THE RESOLUTION OF PROTRUSIO ACETABULI TREATED WITH RING’S HIP PROSTHESIS

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Seven hips with protrusio acetabuli which showed complete or partial resolution of the protrusion after replacement with Ring’s prosthesis are reported. It is suggested that this prosthesis offers a simple and effective method of treating painful protrusion into the pelvis; it allows healing of the medial wall of the acetabulum while avoiding many of the hazards of other methods of treatment.

Primary protrusio acetabuli was first recognised and described by Otto (1824). The protrusion most commonly seen nowadays is secondary to such diseases as rheumatoid arthritis, ankylosing spondylitis, infection, Paget’s disease, osteopenia, rickets and trauma. Protrusio occurs in some 15% of rheumatoid patients with hip involvement; the concentric inflammation and consequent osteoporosis softens the medial wall of the acetabulum (Hastings and Parker 1975).

Treatment of the painful and stiff hip resulting from such secondary protrusio acetabuli has always proved difficult; healing of the medial wall seldom occurs spontaneously, and there is frequently little bony support for a prosthesis. We report an observation of the progress of secondary protrusio acetabuli when treated with Ring’s total hip replacement.

METHOD
We define protrusio acetabuli as displacement of the femoral head medial to the ilio-ischial line; this landmark was originally described by Köhler in 1953 as the line which extends from the inner contour of the pelvis, in an inferior direction, to the medial margin of the ischium.

The protrusion in each hip we studied was graded both before and after operation using the method described by Sotelo-Garza and Charnley (1978). In this method the rim of the true pelvis is used as a reference line (Fig. 1; Table I). A cementless Ring Mark III prosthesis was inserted in each hip via the posterior approach, using a standard method of insertion.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Protrusion (mm)</th>
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<tbody>
<tr>
<td>0</td>
<td>None (0)</td>
</tr>
<tr>
<td>I</td>
<td>Mild (1-5)</td>
</tr>
<tr>
<td>II</td>
<td>Moderate (6-15)</td>
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<tr>
<td>III</td>
<td>Severe (&gt;15)</td>
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PATIENTS
Seven Ring hip replacements were performed for relief of pain and stiffness in six patients with protrusio acetabuli. Four were performed in three patients with rheumatoid disease, and three in patients with osteoarthritis and osteoporosis (Table II).

Fig. 1
Measurement of the protrusion. The dotted line indicates the apex of the rim of the true pelvis; the arrow indicates the apex of the bony outline of the protrusion. The distance between the two (in mm) is the measurement used to grade the extent of the protrusion (Table II).
Table II. Results of surgical treatment in the six patients

<table>
<thead>
<tr>
<th>Case</th>
<th>Diagnosis</th>
<th>Amount of protrusion</th>
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<tr>
<td></td>
<td></td>
<td>Before operation (mm)</td>
</tr>
<tr>
<td>1 (Left—Figures 2 and 3)</td>
<td>Rheumatoid arthritis</td>
<td>17 III</td>
</tr>
<tr>
<td></td>
<td></td>
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<tr>
<td>2 (Right—Figures 2 and 3)</td>
<td>Rheumatoid arthritis</td>
<td>12 II</td>
</tr>
<tr>
<td>3 (Right—Figures 4 and 5)</td>
<td>Osteoarthritis and osteoporosis</td>
<td>3 I</td>
</tr>
<tr>
<td>4 (Left—Figures 6 and 7)</td>
<td>Rheumatoid arthritis</td>
<td>20 III</td>
</tr>
<tr>
<td>5 (Left—Figures 8 and 9)</td>
<td>Osteoarthritis and osteoporosis</td>
<td>17 III</td>
</tr>
<tr>
<td>6 (Left—Figures 10 and 11)</td>
<td>Rheumatoid arthritis</td>
<td>11 II</td>
</tr>
<tr>
<td></td>
<td>Osteoarthritis and osteoporosis</td>
<td>10 II</td>
</tr>
</tbody>
</table>

The average age of the patients at the time of operation was 68 years (range 53 to 79). The average length of follow-up was 43 months (range 12 to 83). In each case, the indication for replacement was stiffness and pain. In all, the bone was noted at operation to be soft, and in one with osteoporosis, the medial wall of the acetabulum began to crack during insertion of the prosthesis.

