Surface replacement of the hip: a late revision

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An 86-year-old lady, who 23 years previously had had a surface replacement of her right hip to relieve pain from osteoarthritis, experienced a sudden pain in her right groin, radiating down to her ankle, when she rose from her chair. She was then unable to bear weight. She recounted having had some groin discomfort for the previous 4 months, but had been pain-free and independently mobile without aids for the antecedent 22 years.

Upon examination, her right leg was found to be shortened, with no active movement at the hip; she had pain on the slightest movement. Her distal neurovasculature was intact. Radiographs (Fig. 1) showed that the acetabular component had failed and displaced. The following day, she underwent hip revision to a conventional cemented Exeter arthroplasty by a posterior approach (Fig. 2). She made excellent progress and was discharged 6 days later.

Discussion

Over the history of hip arthroplasty the concept of surface replacement has been cyclically revisited, initially by Smith-Petersen with his mould-arthroplasty, which progressed through a variety of materials (glass, Viscaloid, Pyrex, Bakelite, and Vitallium chromium-cobalt alloy).[1] In 1951, Charnley performed a double-cup arthroplasty without cement, with Teflon femoral and acetabular components. Unsurprisingly, since this material wears quickly, failure was rapid.

Subsequent attempts at double-cup arthroplasty included Townley's in 1960, who used polyurethane to anchor a metal cup to the femoral head and resurface the acetabulum; Muller in 1968, with both components made of cobalt-chrome; and Gerard in 1970, who used a cementless

FIG 1. Radiograph showing failure and displacement of the acetabular component of a total-hip articular replacement by internal eccentric shells (THARIES) 23 years old.

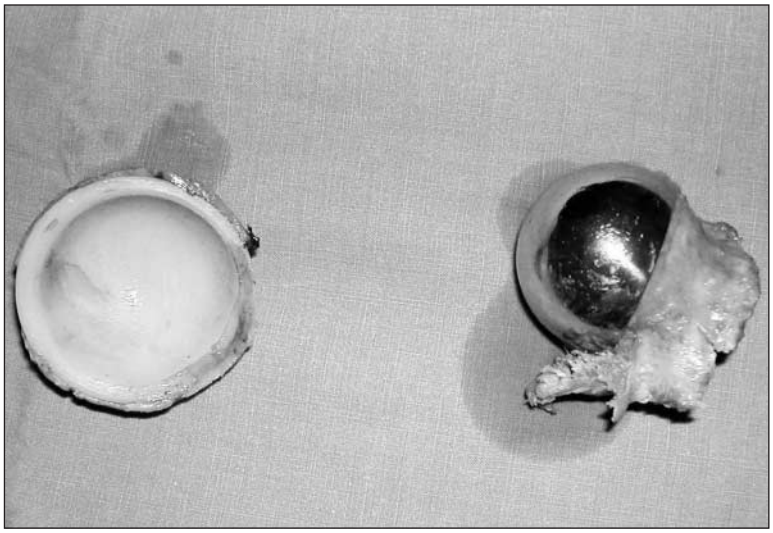

FIG 2. The resected components and femoral neck of the THARIES, 23 years after the resurfacing procedure.

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prosthesis with both components made of cobalt-chrome. Because of unsatisfactory results, Gerard changed the acetabular component to polyethylene; this too wore rapidly and resulted in osteolysis. In a later variation, the acetabular component had a polyethylene surface (to articulate with the metal femoral component) and a metal surface (allowed to move against bone on the acetabular side).

Despite Charnley's success with low-friction arthroplasty, a drive remained to develop a surface replacement in order to avoid removing large amounts of bone from the proximal femur and to reload the calcar in a fashion closer to that found in health. Notable were the Paltrinieri–Trentani and Wagner devices and total-hip articular replacement by internal eccentric shells (THARIES).[2]

Early hopes were shattered by poor medium-term results. At 10 years after insertion, THARIES had a 68% loosening rate.[3] The senior author (JC) performed 52 THARIES procedures over a period of 3 years, discontinuing the procedure in the early 1980s when it became apparent that early loosening and revision was the norm. In Miller's words,[1] "The lesson to be learned from this experience is that a seemingly elegant biomechanical solution often leads to biological disappointment."

The main cause of failure of conventional metal-on-polyethylene total-hip replacement is aseptic loosening, largely attributed to wear-particle–stimulated osteolysis. The same process may have caused the early failure of THARIES, not least because the large diameter of the femoral "male" cup (and necessarily small thickness of the acetabular "female" cup) increases frictional torque at the base of the acetabular cup and predisposes to high rates of volumetric wear.[4] The approach underlying the McMinn prosthesis is to use a metal-on-metal (cobalt-chrome) surface bearing, with better wear properties.[4] This has passed through several variations:[4] (1) uncemented, uncoated, press-fit for both cups; (2) uncemented, uncoated, press-fit cups but with a hydroxyapatite coating for both components; (3) a cemented design for both cups; and (4) a "definitive" type with a redesigned acetabular component: cementless and fully coated with hydroxyapatite on the outer surface.

The THARIES replacement described survived symptom-free for 22 years. This is an exception rather than the rule. Although very limited data are available on the new generation of hip-resurfacing arthroplasty,[5] early results have been encouraging.[4] Intermediate- to long-term results are eagerly awaited.

Competing interests: None declared.

References

1. Miller D. Orthopædic product technology during the second half of the twentieth century. In: Klenerman L, editor. *The evolution of orthopædic surgery*. London: RSM Press Ltd.; 2002. p. 211-25.
2. Amstutz HC, Dorey F, O'Caroll PF. THARIES resurfacing arthroplasty: evolution and long-term results. *Clin Orthop* 1986;213:92-114.
3. Nesse E. THARIES (total hip articular replacement by internal eccentric shells) double cup prosthesis: a 10-year follow-up study. *Tidsskr Nor Laegeforen* 1991;111: 1953-5.
4. McMinn D, Treacy R, Lin K, Pynsent P. Metal on metal surface replacement of the hip: experience of the McMinn prosthesis. *Clin Orthop* 1996;329(Suppl):S89-S98.
5. National Institute for Clinical Excellence. *Guidance on the use of metal on metal hip resurfacing arthroplasty. Technology appraisal no. 44*. London: the Institute; 2002.