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Case report

Two-stage management of a spontaneous fracture of the greater trochanter through osteolytic lesions induced by polyethylene wear of a total hip arthroplasty. A case report

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Summary. Pelvic osteolysis induced by particulate debris derived from bearing surfaces is a well-known complication following total hip arthroplasty (THA). Atraumatic fractures of the greater trochanter (GT) associated with osteolytic lesions have been occasionally described. We present a case of a 71-year-old male patient who sustained an undisplaced fracture of the GT nine years following cementless metal-on-polyethylene THA. The fracture occurred through a 2.5-cm large osteolytic area, and no hip trauma was recorded. Conventional radiographs revealed peculiar signs of massive wear of the polyethylene acetabular liner (marked eccentricity of the prosthetic head and extensive osteolysis around the iliac screws), allowing to immediately conclude about the benign nature of the pathological fracture. To our knowledge, a two-stage management, planning conservative healing of the fracture and subsequent surgical replacement of the worn acetabular liner, has never been previously detailed. (www.actabiomedica.it)

Key words: total hip arthroplasty, trochanteric fracture, osteolytic lesion, periprosthetic fracture, pathological fracture, polyethylene wear

Introduction

Pelvic osteolysis is a well-known complication following total hip arthroplasty (THA) (1). It has been attributed as the biological response to wear debris of several materials, but polyethylene (PE) particles are the most implicated agents (2-4). The occurrence of a spontaneous fracture of the greater trochanter (GT) has been rarely described as a complication of particulate PE debris (5-10). In the reported case, a two-stage management, including conservative healing of the fracture and subsequent surgical exchange of the worn acetabular liner, was immediately planned and successfully performed.

Case Report

On September 2008, a 71-year-old male with a BMI of 33.4 presented to the First Aid of our Hospital with complaints of a severe pain over the lateral aspect of the left hip and inability to bear weight. In 1999 the patient underwent primary cementless THA with metal-on-polyethylene bearing for avascular necrosis of his left femoral head; the contralateral hip had been replaced in 1996. The acetabular component was a 58-mm PCA, hydroxylapatite-coated hemispheric cup (two cancellous screws were used to supplement the primary stability) fitted with an Ultra-High-Molecular-Weight Polyethylene elevated rim liner. The femoral component was a Citation anatomical stem size 3 that accepted a 32-mm diameter, +4 mm long cobalt-chromium alloy (CrCo) head (Howmedica, Rutherford, New Jersey, USA). Both stem and socket were made of a cobalt-chromium alloy (Figure 1). The postoperative course was uncomplicated, and the patient had a complete functional recovery. Since he was asymptomatic, he declined routine follow-up radiographic checks up to April 2007, when x-ray dem-

Figure 1. Immediate postoperative x-ray shows the correct positioning of a left cementless total hip arthroplasty

Figure 2. Emergency radiograph obtained at acute onset of pain documents an undisplaced fracture through a cystic lesion in the greater trochanter. Pelvic osteolysis around acetabular screws and eccentric polyethylene wear are evident

onstrated the occurrence of osteolysis behind the acetabular metal shell, which was not responsible for any pain or hip impairment. Nine years following surgery (September 2008) the patient experienced sudden onset of acute pain. Pain developed after a normal extension movement of the hip joint, and no previous trauma had been recorded. Physical examination revealed an intense tenderness over the trochanteric area. Conventional radiographs showed an undisplaced fracture of the greater trochanter and a 2.5-cm large osteolytic area behind the acetabular shell around the two iliac screws (Figure 2). Though there were no signs of loosening of the metal PCA cup, a marked asymmetric position of the prosthetic head could be detected, revealing eccentric wear of the acetabular polyethylene liner. A two-stage management of the pathological fracture was planned. Given the minimal displacement of the greater trochanter, conservative healing of the fracture was pursued. Consequently, the patient was treated with an abduction brace and pain-limited weight-bearing on the affected limb for four weeks, then he progressed to partial weight-bearing for another four weeks. At 6-week x-ray follow-up, significant signs of

Figure 3. Six-week x-ray check demonstrates significant signs of fracture healing

fracture healing were present (Figure 3). Subsequent computed tomography scan confirmed that fracture of the GT had healed, revealing extended areas of acetabular bone deficiency (Figure 4).

On March 2009, six months after the occurrence of the fracture, revision surgery was performed via an anterolateral approach to address the cause of osteolysis. On arthrotomy both acetabular metal shell and femoral stem were well fixed to the bone, but erosion of approximately one third of the peripheral polyethylene rim was found. The greater trochanter appeared to be definitely healed. A small fragment was obtained

Figure 4. Computed Tomography taken two months after the fracture. Reveals extended areas of acetabular osteolysis

from the tip of the GT and the histological study showed the presence of a vigorous remodelling bone tissue consistent with a normal fracture healing process (Figures 5a and 5b). Revision included removal of both screws, which were completely loose, and filling pelvic defects with morselized bone allograft through the screw holes of the metal-back cup. Finally, brand new coupling surfaces (PE liner and CrCo prosthetic head) were implanted (Figure 6).

At the most recent follow up examination, five years after revision surgery, the patient has resumed all his activities of daily living with no hip pain and successful radiological outcome (Figure 7).

