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Orthopaedics

A Conversion Total Hip Arthroplasty Is Not a Primary Total Hip Arthroplasty

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Conversion to total hip arthroplasty (THA) is frequently more resource intensive and morbidity prone than primary THA. However, reimbursement for both hospitals and surgeons performing these procedures do not appear to provide appropriately matching resource utilization. Ultimately, patient access to these necessary surgeries becomes a question of concern if appropriate incentives are not aligned. Conversion THA is a broad topic and this paper seeks to highlight the technical difficulties and preoperative and postoperative pitfalls associated with this procedure to help address all issues and parties helping to support this procedure.
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Introduction

Over the last decade, there has been an expanding area of research dedicated to outcomes following conversion total hip arthroplasty (THA). The most common indications for conversion THA are failed hip and acetabular open reduction and internal fixation (ORIF).[1] Additionally, conversion THA is considered a salvage procedure for patients previously treated with hip arthroscopy, hemiarthroplasty, pelvic and femoral osteotomies secondary to developmental hip dysplasia, a number of congenital pathologies, hip resurfacing, and the increasingly rare failed hip fusion. Sodhi et al searched the ACS-NSQIP database for conversions from 2008 to 2015 using the CPT code 27132 and found 3004 procedures done during this period.[2] However, the ACS-NSQIP was designed as a validated benchmarking database, not for determining surgical indices. Therefore, to the best of our knowledge it is currently unknown how many conversion THAs are done annually or if this number is increasing.

Conversion THA surgery is not simply "a little more difficult" than primary THA surgery. This is evident from a health system cost, patient morbidity, and surgeon reimbursement perspective. Unlike revision THA which has its own Medicare Severity-Diagnosis Related Group (MS-DRG), the Center for Medicare and Medicaid Services currently considers primary and conversion THA to be similar enough procedures in terms of resource utilization to share MS-DRG 469 and 470. Multiple studies have concluded that the clinical and economic spectrum of care of conversion THA are more like revision THA than primary THA.[1,3-5] Regarding surgeon compensation, 2 separate studies published in 2018 examined surgeon compensation for 3 types of THA by comparing the Relative Value Units (RVUs) per total operation times. The mean RVU per procedure was 21.24 for primary, 25.68 for conversion, and 30.27 for revision.[2,6] However, the RVU/operative time for conversion THA (0.21) was lower than that for both revision THA (0.25) and primary THA (0.26), suggesting a disparity in physician compensation rates. More importantly this analysis does not account for any increased lengths of stay (LOS) or complications associated with conversion THA.[7] Evidence supports the thought that hospitals and surgeons that perform conversion THAs may not be compensated adequately, and conversion THA should be reclassified to its own MS-DRG and RVUs adjusted appropriately.[2,5,6]

As research continues to reveal the economic and clinical differences between primary, revision, and conversion THA, it has become necessary to review the clinical aspects of conversion THA in orthopaedic practice. The goals of this article are to summarize the outcomes following different types of conversion THA based on index procedures. Additionally, we intend to discuss pre- and intraoperative considerations for conversion THA based on index surgery.

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Infection Workup

Treating a septic conversion THA as an aseptic conversion THA can have devastating consequences for both the patient and the hospital system. The 1- and 5-year mortality for PJI after THA was found to be 11.3% and 32.8%, respectively.[8] Conversion THA surgery requires a clinically high index of suspicion for infection if the patient never had a pain free interval following the index procedure, there was rapid onset arthritis, or in the case of hardware failure. Maintaining a high index of suspicion for underlying infection and continuing to pursue subsequent steps if the diagnosis is still unclear is imperative.

Screening may be as simple as combining clinical correlation with clinical suspicion, and the depth of screening should be tailored appropriately. If the patient has been off antibiotics for at least 2 weeks, any elevated erythrocyte sedimentation rate (ESR) or C-reactive protein (CRP) level would trigger a hip aspiration for cell count and differential, cultures (aerobic and anaerobic unless immunocompromised), and crystals (least important). At the time of conversion, intraoperative inspection of the native joint and/or current implants should occur, as well as cultures (≥3-5) and frozen sections.

Patient Optimization and Activation

Prior to conversion THA, it is important to examine the patient and address any modifiable risk factors with the goal of improving overall outcomes and reducing hospital readmission. Many studies have been conducted to assess risk factors for THA failure and hospital readmission. Potentially modifiable risk factors that tend to contribute to worse clinical outcomes in THA include operation time > 115 minutes, body mass index > 40, tobacco use, colonization with *S. aureus*, poorly controlled diabetes mellitus (specifically perioperative hyperglycemia > 200 mg/dL), preoperative anemia, and malnutrition.[9-12] In addition, these risk factors appear to have additive effects when grouped together.[9] Adjustment of modifiable risk factors may positively affect surgical outcomes, although this has yet to be proven.[12]

In addition to attempting to optimize any modifiable risk factors, it is vital to get the patient to become actively engaged in their own healthcare, a term defined as "patient activation". Data supports that higher levels of patient activation lead to better healthcare outcomes and patient experiences.[13] Andrawis et al examined 135 patients undergoing total hip or knee arthroplasty and found that patients with higher baseline Patient Activation Measure (PAM) scores experienced better pain and symptom relief, increased objective mental health, and higher overall satisfaction than those with lower baseline PAM scores.[13] Baseline PAM scores did not correlate with preoperative physical health, indicating that higher postoperative satisfaction was likely unrelated to baseline health levels.[13]