All patients were mobile during the period of follow-up in which radiographs were taken; four could walk normally, one could walk only a limited distance (due to pain in the other hip) and one required a walking frame. Two patients (Cases 1 and 4) later became unable to walk, because of pain from loosening, but not until after the present series of radiographs had been taken.

RESULTS

Of the seven Ring total hip replacements performed, six showed full healing and resolution of the protrusion. In only one (Case 2) was there no change in the grading of the protrusion (Table II); here the follow-up was only 17 months but there was already some improvement.

The pre-operative and postoperative radiographs of each case are shown in Figures 2–13.

DISCUSSION

In the early stages, protrusio acetabuli is a progressive condition, being a function of weight-bearing and activity; healing of the medial wall seldom occurs spontaneously. The factors which may lead to arrest of the progression are not entirely clear, but Hastings and Parker (1975) demonstrated arrest in a patient with rheumatoid arthritis who was confined to bed.

The surgical treatment of the painful and stiff hip with protrusio acetabuli has always proved difficult, because frequently there is no bony support for a prosthesis. Many methods of treatment have been reported, with varying success. For example, Rosemeyer, Viernstein and Schumann (1973) showed that intertrochanteric valgus osteotomy with medial displacement produced good results only in the youngest patients.

Over the past decade prosthetic replacement of the hip has become the most commonly used method of surgical treatment, but reinforcement of an unstable medial wall by a prosthetic socket combined with acrylic cement is now known to be unreliable. It is also inadvisable because great difficulties may be encountered, the most serious being fracture of the weakened medial wall and intrapelvic displacement of the pros-

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Fig. 2
Case 1. Figure 2—Before operation. Figure 3—One year after operation on the left hip, and 3 years 4 months after operation on the right.
Several other methods have been tried. Bone grafting of the medial wall has been carried out, and Eichler (1973) developed a metal ring with a flange. Similarly, Hastings and Parker (1975) developed a moulded coarse vitallium-mesh cup which was embedded in methylmethacrylate cement.

In a review of Charnley hip replacements for protrusio acetabuli, Sotelo-Garza and Charnley (1978) showed progression of the protrusion in only two of 253 hips; the others showed no progression, but nor did they show any resolution of the protrusion, or consolidation of the floor of the acetabulum when a bone graft was used. There have been two series of total hip replacements with bone grafts which showed good results (Ranawat, Dorr and Inglis 1980; McCollum, Nunley and Harrelson 1980). In these series, however, there was no reported resolution of the protrusio. There is no doubt that surgical treatment is technically demanding. The tremendous difficulties which will be encountered if, and when, such a replacement requires revision are obvious. In such cases a Girdlestone procedure may be necessary; Shanahan et al. (1982) report just such a case.

The success of the Ring prosthesis in allowing healing of the medial acetabular wall is due to the altered load-bearing on the pelvis. In the normal hip (Fig. 14) two component forces, one horizontal (Q) and the other vertical (L), produce the resultant force (R) acting on the
femoral head (Pauwels 1965). If the medial wall of the acetabulum is soft, force $Q$ will produce protrusion. The acetabular component of the Ring prosthesis is placed superiorly in the anatomical acetabulum. Therefore force $Q$ is directed away from the medial wall of the acetabulum, and the component forces $Q$ and $L$ now act on the more substantial ilium. We suggest that this was the mechanism in our patients, all of whom were mobile whilst radiological healing of the protrusio took place. Rest due to immobility was not, therefore, the cause of the healing.

**Conclusion.** We present the observation that for the surgical treatment of protrusio acetabuli, the Ring total hip prosthesis is a simple, cementless technique which allows healing and resolution of the medial wall of the acetabulum, while avoiding many of the hazards of other methods. In the event of a Ring prosthesis requiring revision, the healing of the medial wall would facilitate a second surgical procedure.

**REFERENCES**


