Radiographic loosening of cementless threaded acetabular cups

No additional diagnostic value of arthrography in 30 patients

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We compared arthrography with plain radiographs in 30 consecutive patients having a clinical diagnosis of loosening of a smooth-threaded acetabular prosthesis (Mecron, Berlin). Leakage of contrast at the interface between the ring and the bone on the medial side of the prosthesis was seen in 21 patients. Loosening of the cup was also visible on the plane radiographs and loosening was confirmed in all these patients at revision surgery. No false positive arthrographies were seen. In one patient, the arthrography was false negative because of a technical failure. We conclude that no additional information was obtained by arthrography.

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Since the publication of Salvati et al. (1971) the value of arthrography in the evaluation of cemented hip prostheses has been studied extensively (Phillips and Kattapuram 1982, O'Neill and Harris 1984, Maus et al. 1987). However, there is only one report on the role of arthrography in the diagnosis of loosening of cementless acetabular prostheses. Recently, Barrack et al. (1994) described the arthrograms of 16 uncemented acetabular prostheses, of 5 different designs, including 2 patients with a threaded acetabular component.

We evaluated the results of arthrography and plain radiographs in 30 patients with a smooth-threaded acetabular prosthesis and a clinical diagnosis of prosthetic loosening, to define the role of arthrography in this type of prosthesis.

Patients and methods

The arthrograms of 30 consecutive patients with a cementless smooth-threaded acetabular prosthesis (Mecron, Berlin, Germany) (Figure 1) and a cemented femoral component were retrospectively evaluated. In all patients, arthrography had been requested because of a clinical suspicion of loosening of at least one of the components. There were 6 men and 24 women with a mean age of 66 (37–85) years. The time interval between implantation and arthrography was 34 (19–50) months.

For arthrography we used the lateral puncture technique as described by Hendrix and Andersen (1981) and Barentsz et al. (1986). The hip was punctured with an 18 gauge needle, guided by fluoroscopy. After contact of the needle with the neck of the femoral component, fluid was aspirated, if present.

Subsequently, contrast material (Omnipaque 300 mg I/mL, Nycomed AS, Oslo) was injected into the pseudocapsule. The mean volume used was 18 (10–30) mL. The injection was terminated when the patient experienced significant pain. Good contact of

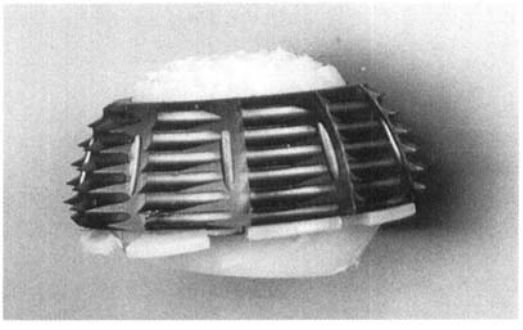

Figure 1. Mecron acetabular cup. Smooth-threaded metallic ring with a polyethylene liner fixed in it. Retrieved, failed cup.

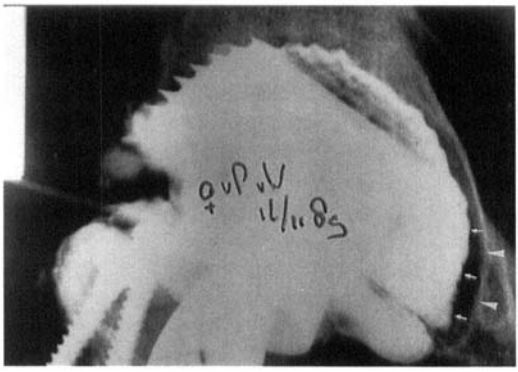

Figure 2. Contrast agent is visible at the interface of the ring and the bone at the medial side (arrows) indicating loosening. Extended demarcation is clearly visible (arrowheads). Note that there is no contrast leakage at the lateral side of the ring. Contrast is present in zone 2.

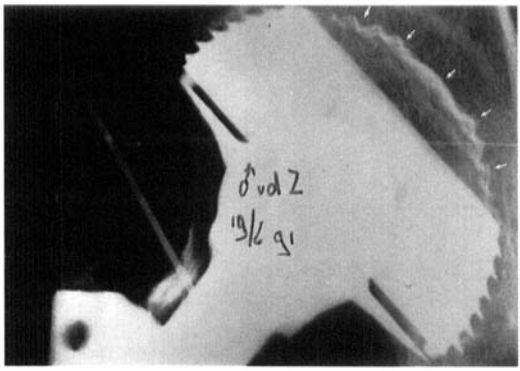

Figure 3. No leakage is seen between the metallic ring and the bone and there is no demarcation, indicating a stable prosthesis. Contrast is present in zone 2 (arrows).

the needle with the femoral prosthesis was easily obtained in all patients and no complications were seen. In 12 patients some fluid, mean volume 4 (1.5–9) mL, was aspirated, and was sent for bacteriological examination. No evidence of infection was found, either in the aspirated fluid, or at surgery.