Previous Hip Arthroscopy

An understanding of risk factors for both arthroscopy failure and conversion THA is necessary to appropriately counsel patients. Multiple recent studies have highlighted these risk factors, which include the presence of femoral head lesions at the time of arthroscopy, older age, higher body mass index, higher preoperative Tönnis grade, lower preoperative modified Harris hip score, decreased femoral anteversion, revision arthroscopy, femoral Outerbridge Grades II-IV, surgical acetabuloplasty, and lack of surgical femoral osteoplasty.[14-16] Truntzer et al report, conversion to THA was 3% after 1 year, and increased to 4.7% after 5 years.[17] Of the 88 patients eventually converted to THA in the study, 37% of them were done within 6 months of hip arthroscopy, and more than 60% by 1 year.[17] Overall, conversion THA after previous hip arthroscopy is a successful procedure and produces outcomes similar to primary THA.[18]

Author Recommendations

Barring any associated index procedures or post arthroscopy complications, conversion THA does not appear to be more challenging following hip arthroscopy.

Failed Hip ORIF (Closed Reduction with Percutaneous Pinning [CRPP])

Kahlenberg et al found the failure rate of CRPP for femoral neck fractures to be between 5% and 6% after 1 year and 10%-11% after 5 years.[19] In another study, the most common reason for conversion to THA was osteonecrosis of the femoral head (44%), post-traumatic/degenerative arthritis (35%), and nonunion (21%).[20] Factors associated with higher risk of conversion to THA include male gender, younger age, comorbid cardiopulmonary disorders, peripheral vascular disease, hypertension, hypothyroidism, acute blood loss anemia, and metastatic cancer.[19] Overall, conversion THA following CRPP is a successful procedure with outcomes similar to primary THA.[21] Five years post conversion THA from in situ screw fixation, Hernandez et al reported 97% survivorship free of operation, no subjects with radiographic evidence of implant loosening, and a statistically significant improvement in Harris hip scores from 35 to 85.[20]

Author Recommendations

Generally, conversion of CRPP can be done without significant alteration of any hip approach. Dislocation of the hip prior to removing the hardware to avoid a stress fracture through the lateral cortical defect is recommended. When converting through the direct anterior approach alteration of the incision path or a small separate incision may be necessary to remove the cannulated screws (Fig. 1). The cannulated screws can be easily removed by placing a guidewire

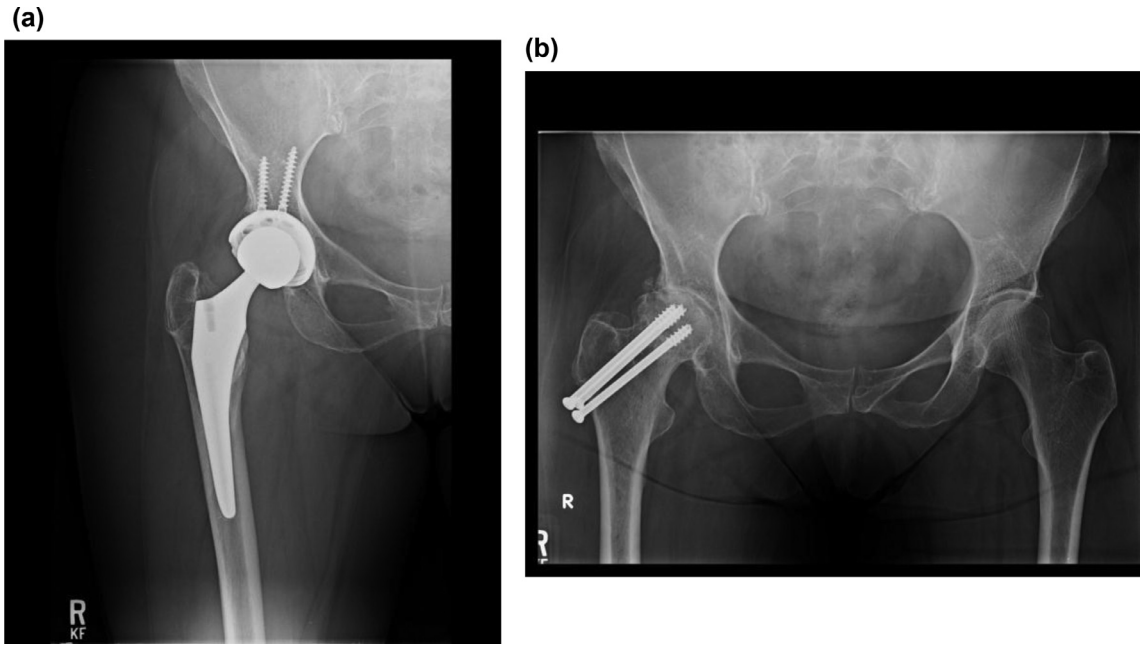

Figure 1 (a and b) 67-year-old female 2 years following closed reduction and percutaneous pinning of right femoral neck fracture. Now has secondary arthritis of the right hip due to avascular necrosis. She was converted to total hip arthroplasty without complication through the direct anterior approach. A small lateral incision was made to remove the 3 screws separately.

through the screw. Poor exposure, insufficient paralysis, or osteoporotic bone may increase the risk of intraoperative fracture. Consideration should be given to a prophylactic calcar cable prior to femoral preparation. Finally, further thought to the use of a "fit and fill", collared, or cement stem in these situations vs a typical "blade" stem may provide additional support.

