Clinical Case Report

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A new strategy to reconstruct type III acetabular bone defect associated with inflammatory pseudotumor: combined medial and lateral acetabular bone grafting

A case report

Jing Wang, MD, PhD*, Dejiu Wang, MM, Jiang Du, MM, Zhen Lin, MD

Abstract

Rationale: Inflammatory pseudotumor has been commonly reported in patients undergoing total hip arthroplasty (THA).

Patient concerns: We reported a patient who had a massive intra-pelvic pseudotumour and acetabular bone defect underwent two-stage revision THA.

Diagnoses: A new surgical strategy for pseudotumor after THA is performed.

Interventions: Thorough debridement intra-pelvic pseudotumour via Smith-Petersen approach, bone grafting on iliac medial surface and plate-screw internal fixation were performed in the first stage, followed by revision of the loosened prosthesis to a cementless primary prosthesis in the second stage.

Outcomes: A follow-up for 5 years showed satisfactory recovery of function.

Lessons: This surgical revision is less invasive than conventional methods, resulting in a stable and well-functioning hip joint after mid-term follow-up for 5 years.

Abbreviations: MoM = metal-on-metal, MoP = metal-on-polyethylene, MRI = magnetic resonance imaging, THA = total hip arthroplasty.

Keywords: pseudotumor, revision, total hip arthroplasty, 2-stage

1. Introduction

Metal-on-metal (MoM) hip replacements have been widely used in Australia and Europe with an excellent short-term and mid-term results.[1] However, metal (chromium and cobalt) ions and particles released from these implants may lead to devastating complications, such as cardiac, neurological effects, and inflammatory pseudotumor.[2–4] Moreover, a few cases of inflammatory pseudotumor after metal-on-polyethylene (MoP) have also been described.[5] Inflammatory pseudotumor, an aggressive granulomatous lesion, can affect the normal structures around the hip, including the bone and muscle.

There are 2 main surgical strategies for the treatment of pseudotumor after total hip arthroplasty (THA): isolated revision of the femoral component and full-revision surgery.[6] In cases presenting with continuous pain and elevated ion levels in the context of well-fixed implants, isolated revision of the femoral component is recommended.[6,7] This revision resulted in excellent short-term follow-up by eliminating the concerns from MoM bearings. However, the procedure is only suitable for the well-fixed resurfacing hip and the long-term follow-up results need further investigation. Moreover, in cases involving massive bone defect and loosened prosthesis, full-revision surgery is preferable. However, full-revision generally performed through posterolateral approach is difficult to remove the intrapelvic pseudotumor. In this study, we presented a patient with an intrapelvic pseudotumor associated with a MoP THA. Total resection of pseudotumor and stable fixation of a periprosthetic femoral component are both great challenges in this case because of the massive intrapelvic pseudotumor and acetabular bone defect. To solve this problem, we developed a new 2-stage surgical strategy to reconstruct acetabular bone defect caused by inflammatory pseudotumor.

The first stage comprised intrapelvic pseudotumor resection, bone grafting on iliac medial surface, and plate–screw internal fixation. After building a stable foundation for the femoral implant, a cementless THA was implanted in the second stage. Our strategy is less invasive than conventional methods, thus

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Patient consent: Written informed consent was obtained from the patient for publication of this case report and any accompanying images.

The authors have no conflicts of interest to disclose.

Department of Orthopedics, The First Affiliated Hospital of Jinan University, Guangzhou, China.

