Arthroplasty Today 14 (2022) 65–70

Contents lists available at ScienceDirect

Arthroplasty Today

journal homepage: http://www.arthroplastytoday.org/

Case report

# Complex Reconstruction for Acetabular Pathologic Fracture in Unusual Chondroblastoma With Aneurysmal Bone Cyst

Paul Rizk, MD [a,*], Gregory LaChaud, MD [a], Ali Zarezadeh, MD [a], Eugene Jang, MD [a], Elham Nasri, MD [b], Hernan A. Prieto, MD [a], Andre Spiguel, MD [a]

[a] Department of Orthopaedic Surgery and Sports Medicine, University of Florida, Gainesville, FL, USA
[b] Department of Pathology, University of Florida, Gainesville, FL, USA

ARTICLE INFO

*Article history:*
Received 4 November 2021
Received in revised form
1 January 2022
Accepted 3 January 2022
Available online xxx

*Keywords:*
Arthroplasty
Pathologic
Complex
Primary
Chondroblastoma
Multidisciplinary

ABSTRACT

Treating bone loss with complex arthroplasty poses a significant challenge for the arthroplasty surgeon. When considering a reconstructive case after pathologic fracture and oncologic excision, a multidisciplinary approach with reliance on arthroplasty principles is critical. An 18-year-old patient presented with a complex acetabular pathologic fracture through a chondroblastoma with a secondary aneurysmal bone cyst. An outside institution performed a biopsy and placed a hip-spanning external fixator. Multidisciplinary planning led to tumor excision, complex acetabular arthroplasty reconstruction including structural bone grafting, and internal fixation. At the third year of follow-up, there was no evidence of mechanical loosening of the hip arthroplasty, reoperation, or tumor recurrence. The structural graft was completely osseointegrated, confirmed by a computed tomography scan obtained at 2 years postoperatively. This report demonstrates an unusual location of chondroblastoma, presenting with acetabular fracture definitively treated with complex multidisciplinary reconstruction leading to an excellent outcome in a young patient.



## Introduction

Chondroblastomas typically present in patients younger than 20 years, in an epiphyseal location, and with significant edema surrounding the lesion seen in magnetic resonance imaging scans. Chondroblastomas are rare, accounting for less than 1% of primary bone tumors [1], and present with site-specific bone and joint pain. Chondroblastomas are found in long bones in 50%-75% of cases, most commonly the proximal tibia (27.6%), proximal femur (26.1%), distal femur (19.1%), proximal humerus (11.6%), and feet (10.6%) [2]. Surgical excision is the mainstay of treatment for chondroblastoma. Radiation is avoided because of risk of malignant progression. Prognosis is good as a "benign" lesion, but it can rarely metastasize (<2%). Local recurrence is relatively high with 14%-18% reported, but this is noted to be correlated with difficulty of resection (eg, skull) [1].

When considering reconstruction for total hip arthroplasty, large defects are common, and several techniques are reported in the literature. Techniques range from allograft reconstruction in a single- or two-stage manner with proximal femoral, acetabular major/minor, and cortical strut grafts [3,4]. Allograft or autograft is typically used to reconstruct the defect to allow for fixation of the planned prosthesis in a more normal manner. Other techniques using manufactured augments are described for simple wall defects and for more complex Paprosky IIIB defects. These authors describe using metal augments to reconstruct the defect with or without a bone graft to supplement the fixation [5]. Large cups are then used for reconstruction of the joint and final implantation of the prosthesis.

We present a case of a patient with periacetabular chondroblastoma, complicated by pathologic fracture and provisional external fixation. This case illustrates complex management of a periacetabular fracture requiring reconstruction.