Anteroposterior radiographs of the prosthesis as well as tangential spot films of the acetabular part of the prostheses, as described by Phillips et al. (1983), were made before and after administration of the contrast material. Subtraction was not used. The arthrograms were assessed by two observers in concert, who were unaware of the plain film findings. The extension of contrast agent between bone and prosthesis was categorized into 3 zones (DeLee and Charnley 1976): zone 1 superior, zone 2 axial, zone 3 medial. Since there is a central hole in the metallic ring of the acetabular prosthesis and the polyethylene liner is not fixed to the bone, contrast agent in zone 2 was not considered to be a sign of loosening, but a sign of sufficient pressure within the pseudocapsule during arthrography. When no contrast agent was present in zone 2, the arthrogram was considered to be a technical failure. Loosening was defined as the presence of contrast material at the bone prosthesis interface in zone 1 and/or 3.

The conventional radiographs were evaluated separately by two observers in concert, who were blinded to the results of the arthrography. Criteria for loosening were migration of the cup compared to previous radiographs, or extended demarcation in at least 1 of the 3 zones.

22 of the 30 patients had revision surgery because of clinical and radiographic signs of loosening. 8 patients were not operated because of decreasing symptoms. The mean follow-up time after arthrography in these 8 patients was 28 (18–35) months. Follow-up consisted of clinical evaluation and at least 2 radiographic examinations.

None of these 8 patients had extended demarcation or migration of the acetabular prosthesis as detected by plain radiography and 6 had no contrast leakage in zone 1 or 3 at arthrography. The other 2 patients showed filling of a bursa, making arthrography less reliable. 1 of these patients developed a demarcation in zone 3 during follow-up and loosening of the acetabular cup was confirmed at revision surgery. The other patient with filling of a bursa did not develop radiological signs of loosening at follow-up, nor did the remaining 6 patients who were not operated on.

Results

Contrast between the acetabular prosthesis and bone was seen in zone 2 in all but 3 patients. In our first examination with a prosthesis of this type, pressure within the pseudocapsule was not sufficient to cause leakage of contrast into zone 2. Filling of a bursa trochanterica was seen in the other 2 patients.

Leakage of contrast material between the metallic ring and bone was seen in 20 patients on the medial side of the prosthesis (zone 3) (Figure 2). In all these patients, there was also visible contrast in zone 2. In 2 of these 20 patients there was also contrast leakage on the lateral side (zone 1). Contrast leakage on the lateral side between the ring and the bone, without leakage on the medial side, was never seen. In the 20 patients with contrast leakage, loosening of the acetabular prosthesis was confirmed at revision surgery. 2 additional patients had revision surgery. In the first patient, contrast was seen only in zone 2 (Figure 3).

At surgery, the femoral stem was loose, but the acetabular cup was not. The other patient had a technically inadequate examination (no contrast visible in zone 2). Loosening of the acetabular component was seen peroperatively.

In all 20 patients with contrast leakage in zone 3, extended demarcation on the medial side of the prosthesis was seen by plain radiography (Figure 2). In the 2 patients who had contrast leakage laterally, extended demarcation was also visible in this zone on plain radiographs. In 10 of these patients radiographs also displayed migration of the cup. No demarcation was seen in the patient with a fixed prosthesis at revision surgery (Figure 3). The patient with a loose acetabular prosthesis and a technically inadequate examination showed an extended demarcation in zone 3 with migration of the cup on radiographs.

Discussion

Little is known about the role of arthrography in cementless hip prostheses. Swan et al. (1991) studied 12 patients, but they only evaluated the femoral component. Barrack et al. (1994) studied 16 arthrographies of loose cementless acetabular components and found one third false negatives, without giving an explanation for this. It appears that they used criteria for loosening developed for cemented components, which may not apply to cementless acetabular components. Moreover, no tangential spot films were obtained, making it easy to overlook small amounts of contrast leakage between bone and prosthesis.

In the smooth-threaded acetabular prostheses that we studied, the interface between the bone and the prosthesis was clearly visible, especially on the tangential spot films. For this reason we decided not to use the subtraction technique.

We found only 1 false negative arthrogram and no false positive arthrograms. In the patient with the false negative arthrogram, the plain film was true positive.

Because of the use of several different cemented femoral prostheses in the patient group, we did not focus on the femoral components. However, only in 1 patient was an arthrographic diagnosis of a loose femoral component made, based on criteria of O'Neill and Harris (1984). This was the only patient in whom a loose femoral prosthesis was found at surgery.

We conclude that arthrography with tangential spot films of the acetabular prostheses and with enough pressure during contrast injection to achieve leakage of contrast in zone 2 was a reliable method to diagnose loosening of the cementless Mecron acetabular prosthesis. However, plain radiography was even better, since no false positive or false negative results were observed.

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