Discussion

Osteolysis associated with particulate debris from the bearing surfaces is a common long-term complication of hip replacement surgery (1). Prosthetic wear debris, expecially derived from polyethylene (3, 11), activate macrophages and osteoclasts, promoting bone resorption (2, 4, 12). Extensive bone loss occasionally may lead to pathological periprosthetic fractures, usually around well-fixed implants (5-10). Bone loss frequently courses symptom-free, even for several years (13). Therefore, most orthopaedic surgeons recommend periodic clinical and radiographic monitoring of prosthetic implants assessing signs and symptoms of osteolysis as well as of loosening (7, 14).

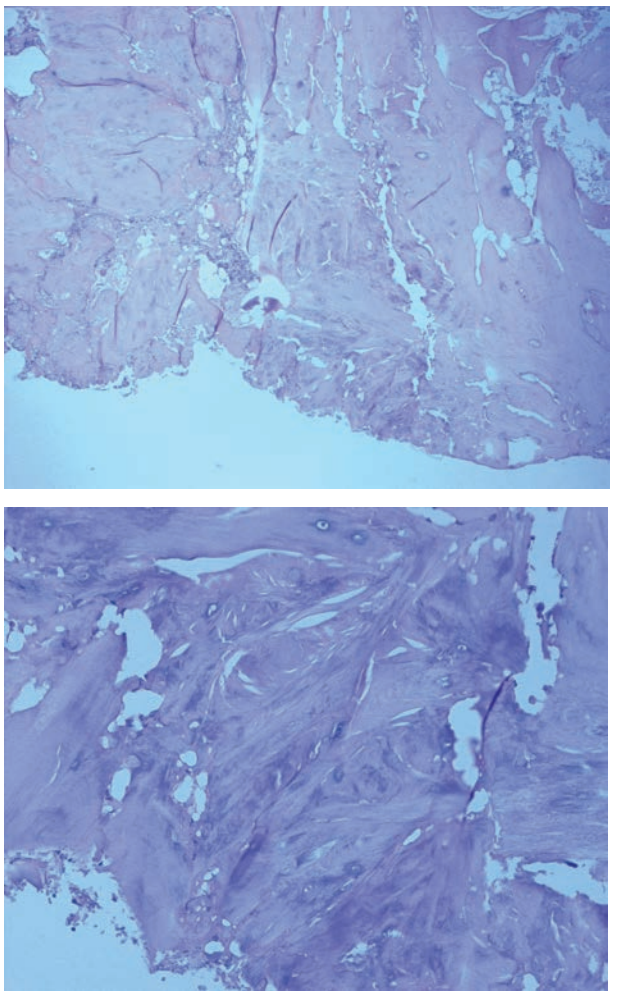

Figure 5. Histopathological findings. (a) Low power view (x40) showing acellular (necrotic) tissue and woven bone in the greater trochanter, which is indicative of a reparative process. (b) The same bone fragment at high magnification (x400) shows woven tissue

Figure 6. Postoperative radiograph. Iliac screws were removed and acetabular bone defect was partially filled with morselized allograft; both prosthetic bearing surfaces were replaced

Spontaneous fractures of the GT through cystic lesions are a late complication of THA, typically presenting with sudden onset of pain in younger and active patients with high activity levels several years after surgery (5, 6-8).

Whether markedly displaced acute fractures of the greater trochanter require immediate wire fixation and allogeneic bone-grafting to fill osteolytic defects (9) or plate osteosynthesis (15), lesions with minimal displacement can undergo nonoperative treatment successfully with an abduction orthosis and limited weight-bearing, leading to bone healing within three months (7). However, the fracture indicates the presence of a significant wear problem. Claus et al. reported that, although the fractures of the GT with minimal displacement healed without the need for surgical stabilization, the size of the osteolytic lesions increased (6). Consequently, osteolysis of the GT secondary to excessive PE wear ultimately requires surgical treatment to address the underlying problem of particulate debris generation promoting periprosthetic bone loss. Immediate curettage and grafting of the trochanteric cyst and simultaneous exchange of the worn acetabular liner has been reported in two patients by Heekin et al. (5).

Figure 7. Conventional x-ray performed five years following revision surgery shows complete healing of the trochanteric fracture with periprosthetic bone stock restoration

The greater trochanter is a frequent area for osteolysis because a large cancellous bone surface is in close proximity to the usual source of particle production, the bearing surfaces. Unfortunately, osteolytic lesions of the GT commonly occur in asymptomatic hips and can be difficult to see until they become larger (7). Brown and Ring described 7 cases of bone resorption and trochanteric separation in a small series of 10 hips with extensive osteolysis in the proximal femur which were assessed up to nine years postoperatively (16). Hence, x-ray appearance of resorptive changes should be regarded as an impending pathological fracture.

In the reported case, the patient did not have a history of trauma, and the prosthesis performed well clinically. At the latest follow-up (April 2007), although pelvic osteolysis had been clearly detected, the hip was found to be well-functioning and painless. After a few months of hip bracing and restricted weight-bearing, which facilitated fracture healing, delayed revision surgery could be undertaken to reduce particle generation (7).

In conclusion, the occurrence of a spontaneous fracture of the greater trochanter associated with THA is an unusual presentation of polyethylene wear debris and related bone resorption (5-9). Undisplaced lesions can be successfully treated with a two-stage approach, including conservative healing of the fracture and subsequent surgical replacement of the acetabular liner, thus addressing the underlying problem of wear.

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