## Case history

An 18-year-old male patient was transferred 5 days after an initial injury from a fall while playing basketball, sustaining a right

* Corresponding author. Department of Orthopaedic Surgery and Sports Medicine, University of Florida, 3450 Hull Road, Gainesville, FL 32608, USA. Tel.: +1 409 223 8487.
*E-mail address:* rizkpa@ortho.ufl.edu

https://doi.org/10.1016/j.artd.2022.01.002

pathologic acetabular fracture. Before the injury, the patient was asymptomatic. The patient underwent an open biopsy through the Pfannenstiel approach and hip-spanning pelvic external fixation for stabilization before transfer (Fig. 1). He had a sciatic nerve palsy upon arrival.

Plain films, axial imaging, and pathology were obtained from the outside institution and were consistent with chondroblastoma with a secondary aneurysmal bone cyst (Figs. 1-3).

The pelvic external fixation was removed upon arrival to our institution, and a distal femur traction pin was placed in anticipation of future arthroplasty requiring a pin holiday to minimize the risk for pin-tract-associated infection. Pin tract infections are extremely common, ranging up to 100% [6]; more common in periarticular locations [7]. An interdisciplinary team composed of the orthopedic oncology, orthopedic trauma, and arthroplasty reconstruction divisions convened with the patient and family and developed a comprehensive surgical plan. The plan included tumor excision with curettage and argon beam ablation for local tumor control, open reduction with internal fixation of the acetabular fracture, and complex total hip arthroplasty including structural bone grafting and the use of ceramic on a highly crosslinked polyethylene bearing surface.

The procedures were performed through an extensile Kocher-Langenbeck approach, with care to protect the superior gluteal neurovascular bundle proximally (5 cm proximal to the tip of the trochanter) and sciatic nerve distally. Ilium dissection was necessary for local tumor excision and preparation and fixation of bone graft with cortical screws. The gluteus maximus tendon was taken down to improve exposure and repaired upon closure. The femoral neck was cut in situ, and the femoral head was removed for structural autograft, giving access to the acetabulum. Tumor had invaded the posterior wall and posterior column and extended into the ischium posteriorly. Medially and anteriorly, tumor had weakened the medial wall of the acetabulum and extended into the superior ramus, which the patient fractured through leading to protrusio.

The lesion was burred, curetted, and ablated with the argon beam coagulator to minimize the risk of local recurrence. This left significant defects to the ischium and superior ramus, virtually no posterior wall, a defect in the posterior column, and no medial wall. The ipsilateral femoral head was prepared to be used as structural autograft augmentation to rebuild the posterior column (1a) and superior defect (1b) in a flying buttress and dome support configuration (Fig. 4), as described in literature [8-10]. The dome structural autograft was fixed with 4 screws extending into the ilium, and the flying buttress structural autograft was fixed with a pelvic reconstruction plate from the ilium to ischium. The medial wall defect was augmented with structural bone allograft from a femoral head in a footing configuration.

Further allograft chips served as an impaction graft for the acetabular dome, and a wafer of the allograft femoral head was cut and placed in the medial wall to reconstruct the quadrilateral surface. The reconstructed acetabulum was reverse-reamed in preparation for a Zimmer trabecular metal (TM) revision shell (Zimmer Biomet Inc., Warsaw, IN). Five supplemental screws were placed through the cup, and a Longevity highly crosslinked polyethylene liner (Zimmer Biomet Inc., Warsaw, IN) was cemented into the TM shell with antibiotic-loaded cement (1.2 g of tobramycin and 1 g of vancomycin in 40 g of Simplex cement [Stryker Inc., Kalamazoo, MI]). A Summit uncemented tapered femoral stem (DePuy Orthopedics Inc., Warsaw, IN) was placed without complication. The arthroplasty was completed with a DePuy Biolox ceramic femoral head (DePuy Synthes Inc., Raynham, MA) and was found to be stable in all physiologic positions. A repair of the capsule and short external rotators was performed, and the patient was made touch-down weight bearing with posterior hip precautions. The patient recovered without event and discharged on postoperative day 8 (Fig. 5).

