

Case Report

Autograft-prosthesis composite use for a Vancouver type B1 periprosthetic femur fracture with pelvic acetabular component migration after bipolar hemiarthroplasty: A case report

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ARTICLE INFO

Keywords:

Bipolar hemiarthroplasty
Acetabular prosthetic protrusion
Periprosthetic femur fracture
Reconstructive surgery
Autograft

ABSTRACT

Introduction: Bipolar hemiarthroplasty (BHA) is a commonly performed procedure for elderly patients with an intra-capsular fracture of the femoral neck. However, surgeons performing BHA worry about the rate of acetabular wear, and acetabular prosthesis protrusion can pose a challenging surgical problem. The number of periprosthetic femur fractures is expected to increase. Generally, well-fixed stems require open reduction and internal fixation (ORIF), whereas loose stems require revision arthroplasty.

Case report: A 68-year-old Asian woman was admitted to our hospital. She had sustained a left displaced femoral neck fracture at the age of 58 years. BHA was performed via a posterior approach in another hospital. Ten years later, she presented with severe left hip pain following a low-energy fall. A radiograph of the hip joint demonstrated a Vancouver type B1 periprosthetic femur fracture with severe acetabular prosthetic protrusion. Single-stage reconstructive surgery was performed. A transgluteal approach was used, with distal extension to the fracture site of the femur. Acetabular reconstruction was performed using a Kerboull-type plate in combination with massive allografts for the large bone defects of the acetabulum. Regarding the femoral side, the proximal bone fragment and cementless stem that had been fixed were longitudinally opened with an osteotomy and separated. After that, the stem was changed to a cemented long stem and combined with the prior proximal bone fragments using cement and wires in an autograft-prosthesis composite technique (autograft-prosthesis composite).

Conclusion: Although the standard treatment for Vancouver type B1 periprosthetic femur fractures is ORIF, it would have been difficult to reconstruct the hip joint solely with osteosynthesis because the femur was severely shortened by marked migration of the BHA. Single-stage reconstructive surgery using an autograft-prosthesis composite was effective treatment for a Vancouver type B1 periprosthetic femur fracture with concomitant severe acetabular prosthetic protrusion after BHA.

Introduction

Bipolar hemiarthroplasty (BHA) is a commonly performed procedure for elderly patients with an intra-capsular fracture of the

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<https://doi.org/10.1016/j.tcr.2019.100213>

Accepted 16 June 2019

Available online 21 June 2019

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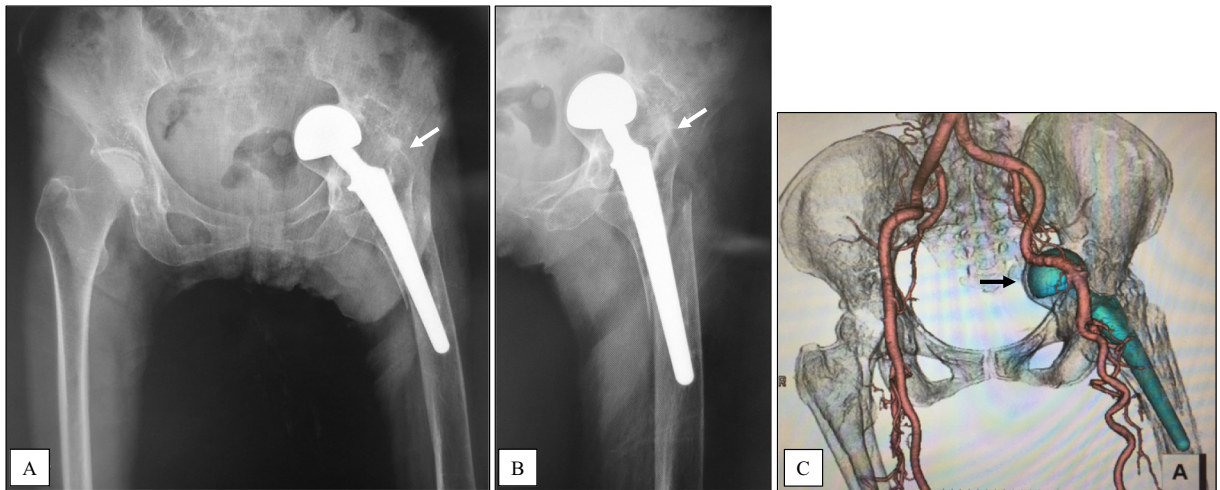