Failed Hip ORIF (Dynamic Hip Screw [DHS] and Cephalomedullary Nail [CMN])

Depending on the specific pattern, both intra- and extracapsular hip fractures can potentially be treated with DHS and/or CMN. Screw cutout in both the DHS and CMN is more common in older patients with osteoporotic bone and younger patients that likely put greater mechanical stress on their fixation. Stockton et al analyzed 796 young patients (ages 18-50, median of 43) treated with internal fixation for femoral neck fractures and found that 30% underwent reoperation at a median time of 16 months.[22] The most common reasons were implant removal (55%) and conversion THA (29%).[22] In all, 14% of the entire study population eventually underwent conversion THA.[22]

An important preoperative consideration in these cases is the ease of conversion after the specific index surgery. One study found lower intraoperative morbidity when converting from cannulated screws as opposed to DHS and CMN.[23] Evidence shows conversion to THA from CMN to be a more challenging procedure with higher rates of overall and orthopaedic-related complications (including intraoperative femur fractures) than conversion from a DHS.[24,25] Overall, conversion THA after DHS or CMN fixation is generally a successful procedure. Five-year survivorship free of operation was 95% and 94% when the index surgery was a DHS and CMN, respectively.[25]

Author Recommendations

Conversions of both DHS and CMN of modern-day designs are certainly more challenging than CRPP (Figs. 2 and 3). This challenge may be made even more difficult if the designs are decades old, encased in bone, discontinued, from unknown manufacturers, and/or come from outside the United States. Caution should be used when converting these implants through the direct anterior approach, especially the CMN. Full exposure of the greater trochanter and proximal femur will be necessary to extract the CMN and to insert a stem long enough to bypass any distal cross-locking screw holes by 2-3 cortical diameters (Fig. 4). Familiarity of the anatomy regarding extension of the anterior approach into the proximal femur is prudent prior to surgery and subvastus elevation is recommended.[26] With healed severely comminuted proximal femur fractures version control or distorted proximal anatomy may present a problem to stem placement, as will any heterotopic ossification (HO) present. Consider HO prophylaxis if necessary. Stems with either distal fixation and/or modularity may be necessary to address these issues. Significant abductor damage is frequently encountered either from the initial CMN placement or subsequent removal. Therefore, in the presence of significant abductor damage and other risk factors for dislocation, dual mobility implants

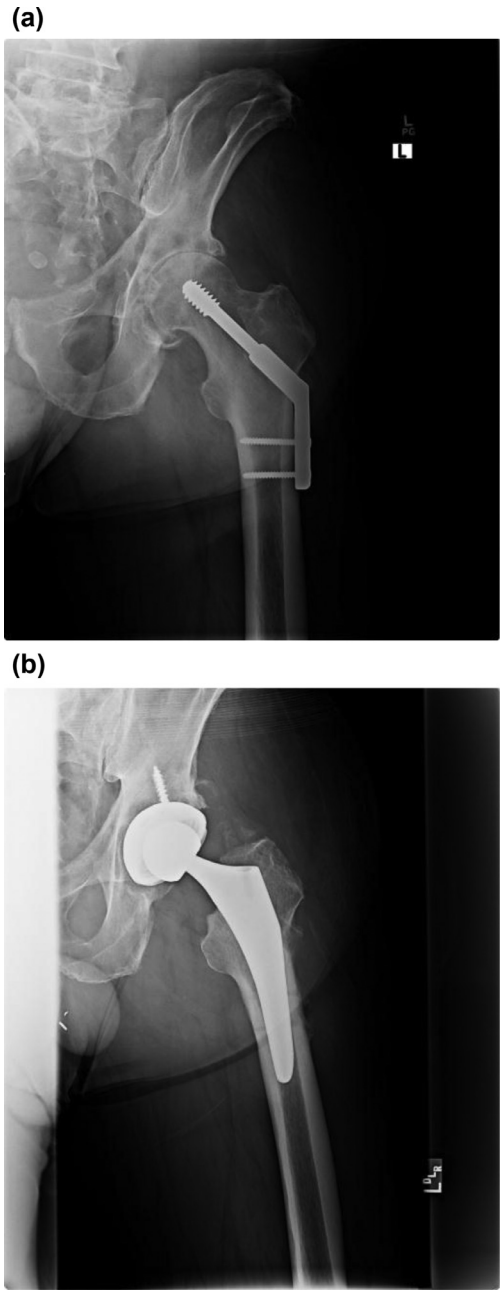

Figure 2 (a and b) 62-year-old male, 5 years status post open reduction and internal fixation of left intertrochanteric hip fracture with a sliding hip screw. This was converted to a total hip through the direct anterior approach. A small lateral incision was made to remove the sliding hip screw and plate.

