SURVIVORSHIP OF THE CHARNLEY TOTAL HIP ARTHROPLASTY IN JUVENILE CHRONIC ARTHRITIS
A FOLLOW-UP OF 186 CASES FOR 22 YEARS


From Tampere University Hospital, Tampere, Finland

Between 1971 and 1991 we performed Charnley low-friction arthroplasty (LFA) on 116 patients (186 hips) with juvenile chronic arthritis (JCA). We have now carried out a survival study, taking endpoints as revision, death or the end of the year 1993.

Overall survival was 91.9% at ten years and 83.0% at 15 years. That of the femoral component was 95.6% at ten years and 91.9% at 15 years and of the acetabulum 95.0% and 87.8%, respectively. Only the use of steroids significantly impaired the survival.

We therefore recommend the use of Charnley LFA for young patients with JCA requiring total hip replacement.

Between 1951 and 1969, we treated a total of 455 patients with juvenile chronic arthritis (JCA) at the Rheumatism Foundation Hospital, Heinola. The hip was involved in 154 (34%) patients, in most of them before the age of 15 years. Since 1971, patients with pain, lack of mobility and radiological evidence of hip involvement have been treated by Charnley low-friction arthroplasty (LFA). From 1971 to 1991, we performed 186 LFAs on 116 patients, and the clinical results in the first five years were reported by Colville and Raunio. They found excellent relief of pain in 90% with pain only at the beginning of walking in others.

The range of movement was also improved.

We performed a longer-term survivorship analysis of the series to clarify the ‘gold-standard’ status of this operation for JCA.

PATIENTS AND METHODS
Of the 116 patients operated on between 1971 and 1991, 102 were female (164 hips) and 14 male (22 hips). Their mean age at operation was 31 years (14 to 67) and their mean weight 52 kg (28 to 86). Forty-seven patients (70 hips) were receiving steroids, 17 (26 hips) had amyloidosis and 11 (13 hips) required a bone graft at operation (Table I).

The operation had been performed following Charnley’s principles until the beginning of the 1980s when modern cementing techniques and bone grafting were introduced. We used an intertrochanteric osteotomy until 1985. Postoperatively, patients were encouraged to walk with protected weight-bearing for two months, and for six months if bone grafts had been used.

Clinical and radiological assessment was performed postoperatively, at six and 12 months after the operation, and then every fourth year. If there was any suspicion of loosening the patient attended annually for radiography.

The survival tables were constructed as standard life-tables with one-year intervals and survival curves using the standard Kaplan-Meier technique with confidence intervals (95% CI). If only one component was removed, this

Table I. Details of the 116 patients who had LFA

<table>
<thead>
<tr>
<th></th>
<th>Male (n = 14)</th>
<th>Female (n = 102)</th>
<th>All (n = 116)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of hips</td>
<td></td>
<td>164</td>
<td>186</td>
</tr>
<tr>
<td>Mean age in years (SD)</td>
<td>31.8 (11.6)</td>
<td>32.2 (12.0)</td>
<td>32.1 (12.0)</td>
</tr>
<tr>
<td>Mean weight in kg (SD)</td>
<td>60.1 (18.4)</td>
<td>50.6 (9.2)</td>
<td>51.8 (11.1)</td>
</tr>
<tr>
<td>Number using steroids (%)</td>
<td>9 (61)</td>
<td>61 (37)</td>
<td>70 (58)</td>
</tr>
<tr>
<td>Number with amyloidosis (%)</td>
<td>3 (14)</td>
<td>9 (5)</td>
<td>26 (14)</td>
</tr>
<tr>
<td>Number of bone grafts (%)</td>
<td>4 (18)</td>
<td>9 (5)</td>
<td>13 (7)</td>
</tr>
<tr>
<td>Bleeding (ml/kg/min) (SD)</td>
<td>0.25 (0.09)</td>
<td>0.27 (0.11)</td>
<td>0.27 (0.11)</td>
</tr>
<tr>
<td>Median</td>
<td>0.24</td>
<td>0.27</td>
<td>0.26</td>
</tr>
</tbody>
</table>

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first revision was used as the endpoint for overall curves. Survival curves were also estimated separately for the acetabular and femoral components, with revision as the endpoint. We used the Mantel-Cox test to determine whether the differences between the survival curves were significant and the proportional hazards model to determine the effect of variables on the risk of loosening of the arthroplasty.

RESULTS

The overall survival was 91.9% (95% CI 86 to 95) at ten years and 83.0% (95% CI 74 to 90) at 15 years. That of the femoral component was 95.6% (95% CI 90 to 98) at ten years and 91.9% (95% CI 84 to 96) at 15 years and of the acetabulum 95.0% (95% CI 90 to 98) and 87.8% (95% CI 79 to 93), respectively (Fig. 1). Two patients had deep infections. One had a revision and the other, with streptococcal infection, was treated with long-term antibiotics.