The patient received prophylactic oral antibiotics for 6 months postoperatively to mitigate the increased risk for infection given the external fixation and magnitude of the procedure. He remained touch-down weight bearing for 3 months and transitioned to weight bearing as tolerated over 6 months. At 3 years, the patient is full weight bearing without an assistive device. He has minimal pain, is employed, and has returned to all activities of daily living (Figs. 6 and 7). His sciatic nerve palsy has mostly resolved with full sensation but no extensor hallucis longus function.

The authors confirm that written informed consent has been obtained from the involved patient, and they have given approval for this information to be published in this case report.

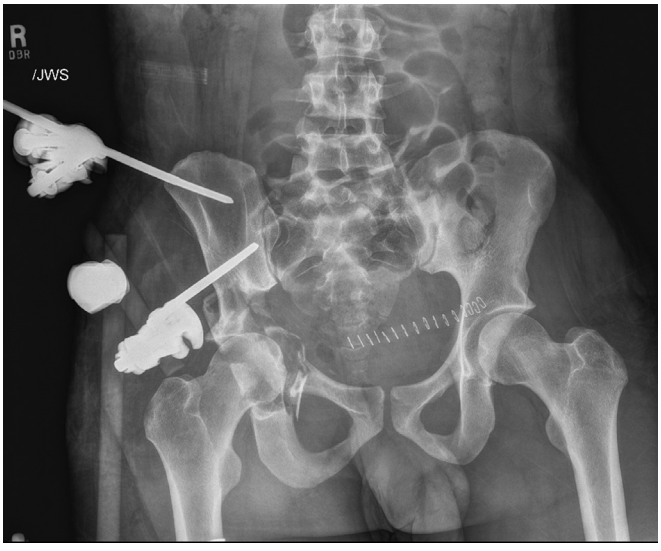


**Figure 1.** A preoperative plain film demonstrating fracture, hip-spanning external fixator, and biopsy incision closure.

## Discussion

This case presents a unique management challenge to address an exceedingly rare clinical scenario. Chondroblastomas are uncommon primary bone tumors and are rarely periacetabular. Presentation with pathologic fracture complicated the planning and execution of the management plan.

Several facets of treatment should be considered, including temporization, evaluation, and reconstruction with the goal of restoring function. Management of pelvic fractures requires restoration of the length of the extremity through femoral reduction.

Treatment for chondroblastoma typically includes surgical management alone as it is benign and not chemosensitive and radiotherapy is thought to advance malignant progression [1]. Surgical intervention can include curettage with adjuvants, bone graft, and stabilization, as well as en bloc resection based on anatomic location, size of the lesion, and extent of involvement.

For this patient, treatment and reconstruction were complicated by periarticular location, fracture, prior surgical intervention, and the patient's age in light of virtually no posterior column, medial wall, and significant defect of the ischium and superior ramus. Longevity of the prosthesis was of utmost importance to minimize the number of future revisions, making preoperative multidisciplinary discussion critical.

