



Dissociation of Bipolar Prostheses with Hip Subluxation: A Case Report and Literature Review

Jung-Jui Chang, Ru-Yu Pan, Leou-Chyr Lin

Department of Orthopaedic Surgery, Tri-service General Hospital, National Defense Medical Center, Taipei, Taiwan, Republic of China

Bipolar hemiarthroplasty, a modular system, has been utilized for decades to treat intracapsular fractures of the femoral neck and avascular necrosis of the femoral head. Dislocation is one of the main complications of hip hemiarthroplasty performed for displaced femoral neck fractures. Classic dislocation of the hemiarthroplasty from the native acetabulum occurs in 2.6% of cases. Dissociation between the small head of the prosthesis and the polyethylene insert is an extremely rare complication of bipolar hemiarthroplasty and results in hip dislocation and severe disability. Surgeons must be cognizant of this rare complication and should proceed to open reduction to treat this problem.

Key words: Hemiarthroplasty, dissociation of bipolar prosthesis, dislocation

INTRODUCTION

The bipolar hip prosthesis has been an alternative choice to the conventional unipolar prosthesis since 1978. The bipolar hip prosthesis can reduce complications such as wear and erosion of the acetabulum, and offers variable prosthetic head sizes and neck lengths and an increased range of motion. However, complications associated with severe disability have been reported with bipolar hemiarthroplasty, including hip dislocation from the native acetabulum. In classic hip dislocations, most patients can be treated with close reduction. The modular design of the bipolar prosthesis can also lead to dissociation of the components and the need for open reduction. Recognition of the difference between dissociation of the bipolar components and classic bipolar prosthesis dislocation is critical for accurate and timely diagnosis and treatment.

CASE REPORT

A 96-year-old female sustained a fracture of the right femoral neck in the subcapital area as a result of a fall from a standing height 17 years ago. She was treated with bipolar

hemiarthroplasty with cement augmentation with good results and was discharged 1 week later. She recovered well and could ambulate by herself without using crutches.

One day in postoperative 17 years, severe right groin pain with an inability to bear weight developed suddenly when squatting in the shower. Radiographs showed a dissociation of the bipolar modular components with hip subluxation. The polyethylene cup was located in extreme varus, and arthritic changes were present in the hip joint [Figure 1]. Revision surgery was performed using a posterior approach along the old surgical scar to change the bipolar polyethylene cup (Osteonics, Omnifit Head/Neck Hip system) [Figure 2]. The size of the polyethylene cup was 44 mm in diameter, and the small head was 28 mm in diameter. The total operative time was approximately 30 min, and the blood loss was <50 ml. The locking ring of the bipolar head prosthesis had been broken, and partial wear of the polyethylene insert was observed, especially in the inferior margin [Figure 3]. One week after surgery, she was discharged and could ambulate well with a crutch.

DISCUSSION

Hip hemiarthroplasty has been used for decades to treat fractures of the femoral neck and avascular necrosis of the femoral head.² The early unipolar endoprosthesis had several disadvantages, including painful loosening and the acetabular erosion. Bipolar hip prostheses were designed in the 1970's with the goal of reducing friction and impact force on the acetabular cartilage.¹ The bipolar prosthesis is a modular design with two motion interfaces, one at the outer head-acetabulum

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Corresponding Author: Dr. Leou-Chyr Lin, Department of Orthopaedic Surgery, Tri-Service General Hospital, National Defense Medical Center, No. 325, Sec. 2, Cheng-Gong Road, Taipei 114, Taiwan, Republic of China. Tel: +886-2-87923311 ext 12811.

E-mail: ltelarryjung@gmail.com

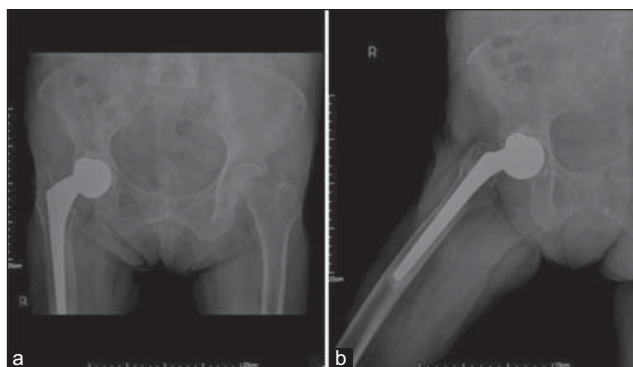


Figure 1. A 96-year-old female presented with bipolar prosthesis dissociation (disassembly of small head and polyethylene insert) with hip subluxation (a). The polyethylene cup was in extreme varus position. The retained locking ring could be found around the small head (b, the arrow). Arthritic change of acetabular surface could also be noted in preoperative plain film

