named types of implant were used, with the four most common (Lubinus SP II, Exeter Polished, Spectron EF Primary, Charnley) accounting for 8808 (86%) (Table II). At the end of the observation period 1302 (28%) of patients in the primary THR group and 1940 (34%) in the secondary group had died. Kaplan-Meier analysis showed that the calculated mortality rate at seven years was 68% (95% CI 64.3 to 72.3) in the primary group and 63% (95% CI 60.6 to 65.7) in the secondary group (p > 0.05). In total 310 THRs were revised in the fracture group during the period of follow-up with dislocation accounting for more than half of the revisions (Table III).

Revision after THR for fracture compared with the control group. Kaplan-Meier analysis at seven years showed that 4.4% (95% CI 3.8 to 5.1) of the THRs for fracture were revised, compared with 2.9% (95% CI 2.7 to 3.1) of those done for other reasons (Fig. 1). In men the figures were 7.8% (95% CI 6.1 to 9.6) compared with 3.6% (95% CI 3.2 to 3.9) (Fig. 2). In women the revision rate in the fracture group was 3.4% (95% CI 2.8 to 4.0) and in the control group 2.4% (95% CI 2.2 to 2.6) (Fig. 3).

Reasons for revision. Revision for dislocation was more common in the fracture group (1.9%; 95% CI 1.5 to 2.2) compared with the control group (0.7%; 95% CI 0.6 to 0.8) (Fig. 4). That for periprosthetic fracture was also more common in the fracture group at 0.8% (95% CI 0.5 to 1.1) compared with 0.2% (95% CI 0.1 to 0.2) in the control group (Fig. 5). The revision rate for aseptic loosening or deep infection did not differ in the groups.

Revision after primary and secondary THR after fracture. The incidence of revision in THR done primarily or secondarily after fracture did not differ between the two groups (Fig. 6). Subgroup analysis of the reasons for revision such as dislocation, periprosthetic fracture, aseptic loosening and deep infection did not change this result. Neither did separate analyses for men and women.

<table>
<thead>
<tr>
<th>Gender</th>
<th>Primary</th>
<th>Secondary</th>
<th>Total</th>
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</thead>
<tbody>
<tr>
<td>Male</td>
<td>1027 (22.4)</td>
<td>1521 (26.7)</td>
<td>2548 (24.8)</td>
</tr>
<tr>
<td>Female</td>
<td>3550 (77.6)</td>
<td>4166 (73.3)</td>
<td>7716 (75.2)</td>
</tr>
<tr>
<td>Total</td>
<td>4577 (100.0)</td>
<td>5687 (100.0)</td>
<td>10 264 (100.0)</td>
</tr>
</tbody>
</table>

Table I. Distribution of primary and secondary total hip replacement (THR) according to gender, by number and percentage

<table>
<thead>
<tr>
<th>Types of femoral component</th>
<th>Number (%)</th>
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<tbody>
<tr>
<td>Lubinus SII</td>
<td>5001 (48.7)</td>
</tr>
<tr>
<td>Exeter Polished</td>
<td>2253 (22.0)</td>
</tr>
<tr>
<td>Spectron EF Primary</td>
<td>890 (8.7)</td>
</tr>
<tr>
<td>Charnley</td>
<td>664 (6.5)</td>
</tr>
<tr>
<td>Stanmore mod</td>
<td>312 (3.0)</td>
</tr>
<tr>
<td>Charnley Elite Plus</td>
<td>241 (2.3)</td>
</tr>
<tr>
<td>Cenator</td>
<td>133 (1.3)</td>
</tr>
<tr>
<td>CPT (CoCr)*</td>
<td>115 (1.1)</td>
</tr>
<tr>
<td>ScanHip II Collar</td>
<td>109 (1.1)</td>
</tr>
<tr>
<td>Müller Straight*</td>
<td>107 (1.0)</td>
</tr>
</tbody>
</table>

* Zimmer, Warsaw, Indiana

Table II. Distribution of the ten most common types of femoral component
Cox regression analysis of the whole fracture group showed that male gender was associated with a doubled risk of revision due to any cause. Use of the Exeter and the Lubinus SPII stems reduced the risk of revision by 40% and 52%, respectively. The risk of revision after an anterolateral approach was reduced by 37% compared with other approaches (Table IV). After correction for the type of femoral component, gender and the surgical approach, neither age nor a primary or secondary procedure was found to influence the risk for revision.