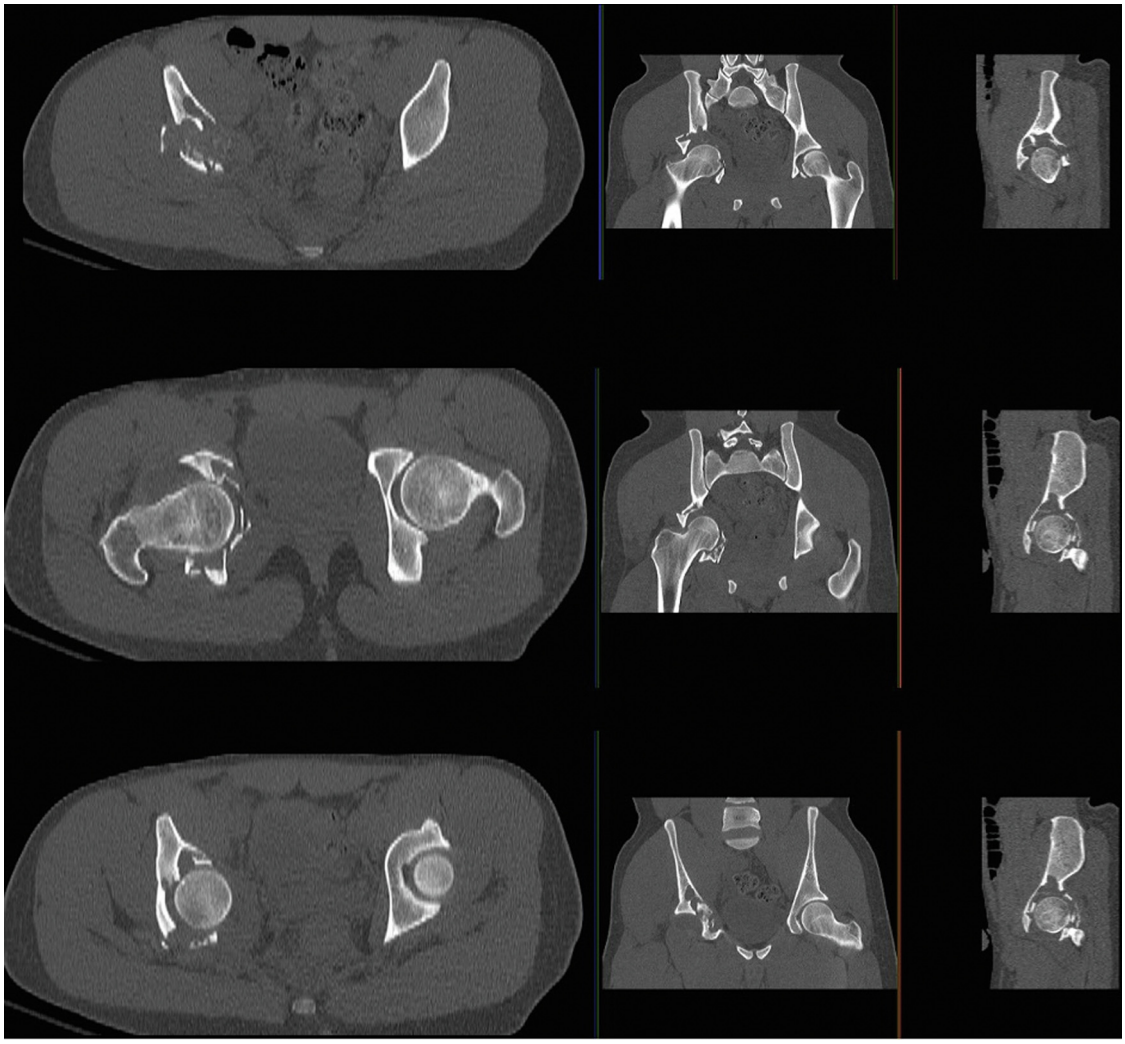

**Figure 2.** A preoperative computed tomography image demonstrating the lesion, pathologic fracture, and protrusio of the femur.

Paprosky described classification of acetabular bony defects beginning with minimal deformity and an intact acetabular rim in type I and ending with type IIIB indicating loss of the medial wall, disruption of the anterior column, ischium, and superomedial defect of the acetabulum [11]. This patient falls into the category a Paprosky type IIIB defect. Per the Paprosky classification, an uncemented shell with porous metal augment is the mainstay of treatment for this type of defect.