can be considered. The DHS implant may create canal obliteration with sclerotic bone requiring the use of an intraoperative burr or in some cases fluoroscopy to ensure medullary canal placement of the stem without complication. Using a large enough diameter drill bit to pass a guidewire with subsequent reaming over the guidewire is a trusted technique. If there are any questions regarding implant fixation, guarded weight bearing is recommended. The consequences of reoperation in the first 3 months following THA surgery should be aggressively avoided if possible.[27]

Failed Acetabular ORIF

Fractures of the acetabulum represent a group of complex intra-articular injuries. They generally occur in a bimodal age distribution, with younger patients sustaining these injuries via high-energy trauma, while older patients sustain lower energy injuries.[28] Indications for conversion THA include post-traumatic osteoarthritis (OA), failure of fixation, and infection.[29] In a large study of 816 displaced acetabular fractures treated with ORIF, Tannast et al found that 9%, 12%, 15%, and 21% of patients were converted to THA after 2, 5, 10, and 20 years respectively.[30]

Clinical outcomes for conversion THA after failed acetabular ORIF are worse than primary THA. In one study, 10-year survivorship after conversion THA was significantly lower than matched patients who underwent primary THA for OA or osteonecrosis (70% vs 90%, $P< 0.001$).[31] Patients treated with conversion THA also were more likely to develop more serious complications than their counterparts, including infection, dislocation, acetabular loosening, and HO.[31]

Author Recommendations

The goals of conversion THA following acetabular fracture are similar to revision THA on the acetabular side. The goal is to achieve a stable implant in proper orientation with appropriate host bone coverage while also maintaining a hip center that is as close as possible to the native one. This may run a spectrum from minimal preoperative planning to consultation with a trauma surgeon regarding staging of hardware removal if the presence of extensive hardware is present. Staged hardware removal is necessary if the hardware is placed from a direction opposite of the planned conversion surgery approach. For example, acetabular ORIF hardware placed though an anterior-based incision should be removed at least 3 months (preferably 1 year) prior to a posteriorly based conversion surgery. Infection workup after hardware removal is recommended. One study found the incidence of PJI to be 3.8% when hardware removal and THA were done in a 2-stage procedure, and this increased to 8.6% in a 1-stage procedure.[32] In either scenario, the authors recommended tissue analysis for infection to be done when the hardware is removed.[32] Only the hardware necessary to be removed to ensure proper acetabular cup placement should be performed. Extensive dissections to remove all hardware prior to conversion surgery should be avoided. Single screws should likely be left alone as they can be addressed with a metal cutting burr at the time of conversion surgery. Care must be taken to control for metal debris if any hardware is going to be cut at the time of conversion surgery. HO prophylaxis should be considered if risk factors exist. Consider the use of modular stems if a high hip center is necessary due to excessive bone loss, but restoration of the native hip center is generally recommended. Native hip center can be achieved with the use of augments or off-center cups (ie, Stryker RAAS cup). If multiple dislocation risk factors are present, the use of a dual mobility