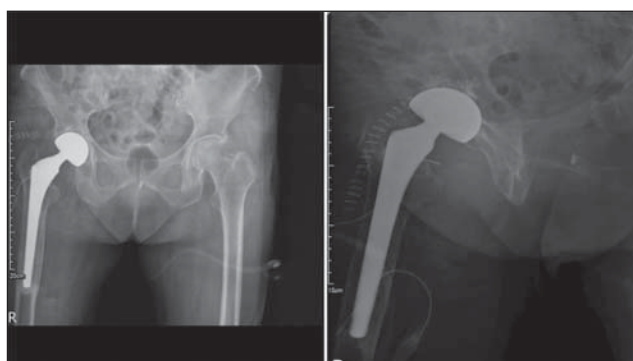


Figure 2. After revision of polyethylene cup, the bipolar prosthesis was in good alignment and no more in varus position



Figure 3. The removed prosthesis showed broken locking ring (the arrow pointed the broken area) and the worn polyethylene insert in the inferior rim (asterisk). There still were some small pieces of polyethylene debris in the hip joint

interface and the other at the inner head-bearing polyethylene interface.⁶ With this new design, the bipolar prosthesis had

several advantages over the unipolar prosthesis, including less wear and erosion of the acetabulum, lower risk of dislocation, variable head sizes/neck lengths to choose from intraoperatively, and an increased range of motion.⁴

Dislocation after primary hemiarthroplasty is still one of the major postoperative complications for bipolar prostheses. In the classic dislocation following hemiarthroplasty, the prosthetic femoral head escapes from the native acetabular cavity. Barnes *et al.* reported a 2.6% incidence of dislocation in 1934 hips treated with bipolar hemiarthroplasty.³ Sierra *et al.* and Varley *et al.* also reported dislocation from the native acetabulum following hemiarthroplasty in 1.2-3.4% of cases.⁴

Dissociation of the components following bipolar hemiarthroplasty is less-documented. Component dissociation frequently coexisted with dislocation/subluxation of the prosthesis from the acetabulum; however, only a few cases of bipolar dissociation were reported. Ito *et al.* reported a dissociation rate of 4% in their 23 bipolar prostheses in which the Osteonic Universal Hip replacement system was utilized.⁶ When dissociation of bipolar prostheses occurs, physical examination may show leg length discrepancy, severe hip pain with limited range of motion, and the inability to bear weight on the affected extremity.

Several mechanisms for bipolar dissociation have been reported.⁵ The first mechanism was referred to as the “bottle-opener.” The dislocating force or close reduction maneuver might induce dissociation if the cup was incidentally locked in the posterior rim of the acetabulum. The second mechanism was creep deformation of the inner-bearing polyethylene cup. The third mechanism was the failure of the polyethylene liner (insert wear). The fourth mechanism was the failure of the polyethylene locking mechanism, possibly related to faulty material or poor installation of the locking ring.³

In our case, the locking ring between the small head and polyethylene cup was broken, and the bearing insert was worn out in the inferior margin. Based on the morphologic classification of failure of the locking ring reported by Lee *et al.*, our case could be classified as a type II failure (i.e., dislocation of the inner head with detachment of the locking ring).⁶ Arthritic changes in the hip joint were also noted intraoperatively in our case. Phillips *et al.* and Eiskjaer *et al.* reported the bipolar cup is not uncommonly fixed in an extreme varus position in the arthritic hip.¹ A possible mechanism for the failure of the locking ring in our patient with an arthritic hip joint is related to the extreme varus position of the bipolar cup. The inferior margin of the polyethylene cup was worn out by impingement of the femoral stem, which subsequently broke the locking mechanism. Once dissociation of the bipolar prosthesis developed, open reduction or revision surgery is needed to treat this complication.

CONCLUSION

Orthopedic surgeons should be able to recognize the mechanism of bipolar dissociation and identify this rare complication of the bipolar prosthesis. Routine radiographic examination should be arranged for patients treated with bipolar hemiarthroplasty. Patients with dissociated bipolar prostheses require timely, accurate diagnosis and treatment with open reduction.

DISCLOSURE

The authors declare this study has no conflict of interest.

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