** Correspondence: Jing Wang, Department of Orthopedics, The First Affiliated Hospital of Jinan University, Guangzhou, China (e-mail: twjing@jnu.edu.cn).*

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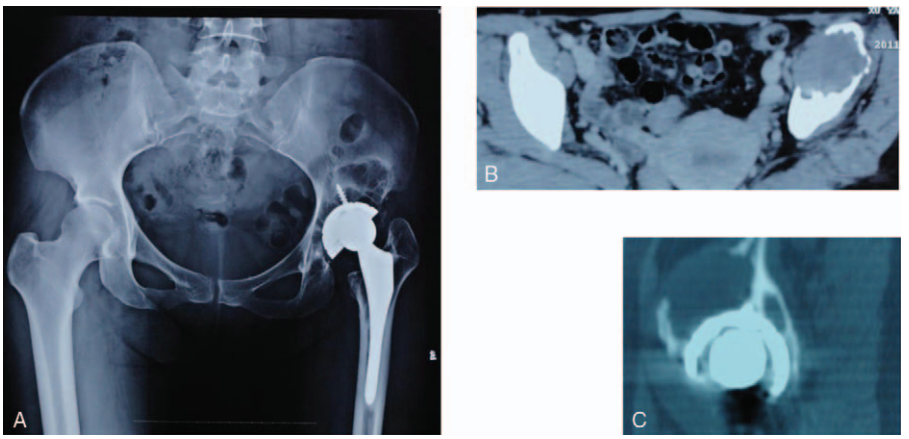

Figure 1. (A) Preoperative radiograph indicating osteolysis around the acetabular prosthesis after the left THA. (B) CT scanning showing extensive osteolysis around the acetabular prosthesis and massive inflammatory granulation tissue. (C) Coronal CT images demonstrating large bone defect in the acetabular roof, which broke the acetabular medial wall. CT = computed tomography, THA = total hip arthroplasty.

results in a stable and well-functioning hip joint after mid-term follow-up for 5 years.

2. Methods

A 44-year-old woman underwent left THA in 2003. She had a normal postoperative follow-up with an excellent initial result. She presented with 2 months of worsening left hip pain with a history of fall. This was described as a constant pain that did not relived by rest, along with mild claudication.

Physical examination: The left limb was 2 cm shorter than the right one, with local percussion pain and positive Patrick sign in the left hip. Imaging examination: x-ray showed osteolysis around acetabular component with loosening of the implant; computed tomography (CT) scanning indicated massive osteolysis around acetabular prosthesis, with abundant soft tissue mass formation (Fig. 1).

The operation was divided into 2 stages. At the first stage, the patient was placed in the supine position, and left iliopsoas was stripped via the Smith–Petersen approach, with exposure of iliac internal wall and the medial surface of the acetabular roof. Massive bone defect was observed in the acetabular roof and pelvic internal wall, with yellow brown necrotic soft tissue intruding into the pelvic cavity. After thoroughly eliminating the necrotic soft tissue, acetabular prosthesis cup and screws were observed through the bone defect area (Fig. 2). Double-sided cortex allografts were trimmed and implanted into the bone defect region under the cortex of iliac internal wall. A 7-hole pelvic reconstruction plate was placed on the inner wall of ilium, covering the surface of the large graft bone, and fixed by two 3.5-mm cancellous bone screws. The removed necrotic soft tissue was sent for pathological examination and culture.

The second stage was performed via a posterolateral approach to the left hip. The loosed acetabular prosthesis was dislodged, and necrotic soft tissue was thoroughly eliminated. The autologous tricortical iliac crest was trimmed and implanted into the bone defect region, and then fixed by 4 Kirschner wires (1.0 mm in diameter). The acetabulum was reversely grinded with