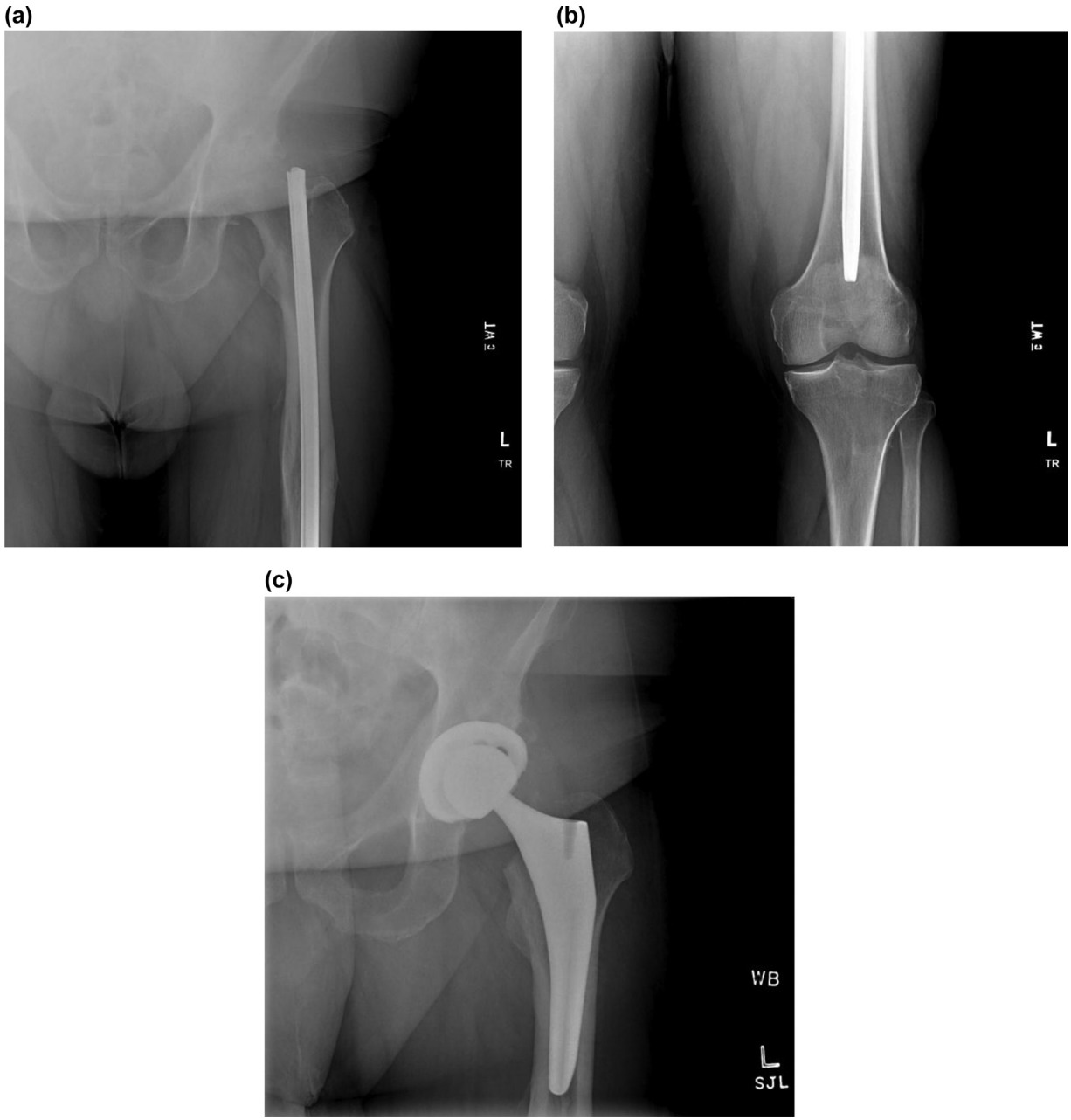

Figure 3 (a-c) 57-year-old male, 25 years status post IM nailing of left femur with Kuschner nail, now with osteoarthritis of left hip. The hardware was identified pre op and appropriate equipment available for removal as the implant was quite old. Through a direct lateral approach the nail was removed and a total hip arthroplasty performed without complication.

liner should be considered. Generally, most of the cases can be completed with the use of a hemispherical jumbo cup. In the presence of pelvic discontinuity, posterior column plating (or not removing an existing posterior column plate) for tension band effect, pelvic distraction technique, cup/cage, or custom triflange cups are all acceptable options depending on the situation. Surgical approach for the acetabular conversion should be based on many factors including patient body habitus, associated comorbidities, difficulty level of revision surgery, previous procedures, possibility for future surgeries, and surgeon surgical experience.

Previous Dysplasia Surgery

Patients with developmental dysplasia of the hip (DDH) have abnormal hip anatomy, including a shallow acetabulum, ligamentous laxity, and the potential for an abnormal proximal femur.[33] DDH can lead to a decreased contact area and edge loading of the acetabular rim as a result of femoral head uncoverage. Regarding femoral changes, there is often increased femoral anteversion and high valgus neck-shaft angles. DDH is the most common cause of end stage OA in patients under age 50.[33] A frequently performed surgical treatment option for DDH on the acetabular side is a

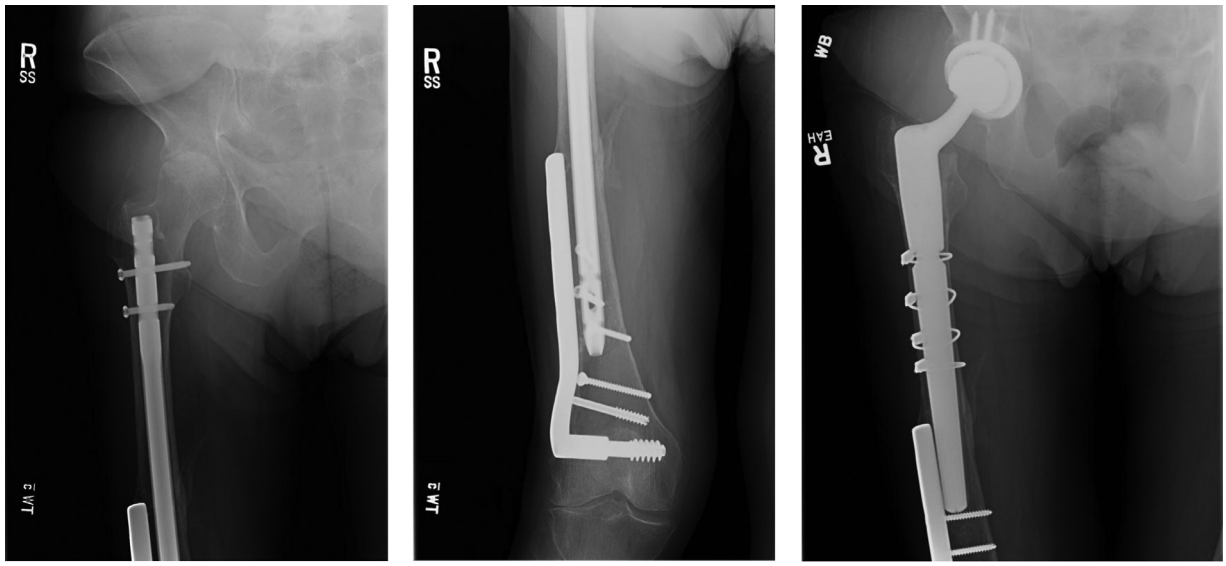

Figure 4 (a-c) 87-year-old female status post multiple fracture to her right femur, now with end stage arthritis of right hip. The femur has an intramedullary nail and blade plate distally. Through a direct lateral approach, the nail is removed. A total hip arthroplasty is performed but is complicated by periprosthetic femur fracture due to poor bone quality. This was repaired with several cerclage cables. Ultimately did well with partial weight bearing for 8 weeks. Post-op radiographs are 1 year following surgery.

periacetabular osteotomy. There are also femoral sided surgeries that can be performed for DDH such as a varus derotational osteotomy.

