AGGRESSIVE GRANULOMATOUS LESIONS IN CEMENTLESS TOTAL HIP ARTHROPLASTY

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We describe six patients with aggressive granulomatous lesions around cementless total hip prostheses. Two patients previously had a cemented prosthesis in the same hip. The Lord prosthesis was used in five patients, the PCA in one. Both prostheses were made of chrome-cobalt alloy. Pain on weight-bearing occurred on average 3.2 years after the cementless arthroplasty, and at that time radiography revealed aggressive granulomatosis around the proximal femoral stem and the acetabular component in five of the patients; one had a large solitary granuloma in the proximal femur.

Revision was performed on average 4.8 years after the cementless arthroplasty. At that time all granulomas had grown large in size; while waiting for revision operation, two femoral stem components fractured. All the granulomas showed a uniform histopathology, which included histiocytosis; the cause for these lesions was thought to be plastic debris from the acetabular socket.

Harris et al (1976) were the first to describe aggressive granulomatous lesions around the cemented femoral stem in total hip replacement. According to their definition, aggressive granulomatosis is a condition of localised, tumour-like bone resorption which appears on the radiograph as ovoid cysts around the stem, in the definite absence of infection. The lesions may grow rapidly in size and there is often very extensive bone loss (Tallroth et al 1989; Eskola et al 1990). Our earlier work has shown that not only clinically and radiologically, but also histopathologically, aggressive granulomatosis is an entity distinct from the common form of prosthetic loosening (Santavirta et al 1990). Previously it has been thought to occur only around the stems of cemented hip replacements. Now, with cementless hip replacements becoming more common, it appears that aggressive granulomatosis may also occur around uncemented prostheses.

PATIENTS

We report six patients who were treated by cementless total hip replacement between 1982 and 1985. They developed aggressive granulomatosis and then underwent revision operations. Details of these patients are shown in Table I. Patient 5 had Sjögren's syndrome and had been treated with systemic cortisone for 11 years. In two patients the cementless total hip replacement was for revision of a previous cemented arthroplasty. The patient with an old acetabular fracture (No. 1) had been previously treated with cemented Wagner resurfacing arthroplasty, which had to be revised four years later due to aseptic loosening. The patient with coxa vara (No. 4) had a Lagrange–Letournel cemented hip replacement, which was revised due to aseptic loosening five years later. Both the Lord and the PCA prostheses are made of chrome-cobalt alloy.

Pain on weight-bearing was the first sign of impending aggressive granulomatosis and it developed, on average, 3.2 years (0.5 to 5.1) after the cementless arthroplasty. At that time, radiography revealed granulomatosis around the proximal femoral stem and the acetabular component in five patients (Fig. 1) and one (patient 5) had a large solitary granuloma in the proximal femur (see Fig. 2).

Revision for aggressive granulomatosis was per-
Table I. Details of six patients who had aggressive granulomatous lesions around uncemented femoral stems

<table>
<thead>
<tr>
<th>Patient number</th>
<th>Sex</th>
<th>Age (yr) at time of cementless arthroplasty</th>
<th>Primary diagnosis</th>
<th>Previous hip operations</th>
<th>Type of prosthesis</th>
<th>Time (yr) from arthroplasty to appearance of granuloma</th>
<th>Time to revision (yr)</th>
<th>Location of granuloma*</th>
<th>Fracture of femoral stem</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>F</td>
<td>25</td>
<td>Acetabular fracture</td>
<td>Cemented Wagner resurfacing prosthesis</td>
<td>Lord</td>
<td>4.2</td>
<td>5.6</td>
<td>A, F</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>F</td>
<td>49</td>
<td>Osteoarthritis</td>
<td>–</td>
<td>Lord</td>
<td>3.4</td>
<td>4.8</td>
<td>A, F</td>
<td>+</td>
</tr>
<tr>
<td>3</td>
<td>F</td>
<td>42</td>
<td>Perthes' disease</td>
<td>–</td>
<td>Lord</td>
<td>0.5</td>
<td>5.1</td>
<td>A, F</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>F</td>
<td>44</td>
<td>Coxa vara</td>
<td>Lagrange-Letournel cemented THR</td>
<td>Lord</td>
<td>3.7</td>
<td>3.8</td>
<td>A, F</td>
<td>+</td>
</tr>
<tr>
<td>5</td>
<td>F</td>
<td>69</td>
<td>Osteoarthritis</td>
<td>–</td>
<td>PCA</td>
<td>2.5</td>
<td>3.3†</td>
<td>F</td>
<td>-</td>
</tr>
<tr>
<td>6</td>
<td>M</td>
<td>45</td>
<td>Ankylosing spondylitis</td>
<td>–</td>
<td>Lord</td>
<td>5.1</td>
<td>6.3</td>
<td>A, F</td>
<td>-</td>
</tr>
</tbody>
</table>

