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Massive pelvic and femoral pseudotumoral osteolysis secondary to an uncemented total hip arthroplasty

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Abstract A 51 year-old man developed an extensive osteolytic response to wear debris in an uncemented porous-coated total hip arthroplasty, with metal/polyethylene interface, which had been implanted eighteen years previously. This reaction, which involved the upper femur and the ilium, produced a mass which compressed the pelvic viscera.

Résumé Nous rapportons un cas d'ostéolyse massive réactionnelle aux débris d'usure d'une prothèse totale de hanche non cimentée avec un revêtement poreux et un couple de frottement métal/polyéthylène implantée dix-huit ans auparavant chez un patient de 51 ans. L'ostéolyse détruisait l'extrémité supérieure du fémur et l'aile iliaque produisant une masse pelvienne qui refoulait les organes avoisinants. Le produit de curetage contenait des amas d'histiocytes ainsi que des corps étrangers constitués de débris de métal et de polyéthylène. Les cultures bactériologiques en milieux aérobie et anaérobie étaient stériles. L'examen histologique excluait une ostéolyse tumorale. L'ostéolyse périprothétique est fréquente et a été également observée autour d'implants fémoraux et acétabulaires, cimentés et non cimentés, bien fixés et descellés. Bien que la plupart des ostéolyses restent stables et asymptomatiques pendant plusieurs années, certaines d'entre elles peuvent devenir massives entraînant une destruction osseuse importante et une reprise chirurgicale difficile. Une surveillance radiographique régulière est le meilleur moyen pour diagnostiquer et mesurer la taille d'une ostéolyse, les examens sanguins et la scintigraphie n'ayant pas de valeur prédictive pour identifier une lésion au potentiel évolutif. Une reprise chirurgicale précoce devrait être réalisée dès qu'une ostéolyse, même asymptomatique, s'accroît.

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Introduction

Osteolysis is a frequent complication which affects the outcome of total hip arthroplasty. Since Charnley's first description concerning a cemented prosthesis in 1968 [5], osteolysis has been described as occurring around loose and well-fixed femoral and acetabular implants of cemented and cementless prostheses. This complication results from an inflammatory foreign body reaction to the different prosthetic components and wear debris from the articulating surfaces and the interfaces has been implicated as a causative factor [1]. Polymethylmethacrylate cement, polyethylene, metal and more recently ceramic [27] debris may be the cause of osteolytic response, although polyethylene debris is considered to be the most damaging. Phagocytosis of debris by macrophages releases the mediators of osteolysis. Lack of bone ingrowth in uncemented implants or defective fixation at the bone-cement interface in cemented prostheses play a role in producing particles and activating the reaction [1, 10, 27]. Once radiologically identified, the majority of the osteolytic lesions remain stable over many years or else evolve slowly [15, 18, 25, 26, 28]. A minority progress, mimicking a tumour [3, 10, 12–14, 17, 19–21, 27]. These massive osteolyses constitute a real clinical problem, because of the eventual failure of the implant and technical difficulties at revision due to bone loss. We report an unusual case of an aggressive pelvic and femoral osteolysis secondary to an uncemented hip prosthesis which had been implanted eighteen years previously.

Case report

In March 1995, a black male aged 51 years was admitted into our Department of Orthopaedic Surgery with pain and swelling affecting the proximal third of the left thigh. He had the sequelae of neonatal cerebral palsy (Little's syndrome) and had started to walk with an aid at the age of seven years. In December 1977, at the age of 34 years, he was treated in another hospital for a femoral neck non-union which occurred two years after a femoral neck fracture. Replacement arthroplasty was undertaken using an uncemented

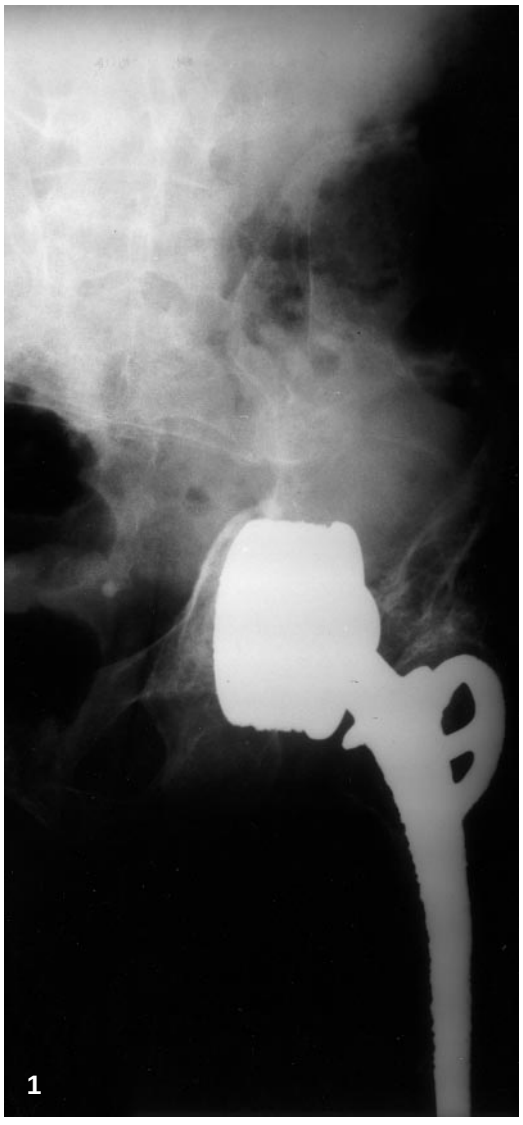

Fig. 1 Anteroposterior radiograph demonstrating a large area of osteolysis around the acetabular cup

Fig. 2 CT scan: pseudotumoural mass compressing the pelvic viscera

Fig. 3 Photomicrograph of a representative section of tissue obtained from the region of osteolysis (×125). The numerous histiocytic cells are consistent with a foreign body reaction. Polarised light microscopy revealed many particles of birefringent polyethylene

porous-coated total hip prothesis with a metal/polyethylene interface and a 32 mm-head. In 1990, he began to experience hip pain and had difficulty in walking. At this time, an anteroposterior radiography revealed a large area of focal osteolysis behind the acetabular component (Fig. 1).

