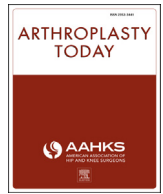




Contents lists available at ScienceDirect

Arthroplasty Today

journal homepage: <http://www.orthoplastytoday.org/>

Case report

The direct anterior approach for acetabular augmentation in primary total hip arthroplasty

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ARTICLE INFO

Article history:

Received 30 January 2017
 Received in revised form
 13 March 2017
 Accepted 13 March 2017
 Available online xxx

Keywords:

Total hip arthroplasty
 Direct anterior approach
 Acetabular augment
 Acetabular defect

ABSTRACT

Addressing acetabular bone defects can be difficult and depends on the amount of bone loss. Augments, either with bone or highly porous metals, are options that still allow the use of a hemispherical cup. Almost all previous research and publication on acetabular augments have focused on revision hip arthroplasty utilizing either a modified lateral or a posterolateral surgical approach. We describe 3 cases of augmenting acetabular bone defects through a direct anterior approach for primary total hip arthroplasty. We achieved proper cup placement, alignment, and augment incorporation while reconstructing complex acetabular deficiencies. All patients had complete pain relief and a satisfactory clinical outcome with stable radiographs at follow-up. With appropriate training, acetabular augmentation can be performed safely and efficiently with excellent clinical results through this approach.

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Introduction

Historically, osteolysis secondary to polyethylene wear after failed total hip arthroplasty (THA) often resulted in large peri-acetabular bone defects. Similar bone deficiency in the acetabulum can also be seen in patients with native hips secondary to developmental hip dysplasia, avascular necrosis, and inflammatory arthritis, among other causes. Managing acetabular defects in both primary and revision hip arthroplasty can be accomplished in several different ways depending on the amount of bone loss. The use of acetabular augments can add support when the acetabular dome alone is unable to properly support a hemispherical cup [1,2]. Initially, either bulk allograft or autograft bone grafts were used [3], but the advent and availability of highly porous metal augments have increased the number of available options for lateral rim augmentation.

Augments for the deficient acetabulum are most commonly performed via traditional laterally based approaches, including both the modified lateral and posterolateral approach. However, with the increasing popularity of the direct anterior approach (DAA), expert hip surgeons have become more comfortable managing revision hip arthroplasty through this approach. Exposure of the lateral acetabulum can be readily accomplished using the DAA and many acetabular defects can now be reconstructed using this surgical approach. We describe 3 similar cases of acetabular augmentation performed through the DAA for primary THA in the setting of Paprosky IIB and IIIA defects of the native hip joint. Finally, we discuss the outcomes of the DAA and the 2 reconstruction options presented for augmentation. This is the first report we are aware of that describes complex reconstruction of acetabular deficiency through the DAA.

Case histories

Case 1

This is a 72-year-old male, body mass index 29, with a nearly 1-year history of right hip pain. His past medical history is significant for alcoholism and he has currently been sober for the past 3 years. Radiographs of his right hip showed avascular necrosis of the femoral head with complete collapse and secondary

One or more of the authors of this paper have disclosed potential or pertinent conflicts of interest, which may include receipt of payment, either direct or indirect, institutional support, or association with an entity in the biomedical field which may be perceived to have potential conflict of interest with this work. For full disclosure statements refer to <http://dx.doi.org/10.1016/j.artd.2017.03.007>.

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<http://dx.doi.org/10.1016/j.artd.2017.03.007>

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degenerative changes (Fig. 1). There was also a Paprosky IIIA acetabular defect and hip subluxation. He was taken to the operating room (OR) for a THA utilizing the DAA.

Intraoperatively, the psoas tendon was found to be contracted that required a recession lengthening to facilitate exposure of the acetabulum. The defect was quite large and would be addressed with a highly porous metal augment. The cotyloid fossa and the transverse acetabular ligament were identified during the exposure to define the true acetabulum and reconstruct the hip center. Sequential reaming revealed that a 52-mm trial obtained excellent position and apposition between the anterior and posterior walls. The superior and lateral acetabular defect left nearly half of the cup uncovered. A 54 × 20 mm metal augment (GRIPTION TF; DePuy Synthes, Warsaw, IN) would be used for the reconstruction. With the trial cup in position and serving as the “scaffold,” the augment was secured to the ilium with 3 screws. Then the cup was impacted and secured first with a screw into the ischium, followed by 2 screws into the ilium. A small amount of cement was placed between the augment and the cup prior to final seating (Fig. 2a-c). Reconstruction of the femur ensued with a trial reduction of the hip followed by final implantation of the components. A single fluoroscopic image was obtained with the trials in place to confirm satisfactory position of the components and restoration of the hip center, leg length, and offset (Fig. 3). Postoperatively, he ambulated with a walker for protected weight bearing for 4 weeks. The patient was ambulating without assistive devices at 6 months postoperatively, and was completely pain free.