Lerch et al found following periacetabular osteotomy at 30-year follow-up; 70% had developed significant pain, OA, or underwent a conversion THA.[34] Van Stralen et al found that the need for conversion THA was 13% at 15 years, 24% at 20 years, and 33% at 25 years.[35] Tamaki et al compared 3 types of acetabular osteotomies (Chiari osteotomy, rotational periacetabular osteotomy, and shelf acetabuloplasty) to determine the type most conducive to future conversion THA using a direct anterior approach.[36] The conversion rotational periacetabular osteotomy group had longer operative times and utilized more bulk bone graft vs Chiari osteotomy and shelf acetabuloplasty. Neither the Chiari osteotomy nor shelf acetabuloplasty had a significant difference in operative time or blood loss when comparing to the control (primary THA) (Fig. 5).[36] There may be posterior wall defects due to the anterior and lateral rotation of the osteotomized acetabular fragment. There is also a possibility for the osteotomized acetabular fragment to collapse which leads to proximal migration of the femoral head causing anterior and posterior wall defects at the native acetabulum site.[36]

Regarding conversion THA outcomes, Parvizi et al found at an average of 6.9 years, 4.9% of the conversion THA patients (2 out of 41 patients) had revisions of the conversion THA due to component loosening.[37] Amanatullah et al found in a matched cohort, no significant differences following THA in patients with and without previous periacetabular osteotomy.[38] However, their study was admittedly underpowered even with 15 years of patient data across 2 high volume centers (Mayo Clinic and Washington University).

Author Recommendations

A complete review regarding the potential intraoperative challenges of THA for dysplasia on the acetabular or femoral side is beyond the scope of this chapter but has been provided by Greber et al.[39] Regarding potential staging of hardware removal on the acetabular side, please see the author recommendations from the section on "Failed Acetabular ORIF" as the considerations and challenges will be similar. Similarly, potential issues to be addressed on the femoral side are like the challenges and considerations of "Failed Femoral ORIF" specifically CMN or DHS removal.

Hip Fusion

Hip fusions are rarely performed in the United States. However, the traditional indications are younger and highly active patients with monoarticular hip arthrosis. However, certain conditions may present with a pseudoarthrosis or autofusion and therefore present with similar clinical challenges. The incidence of arthrodesis conversion is 13%-21%.[40] Kim et al found the 10-year revision rate for conversion THA after hip fusion to be 16% for surgical fusion patients and 18% for spontaneous fusion patients.[41]

Conversion hip arthrodesis to THA has unique intraoperative challenges with complication rates as high as 54%.[42] Nonunion, fracture, heterotopic ossification, infection, nerve palsies, and abductor muscle damage leading to dislocation are some possible adverse outcomes.[40,42] Since there will be some degree of abductor atrophy and fibrosis secondary to the fusion, it is not uncommon for these patients to exhibit a