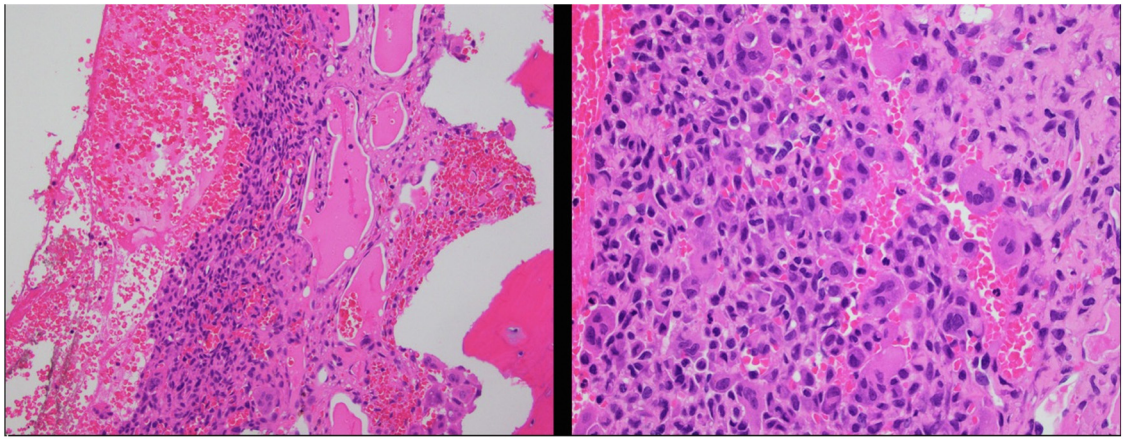

**Figure 3.** Pathology slides demonstrating blood-filled cystic spaces (left). The cyst wall shows background mononuclear cells with distinct cytoplasmic borders, eosinophilic cytoplasm, and irregular and grooved nuclei. Scattered multinucleated osteoclast-like giant cells are present (right).

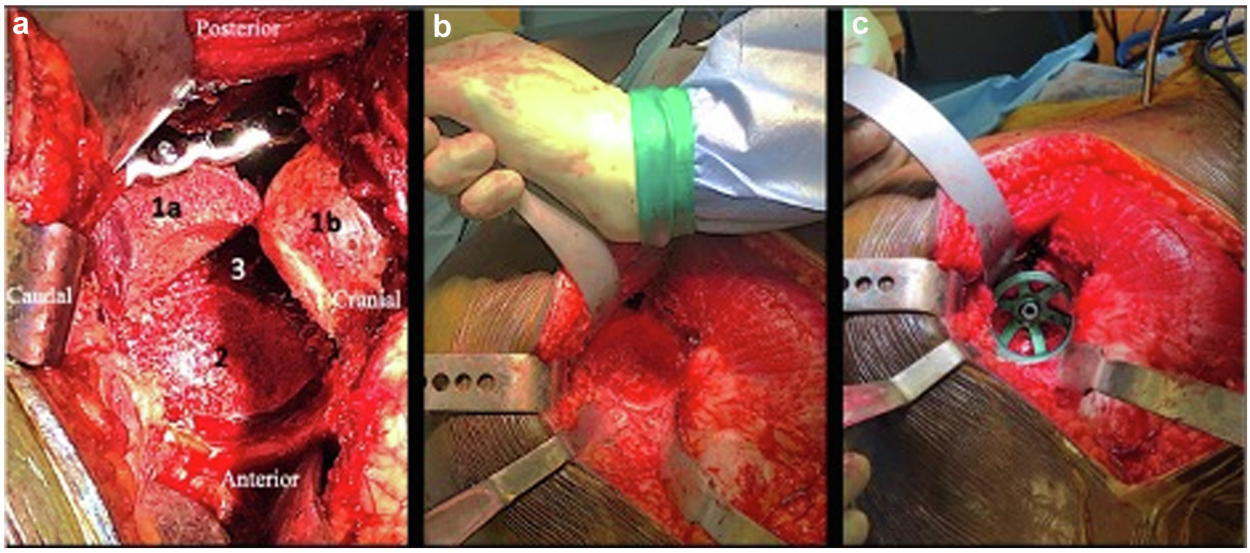


**Figure 4.** Intraoperative photographs. (a) Illustrating structural autograft femoral head augmentation to reconstruct the posterior acetabular column (1a) and superior (1b) acetabulum in a flying buttress and dome support configuration, respectively. "2" Indicates the allograft femoral head for medial wall, and "3" designates the void that was filled with impaction of morselized bone allograft for the final acetabular reconstruction (b). (c) Acetabular trial in place after reverse reaming the allograft/autograft reconstruction.

