Dislocation of the polyethylene liner in hip arthroplasty

6 patients with dislocation within 3 years

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ABSTRACT – We revised 6 patients with early destruction of the liner in a cementless press-fit acetabular cup. They had no signs of infection or evidence of trauma. The failures were probably due to rotation of the liner inside the metal shell and destruction of the polyethylene by the cutting edge of the metal. This early complication may be difficult to diagnose because of normal radiographs. We suggest that the manufacturer should provide the insert with a metal marker to make this complication easier to detect.

The 5–13 years of clinical and radiographic results with the Harris-Galante II (Zimmer, Dietzenbach, Germany) press-fit cup have been well documented (Schmalzried and Harris 1992, Tanzer et al. 1992, Schmalzried et al. 1994, Lachiewicz and Poon 1998, Petersen et al. 1999, Ricci et al. 2000). Recently, some authors have reported destruction and dislodgement of the liner after 3 or more years (Louwerse and Heyligers 1999, Della Valle et al. 2001). We present 6 patients with liner dislocation within 3 years of hip replacement.

Patients

We treated 6 patients with a dislocated liner between 1996 and 2001 (Table). On revision of the prostheses, we found that all inserts were extremely worn and the edge had been cut off. In 3 patients the liner had broken into two parts. Biopsies showed massive metallosis and a foreign-body giant cell reaction in all the patients. None of them had a history of trauma, only 2 had an acute

Patient data of 6 patients at time of implantation of the Harris-Galante II cup

Pts	Age	Sex	Body mass index	Approach [a]	Stem [b]	Cup diameter (mm)	Months to operation from onset of symptoms	Months to symptoms	Intraoperative findings			Operative procedure	
									Liner [c]	Metallosis	Loose shell	Bone stock[d]	Cup[e]
1	33	F	26.4	T	TPP	52	11	20	E	+	–	G	C–
2	29	F	22.3	T	TPP	52	1	13	B	++	–	G	C–
3	76	F	27.7	P	SP II	50	1	25	D, E	+	–	F	C–
4	39	M	27.4	P	TPP	50	2	36	B	(+)	–	P	C+
5	49	M	23.7	P	SP II	56	3	31	D, E	+	–	P	C–
6	45	M	29.1	T	TPP	54	1	27	B	++	+	P	C+

[a] T transgluteal, P posterior
[b] TPP thrust plate prosthesis, AlloPro–Sulzer, Gelsenkirchen, SP II shaft prosthesis, Link, Norderstedt, Germany
[c] E edge destroyed, B broken, D dislocated
[d] G good, F fair, P poor, the H-G cup was completely removed in all patients; no case was treated with a bone graft
[e] C– cementless cup, C+ cemented cup

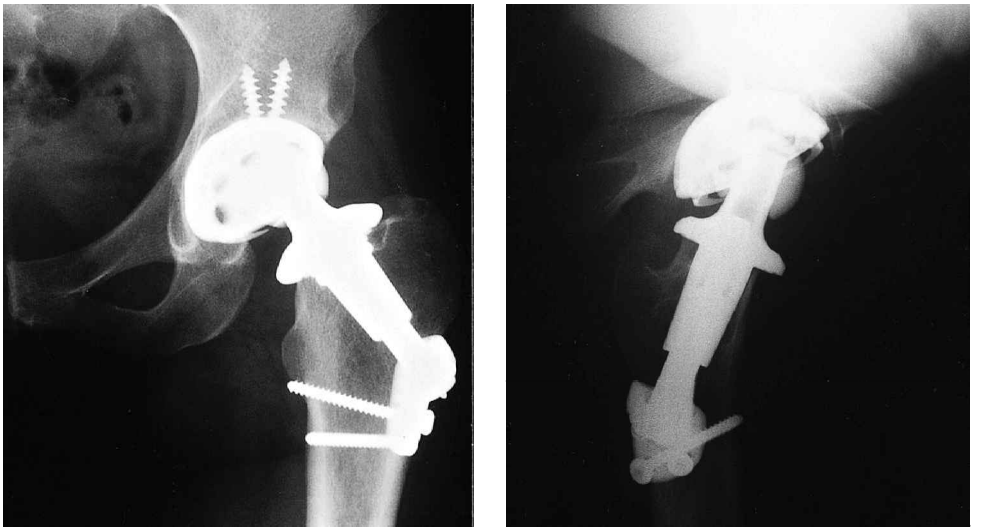

Figure 1. The eccentric position of the head of the thrust plate prosthesis in the cup is due to luxation of the liner.