Case 2

This is a 69-year-old female, BMI 25.4, with a 1-year history of worsening left hip pain. She experienced severe pain, rated as 7/10, with notable grinding and crunching, and a feeling of shortening of the limb. There was no history of septic joint, prior hip trauma, or other known injury or prior surgery. There was no pain or symptoms in the contralateral right hip. She walked with a single-point cane and visible pelvic obliquity upon ambulation. Radiographs revealed severe osteoarthritis with femoral head collapse and irregularity of the joint surface (Fig. 4). Avascular necrosis with collapse was considered, but the patient had no known risk factors for the disease. A Paprosky IIB defect in the lateral rim was identified and anticipated during the templating process for a complex THA.



Figure 1. Preoperative anteroposterior pelvis radiograph of case 1 demonstrating avascular necrosis of the right femoral head with complete collapse, superolateral acetabular bone loss, and hip subluxation consistent with Paprosky 3A defect.

In the OR, a DAA was utilized on a radiolucent OR bed for exposure and the transverse acetabular ligament was identified for “cup-first” reconstruction, using anatomic placement of a 58-mm DePuy multihole revision acetabular shell with 2 screws placed into the posterior column. Next, attempted preparation for a 58 × 10 mm metallic augment was made with the manufacturer’s rasps and a burr, but the augment size proved to be too large to fit the patient’s anatomy without further bone compromise. A significant bone defect was identified between the lateral shell and the residual lateral ilium, so the most eburnated apex portion of the native femoral head was identified. Two custom autologous trapezoidal bone wedges were created from this area of bone using the sagittal saw, then each was impacted into the lateral defect for a press-fit custom augment reconstruction (Fig. 5a and b). Two additional screws were placed into the construct to achieve a secure fit. A 36-mm neutral liner was secured, and a #6 high-offset Summit stem and +5 mm × 36 mm Metal head completed the construct. Postoperatively, she was listed as partial weight bearing with a rolling walker for 6 weeks (Fig. 6). She had virtually no pain during the recovery, and regained full range of motion, complete weight-bearing capability, and complete graft incorporation at the 12-month follow-up visit (Fig. 7).

Case 3

This is a 56-year-old female, BMI 23.9, with known bilateral hip osteoarthritis. She previously underwent contralateral right THA 3 years prior to presentation, with excellent pain relief, but with worsening left hip pain, limping, and a short left leg. Her hip was grinding and she often used both a cane and a walker for basic ambulation, describing herself as “chair bound,” with 10/10 discomfort and failure of numerous analgesic and nonsteroidal anti-inflammatory drug options previously. She had a known history of alcohol abuse and had previously been cancelled for the left hip replacement 1 year prior to presentation by another local surgeon. Her medical history was also significant for hepatitis C, bipolar disorder, anxiety, and depression, with $\frac{1}{2}$ pack of cigarette smoking daily. Radiographs demonstrated severe osteoarthritis with extensive cystic erosions of the acetabulum, and loss of the lateral rim consistent with a Paprosky grade IIB defect (Fig. 8). Additionally, she had baseline pelvic obliquity due to residual apex right adolescent idiopathic scoliosis, causing extrinsic elevation of the left hemipelvis and further shortening of the left lower extremity. With risk factor optimization, she was able to stop smoking completely, ceased all alcohol intake, and was otherwise stable and prepared for complex THA.

In the OR, a DAA was utilized on a radiolucent OR bed for exposure and the transverse acetabular ligament was identified for attempted cup-first reconstruction, using anatomic placement of a 52-mm DePuy multihole revision acetabular shell. Unfortunately, there was a very large lateral defect and the loss of the lateral buttress precluded stable cup placement. With a trial shell in place, we prepared the lateral ilium with a burr to accept a 50 × 15 mm metal augment (GRIPTION TF; DePuy Synthes) to re-create the lateral wall using an “augment-first” technique. This was secured to bleeding host bone with multiple screws, then the final shell was secured with bone cement at the interface and 3 screws placed into the posterior-superior quadrant. Finally, a neutral 36-mm liner was secured, and a #3 high-offset Trilock femoral stem and +5-mm Delta ceramic femoral head were used to complete the construct (Fig. 9). Postoperatively, her pain and grinding were completely relieved early on, and 4 weeks of shared weight bearing using a walker was utilized. She recovered uneventfully, and demonstrated osteointegration of the cup and augment at 12 months with complete restoration of gait mechanics (Fig. 10).

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