Management of Instability and Osteolysis After Total Hip Arthroplasty

A 54-year-old man who had undergone a left total hip arthroplasty 11 years prior presented to the emergency department with dislocation and acute-onset pain and deformity. He had a history of dislocation less than 1 year after his total hip arthroplasty. He did well for approximately 9 years but had progressively increasing pain for the past 2 years. He had no history of neoplasm and no evidence of infection. Anteroposterior pelvis (A), cross table lateral (B), and anteroposterior hip (C) radiographs at initial presentation are provided. What would you do?

William J. Hozack, MD, Department of Orthopedics, Thomas Jefferson University Medical School, Rothman Institute Orthopedics, Philadelphia, Pennsylvania
Charles L. Nelson, MD, Department of Orthopaedic Surgery, University of Pennsylvania, Philadelphia, Pennsylvania

William J. Hozack, MD: The radiographs demonstrate a dislocated total hip arthroplasty (THA) with extensive bone lysis on both the acetabular and femoral sides. Component fixation appears intact. Closed reduction is indicated in this case, as in virtually all cases of dislocation. A dislocated THA is painful for the patient and requires immediate attention. Furthermore, there are many instances of single dislocations related to an unusual patient position that, once reduced, may never occur again. In this patient, further treatment is required, so the closed reduction gives the surgeon time to more...
carefully evaluate the situation and plan a revision surgery carefully.

Physicians have general algorithms for dislocation, which must be tailored to the patient. I feel that early dislocations that occur in the immediate postoperative period (eg, 3 months) can often be treated successfully with closed reduction and activity/position modification. Once the healing process is complete, THA is substantially more stable. However, my general approach is as follows. Total hip arthroplasty instability can be caused by several factors related to component position, soft tissue tension, impingement, and polyethylene wear. Patients are often blamed but are rarely the cause. First, I look at the components. Is acetabular component version and inclination appropriate? Is femoral offset adequate? Have leg lengths been restored? Is there evidence of abductor insufficiency (perhaps a trochanteric nonunion)? Is there a possibility of impingement? Are there residual osteophytes? What is the head-neck ratio (a ratio of less than 2 can lead to impingement during activities of daily living)? Is there polyethylene wear that could lead to impingement and instability?

This patient presents with 2 separate problems: late dislocation and extensive periprosthetic osteolysis. The patient’s late instability is likely related to polyethylene wear. He experienced an early dislocation, which may have been related to the large cup and relatively small femoral head. The patient’s most significant problem is the extensive periprosthetic osteolysis. It is so dramatic that one has to worry about a neoplastic process. I would request an oncologic consultation and workup. I would then obtain a more detailed evaluation of the extent of the osteolysis. More specifically, I would worry about the residual bone stock available on the acetabular side. If substantially compromised, revision with the standard highly porous hemispherical component alone may not be possible. In these cases, a 3-dimensional reconstruction can be helpful in understanding the bone stock situation and planning the appropriate revision technique.

On the femoral side, the extensive osteolysis is easily treated with revision to a modular tapered revision component and appropriate bone grafting. On the acetabular side, several options are available. If the acetabular component is well fixed and well positioned, then a polyethylene exchange and bone grafting would be the easiest option. If not, then converting to a highly porous hemispherical socket (supplemented by screws) would be my next choice. An acetabular cage should also be available in this case because fixation with the cup alone may not be sufficient. One concern related to the cage is ischial lysis, which may complicate fixation of the ischial flange of a cage. Augments for the cup may be appropriate, again depending on the degree of bone stock deficiency seen on computed tomography and found intraoperatively.

Generally, I favor using a larger femoral head into a cross-linked polyethylene liner. It would be possible to use head sizes as large as 40 or 44 mm in this patient because the cup size is likely to be large. The particular advantage of these larger head sizes is not only reducing impingement but also increasing the jump distance required before dislocation can occur. This is important in more extensive revisions with larger disruption of the soft tissue envelope. One other effective alternative is to use a dual mobility device. I do not favor using a constrained component in this case because cup fixation may be compromised and the constrained liner could increase the chance of cup loosening.

