Notching of the femoral stem neck in metal-on-metal total hip replacement: a case report

Ka-Hei Leung, Kwong-Yuen Chiu, Fu-Yuen Ng, Li Yin

1 Department of Orthopaedics and Traumatology, Queen Mary Hospital, Hong Kong
2 Department of Orthopaedics, The First Affiliated Hospital of Zhengzhou University, Zhengzhou, China

ABSTRACT

We report a case of impingement in a metal-on-metal total hip replacement causing both notching of the femoral stem neck and aseptic loosening of the acetabular component. The acetabular component was inserted in excessive anteversion. The femoral stem and acetabular components were retrieved. A larger femoral head was used, and an acetabular component was placed in a less anteverted position. Intra-operative testing through different ranges of movement is recommended to identify potential impingement.

Key words: arthroplasty, replacement, hip; metal-on-metal joint prostheses; postoperative complications

INTRODUCTION

Aseptic loosening is a major cause of failure of total hip replacement (THR).1 We report on a case of aseptic loosening of a metal-on-metal THR secondary to impingement of the femoral stem.

CASE REPORT

In November 2006, a 56-year-old woman with osteoarthritis of the left hip underwent a cementless metal-on-metal THR via a posterior approach using a 52-mm Wagner cup, a 28-mm Metasul metal liner, a corresponding 28-mm femoral head, and a Natural Hip femoral stem (Zimmer, Warsaw [IN], USA). Postoperatively, she was free of pain and had good mobility with the help of a stick. From October 2008, she complained of clunking and a squeaking noise from her prosthesis when walking. Her walking tolerance was not changed. She had no history of trauma or subluxation. Radiographs showed loosening of the Wagner cup, as delineated by a continuous radiolucency occupying all the 3 DeLee and Charnley zones (Fig. 1). The femoral stem appeared stable. Inflammatory markers were normal. She was scheduled for revision of the acetabular and femoral head components.

Address correspondence and reprint requests to: Dr Ka-Hei Leung, Room 429, Block K, Queen Mary Hospital, 102 Pokfulam Road, Hong Kong. Email: leungkahei@hotmail.com
The hip joint was exposed through a posterior approach. The acetabular cup was placed in about 25º of anteversion. It was loosely held in place by 2 screws, which were also loosened. There was no bone ingrowth. Extensive metallosis was noted on the granulation tissue surrounding the joint. There was a 5-mm notch at the neck of the femoral stem over the posterior surface corresponding to the site of impingement caused by the metal liner (Fig. 2). The metal liner was well fixed to the acetabular cup but appeared to be more exposed owing to severe wear of the polyethylene component posterior to it. The femoral stem was well fixed.

In view of the presence of a stress riser and risk of fracture of the neck of the femoral stem, the femoral and acetabular components were removed by an extended trochanteric osteotomy. Granulation tissue was debrided thoroughly. The acetabulum was reamed from 52 to 57 mm and a size 58-mm Pinnacle acetabular cup was impacted at 45º inclination and 15º anteversion. A polyethylene insert with a 10º lip was impacted at the one and a half o’clock position. The femoral canal was reamed to 12 mm. A Solution Stem (12 mm in diameter, 6-inch long) was inserted at 15º anteversion. A 36-mm femoral head was used. The joint was reduced with satisfactory stability. Intra-operative testing through different ranges of movement showed no impingement. The extended trochanteric osteotomy was repaired with 2 Dall-Miles cable systems.

Cultures of the granulation tissue were negative. Histopathology showed abundant small, blackish, metallic deposits compatible with titanium, intermixed with refractive particles compatible with polyethylene.

The postoperative course was uneventful and the patient resumed independent walking. Radiographs showed the prosthesis was stable (Fig. 3).

Figure 1  Loosening of the Wagner cup.

Figure 2  Wear of the polyethylene insert, the exposed metal liner, and a 5-mm notch at the posterior part of the neck of the femoral stem.

Figure 3  Revision of the acetabular and femoral components.
DISCUSSION

Impingement is a major cause of aseptic loosening of THR. Impingement is difficult to detect by clinical evaluation or radiography. Combining fluoroscopy and 2- to 3-dimensional registration techniques enables assessment of 3-dimensional motion of the artificial hip joint and impingement in THR.

Impingement mechanisms can be classified into: pincer, cam, or a combination of both. Pincer impingement is caused by inadequate removal of acetabular osteophytes and malposition of acetabular components. The impingement in our patient was of this type. Cam impingement is usually due to a small head-to-neck ratio. Impingement is associated with higher rates of dislocation, catastrophic wear, limitation in movement, and pain. Impingement can occur in metal-on-metal articulation. It can occur early after THR or after a long duration, following loosening and substantial rotation of the acetabular cup.

Four case reports of impingement causing notching of the femoral neck component in metal-on-metal THR have been reported. In one report, the impingement occurred at the end range of movement because the patient had an exceptionally wide range of movement. This complication is difficult to avoid irrespective of how correctly the components are positioned. In another report, impingement occurred secondary to a loosened Metasul metal liner, and the importance of secure fixation of metal liners was stressed. These patients had impingement of the anterior surface of the neck of the femoral stem. In another report, a metal liner impinged on the posterior surface of the neck of the femoral stem. Anteversion of the acetabular cup was 45º, and the site of impingement and the aetiology of excessive cup anteversion was similar to that seen in our patient. However, the clinical presentation differed. Extensive osteolysis (secondary to the liberation of polyethylene wear particles) and fracture of the greater trochanter was reported.

The safe range of cup orientation should be an anteversion of 15º±10º and a lateral opening of 40º±10º. Even within this range, impingement is not always preventable. In our patient, the cause of impingement was excessive anteversion of the acetabular component (25º). Whenever the patient stood or walked and extended her hip, the femoral component (made of titanium-aluminium-vanadium alloy) hit on the metal liner (made of cobalt-chromium-nickel-molybdenum alloy), which was much harder, and notching occurred (Fig. 4). The screws, which were initially still holding, stopped the cup from changing into a less anteverted position. The polyethylene insert was eroded by the femoral component distal to the notch. As more polyethylene was eroded, a larger area of metal liner was exposed to cause more notching and this became a vicious cycle.

The Wagner cup is composed of a titanium metal back, a conventional polyethylene insert, and a cobalt-chrome metal inlay. This cementless acetabular cup has a rough-blasted surface and sharp-edged elevations. Primary fixation is achieved with a press-fit mechanism and can be augmented by screws. Secondary fixation is by bony ingrowth onto the titanium surface. Metal-on-metal articulation reduces the wear rate and thus increases the longevity of the implant. However, the use of the Wagner cup in primary metal-on-metal THR does not always have promising results. In 55 hips using a Wagner cup, 12 showed radiological signs of aseptic loosening over a mean period of 31 months. Of these, 9 cups were revised and all showed no secondary bony ingrowth onto the titanium surface. The sand-blasted surface of the Wagner cup and the gap between the metal back of the cup and the subchondral bone of the acetabulum owing to the screw holes projecting from the cup were the reasons for the failure of osteointegration.

In our patient, repetitive impingement further inhibited osteointegration of the Wagner cup at the implant-bone interface owing to micromotion. If timely revision surgery had not been performed, fracture of the neck of the femoral stem would have occurred. Thus, excessive anteversion should be
avoided. The joint should be tested intra-operatively through different ranges of movement to ensure no impingement.

DISCLOSURE

No conflicts of interest were declared by the authors.

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