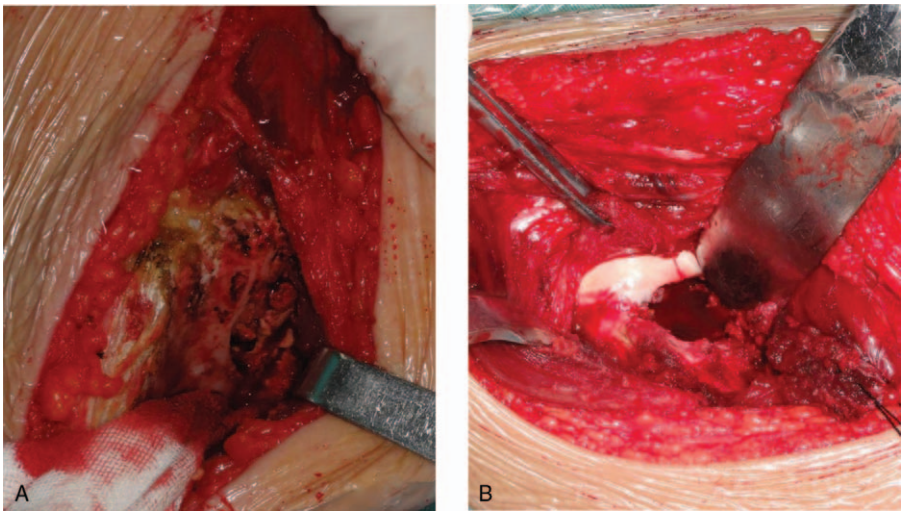

Figure 2. (A) In the first stage, bone defect was observed in the acetabular roof and pelvic internal wall, with yellow brown inflammatory granulation tissue intruding into the pelvic cavity. (B) Bone defect region after removal of the inflammatory granulation tissue.

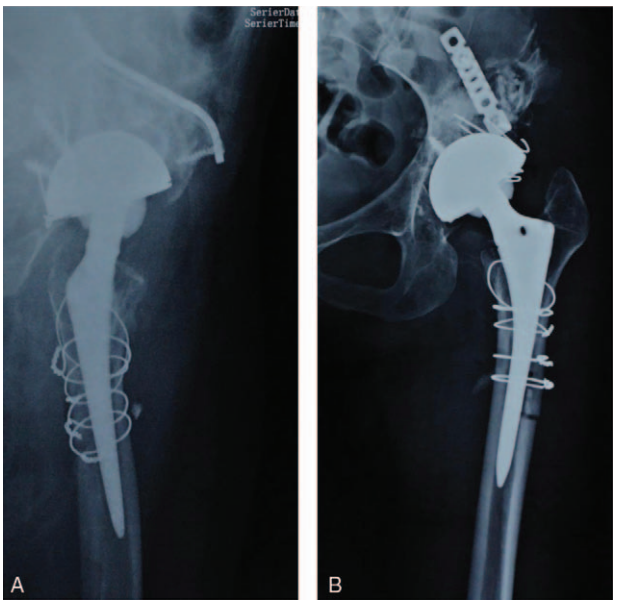

Figure 3. (A) Anteroposterior and (B) lateral radiographs of the left hip showing that the prosthesis was well fixed and positioned.

the abduction angle at 45° and the anteversion angle at 20°. Then a 48-mm trabecular acetabular prosthesis was placed and fixed by 2 screws (25 and 20 mm in length, respectively).

Hip functions before and after surgery were assessed according to the Harris hip scoring system. The length of the left limb before and after surgery was measured. Bone graft fusion was evaluated according to Gross criteria.

3. Results

Results of postoperative cultures were negative. Anteroposterior and lateral radiographs of the left hip showed that the prosthesis was well-fixed and positioned (Fig. 3). Preoperatively, the Harris hip score was 51, while the score increased to 97 at the 5-year follow-up. The left leg shortened 2 cm than the right one preoperatively, while the left leg only shortened 1 cm postoperatively. At 2-year follow-up, CT showed trabecular connection between allograft and host bone which indicated bone graft fusion (Fig. 4). Bone resorption and prosthesis loosening were not observed by radiography in the last follow-up (Fig. 5). The patients informed us that the continuous pain of the left hip she had experienced preoperatively had disappeared soon after surgery and had not returned since.