Charles L. Nelson, MD: I agree that an attempt at closed reduction is indicated in nearly every case of a dislocated THA. This case is complex—there is severe femoral and acetabular bone loss, most likely due to osteolysis—but I would recommend an oncologic workup prior to revision surgery due to the extent of osteolysis.

Regarding the dislocation, most dislocations, and especially recurrent dislocations, are usually a result of a technical or prosthetic-related issue. A number of algorithms have been described, often advocating closed reduction and bracing for initial dislocations, revision surgery after multiple dislocations, and the use of constrained cups in the setting of failed revisions for dislocation.

Because every revision procedure is a serious undertaking with significant risks to the patient, once a decision is made that a revision THA procedure is indicated, the algorithm that I have developed and used over the past decade involves carefully accessing the stability of the existing total hip prior to component revision with provocative anterior and posterior dislocation maneuvers with the components in their pre-revision state. Then I would advocate revising the femoral and acetabular components as necessary, addressing every source of perceived instability (eg, femoral and acetabular component position; removal of osteophytes or any sources of impingement; and soft tissue tension optimization via increasing offset, length, or abductor repair or advancement as indicated). At this point, a repeat trial reduction and hip stability evaluation is performed. If there is a significant improvement in hip stability, then I generally do not use a constrained liner. On the other hand, if hip stability is not improved or modestly improved, particularly if the hip can be dislocated both anteriorly and posteriorly and leg-length reconstruction is appropriate, which implies reasonable component position and inadequate soft tissue tension or abductor insufficiency, then I generally advocate the use of a constrained acetabular liner.

However, this case represents one circumstance in which I would not use a constrained liner, even if the hip stability is suboptimal follow-
In component revision and stability optimization, due to the presence of severe acetabular bone loss. I would prioritize fixation over hip stability and would only consider a subsequent revision to a constrained liner after acetabular biologic fixation had been obtained.

Regarding the second problem noted in this case, although there is extensive femoral osteolysis proximally, there is still good diaphyseal bone stock, which allows reliable femoral fixation using a number of implants, including a cylindrical extensively coated porous stem or a tapered modular or nonmodular revision component. My preference for this case would be a modular tapered revision stem, which allows optimization of length, offset, and anteverision independent of diaphyseal fixation. Strut allograft and cables or a trochanteric plate and cable system may be useful in establishing continuity between the greater trochanter and femur and allowing optimal, abductor function.

On the acetabular side, although the easiest option would be leaving what appears to be a well-fixed cup alone and performing a liner exchange and bone grafting, I would have a few concerns in this patient. The 2-year history of pain prior to the dislocation is suggestive of micromotion between either the stem and bone or the cup and bone. In addition, the early dislocation may indicate suboptimal cup position. Therefore, my plan would be to proceed with acetabular component revision with bone grafting as necessary. I agree that the use of a highly porous acetabular shell would allow the most reliable biologic fixation. In this case, I would also advocate having porous metal augments and an acetabular reconstruction cage available as well as ample bone graft. Although I would recommend having an acetabular reconstruction cage available, in this case I would be concerned with the ability of a cage to provide any inferior fixation due to the extensive ischial osteolysis present. Consequently, I would plan on use of multiple screws through the highly porous metal shell with at least one inferior screw, most likely into the pubic rami, which appears to be the best inferior bone in this case.

I would favor the use of a large femoral head and a nonconstrained liner to optimize stability in this case. Although I am generally not a proponent for dual-mobility devices, if hip stability were not good enough with a large head, I would favor the use of a dual-mobility device in this patient over a constrained liner due to the presence of tremendous acetabular bone loss and concern a constrained liner could pull out with the shell and further compromise the already massive bone loss present.

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Dr Hozack is a consultant for and receives royalties from Stryker Orthopedics. Dr Nelson is a consultant for Zimmer, Inc.

Correspondence should be addressed to: John D. Kelly IV, MD, Sports Medicine, University of Pennsylvania, 235 S 33rd St, Philadelphia, PA 19104 (johndkellyiv@aol.com).

doi: 10.3928/01477447-20131120-08