Fig. 1. (A and B) A radiograph of the hip joint (A: Anteroposterior view, B: Lowenstein lateral view) demonstrated a Vancouver type B1 or Baba classification type 1B periprosthetic femur fracture with severe acetabular prosthetic protrusion on the left side. There was impingement between the acetabulum and proximal femur due to severe shortening of the affected limb (arrows). (C) Three-dimensional computed tomography showed that the medial wall of the acetabulum where there was a large bone defect and acetabular prosthesis protrusion was not disrupted (arrow). The migrated head was close to the external iliac artery through the thinned acetabular wall. These indicated that the prosthesis has markedly migrated into the pelvis chronically not acutely.

femoral neck [1]. However, surgeons performing BHA worry about the rate of acetabular wear, and acetabular prosthesis protrusion can pose a challenging surgical problem, especially when the prosthesis migrates into the pelvis [1].

The number of periprosthetic femur fractures is expected to increase [2]. When deciding how to treat a periprosthetic femur fracture, the first step is to determine whether the stem is well-fixed [2]. Generally, well-fixed stems require open reduction and internal fixation (ORIF), whereas loose stems require revision arthroplasty [2]. We report a case of reconstructive surgery using an autograft-prosthesis composite for a Vancouver type B1 periprosthetic femur fracture concomitant with severe acetabular prosthetic protrusion after BHA.

Case report

A 68-year-old Asian woman was admitted to our hospital. She weighed 34.8 kg, was 150 cm tall, and had a body mass index of 15.4 kg/m². She had sustained a left displaced femoral neck fracture at the age of 58 years. BHA was performed via a posterior approach in another hospital and she recovered well postoperatively. The details of her operation were unclear, and she was later lost to follow-up postoperatively. Ten years later, she presented with severe left hip pain following a low-energy fall. Before the injury she ambulated using a walker. A radiograph of the hip joint demonstrated a Vancouver [3] type B1 or Baba classification [4] type 1B periprosthetic femur fracture with severe acetabular prosthetic protrusion on the left side (Fig. 1A and B). Three-dimensional computed tomography showed that the medial wall of the acetabulum with a large bone defect and acetabular prosthesis protrusion was not disrupted (Fig. 1C). Periprosthetic joint infection was excluded on the basis of a thorough history, physical examination, and serum inflammatory markers, including C-reactive protein. Single-stage reconstructive surgery was performed following the surgical technique.

Surgical technique

Surgery was performed under general anesthesia in the right lateral decubitus position. Fluoroscopy was used intraoperatively. A transgluteal approach was used, with distal extension to the fracture site of the femur. The atrophied gluteus medius and vastus lateralis were exposed and split longitudinally in line with their fibers. They could then be detached as flaps from the femur anteriorly and posteriorly. The cementless stem was fixed to the proximal bone fragment of the femur, and it was removed from the outer head of the BHA in one piece after detaching it from the surrounding scar tissue (Fig. 2A and B). The outer head that protruded into the acetabulum was then removed carefully so as to not damage the acetabulum. The one large bulk freeze-dried femoral head allograft was trimmed to remove cartilage and placed into the large bone defect region of the acetabular prosthesis protrusion (Fig. 3A). After the contact between the flange of the Kerboull-type plate (KT plate, Kyocera Medical Corporation, Osaka, Japan) template and the host bone was checked, the extent of the bone defect, in particular the weight-bearing region of the acetabular roof, was checked and the defect was filled with another trimmed freeze-dried femoral head allograft in the shape of bulk bone (Fig. 3A). After confirming the optimum size of the KT plate, the true KT plate was placed in an appropriate position (Fig. 3A). An optimally sized polyethylene liner was fixed with cement targeting a lateral opening angle of 40° and an anterior opening angle of 20°. Regarding the femoral side,