4. Discussion

Pseudotumor formation and local soft tissue damage have been described since 1976. Toward the end of the 20th century, there have been increasing reports of inflammatory pseudotumor after MoM THA.[8,9] Inflammatory pseudotumor presenting with aggressive granulomatous lesions are commonly reported in MoM THA but also occurred in MoP THA. The incidence of asymptomatic pseudotumors after MoM THA has been reported to be 8%.[10] The latent period of pseudotumors after MoM THA is reported to be 2 to 15 years.[1]

The incidence of pseudotumor following MoM THA differs from detection methods in the literature. Konan et al[11] indicated that the incidence of asymptomatic pseudotumors is as high as 32% in patients who underwent a MoM THA after ultrasound examination at early follow-up. However, most of asymptomatic pseudotumors with an early positive ultrasound scan remain asymptomatic at interval follow-up. Only 35% of patients with asymptomatic pseudotumors underwent revision THA.[11]

Symptomatic hip pain affecting sleep, activities of daily living, and quality of life were the indications for revision.[7] The most widely used method for pseudotumor after THA is full-revision surgery. Studies also reported that isolated revision of the femoral component led to poor outcomes compared with full-revision surgery.[12] However, Verhelst et al[6] indicated to leave the metal socket in situ and replace the femoral implant with a double-mobility component for patients with continuous pain and well-fixed resurfacing hip. The early results at short-term follow-up are satisfied. Although this treatment creates a highly stable construct for the short term, the long-term follow-up needs further investigation. In addition, this strategy is only suitable for cases which are well fixed and adequately positioned.

There is a general consensus that cases presenting with massive necrotic tissues and loosened prosthesis should be treated by totally revision surgery. The traditional revision is commonly performed in a posterolateral approach including removal of the necrosis tissues, bone grafting, and implantation of the revision prosthesis. This revision is too aggressive, with a high frequency of complications and reoperations.[13] In advanced cases with iliac internal wall and acetabulum upper wall destroyed, acetabulum cannot effectively support the prosthesis. Generally, the acetabular reinforcement cup is recommend to be used in this situation.[13] However, treatment of these cases is difficult, and

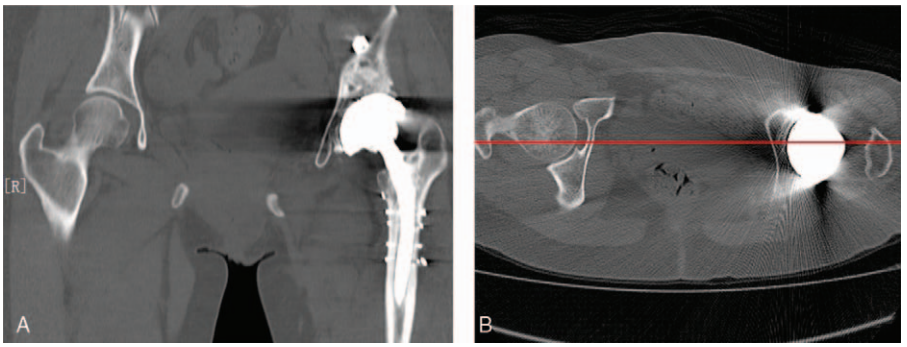

Figure 4. (A) Coronal and (B) cross CT images indicating bone fusion of allografts and host bones 2 years after the operation. CT = computed tomography.