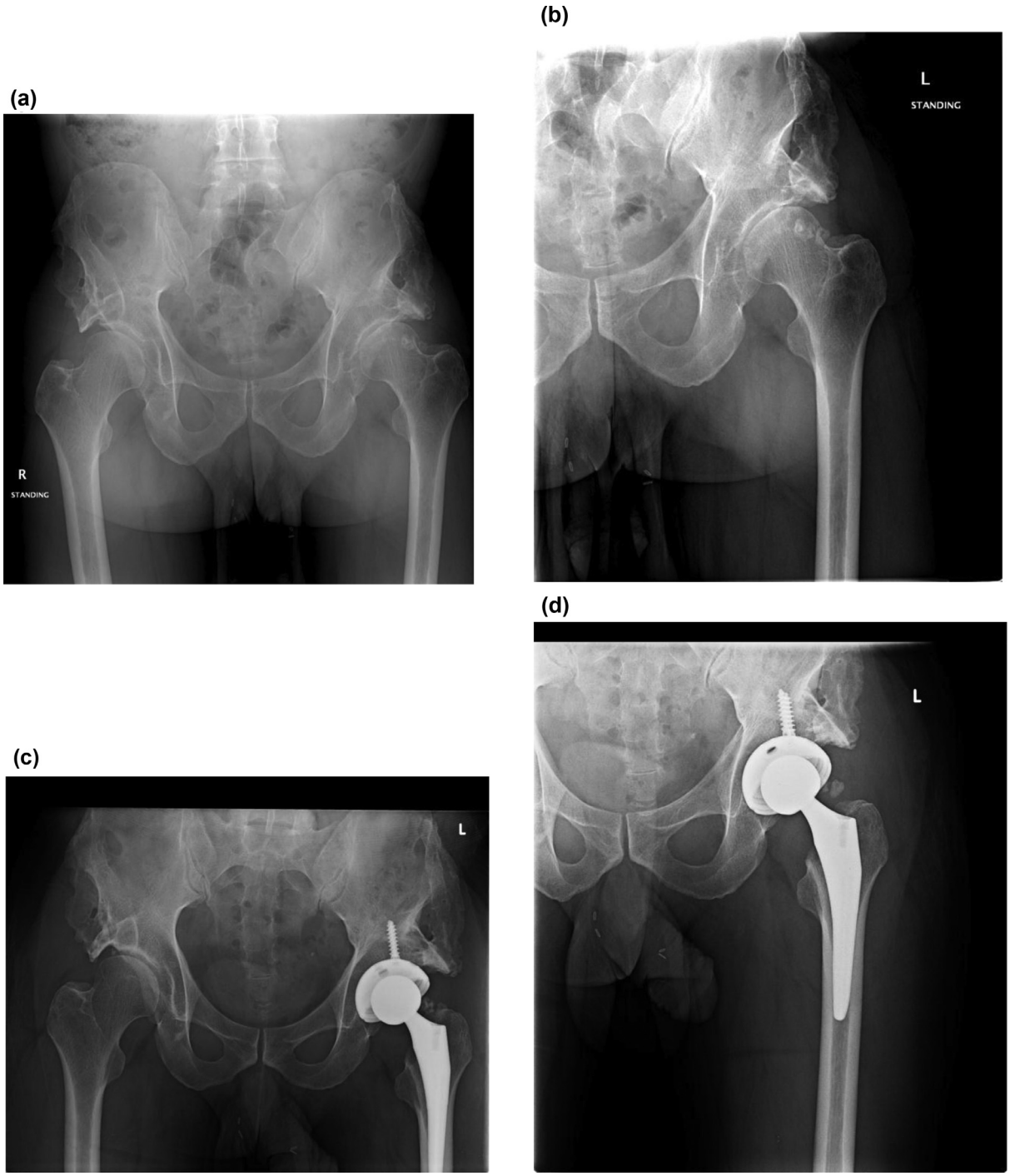

Figure 5 (a, b, and c, d) 47-year-old male, status post acetatabular osteotomy for dysplasia as a child. Now with degenerative arthritis of the left hip. Underwent uncomplicated THA through the anterior approach.

Trendelenburg sign and limb length discrepancy.[40] While it is controversial as to how to evaluate the abductors, Celiktas et al and Kim et al believe the best method is intraoperative observation of red, bleeding abductors and gluteal muscles.[40,41] Some studies have evaluated electromyography (EMG) and muscle biopsies as a possible way to assess abductor function preoperatively; however, they found no clinically significant data to suggest that EMG and biopsies accurately assessed abductor function.[41,43]

Although not an explicit complication of conversion THA, studies have shown that the pain in adjacent joints may not be eliminated with surgery and may actually progress.[44] Kim et al and Flecher et al showed that in conversion THA cases, the majority of patients have resolution of their adjacent joint pain.[41,45] However, 37% of the patients with preoperative ipsilateral knee pain and 6% with preoperative back pain continued to have pain after surgery or progressed to the need for surgery.[41]

Author Recommendations

Femoral mobilization is key in order to visualize the acetabulum to ensure cup placement in proper orientation and to avoid an intraoperative femur fracture. Familiarity with advanced extensile approaches should be expected. For the posterior approach, this may include release of the gluteal sling, anterior capsule, or iliopsoas tendon to provide femoral mobilization and protection of the sciatic nerve. For the anterior approach, this may involve both extensive release of the posterior structures and release of the illiotibial band off the iliac crest either by soft tissue release or osteotomy. After extensive posterior structure release, any potential stability benefits of the anterior approach may be nullified. Identifying the true acetabulum may be difficult and the use of an intraoperative x-ray may be necessary to ensure proper height and depth of cup placement.

Failed Hemiarthroplasty (Bipolar or Unipolar)

Hemiarthroplasty is a common treatment for femoral neck fractures when the patient is a noncommunity ambulator. Bayam found that the most common reason for conversion THA from HA was for acetabular erosion (62%) with an average time to conversion THA of 5 years.[46] There are 5 categories of hemiarthroplasty failure: an acetabular issue, a femoral issue, a combination of femoral and acetabular issues, instability, and infection.[47] The incidence of dislocation after hemiarthroplasty varies depending on the approach. Abram et al. when comparing approaches found that the posterior approach hemiarthroplasty had a higher dislocation rate compared to anterolateral approach (13% vs 2%).[48] When closed reduction cannot be obtained, a conversion THA is the gold standard for treatment.[49]

