ACETABULAR CUP FAILURE AFTER TOTAL HIP REPLACEMENT

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Fracture of the polyethylene acetabular cup is a rare late complication of total hip replacement. Five cases are reported. In each one this followed a fall, and involved a Müller arthroplasty which had previously been symptomless.

It is postulated that ridges or other irregularities of bone, produced by keying holes, could lead to areas of thin cement and potential weakness of support for the cup.

Total hip replacement is now the accepted method of treatment for severe degenerative disease of the hip. Early complications have been reduced to low levels (Charney 1979) but, as time passes, the prevalence of late complications is increasing. Loosening and breakage of the femoral component have been well documented (Sutherland et al. 1982), but we have found reports of fracture of the polyethylene acetabular cup in only four patients in the literature (Salvati et al. 1979; Stout and Marsh 1981; Collins, Chetta and Nelson 1982). We report five further cases of fracture of the acetabular cup following total hip replacement.

CASE REPORTS

Case 1. A 65-year-old woman, weighing 75 kg and 1.55 m tall, underwent a left Müller total hip replacement in 1977 for degenerative disease. A 44 mm acetabular component was used. She had no symptoms from her hip until she fell heavily onto her left side four years later. She experienced immediate pain in the left groin, radiating down the left thigh. Radiographs taken later (Fig. 1) showed that the marker wire of the acetabular component was distorted and that the femoral component had subluxated medially and upwards in the acetabulum. At a revision operation, the cup was found to be broken into many small pieces which were lying loose within the fragmented cement. The bony acetabulum was intact.

Case 2. A woman weighing 43.6 kg and 1.42 m tall had a right Müller total hip replacement for osteoarthritis in 1973. A 44 mm cup was used, and the arthroplasty was painless until 1979, when she was hit on the right side by a car and suffered multiple injuries. Radiographs (Fig. 2) revealed disruption of the marker wire of the cup with superomedial displacement of the femoral head. The bony acetabulum was intact. At operation for revision, disruption and fragmentation of the superior aspect of the acetabular cup and the overlying cement were found.

Case 3. A woman weighing 88.9 kg and 1.65 m tall had a right Ring hip arthroplasty in 1974 because of degenerative disease. In 1975 this was revised to a cemented Müller arthroplasty because of loosening, and a 44 mm acetabular component was used. The joint remained...
completely asymptomatic until 1983, when the patient slipped and fell heavily onto her right side. She had immediate pain in the right groin and thigh, made worse by weight-bearing and eased by lying down. Radiographs (Fig. 3) revealed disruption of the cup marker wire with upward subluxation of the femoral head and an intact bony acetabulum. At the revision operation, the polyethylene cup was seen to be destroyed at its superior lip, with a radial crack extending from this area to the centre of the cup (Fig. 4). The cement under the superior lip was fragmented, but the rest of it was intact and soundly fixed to the bone.

**Case 4.** A 58-year-old woman, weighing 63.5 kg and 1.66 m tall, had a right Müller total hip arthroplasty in 1975 for degenerative disease, and again a 44 mm acetabular cup was used. The arthroplasty was asymptomatic until 1981 when, after slipping and falling onto her right side, the patient immediately felt pain in her right groin, radiating down the right thigh. Symptoms increased in severity and later radiographs (Fig. 5) showed disruption of the acetabular marker wire with subluxation of the femoral component superiorly and medially in the acetabulum. At operation the upper rim of the acetabular component (Fig. 6) was found to be badly damaged, with a radial fracture extending to the centre of the cup. There was a hole in the cup at the superior part of the radial fracture. The cement lying above the cup in the bony acetabulum was fragmented, but the remainder of the cement fixation to bone was secure. However, the acetabular cup was loose within this intact part of the cement mantle, with a fibrous layer separating the polyethylene and the cement.
DISCUSSION

The five cases have several common features. Each arthroplasty was asymptomatic until a significant injury caused sudden and persisting pain in relation to the joint. Each arthroplasty was of the Müller type and, in all five cases, the polyethylene cup failed in an area near a keying hole where the cement had fragmented. In the first case failure was near a hole perforating the medial wall of the pelvis, while in the other four cases the failure was near a keying hole in the ilium. In the last three cases a distinct bony edge was seen and felt in association with the superior keying hole. In one case a bony bar between a keying hole and the previous fixation hole for a Ring arthroplasty had formed a ridge. In none of the cases, at any stage, was there a fracture of the bony acetabulum.

In Cases 2, 3, 4 and 5 the polyethylene had failed at the area of maximum stress, namely in the superior aspect of the cup, and the fracture line lay radially in all four. We cannot therefore agree with the suggestion of Salvati et al. (1979) and Collins et al. (1982) that dispensing with the circumferential fixation grooves in the acetabular component could help to prevent acetabular failure because our cases, unlike theirs, did not fracture along the potentially weak line of one of these grooves. In all our cases there was evidence of loosening, either at the cup–cement interface, or at the cement–bone interface. It is uncertain whether this occurred before or after the incident causing sudden failure, because no patient had an operation soon after pain started and none had radiographs taken just before the traumatic episode.

We also disagree with Volz (1980), who suggested that disruption of the acetabular marker wire indicates fracture of the bony acetabulum, because there was no direct or radiographic evidence of such a fracture in any of our cases. We consider that fracture of the acetabular cup may be influenced by a bony ridge in the superior aspect of the acetabulum, which can be produced by the formation of a keying hole in the ilium. This ridge may cause thinning of the cement layer in that area, giving a potential for stress concentration. This situation may be satisfactory for normal use of the hip, but the force of a fall may disrupt the supporting cement in this weaker area and fracture the polyethylene cup. Disruption of the acetabular marker wire and subluxation of the femoral head upwards within the acetabulum must indicate a cup fracture and make a revision operation necessary.

We would suggest that, while some roughness of the acetabular bone is needed to help key the cement, care should be taken to ensure that there are no distinct edges or bars in the roof of the acetabulum, especially in relation to keying holes, since these may cause thinning of the cement and potential weakness.

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REFERENCES


