Total Hip Arthroplasty After Contralateral Hip Disarticulation: A Challenging "Simple Primary"

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Abstract

Patients with lower limb amputation have a high incidence of hip and knee osteoarthritis in both the residual limb and the contralateral limb. Hip disarticulation is a radical surgery usually performed in younger patients after malignancy or trauma. Compliance is poor with existing prostheses, resulting in increased dependency on and use of the remaining sound limb.

We describe a case of a crutch-walking 51-year-old woman who presented with severe left hip arthritis 25 years after a right hip disarticulation, and was treated with total hip arthroplasty. Total hip arthroplasty without a contralateral hip joint is challenging. We discuss the complex technical considerations associated with the patient's arthroplasty, in particular the selection of prostheses and bearing surfaces, and the preoperative and intraoperative assessment of limb length and offset.

Patients with lower limb amputation have a high incidence of hip and knee osteoarthritis (OA) in the residual limb as well as the contralateral limb. A radical surgery, hip disarticulation is generally performed in younger patients after malignancy or trauma. Compliance is poor with existing prostheses, resulting in increased dependency on and use of the remaining sound limb.

In this case report, a crutch-walking 51-year-old woman presented with severe left hip arthritis 25 years after a right hip disarticulation. She underwent total hip arthroplasty (THA), a challenging procedure in a person without a contralateral hip joint. The many complex technical considerations associated with her THA included precise perioperative planning, the selection of appropriate prostheses and bearing surfaces, and the preoperative and intraoperative assessment of limb length and offset. The patient provided written informed consent for print and electronic publication of this case report.

Case Report

A 51-year-old woman presented to our service with a 3-year history of debilitating left hip pain. Twenty-five years earlier, she had been diagnosed with synovial sarcoma of the right knee and underwent limb-sparing surgery, followed by a true hip disarticulation performed for local recurrence. After her surgery, she declined the use of a prosthesis and mobilized with the use of 2 crutches. She has remained otherwise healthy and active, and runs her own business, which involves some lifting and carrying of objects. During the 3 years prior to presentation, she developed progressively debilitating left hip and groin pain, which radiated to the medial aspect of her left knee. Her mobilization distance had reduced to a few hundred meters, and she experienced significant night pain, and start-up pain. Activity modification, weight loss, and nonsteroidal anti-inflammatory medication afforded no relief. She denied any back pain or radicular symptoms.

Clinical examination showed a well-healed scar and pristine stump under her right hemipelvis. Passive range of movement of her left hip was painful for all movements, reduced at flexion (90°) and internal (10°) and external rotation (5°). Examination of her left knee was normal, with a full range of movement and no joint-line tenderness. A high body mass index (>30) was noted. Radiographic imaging confirmed significant OA of the hip joint (**Figure 1**). Informed consent was obtained for THA. The implants were selected—an uncemented collared Corail Stem (DePuy, Warsaw, Indiana) with a stainless steel dual mobility (DM) Novae SunFit acetabular cup (Serf, Decines, France), with bearing components of ceramic on polyethylene. A preoperative computed tomography (CT) scan of the left hip was performed (**Figure 2**) to aid templating, which was accomplished using plain films and CT images, with reference to the proximal femur for deciding level of neck cut, planning stem size, and optimizing length and offset, while determining cup size, depth, inclination, and height for the acetabular component.

Prior to surgery, the patient was positioned in the lateral decubitus position, using folded pillows under the medial

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Figure 1. Preoperative radiograph showing left hip osteoarthritis.

Figure 2. Preoperative computed tomography to optimize templating.

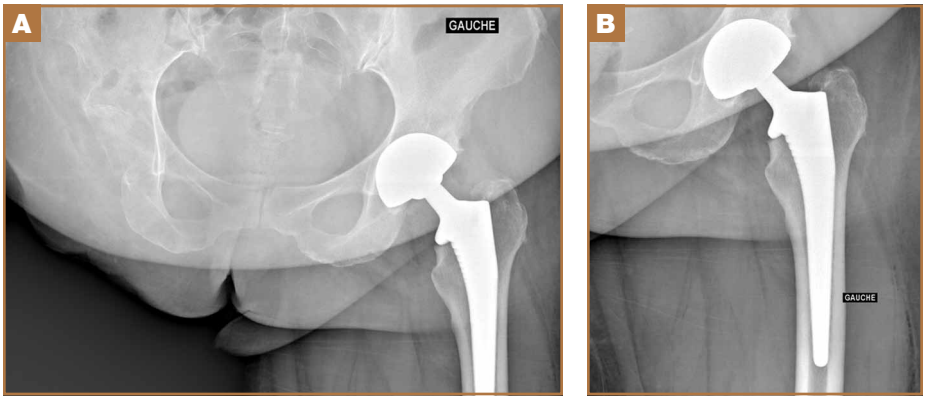

Figure 3. Postoperative anteroposterior imaging of (A) pelvis and (B) left hip showing dual mobility cup, ceramic-on-polyethylene bearing surfaces, and uncemented stem.