Figure 2. The acetabular cup with metallosis of the ceramic head has been removed. The liner is intact, but the edge is cut off.

onset of the clinical symptoms and they were not unusally active or overweight. The following case report is representative.

Case report

In 1994, a 33-year-old woman underwent surgery because of a giant cell tumor of the synovia and a cementless thrust plate femoral component (Allo-Pro-Sulzer, Gelsenkirchen, Germany, Bereiter et al. 1991), and Harris-Galante II cup (Ø = 52 mm) were inserted. This patient had a normal rehabilitation after the operation.

9 months later, she complained about painful blockades of the hip. We found no clinical or radiographic evidence of loosening or infection. A technetium bone scan was normal. 2 months afterwards, she had an acute onset of severe pain in her hip with reduced motion. Radiographs showed that the head of the thrust plate prosthesis had an eccentric position in the cup (Figures 1 and 2). The hip was revised 31 months after surgery because of suspected damage to the liner. At operation, the polyethylene had dislodged from the metal shell and the edge of the liner was almost completely cut off. The metal shell was well fixed, but was removed because the surgeon thought that insertion of a new liner or cementation of a smaller liner or cup with cement was hazardous. A cementless Plasma-cup (Aesculap, Freiburg, Germany) was inserted without a bone graft. Histological

examination of the resected capsule and soft tissue showed polyethylene wear and foreign-body giant cells. No complications have occurred up to the latest follow-up 4 years after revision surgery.

Discussion

Standing or walking places a load on the hip joint that amounts to several times the body weight (Brien et al. 1990, Louwerse and Heyligers 1999). During walking motions in the hip induce tangential friction forces. These shear forces may cause motion between the bone and the prosthesis and its various components (Wilson et al. 1988). Thus, even small changes in the direction of the movement of the hip may induce high forces especially when the inlay becomes asymmetrical due to wear.

In our reported cases, the complication is probably due to the following mechanism. After an initial rotation of the liner in the shell, any asymmetrical position or slight subluxation of the liner will damage the periphery of the liner by the sharp metallic edge of the shell. When the edge is cut off, complete luxation and fracture of the liner will occur more easily. Mechanical testing of the Harris-Galante II acetabular cup and polyethylene liner has shown that minimum rotary torque is transmitted from the joint to the liner/shell interface, if the acetabular cup and liner are placed and fixed correctly without impingement (Schmalzried and Harris 1992, Tanzer et al. 1992, Padgett et al. 1993, Schmalzried et al. 1994).

Senior orthopedic surgeons operated on all our patients. Therefore, we do not think that component malposition was the primary cause of the liner dislocations. Theoretically, an impingement in the thrust plate prosthesis at the lateral side of the acetabular cup can occur, but was excluded intraoperatively by testing the range of motion of the hip prosthesis. Flexion of 100°, abduction to 30° and external rotation of 30° in full extension of the hip was possible without impingement in all of the patients.

We believe that the reason for the early liner problems was a mismatch between the articulating components. A combination of polyethylene liners and femoral heads not perfectly matched to each other may increase friction or movement in the joint. We combined acetabular and femoral components from different manufacturers, who may not have used the same tolerances.

We found an excessive wear on the outside of all the polyethylene liners, but only slight wear on the inside. Thus, rotation of the liner in the metal shell would probably cause this particular pattern of wear, as reported by others (Jasty and Harris 1990, Louwerse and Heyligers 1999, Della Valle et al. 2001).

Rotation of the liner is a rare complication, especially during the first postoperative years. A rotating liner should cause metallosis and faciliate third body wear of the articulation, not secondary fixation. This complication is difficult to show while the liner is still located in the shell. It cannot be detected on ordinary radiographs, as happened in two of our patients. The typical radiographic signs of component loosening, such as radiolucent lines and migration of the metal shell, were not seen. If present, an eccentric position of the head of the femoral prosthesis in the acetabular cup is a typical sign (Jasty and Harris 1990). Examination of the hip under the image amplifier can show a pathologic pattern of motion due to dislocation or destruction of the liner. CT scan or MRI of the hip is not useful in these cases because of metal artefacts. Other authors have reported histologic examination of synovial samples and findings of metallosis in the synovial fluid (Tkaczuk 1976). Jasty and Harris (1990) used the subtraction arthrogram and showed filling defects caused by the displaced liner, but the rotation of the liner, as the likely starting point of the complication, could not be visualized.

Early dislocation of the liner is rare, but should be considered in patients with hip pain and normal radiographs. To facilitate diagnosis, a radiographic marker of the liner would be helpful, especially in the early stages when the typical eccentric position of the head of the prosthesis is not present.

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