Preoperatively, discussion among the treating surgeons for fixation covered a breadth of reconstructive options. In addition to the primary plan, which was implemented, the possible addition of a cup cage construct and TM augments was discussed. Considering the patient's age, biological augmentation with bone graft was preferred. The other alternative discussed was a staged reconstruction, with the first stage consisting intralesional tumor excision/curettage, filling the acetabular massive segmental and uncontained bone loss with bone graft, and hip reconstruction using a bipolar arthroplasty followed by a long period of weight bearing restriction until radiographic determination of bone graft osseointegration. The second stage would consist conversion from hemiarthroplasty to total hip arthroplasty. This was less favored because of multiple operations, risk of infection, and long period of weight bearing restriction. The distraction technique is an option with good outcomes in chronic pelvic discontinuity cases [12], but its use in acute discontinuities is unpredictable. A custom-made triflange implant was another option, but the authors are less familiar with this technique. Given the benign nature of the lesion, the authors attempted to preserve as much of his native anatomy as possible. Predicting that it is necessary to perform bone resection to achieve an adequate intralesional removal of the tumor would make the design of a custom-made triflange challenging.

Utilization of femoral head autograft to replace bone stock in pelvic discontinuity or acetabular defects is well described in the literature and was an excellent option for this patient who required as much native bone preservation as possible [13,14]. This combination of techniques created a surgical plan with optimal longevity and judicious use of native biology. The use of antibiotic cement for defect augmentation is described in the literature [15,16] but is restricted to contained defects where extravasation of cement is of low risk. This patient's defect was uncontained, and significant risk of extravasation was a concern. Furthermore, maximizing biologic fixation was a priority given the extremely young age of this patient. To minimize the risk of infection, antibiotic cement was used to fix the longevity liner into the TM shell.

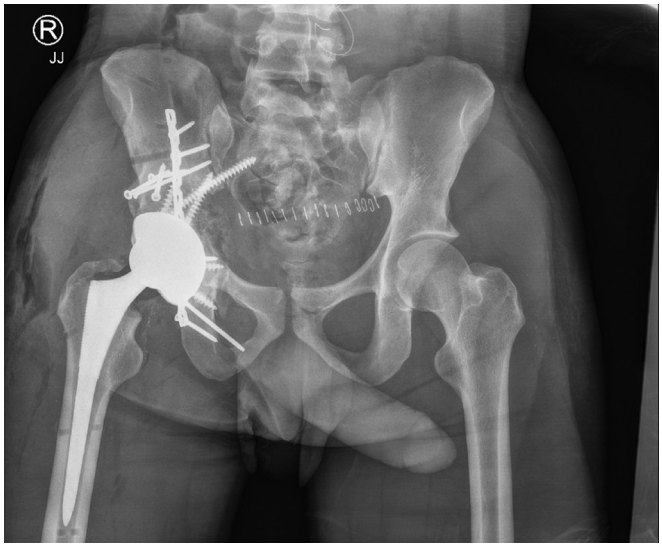


**Figure 5.** Immediate postoperative films demonstrating reconstruction, superior and posterior augmentation, and total hip arthroplasty.

**Figure 6.** Plain films obtained at 3 years postoperatively demonstrating a well-fixed and well-positioned uncemented acetabular and femoral components, stable posterior wall fixation, augmentation and bone graft osseointegration, and no evidence of local tumor recurrence.

Exposure and reconstruction for a case of this magnitude, although oncologic, is transferable to arthroplasty with consideration of dysplasia or revision cases. Exposure of the ilium and ischium, orientation, direction and type of fixation, and technique all play a critical role in successful placement of final implants.