aspect of her left proximal and distal thigh in lieu of her amputated limb. Pillows were secured to the table with elastic bandage tape. Standard pubic symphysis, lumbosacral, and midthoracic padded bolsters stabilized the pelvis in the normal fashion, with additional elastic bandage tape to further secure the pelvis brim to the table and reduce intraoperative motion. A posterior approach was used. A capsulotomy was performed with the hip in extension and slight abduction, with meticulous preservation of the capsule as the guide for the patient's native length and offset. Reaming of the acetabulum was line to line, with insertion of an uncemented DM metal-back press-fit hydroxyapatite-coated shell placed in a standard fashion parallel with the transverse acetabular ligament, as described by Archbold and colleagues.[1] The femur was sequentially reamed with broaches until press fit was achieved, and a calcar reamer was used to optimize interface with the collared implant. The surgeon's standard 4 clinical tests were performed with trial implants after reduction to gauge hip tension, length, and offset. These tests are positive shuck test with hip and knee extension, lack of shuck in hip extension with knee flexion, lack of kick sign in hip extension and knee flexion, and palpation of gluteus medius belly to determine tension. Finally, with the hip returned to the extended and slightly abducted position, the capsule was tested for length and tension. The definitive stem implant was inserted, final testing with trial heads was repeated prior to definitive neck length and head selection, and final reduction was performed. A layered closure was performed, after generous washout. Pillows were taped together and positioned from the bed railing across the midline of the bed to prevent abduction, in the fashion of an abduction pillow.

The patient was mobilized the day after surgery and permitted full weight-bearing. Recovery was uneventful, and the patient returned to work within 6 weeks of surgery after her scheduled appointment and radiographic examination (**Figure 3**). Ongoing regular clinical and radiologic surveillance are planned.

Discussion

Hip and knee OA in the residual limb is more common for amputees than for the general population.[2,3] THA for OA in amputees has been reported after below-knee amputation in both the ipsilateral and the contralateral hip.[4] A true hip disarticulation is a rarely performed radical surgical procedure, involving the removal of the entire femur, and is most often related to surgical oncologic treatment or combat-related injuries, both being more common in younger people. Like many patients who have had a hip disarticulation,[5] our patient declined a prosthesis, finding the design cosmetically unappealing and uncomfortable, in favor of crutch-walking. This accelerated wear of the remaining hip, and is a sobering reminder of the high demand on the bearing surfaces of the implants after her procedure.

The implants chosen for this procedure are critical. We use implants which are proven and reliable. Our institution uses the Corail Stem, an uncemented collared stem with an Orthopaedic Data Evaluation Panel (ODEP) 10A rating,[6] widely used

for THA.[7] For the acetabulum, we chose the Novae SunFit, a modern version based on Bousquet's 1976 DM design. The DM cup is a tripolar cup with a fixed porous-coated or cemented metal cup, which articulates with a large mobile polyethylene liner. A standard head in either metal or ceramic is inserted into this liner. The articulation between the head and the liner is constrained, while the articulation between the liner and the metal cup is unconstrained. This interposition of a mobile insert increases the effective head diameter, and the favorable head-neck ratio allows increased range of motion while avoiding early femoral neck impingement with a fixed liner or metal cup. A growing body of evidence indicates that DM cups reduce dislocation rates in primary and revision total knee arthroplasty and, when used with prudence, in selected tumor cases.[8] A study of 1905 hips, using second-generation DM cups, reported cumulative survival rate of 98.6% at 12.2 years,[9] with favorable outcomes compared with standard prostheses in the medium term for younger patients,[10] and in the longer term,[11] without increasing polyethylene wear.[12]

We use DM cups for 2 patient cohorts: first, for all patients older than 75 years because, in this age group, the risk of dislocation is higher than the risk of revision for wear-induced lysis; and second, in younger patients with any neuromuscular, cognitive, or mechanical risk factors that would excessively increase the risk of dislocation. This reflects the balance of risks in arthroplasty, with the ever-present trade-off between polyethylene-induced osteolysis and stability. Dislocation of the remaining sound limb for this young, active, agile patient would be a catastrophic complication. Given our patient's risk factors for dislocation—female, an amputee with a high risk of falling, high body mass index, and lack of a contralateral limb to restrict adduction—the balance of risks favored hip stability over wear. We chose, therefore, a DM cup, using a ceramic-head-on-polyethylene-insert surface-bearing combination.

CT scanning is routinely performed in our institution to optimize preoperative templating. The preoperative CT images enable accurate planning, notably for the extramedullary reconstruction,[13] and are used in addition to acetates and standard radiographs. This encourages preservation of acetabular bone stock by selecting the smallest suitable cup, reduces the risk of femoral fracture by giving an accurate prediction of the stem size, and ensures accuracy of restoring the patient's offset and length. Although limb-length discrepancy was not an issue for this patient with a single sound limb, the sequalae of excessively increasing offset or length (eg, gluteus medius tendinopathy and trochanteric bursitis) would arguably be more debilitating than for someone who could offload weight to the "good hip." For these reasons, marrying the preoperative templating with on-table testing with trial prostheses and restoring the native capsular tension is vital.

The importance of on-table positioning for proximal amputees undergoing hip arthroplasty has been highlighted.[14] Lacking the normal bony constraints increases the risk of intraoperative on-table movement, which, in turn, risks reducing the accuracy of implant positioning. Crude limb-length checking using the contralateral knee is not possible. In addition, the lack of a contralateral hip joint causes a degree of compensatory pelvic tilt, which raises the option of increasing the coverage to compensate for obligate adduction during single-leg, crutch-walking gait. Lacking established guidelines to accommodate these variables, we inserted the cup in a standard fashion, at 45°, referencing acetabular version using the transverse acetabular ligament,[1] and used the smallest stable cup after line-to-line reaming.

This case of THA in a young, crutch-walking patient with a contralateral true hip disarticulation highlights the importance of meticulous preoperative planning, implant selection appropriate for the patient in question, perioperative positioning, and the technical and operative challenges of restoring the patient's normal hip architecture.

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