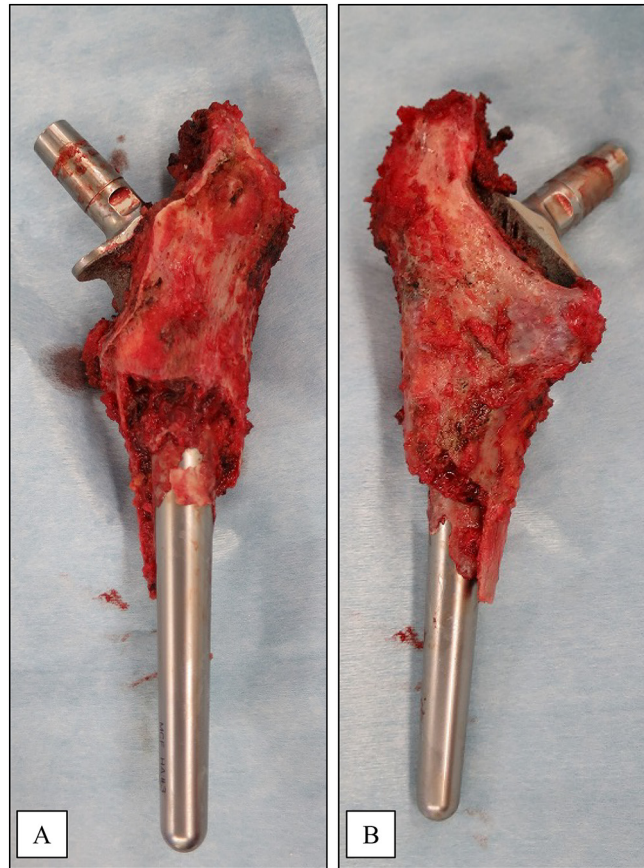


Fig. 2. (A and B) The cementless stem was fixed to the proximal bone fragment of the femur, and it was removed from the outer head of the bipolar hemiarthroplasty in one piece. (A: Anterior view, B: Posterior view) This proved that this periprosthetic femur fracture type was actually a Vancouver type B1 or Baba classification type 1B.

the proximal bone fragment and cementless stem that had been fixed were longitudinally opened with an osteotomy and separated. After that, the stem was changed to a cemented long stem (Exeter Long Stem, Stryker, Mahwah, NJ, US) and combined with the prior proximal bone fragments using cement and wires in an allograft-prosthesis composite technique [5] (autograft-prosthesis composite) (Fig. 3B and C). A trial reduction was performed with the autograft-composite prosthesis, but was not cemented. Adjustments of length and version were performed during multiple trial reductions with a direct view and a fluoroscopic view. Adjustment of leg length was performed with an osteotomy on the distal femur side of the fractured portion. When all of these parameters had been satisfied, the autograft-prosthesis composite was inserted into the distal femur and fixed at the junction with cement. A 32-mm-diameter metal femoral head was used. Furthermore, the bone junction was augmented with a reversed condylar locking compression plate (LCP Distal Femur Plate, Johnson & Johnson, New Brunswick, New Jersey, USA) [6]. After implant placement, the anterior and posterior flaps of the gluteus medius and vastus lateralis were repaired as anatomically as possible and closed as one layer, because it was difficult to reattach the flaps to the intertrochanteric region due to severe muscle atrophy of the gluteus medius.

Postoperative treatment

Range-of-motion exercises were started immediately after surgery. The patient was non-weight-bearing on the affected side for 4 weeks postoperatively, after which partial weight-bearing was allowed. At 8 weeks after surgery, walking exercise with full weight-bearing was started. At the 24-month follow-up, she could walk steadily using a walker and her modified Harris hip score was 75. The radiographs and computed tomography scan showed stable components and complete bone union of the autograft-host junction (Fig. 4A–D).

Discussion

Single-stage reconstruction surgery using an autograft-prosthesis composite was performed for a Vancouver type B1 periprosthetic femur fracture concomitant with severe acetabular prosthetic protrusion after BHA. It was judged that more stable walking ability could be obtained postoperatively with reconstructive surgery than solely with osteosynthesis because it was possible to