## Summary

Management of patients with a complex fracture dislocation through a rare acetabular chondroblastoma poses a diagnostic and treatment challenge due to location, presence of an extensive disease, and subsequent bony defect in a periarticular area. Oncologic management of chondroblastoma initiated the decision-making cascade and treatment algorithm. Trauma principles of acetabular fixation recreated anatomy allowing for final reconstruction. Using several principles of bony defect augmentation led to implantation of a stable and durable prosthesis, and principles of longevity led to an optimal bearing surface for a young patient, namely ceramic on highly crosslinked polyethylene. Preoperative planning and cooperation in a multifaceted approach eliminated staged or delayed surgery for this patient. Multidisciplinary planning and execution of a management plan incorporating principles of oncology, trauma, and arthroplasty were all necessary to achieve the optimal outcome in this young patient. Ultimately, this case illustrates several arthroplasty principles transferable to complex primary arthroplasty, dysplasia, and revision arthroplasty with massive bone loss.

## Conflicts of interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: H. A. Prieto is a paid consultant for “Exactech, Inc.” and is a chair program committee member for the Florida Orthopaedic Society.

For full disclosure statements refer to https://doi.org/10.1016/j.artd.2022.01.002.

## Informed patient consent

The authors confirm that written informed consent has been obtained from the involved patient or, if appropriate, from the parent, guardian, or power of attorney of the involved patient and that they have given approval for this information to be published in this case report (series).

Please refer to Elsevier's policy regarding written patient consent requirements

https://www.elsevier.com/about/policies/patient-consent#:~:text=That%20individual%2C%20legal%20guardian%20or,writing%20of%20all%20such%20conditions.

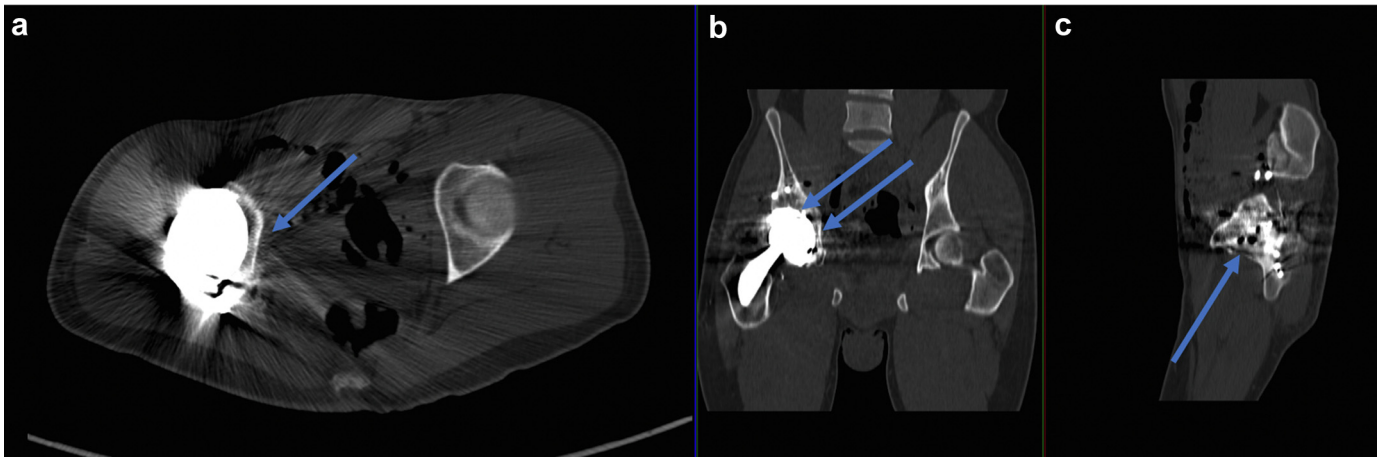


**Figure 7.** Computed tomography images (a; axial, b; coronal, and c; sagittal) at 1 year postoperatively demonstrating hip reconstruction with resolution of protrusio, stable fixation of acetabular fixation, and osseointegration of the acetabular shell as indicated by the blue arrows. There is no evidence of local tumor recurrence.