Cox regression analysis in the fracture patients subgrouped according to reasons for revision including dislocation, periprosthetic fracture, aseptic loosening and deep infection, was also carried out (Table IV). The risk of revision due to dislocation was increased in men (1.9 times) and in hips operated on through a posterior approach (1.7 times). Revision due to periprosthetic fracture was 2.7 times more common in men than in women. Use of the Cenator stem increased the risk by 3.6 times whereas that of the Lubinus SPII stem reduced the risk by 68%.

The risk of revision due to aseptic loosening was 2.4 times higher in men. The type of component also influenced the risk of revision for aseptic loosening with an increase of 13.2 times for the ScanHip stem, 4.4 times for the Cenator stem and 2.6 times for the Charnley component. There was a risk reduction of 62% for the posterior approach and the risk decreased with increasing age at operation.

The risk for revision due to infection was 2.3 times higher in men, and it decreased with increasing age.
The increasing number of THRs carried out primarily on patients with a subcapital fracture reflects the change of opinion in Sweden towards a more positive view on replacement as the initial choice of treatment for these fractures. Our study showed that THRs for fracture were revised more often than those done for other reasons, although the overall increase was only 1.5% over seven years. Overall, the revision rate was significantly higher in men regardless of the underlying cause. It was similar for THRs undertaken either as a primary or secondary procedure after fracture.

The elevated rate of revision in the fracture-related group was similar to that noted in the Norwegian Arthroplasty Register.13,14 The higher revision rate in THR after fracture was related to dislocation and periprosthetic fracture. Similar findings were noted by Gjertsen et al.,14 although they also observed an increased rate due to infection. Our figures do not include closed reduction of dislocations since the predominant policy in Sweden is to abstain from a revision operation until the patient has had more than one dislocation. Therefore our study underestimated the number of dislocations which occur. We could not identify any significant difference between the rates of revision in primary or secondary THR for fracture, irrespective of the choice of femoral component, gender or surgical approach. It has been assumed previously that secondary THRs have an increased rate of post-operative complications and revision, as shown by McKinley and Robinson.15

Men had an increased risk of revision for all causes with almost 8% revised after seven years. Although the results for men are still vastly superior to those of internal fixation, special attention should be given to the selection of cases for THR, the choice of implant and to the post-operative management in men.

The risk of revision due to aseptic loosening increased greatly with the ScanHip stem and to a less extent with the Charnley component. The Cenator component had a higher rate of revision for both aseptic loosening and periprosthetic fracture. The use of these components has decreased during the last few years and they are now rarely used in Sweden.

Use of the Exeter and the Lubinus SPII components reduced the risk of revision for any reason, whereas that of the Lubinus SPII also reduced the risk of revision for periprosthetic fracture. At present, the Lubinus SPII and the Exeter femoral components are the most used in Sweden.

An anterolateral approach reduced the risk of revision when the underlying cause for revision was disregarded. A posterior approach increased the risk of revision for dislocation, but reduced it for aseptic loosening. However, aseptic loosening is largely a long-term problem and considering the high mortality rates this finding may be of minor importance.

There was a reduced risk of revision for infection and aseptic loosening with increasing age. This may not be
because there are fewer infections in elderly patients, but
because surgeons may prefer management by conservative
means with antibiotics in this age group, particularly if the
organisms are of low virulence.

Periprosthetic fracture and recurrent dislocation, however,
are indications for surgery regardless of the patient’s age. A
number of studies support the finding that higher age reduces
the relative risk of revision for aseptic loosening.\textsuperscript{16-19} In the case
of aseptic loosening a conservative approach is more likely to be favored in the elderly.

Studies by Blomfeldt et al9 and McKinley and Robinson15 focused on the patient-related outcome after primary and secondary THR after fracture. Patients with a secondary THR had worse function and more pain compared with those who had been treated primarily by a THR after a fracture. During the time in which they waited for the secondary procedure they experienced a significant reduction in the HRQoL. Revision as the endpoint in our study represented only the terminal part of a clinical problem. Because of frailty, many patients may be advised against revision.

According to Swedish guidelines, THR is recommended as a primary procedure for the more active and fitter patient with a fracture of the hip. This is reflected in the lower mean age of 75 years in our study, compared with a mean age of 82 years in patients in general with a fracture of the hip.2 This selection bias is a weakness of our study, since our data did not allow adjustment for patient-related factors which governed this selection. However, we have studied a very large number of patients with manual validation of the diagnostic coding. Our study included all orthopaedic departments in Sweden and the procedures were performed by surgeons with different degrees of experience. We have not addressed the question of more subjective outcomes such as pain and function which have been shown to be better after primary THR in other studies, but prospective studies on patient-reported outcome are planned. Our findings indicate that THR is a safe method for the primary treatment of subcapital fracture of the hip and as salvage procedure for failed internal fixation.

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References