Five years later, at the time of admission to our department, he complained of hip pain and inability to walk. The left leg was shortened by 5 cm and in permanent lateral rotation. Clinical examination revealed a large swelling involving the buttock, the iliac fossa and the proximal thigh. Passive motion was very painful and active movements were impossible. An anteroposterior radiograph showed an extensive osteolysis involving the ilium and the upper femur, associated with intrapelvic migration of the prosthesis. A CT scan revealed an homogenous mass of 25 cm in diameter, non-enhanced by iode, which compressed the pelvic viscera without invading them (Fig. 2). Angiography revealed no hypervascularity within the osteolytic area and the technetium bone scan showed no increased uptake in the ilium. Chest radiography and abdominal ultrasound yielded normal results. A surgical exploration of the left hip was undertaken. We found a mass surrounded by a periosteal capsule and filled with haematoma. The stem of the prosthesis was firmly fixed in the remaining femur. The lesion was completely evacuated by curettage after removal of the prosthesis. Aerobic and anaerobic bacteriological cultures of surgical samples were sterile. Histological staining revealed no tumoural process and no chronic infection. The capsule of the pseudotumour consisted of dense fibrous tissue enclosing haemosiderin, calcium deposits, histiocytes filled with metal debris, eosinophil necrosis and neoangiogenesis. Under polarised light, it was evident that several of the cells had phagocytosed bi-refringent particles of polyethylene (Fig. 3). We concluded that a massive pseudotumoural bony osteolysis secondary to an inflammatory granuloma had developed due to wear debris from the hip component. Because of the extensive bone loss and the patient's neurological status, a resection arthroplasty was performed using a femoral nail and cement as a spacer, in order to restore the length of the lower limb.

Discussion

The differential diagnosis in our patient included osteomyelitis, benign or malign bone tumour, aneurysmal bone cyst and the Gorham-Stout syndrome. Cultures and histological staining of samples obtained during operation showed no infectious or tumoural process but revealed a histiocytic response to metal and polyethylene wear debris.

An aneurysmal bone cyst most often affects persons under the age of 20 years and comprises cavities full of sero-haematic liquid; monostotic bone localisation is usual [4, 7]. The rare Gorham-Stout syndrome, also termed ''idiopathic osteolysis'', was excluded because of the patient's age (over 30 years) and presence of the hip prosthesis, together with the macroscopic and histological findings [9, 11].

Periprosthetic osteolysis occurs in from 0% to 52% of hips among the reported series [2, 6, 8, 18, 22, 24–25, 28–29]. These percentage values are influenced by different factors including the duration of follow-up, the head size and polyethylene cup thickness [16], linear and volumetric polyethylene wear [26], the age of the patient at surgery [26, 28], fixation with or without cement [8, 29] and the design and position of prosthetic components [2, 17, 23]. Osteolyses are identified radiographically as ovoid or rounded lucencies which are usually limited to the proximal third of the femur (zones 5, 6 and 7 of Gruen) and the acetabular rim [10]. About 40 to 70% of osteolyses increase in size during the postoperative follow-up period [15, 18, 25, 28]. According to Wan, this progression of size is slow, with an average rate of 0.89 mm per year [26]. Less than 10% of osteolyses become massive and lead to significant loss of bone stock [15]. Massive osteolyses have been described on loose and well-fixed femoral or/and acetabular components of cemented [3, 10, 12–14, 19–21] and uncemented [15, 17, 27] hip prostheses. The usual macroscopic findings are of cavities filled with yellow caseous material. Blood clots within a cystic cavity as in our patient have been reported in two similar instances of extensive osteolysis of the ilium [13, 19]. According to Mayo-Smith [19], the presence of a large amount of blood within the cystic space may account for the rapid expansion of the lesion. The histological features were similar in all cases and consisted of chronic granulomatous inflammation with dense fibrous tissue and numerous histiocytic cells, including multi-nucleated giant cell forms [10].

To the best of our knowledge, our patient is unique by virtue of the extent of bone loss affecting both the ilium and the femur; the occurrence in an osteoporotic bone probably influenced the rapid expansion of the osteolysis. Such osteolysis has considerable destructive potential, making one stage revision arthroplasty impossible.

The majority of osteolyses remain asymptomatic for several years, [17, 25, 28]. In several reported series, the time between joint replacement and the diagnosis of postoperative osteolysis ranged from six months [10, 26] to more than ten years [3, 10, 21]. According to Wan, 71% of the osteolyses are radiologically identified between six months and five years after hip arthroplasty [26]. In clinical practice the problem is to predict whether or not a seemingly benign lesion will become aggressive and rapidly destructive. Blood tests and technetium bone scans are not of predictive value for the identification of lesions which will become progressive [15]. Radiography remains the most efficient way to diagnose and measure the extent of bone loss and we suggest that annual radiographs should be commenced six months after surgery. Once lesions have been identified radiologically, more frequent follow-up is mandatory, with serial radiography at six monthly intervals. As soon as osteolysis progresses in extent, it is necessary to perform a revision arthroplasty, even in the asymptomatic patient. It is of practical importance that massive osteolysis can lead to dramatic bone loss while remaining clinically silent. Although rare, this complication can be detected by regular radiographic monitoring thereby facilitating early revision surgery before massive bone destruction occurs.

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