Complete written informed consent was obtained from the patient for the publication of this study and accompanying images.

## References


[1] Chen W, DiFrancesco LM. Chondroblastoma: an update. Arch Pathol Lab Med 2017;141(6):867.

[2] Xu H, Nugent D, Monforte HL, et al. Chondroblastoma of bone in the extremities: a multicenter Retrospective study. J Bone Joint Surg Am 2015;97(11):925.

[3] Lee PTH, Clayton RA, Safir OA, Backstein DJ, Gross AE. Structural allograft as an option for treating infected hip arthroplasty with massive bone loss. Clin Orthop Relat Res 2011;469(4):1016.

[4] Busanelli L, Castagnini F, Bordini B, Stea S, Calderoni PP, Toni A. The biological acetabular reconstruction with bone allografts in hip revision arthroplasty. Musculoskelet Surg 2019;103(2):173.

[5] Melnic CM, Knedel M, Courtney PM, Sheth NP, Paprosky WG. The dome technique, an option for massive anterosuperior medial acetabular bone loss: a retrospective case series. HSS J 2020;16(Suppl 2):521.

[6] Ferreira N, Marais LC. Prevention and management of external fixator pin track sepsis. Strateg Trauma Limb Reconstr 2012;7(2):67.

[7] Gordon JE, Kelly-Hahn J, Carpenter CJ, Schoenecker PL. Pin site care during external fixation in children: results of a nihilistic approach. J Pediatr Orthop 2000;20(2):163.

[8] Prieto HA, Kralovec ME, Berry DJ, Trousdale RT, Sierra RJ, Cabanela ME. Structural allograft supporting a trabecular metal cup provides durable results in complex revision arthroplasty. J Arthroplasty 2017;32(11):3488.

[9] Nehme A, Lewallen DG, Hanssen AD. Modular porous metal augments for treatment of severe acetabular bone loss during revision hip arthroplasty. Clin Orthop Relat Res 2004;429:201.

[10] Lewallen D, Mardones R, Poggie R, Hanssen A. Revision hip arthroplasty with porous tantalum augments and acetabular shells. In: Scientific Exhibit. AAOS Annual Meeting; 2006.

[11] Paprosky WG, Perona PG, Lawrence JM. Acetabular defect classification and surgical reconstruction in revision arthroplasty. A 6-year follow-up evaluation. J Arthroplasty 1994;9(1):33.

[12] Brown NM, Hellman M, Haughom BH, Shah RP, Sporer SM, Paprosky WG. Acetabular distraction: an alternative approach to pelvic discontinuity in failed total hip replacement. Bone Joint J 2014;96-B(11 Supple A):73.

[13] Kobayashi S, Saito N, Nawata M, Horiuchi H, Iorio R, Takaoka K. Total hip arthroplasty with bulk femoral head autograft for acetabular reconstruction in DDH. Surgical technique. J Bone Joint Surg Am 2004;86-A(Suppl 1):11.

[14] Pizarro FC, Young SW, Blacutt JH, Mojica R, Cruz JC. Total hip arthroplasty with bulk femoral head autograft for acetabular reconstruction in developmental dysplasia of the hip. ISRN Orthop 2013;2013:794218.

[15] Gandhi R, Backstein D, Zywiel MG. Antibiotic-laden bone cement in primary and revision hip and knee arthroplasty. J Am Acad Orthop Surg 2018;26(20):727.

[16] Farhan-Alanie MM, Burnand HG, Whitehouse MR. The effect of antibiotic-loaded bone cement on risk of revision following hip and knee arthroplasty. Bone Joint J 2021;103-B(1):7.