However, there continues to be a risk of dislocation after conversion THA from an unstable hemiarthroplasty. The dislocation rate is 16%-22% after conversion THA as compared to a dislocation rate of around 10% after revision of primary THA.[50,51] The proposed reasons for dislocation following conversion THA from the index hemiarthroplasty are: malpositioned retained femoral stem (usually retroverted), malpositioned acetabular implant, older age, or decreased diameter and offset of the femoral head can lead to decreased soft tissue tension around the joint.[50,52] Figved et al showed a lower risk of instability when the femoral stem was revised which provides evidence for stem revision if femoral implant position is suboptimal and clearly a source of instability.[53] Another option to decrease conversion THA dislocation rates is to use dual mobility cups which reproduce a large femoral head. The dual mobility cup increases the stability by increasing the head to neck ratio and jump distance. Carulli et al and Chalmers et al found there was no recurrence of dislocation with the dual mobility cups in conversion THA patients from an index hemiarthroplasty.[49,52]

Author Recommendations

Conversion of a failed hemiarthroplasty will be dictated by the cause of failure as outlined above. However, instability deserves further commentary due to its multifactorial and demanding nature. The senior author has anecdotally found that the stability of a hemiarthroplasty through a posterior approach is on average not as stable intraoperatively as a THA performed through the same posterior approach. The hypothesis is, the increased hemiarthroplasty instability is due to a lack of control of native acetabular version, inclination, and subsequent "capture" of the femoral head in the hemiarthroplasty situation. If appropriate intraoperative stability cannot be achieved during an index hemiarthroplasty, placement of an acetabular implant in order to gain control of acetabular orientation is the most prudent solution. Continued intraoperative or postoperative instability following conversion may require dual mobility or constrained liners. In the highly unstable post conversion THA setting, it is usually best to wait 3 months to allow for soft tissue recovery to mitigate infection risk and allow osseointegration of the acetabular component. Placing constrained liners in active patients with malposition implants (or even well positioned implants) has a relatively poor midterm track record and should only be considered in exceptional situations.

Failed Resurfacing

Hip resurfacing arthroplasty (HRA) was designed to provide an alternative to a THA in younger, active patients. The modern HRA was designed to improve the wear, decrease dislocations, and preserve proximal femoral bone stock.[54] HRA can fail through infection, dislocation, aseptic loosening, femoral neck fracture, and metal-on-metal (MOM) complications.[55] The Australian Joint Replacement Registry reported a cumulative HRA revision rate of 9.5% at 10 years. They identified female gender, DDH, and femoral head sizes <49 mm as significant risk factors.

Langton et al completed a study that compared ASR, BHR, and the conserve plus HRA systems to see which had the higher rate of revision secondary to ALTR.[56] They found that ASR had the highest rate ranging from 3.4% to 6.3% depending on the center. BHR had a revision rate of 0.45%-1.2%. Conserve plus had a revision rate of 0.42% but a smaller follow-up window of 37 months on average compared to 65-68 months on average for the other 2 systems. The Finnish Arthroplasty Register found the 8-year survival rate to be 88% with the BHR system having the highest survival (93%).[57] A full review of MOM implant workup is beyond the scope of this chapter but should include serum cobalt and chrome metal ion levels, inflammatory markers, and cross-sectional imaging in order to make the diagnosis of ALTR.[54]

MOM adverse events can mimic infection and vice-versa, and the diagnosis of concurrent PJI can at times be particularly challenging.[58] A manual count of the synovial WBC must be performed, as the metallic particles will register as WBCs on the automated cell counters. Okroj et al found that there was a 31% false positive rate with alpha-defensin testing.[58] They also

observed that the false positive patients had a higher ESR, CRP, and synovial WBC than the true negative patients.[58]

When revising the HRA monoblock system to a THA, one of the decisions is whether to revise the shell. It is possible to retain the shell and convert to a dual mobility THA if the acetabular shell is positioned correctly and well fixed. The conversion to a dual mobility THA results in decreased dislocation rates, shorter operating times, and increased retention of the native bone stock.[54] If the acetabular shell is going to remain, there is the potential for the acetabular bearing surface to be worn or have a deformity which can lead to an increased rate of wear of the outer dual-mobility bearing, especially if the shell and liner are from different companies. The mating of shells and liners from different companies is considered "off label" and not Food and Drug Administration approved.[54] Discussions regarding "off label" use of devices should be documented in the informed consent prior to surgery. Conversions of HRA for ALTR are associated with high complication rates. Connelly et al reported following conversion there is an overall complication rate of 45% and a subsequent revision rate of 38%.[59]

Author Recommendations

When an HRA requires conversion, the technical portion of the surgery can range from relatively straightforward to extremely challenging. If the cup is well fixed, in optimum position, and without articulating surface damage cup retention should be attempted with the same manufacturer. If the patient is relatively young or there are issues with the acetabular component, either a low threshold for or a mandatory cup revision should be performed, respectively. The presence of severe or complete abductor deficiency is an indication for dual mobility with or without attempted soft tissue repair. With cup revision, great attention should be paid to cup position both for initial stability and optimal positioning for a constrained liner later.

Conclusion

Currently, conversion THA is considered equivalent to primary THA in resource utilization as judged by MS-DRG and RVU/minute reimbursement. Studies citing the increased technical complexity of these surgeries combined with the increased LOS and complication rates support the statement that current reimbursement strategies do not appear to be reasonable for healthcare organizations or surgeons. Several subtypes of conversion THA exist and each has unique challenges depending on prior surgeries and potential anatomical abnormalities. Although technically challenging and financially costly, conversion THA in many scenarios should be considered a salvage procedure with net positive outcomes.

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