*A, granuloma around acetabular component; F, granuloma around femoral stem
† in this case, the granuloma cavity was emptied and filled with cancellous bone without removal of the prosthesis

Figure 1a – Postoperative radiograph of a 25-year-old woman (patient No. 1) who had a cementless Lord total hip revision arthroplasty after failed cemented resurfacing arthroplasty. Figure 1b – One year later the prosthesis was well incorporated. Figure 1c – At 5.6 years postoperatively there was a large aggressive granulomatous lesion around the acetabular component and a minor lesion in the proximal femur (arrows).

formed on average 4.8 years (3.3 to 6.3) after cementless total hip replacement. At that time, all the granulomas had grown in size and granulomatosis around the acetabular component was always associated with its migration. At the revision operation, the patient with Sjögren’s syndrome (No. 5) and the one with ankylosing spondylitis (No. 6) both had elevated blood sedimentation rates (29 and 38 mm/h); the values for the other four patients were within the normal range. Cultures from the granulomatous tissue samples were negative in every
case. While waiting for the revision operation, two femoral stem components fractured (patients 2 and 4, Fig. 3).

All the granulomas were analysed histopathologically and their appearances were all similar. They contained histiocytes of varying size, numerous giant cells and locally eosinophilic necrotic debris. There were microscopic particles of non-metallic material scattered in these areas, apparently debris originating from the plastic socket of the acetabular component (Fig. 4a). The debris was identified by polarised light techniques as polyethylene (Fig. 4b). Naked eye examination revealed no black metal staining, nor was there histological evidence of metallic debris.

DISCUSSION

Our previous work has shown that aggressive granulomatosis in cemented total hip replacements is relatively common; about 5% of the patients who have undergone revision hip arthroplasty in our unit have had these lesions (Tallroth et al 1989; Eskola et al 1990). Most previous reports have described patients with cemented prostheses. However, Lord et al (1988) reported cystic bone resorption in the metaphysis which they thought was due to debris from polyethylene wear.

All the aggressive granulomas which have previously been reported in cemented total hip replacements have occurred around the femoral stem, and a large number of them have been located around its distal part (Bell et al 1983; Reinus et al 1985; Scott, Riley and Dorfman 1985; Jasty et al 1986).

Recent research has indicated that many patients react adversely to cemented implants. This reaction, leading to failure of the arthroplasty, has been called 'cement disease' (Jones and Hungerford 1987). In fact, we have recently shown that in aggressive granulomatosis in cemented arthroplasties there is an immunopathological response, which includes the appearance of C3bi-receptor and non-specific esterase-positive monocyte-macrophages and multinucleate giant cells (Santavirta et al 1990). Our laboratory work in progress indicates increased collagenase activity in aggressive granulomatosis.

The question arises: is there a condition associated with cementless total hip arthroplasty which could be called 'metal disease'? In our six patients, the aggressive granulomatosis was located as often around the acetabular component as around the femoral, which is quite different from the cases reported in cemented total hip replacements. However, the histopathological findings resembled those seen in cemented prostheses and...
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Figure 3a – Radiograph one year after a 44-year-old woman (patient No. 4) had cementless Lord revision arthroplasty, with cancellous bone grafting of the proximal femoral cavity, after aseptic loosening of a conventional cemented prosthesis. Figure 3b – A radiograph, 3.8 years postoperatively, revealed fracture of the femoral component.

Figure 4a – A general view of a microscopic section of aggressive granulomatous tissue removed at a revision operation (patient No. 5). Numerous histiocytes and macrophages are present. Small, double contrasting particles are scattered around the field (some marked with arrows). (× 100).

Figure 4b – A detail of the same section, studied with polarised light, to show a multinucleated giant cell (arrows) containing polyethylene particles. (× 200).

included microscopic particles of polyethylene debris originating from the acetabular socket. It is therefore probable that it is the plastic material and not the metal which causes the aggressive granulomatous reaction. The fact that none of the patients in the present series had signs of granulomatosis around the distal part of the stem supports this theory. Lord et al (1988) thought that wear of the polyethylene might be one of the long-term problems of cementless total hip replacements.

When there is extensive bone lysis around the proximal part of the stem and the distal part is still well fixed, there is a risk of femoral stem fracture. Extraction of the distal stem fragment in the Lord prosthesis is usually difficult.

In summary, we note that even in cementless total hip replacements there is a risk of aggressive granulomatosis which may be associated with severe migration of the acetabular component and fracture of the femoral stem. The cause of this phenomenon is probably the release of plastic debris from the acetabular socket.

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REFERENCES


Scott WW Jr, Riley LH Jr, Dorfman HD. Focal lytic lesions associated with femoral stem loosening in total hip prosthesis. AJR 1985; 144:977-82.