CASE REPORT

Focal femoral osteolysis after revision hip replacement with a cannulated, hydroxyapatite-coated long-stemmed femoral component

A NEW ROUTE FOR PARTICULATE WEAR DEBRIS

We describe a case of symptomatic focal femoral osteolysis around a screw hole distal to the hydroxyapatite-coated portion of a cannulated femoral component in a revision hip replacement. No locking screw had been inserted into this, the most proximal of the three distal holes for locking screws. The presence of polyethylene wear debris in the tissue excised from the lesion suggested that it had passed through the cannulated portion of the stem and out of the proximal unfilled distal locking hole, initiating an osteolytic reaction in an otherwise well-fixed stem. This case highlights an important design characteristic of such cannulated, uncemented femoral components. We recommend that the proximal aperture of these cannulated stems be occluded at implantation.

Hydroxyapatite (HA)-coated implants offer excellent medium- to long-term survival rates and they are widely used in primary and revision hip replacement. The cementless Cannulok revision femoral component (Orthodynamics Ltd, Christchurch, United Kingdom) is a long, curved, distally interlocked, titanium-alloy stem which is plasma-sprayed with HA (thickness 90 µm) on its proximal two-thirds. The uncoated distal one-third has three locking holes. It is cannulated, allowing the prior passage of a guidewire which facilitates closed reduction and correct placement of the component when used in the operative treatment of peri-prosthetic fractures of the femur.

We describe an unusual pattern of symptomatic osteolysis associated with the use of this component.

Case report

A fit, active 68-year-old self-employed builder complained of pain in his right thigh which had become progressively worse over the previous six months. He described the pain as a dull ache, intermittent in nature and worse on weight-bearing. Ten years previously, he had undergone primary total hip replacement (THR) with a cementless ABG I total hip implant (Anatomique Benoist Gerard; Stryker Howmedica Osteonics, Newbury, United Kingdom). Six years later, he sustained a traumatic, unstable peri-prosthetic fracture of the femur (Vancouver type A7) and the femoral component was revised to a cementless HA-coated Cannulok implant, which was locked distally by a single screw using the middle of the three distal locking holes. His medical history was unremarkable, and there were no symptoms or signs of infection. On clinical examination he had a normal gait and a full pain-free movement of the right hip.

Radiographs showed a well-bonded femoral component with a focal area of osteolysis around the most proximal distal locking hole. There was also eccentric wear of the polyethylene liner (Fig. 1). The original ABG I acetabular component appeared to be well fixed and there was no evidence of peri-acetabular osteolysis. A radionuclide bone scan was performed and, on the delayed bone phase, a focal area of increased uptake was seen at the distal end of the femoral component, corresponding to the position of the osteolytic lesion. The focal distribution of radionuclide uptake indicated that the prosthesis was unlikely to be loose. There was no evidence of increased vascularity in the region of the right hip or femur on the early phase of the bone scan, demonstrating that infection was unlikely. Haematological markers of inflammation including the white cell count, erythrocyte sedimentation rate and the level of C-reactive protein were all within normal limits.
We observed a discrete area of osteolysis in relation to the first implication was that polyethylene wear particles, generated the component was found to be stable and well integrated. The osteolysis or loosening. This was confirmed at operation when appeared, radiologically, to be well fixed with no evidence of implant. The proximal two-thirds of the HA-coated implant distal ‘unfilled’ locking hole of the Cannulok revision femoral

Discussion

Operative exploration of the site of osteolysis revealed a thinned femoral cortex with an underlying gelatinous mass of tissue. Further gelatinous tissue was found extending proximally through the lumen of the Cannulok stem as far as the hip. Debridement and autogenous bone grafting of the osteolytic area were carried out as well as exchange of the worn liner and the cobalt-chrome femoral head. In an attempt to limit further migration of polyethylene wear particles through the lumen of the stem, its proximal aperture was filled with a plug of bone cement. Both the acetabular and femoral components were well fixed and were not revised. Tissue sampled from the lesion produced no bacterial growth on microbiological culture. Histopathological analysis showed a florid xanthogranulomatus-type histiocytic inflammatory reaction, as well as the presence of birefringent polyethylene wear particles.

On review at six months after surgery, the patient reported his thigh pain had subsided and plain radiographs suggested that some filling-in of the osteolytic lesion had taken place (Fig. 2).

We observed a discrete area of osteolysis in relation to the first distal ‘unfilled’ locking hole of the Cannulok revision femoral implant. The proximal two-thirds of the HA-coated implant appeared, radiologically, to be well fixed with no evidence of osteolysis or loosening. This was confirmed at operation when the component was found to be stable and well integrated. The implication was that polyethylene wear particles, generated from the acetabular component, had passed down the cannulation of the stem before exiting through the most proximal distal locking hole. This had triggered osteolysis in the adjacent cortical bone. The discovery of polyethylene particles in association with inflammatory tissue in samples taken from the lesion supported this theory.

The long-term stability of HA-coated implants is achieved by the strong biological bond between the implant and bone encouraged by the HA coating. Rahbek et al, in a canine model, showed that HA-coated implants were able to inhibit migration of wear particles at the implant-bone interface, thereby reducing the effective joint space. However, the benefit of this sealing effect was negated in our case since the osteolytic process was distal to the HA-coated portion of the stem. We believed that it was initiated by wear particles migrating down the lumen of the stem.

The relatively early development of osteolysis (four years after insertion of the stem) in our patient may be explained by the fact that he was very active for his age. Also, the ABG I acetabular component has been associated with excessive polyethylene wear and early failure. Despite this, there did not appear to be a significant degree of peri-acetabular osteolysis and therefore the acetabular component was not revised. Pressures within a joint have been shown to rise after replacement and we considered that by occluding the proximal aperture we would reduce any pumping of joint fluid at high pressure down the lumen of the component. This, we hoped, would reduce the likelihood of recurrence of the osteolysis.

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

References