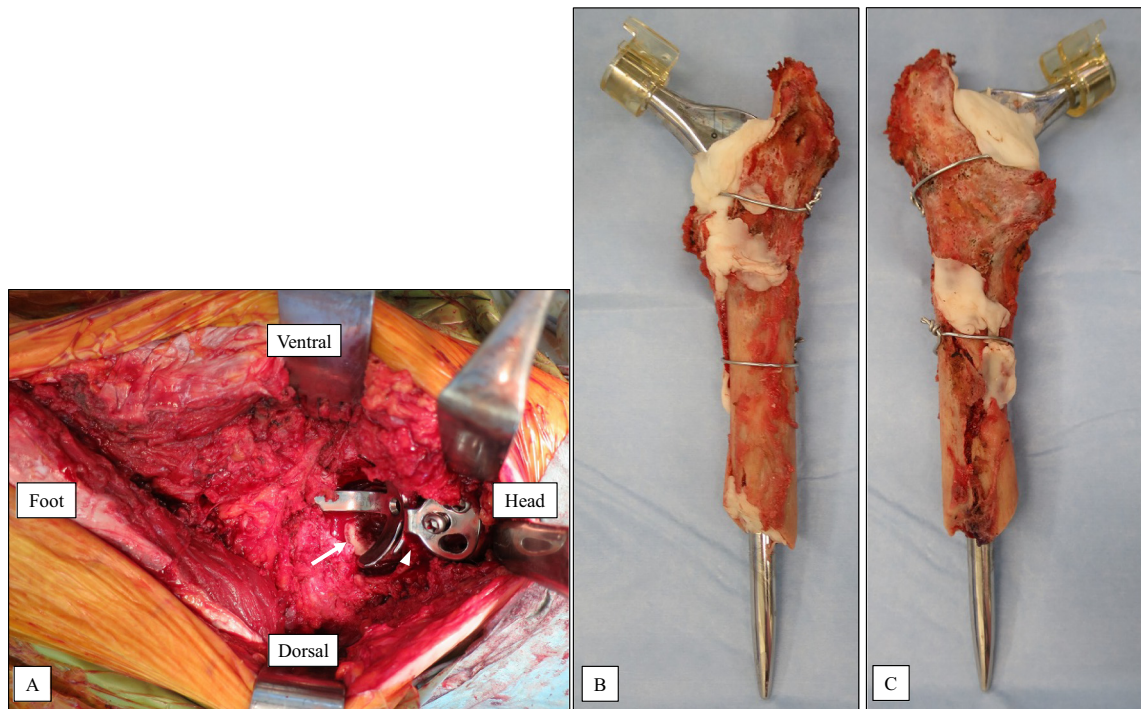


Fig. 3. (A) The freeze-dried femoral head allografts were placed into the large bone defect region of the acetabular prosthesis protrusion (*arrow*) and the weight-bearing region of the acetabular roof in the shape of the bulk bone (*arrowhead*). (B and C) The cemented long stem was combined with the prior proximal bone fragments using cement and wires in an allograft-prosthesis composite technique (autograft-prosthesis composite). (B: Anterior view, C: Posterior view).



Fig. 4. (A and B) The radiographs (A: Anteroposterior view B: Lowenstein lateral view) and (C and D) coronal plane of the computed tomography scan (C: Acetabular side D: Femoral side) showed stable components and complete bone union of the autograft-host junction at the 24-month follow-up.

reconstruct the hip joint and fix the fracture more firmly.

Acetabular reconstruction was performed using a KT plate in combination with massive allografts for the large bone defects of the acetabulum in this case. The failure of acetabular revision surgery using bulk allografts without support has been reported [7]. To achieve successful grafting, a mechanically stable environment with a support ring is required in cases of larger defects [7]. The

Kerboull-type plate should be used in combination with a bone graft for bone defects in order for the prosthesis to be placed in the original acetabular position for long-term maintenance of the function of the hip prosthesis after revision [8]. Baba et al. reported that the results were better using a Kerboull plate or a KT plate in combination with a bulk graft than a morselized graft when the acetabular bone defect was large [8].

The standard treatment for Vancouver type B1 periprosthetic femur fractures is ORIF because of the stem stability and remaining bone quantity [2]. However, in this case, it was judged to be difficult to reconstruct the hip joint solely with osteosynthesis because the femur was severely shortened by marked migration of the BHA. For an extensive proximal femoral bone defect, the standard method of treatment involves using either a megaprosthesis or an allograft-prosthesis composite [9]. However, Parvizi et al. reported that megaprosthesis showed an unacceptably high failure rate in younger patients [10]. Kellett et al. reported that the use of a proximal femur allograft-prosthesis composite for the treatment of a Vancouver type B3 periprosthetic femur fracture provided satisfactory results in terms of pain relief and function [5]. However, the large quantity of bone required to perform this allograft-prosthesis composite procedure is problematic, but in this case, the remaining proximal femur bone fragments of the Vancouver type B1 periprosthetic femur fracture could be used instead of an allograft. We have named this the autograft-prosthesis composite technique.

Conclusion

Single-stage reconstructive surgery using an autograft-prosthesis composite was effective treatment for a Vancouver type B1 periprosthetic femur fracture concomitant with severe acetabular prosthetic protrusion after BHA. It was possible to acquire good hip joint function and walking ability with bone union of the autograft-host junction.

Ethical approval

The study was carried out in accordance with the Declaration of Helsinki and the appropriate ethical framework.

Consent

Informed consent was obtained from the patient for publication of this case report and any accompanying images.

Declaration of Competing Interest

The authors declare that they have no conflicts of interest.

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