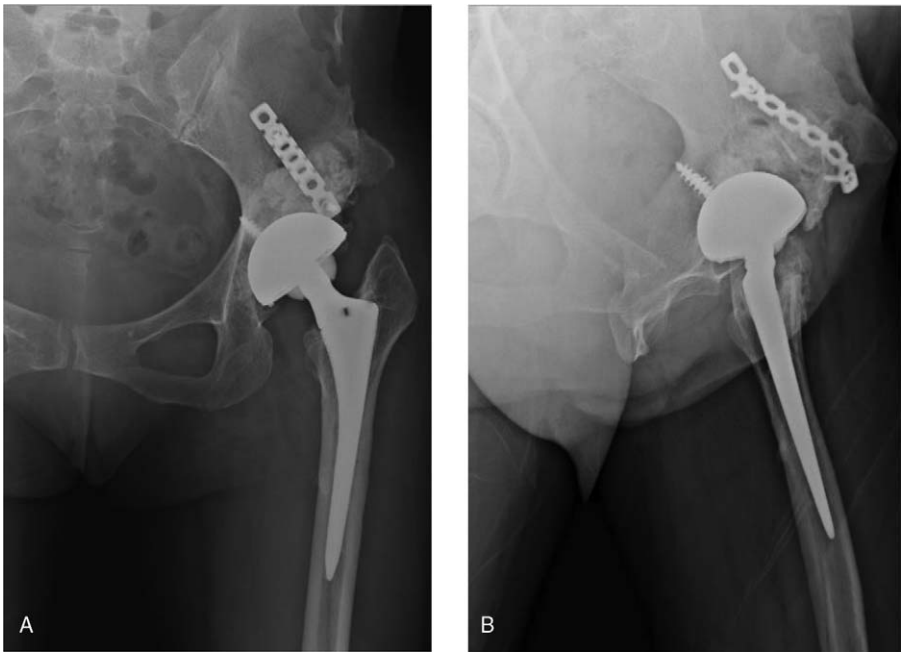

Figure 5. (A) Anteroposterior and (B) lateral radiographs did not indicate bone resorption and prosthesis loosening at the last follow-up.

there is a need for improved strategy that is less invasive and more straightforward to perform.

Whether the intrapelvic pseudotumor required resection is highly controversial. Almousa et al[14] illustrated a case report presenting resolution of the intrapelvic mass and normalisation of metal ion levels with pseudotumor was left in situ 7 months postoperatively. However, Liddle et al[15] indicated the risk of recurrent pseudotumor formation with incomplete debridement at a mean follow-up of 30 months. Hasegawa et al[16] reported the natural history of pseudotumors following MoM THA using magnetic resonance imaging. About 33% of patients presenting pseudotumors increased in size (8 of 24 patients at a mean follow-up of 26 months). Therefore, clearly exploration of intrapelvic pseudotumor and thoroughly elimination of the lesion would reduce the risk of recurrent pseudotumor formation.

Given this patient's presentation with continuous hip pain, large pseudotumor, and massive bone defect, totally revision was clearly needed. This case showed invasive osteolysis presenting with the iliac internal wall and acetabulum upper wall destroyed. Therefore, the corrosive acetabulum cannot effectively support the revision prosthesis. Thus, we decided to perform a 2-stage revision in this case. In the first stage, the invasive necrosis tissue was thoroughly removed via the Smith–Petersen approach, the large bone defect region was filled up with allografts and fixed by plate, providing enough mechanical support for prosthesis. In the second stage, the loosed prosthesis was removed and a new cementless primary hip prosthesis was implanted. Our strategy has the benefit of less invasive and higher safety.

Repair of massive osteolysis in acetabulum using bone allografts is very important to acquire good stability of prosthesis.[17,18] The major difference between our procedure and the conventional procedure is that in our procedure, bone allografts was used to fill up the bone defect region in acetabulum in the first stage. The procedure makes it easy to acquire stable support for prosthesis and good alignment. Moreover, we suggest that our procedure facilitates the exploration via the Smith–Petersen approach, as it is easy to expose the pseudotumor intrapelvic. Although the operation was operated in 2 stages, the risk of surgery decreased significantly.

In conclusion, our new treatment method using a combined approach is a useful procedure for pseudotumor with intrapelvic necrosis tissues formation and invasive osteolysis. The advantages are that it is less invasive and simple compared with conventional methods. The disadvantage is that it requires 2-stage surgery. Although only 1 case has been illustrated, we suggest that this new strategy can be recommended and will be beneficial for treating pseudotumor with intrapelvic necrosis tissues formation and invasive osteolysis.