The use of steroids significantly reduced the LFA survival (Tables II and III). Risk factors such as gender, age, weight, peroperative bleeding and bone grafting were not statistically significant.

DISCUSSION

In survival studies it is important that there is a regular follow-up. Our patients were seen every fourth year, but if there was a suspicion of loosening of components, radiography was performed annually. Revision of any component of the LFA as the endpoint in our survival study correlated well with the clinical significance of component loosening as seen in other recent reports. Survival analysis based on revision as the endpoint is more predictable than evaluation based only on aseptic loosening, because this depends on the definition selected.10

Our results are excellent and comparable with those of other reviews of young patients with this length of follow-up (Figs 2 and 3). Joshi et al. reviewed 141 patients who were 40 years old or younger at the time of operation. At 20 years the overall survival rate was 75%; that of the femoral

Table II. Proportional-hazards model to determine the effect of variables on risk of loosening of the THA

<table>
<thead>
<tr>
<th>Variable</th>
<th>Hazard ratio (95% CI)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (per 10 years)</td>
<td>1.04 (0.73 to 1.48)</td>
<td>0.85</td>
</tr>
<tr>
<td>Gender (male)</td>
<td>1.68 (0.48 to 5.88)</td>
<td>0.41</td>
</tr>
<tr>
<td>Weight (per 10 kg)</td>
<td>1.28 (0.86 to 1.91)</td>
<td>0.23</td>
</tr>
<tr>
<td>Steroids</td>
<td>2.64 (1.09 to 6.35)</td>
<td>0.03</td>
</tr>
<tr>
<td>Amyloidosis</td>
<td>1.20 (0.37 to 3.90)</td>
<td>0.77</td>
</tr>
<tr>
<td>Bone graft</td>
<td>0.52 (0.06 to 4.63)</td>
<td>0.56</td>
</tr>
<tr>
<td>Bleeding (&gt;median)</td>
<td>0.69 (0.30 to 1.59)</td>
<td>0.38</td>
</tr>
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* Mantel-Cox test for difference in survival curves between groups
component 86% and of the acetabulum 84%. Overall survival was much better in rheumatoid patients (96%) than in patients with osteoarthritis (51%). Schulte et al. evaluated 330 Charnley total hip arthroplasties with a 20-year follow-up and showed an overall survival rate of 80%. Wroblewski and Siney reported that 79% of their young patients (mean age 41 years) were free from pain, and that the revision rate was 10.5% after a mean follow-up of ten years four months.

The results of hip arthroplasty in JCA have not usually been as encouraging. Mogensen et al. had a revision rate of 19% in 33 patients (41 hips) at an average follow-up of six years three months. The average age of their patients was 26 years. Scott, Sarokhan and Dalziel had a 7% revision rate, but the follow-up was only five years. Williams and McCullough studied 34 adolescents and showed an overall loosening rate of 24.6% at a mean follow-up of 4.7 years, and Witt, Swann and Ansell had a revision rate of 25% in patients with a mean age at operation of 16.7 years. We showed better long-term durability, but did not have many adolescents in our series, and the mean age at the time of operation was higher. The activity of the disease may already have peaked in some of our patients, but it should be noted that 38% of our patients were receiving steroids for active disease. Juvenile ankylosing spondylitis has a very different outcome, and was
therefore excluded from our series. In our study the main risk factor for loosening was the use of steroids, which possibly influences the results by producing osteopenia. Jinnah et al have shown that failure is higher in younger and heavier patients, but we found that neither age nor weight affected the survival rate, possibly because our patients were young and usually of low weight. Our results do not parallel the high revision rates of 32% to 39% with a follow-up of ten years or less reported by Dorr, Lueckett and Conaty, but Chandler et al stated that patients with JCA seem to have better results than the “average patient.”

There has been some progress in surgical technique and cement application during the 20-year period of our study. The effect of technical improvements such as bone grafting, however, can only be seen after 10 to 15 years. There has also been development in uncemented total hip arthroplasties (THA), but a reported survival rate of 57% at eight years is much too low. According to Huiskes many innovative devices introduced in recent years have failed because movement between the modular components creates wear, abrasion and corrosion. Many of these patients may have benefited more from a conventional Charnley procedure.

Unfortunately, despite all possible efforts, THAs do eventually fail, and we must therefore have reasonable objectives. We have shown that in more than 80% of young patients problems of daily activity can be helped for 15 years, and it is justifiable to conclude that the Charnley low-friction arthroplasty has satisfactory acceptable durability and results. It remains the ‘gold standard’ for hip replacement in juvenile chronic arthritis.

We acknowledge financial support from the Medical Research Fund of Tampere University Hospital, the Rheumatism Research Foundation and the Orthopedic and Traumatologic Research Fund.

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