References

[1] Lim D, Jeremiah C, Altuntas A, et al. Pseudotumor after metal-on-metal hip arthroplasty. J Am Geriatr Soc 2015;63:1274–6.
[2] Hjorth MH, Stilling M, Soballe K, et al. No association between pseudotumors, high serum metal-ion levels and metal hypersensitivity in large-head metal-on-metal total hip arthroplasty at 5-7-year follow-up. Skeletal Radiol 2016;45:115–25.
[3] Kilicoglu ZG, Kilicoglu OI, Simsek MM. Total hip arthroplasty-related pelvic pseudotumor: unusual presentation with hydronephrosis. Acta Orthop Traumatol Turc 2016;50:470–2.
[4] Asaad A, Hart A, Khoo MM, et al. Frequent femoral neck osteolysis with Birmingham mid-head resection resurfacing arthroplasty in young patients. Clin Orthop Relat Res 2015;473:3770–8.
[5] Sakamoto M, Watanabe H, Higashi H, et al. Pseudotumor caused by titanium particles from a total hip prosthesis. Orthopedics 2016;39: e162–5.
[6] Verhelst VA, Van der Bracht H, Vanhegan IS, et al. Revising the well-fixed, painful resurfacing using a double-mobility head: a new strategy to address metal-on-metal complications. J Arthroplasty 2012;27:1857–62.
[7] Sassoon AA, Barrack RL. Pseudotumour formation and subsequent resolution in metal-on-metal total hip arthroplasty following revision: instructional review and an illustrative case report with revision using a dual mobility design. Bone Joint J 2016;98-B:736–40.
[8] Barrett WP, Kindsfater KA, Lesko JP. Large-diameter modular metal-on-metal total hip arthroplasty: incidence of revision for adverse reaction to metallic debris. J Arthroplasty 2012;27:976.e1–83.e1. e971.

[9] Reito A, Puolakka T, Elo P, et al. Outcome of Birmingham hip resurfacing at ten years: role of routine whole blood metal ion measurements in screening for pseudotumours. Int Orthop 2014;38:2251–7.
[10] Krishnan H, Sugand K, Ali I, et al. 'Pseudotumour' invading the proximal femur with normal metal ions following metal on metal hip resurfacing. BMJ Case Rep 2015;2015:pii: bcr2014206368.
[11] Konan S, Duncan CP, Masri BS, et al. What is the natural history of asymptomatic pseudotumors in metal-on-metal THAs at mid-term followup. Clin Orthop Relat Re 2017;38475:433–41.
[12] Corten K, Ganz R, Simon JP, et al. Hip resurfacing arthroplasty: current status and future perspectives. Eur Cells Mater 2011;21:243–58.
[13] Liow MH, Dimitriou D, Tsai TY, et al. Preoperative risk factors associated with poor outcomes of revision surgery for "pseudotumors" in patients with metal-on-metal hip arthroplasty. J Arthroplasty 2016; 31:2835–42.
[14] Almousa SA, Greidanus NV, Masri BA, et al. The natural history of inflammatory pseudotumors in asymptomatic patients after metal-on-metal hip arthroplasty. Clin Orthop Relat Res 2013;471:3814–21.
[15] Liddle AD, Satchithananda K, Henckel J, et al. Revision of metal-on-metal hip arthroplasty in a tertiary center: a prospective study of 39 hips with between 1 and 4 years of follow-up. Acta Orthop 2013;84:237–45.
[16] Hasegawa M, Miyamoto N, Miyazaki S, et al. Longitudinal magnetic resonance imaging of pseudotumors following metal-on-metal total hip arthroplasty. J Arthroplasty 2014;29:2236–8.
[17] Blumenfeld TJ. CORR insights®: custom acetabular cages offer stable fixation and improved hip scores for revision THA with severe bone defects. Clin Orthop Relat Res 2016;474:741–3.
[18] Li H, Qu X, Mao Y, et al. Custom acetabular cages offer stable fixation and improved hip scores for revision THA with severe bone defects. Clin Orthop Relat Res 2016;474:731–40.