

# Open Surgical Treatment: Advantages and Potential Complications of Modern Surgical Approaches

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Hany Bedair

## Introduction

Although the arthroscopic treatment of hip diseases has experienced enormous popularity with an explosion in surgical techniques and instruments to treat a vast array of pathologies, there are limitations to hip arthroscopy. There are certain conditions that are better addressed through open approaches and certainly many procedures where arthroscopy is not an option, like open reduction and internal fixation of pelvic fracture or total hip arthroplasty (THA). Many open approaches to the hip exist and hip surgeons should be facile with most, if not all, of these approaches. Certain surgical procedures demand the use of a specific approach, for example, the sliding trochanteric osteotomy for surgical dislocation of the hip or a posterior approach for the fixation of a posterior column fracture, but for most procedures, more than one approach can safely and effectively be used. There are specific approaches that are almost exclusively used for pediatric patients and pediatric diseases, such as the Ludloff and Ferguson approaches, that will not specifically be addressed in this chapter. The choice of approach is often based on surgeon comfort level, experience, the need for an extensile approach, or perceived benefits of one approach over another. As most of the reports of complications regarding various approaches to the hip have been reported in relation to THA, data presented in the chapter will necessarily be biased toward hip arthroplasty, but fundamentally similar for any surgery performed through a specific approach.

The zeal for potential benefits of different open approaches can sometimes overshadow the potential complications. In THA, for example, the two-incision approach was touted as a muscle sparing, minimally invasive approach for total hip

replacement that resulted in early recovery, reduced pain, and high levels of patient satisfaction. As many surgeons began to adopt this technique and it was critically studied [1], it became clear that these advantages were most likely due to the perioperative management protocols rather than the surgical approach itself and that this approach was associated with higher rates of complications compared to other approaches [2]. Potential complications of a surgical approach should be clearly understood from the etiology to rates of occurrence so that the surgeon may make the optimal choice of approach for each individual patient.

## Direct Anterior

The anterior approach was described by Smith-Petersen in 1917 [3] and then later in 1949 for the mold arthroplasty. It has been and can be used for multiple procedures including the reduction of congenital hip dislocation, debridement of a septic joint, labral repair and osteoplasty, as well as THA. The direct anterior approach to the hip recently has gained popularity for THA with the development of specialized retractors, instruments, and traction tables and more resembles the approach described by Hueter in 1883 [4].

This approach takes advantage of the intermuscular and internervous planes superficially between the sartorius (femoral nerve) and tensor fascia lata (superior gluteal nerve) and deep between the rectus femoris (femoral nerve) and the gluteus medius (superior gluteal nerve), providing excellent exposure to the acetabulum and a limited exposure to the proximal femur. The patient is positioned supine.

## Anatomic Consideration

There are several potential complications to this approach, the most common being injury to the lateral femoral cutaneous nerve (LFCN) which lies on the sartorius muscle. Incising the fascia over the TFL more laterally to the interval

H. Bedair, MD (✉)  
Department of Orthopaedic Surgery, Massachusetts General Hospital/Newton Wellesley Hospital, 55 Fruit Street, Boston, MA 02114, USA  
e-mail: [HBEDAIR@mgh.harvard.edu](mailto:HBEDAIR@mgh.harvard.edu); [hbedair@partners.org](mailto:hbedair@partners.org)

between the sartorius and TFL can best mitigate this complication by avoiding the LFCN and keeping it medial to the plane of dissection along with the sartorius. The TFL is retracted laterally and the deep fascia overlying the hip joint accessed. Another common complication is inadvertent injury to the ascending branches of the lateral circumflex vessels of the hip. If dissection is needed far enough distally to encounter these vessels, they should be identified and either ligated or cauterized as they can be a significant source of intraoperative bleeding. The release of the reflected head of the rectus femoris is required to obtain adequate exposure, but the clinical significance of this is unknown. Other potential complications are related to suboptimal access to the proximal femur, particularly in muscular males, which may hinder completion of the preparation of the femur in THA. This can result in undersized stems, malposition of components, femoral fracture, perforation of the lateral or posterior cortex, and inadvertent cutting or fracture of the greater trochanter. Unfortunately, due to the limited possibility to extend this approach, addressing these complications can be difficult, if not impossible. Increased surgical time and complications related to traction tables, including pudendal nerve injuries, ankle fractures, and medial collateral ligament injuries of the knee, have all been reported [5].

### Clinical Considerations

The direct anterior approach is best suited for those patients with low BMI who are flexible and nonmuscular and who have no significant femoral deformity or retained hardware. The concern with this approach in larger patients may be related to large abdominal pannus that may overhang onto the incision resulting in wound healing problems [6]. Advocates of this approach claim that due to the relative lack of subcutaneous adipose tissue anteriorly compared to laterally and posteriorly, this approach may be easier than others in large patients. Roue et al. [7] prospectively compared patients with BMI <25 and >25 and observed longer operative times, increased blood loss, incision extension, and abrasions in the larger patients with the anterior approach. Component positioning and infection rates were not different. Restrepo et al. [8] compared patients with BMI <30 undergoing THA through a direct anterior vs. a direct lateral approach and found no differences in complication rates and modest short-term improvement (<2 years) in patient-reported outcome measures in the direct anterior group. Barrett et al. [9] reported on a prospective randomized trial of direct anterior THA vs. posterior THA. These authors reported only minimal improvement in function in the direct anterior group that did not exceed 6 weeks postoperatively for most measures and no difference in any measure beyond 3 months. There were no differences in complication rates. The most common complication, injury to the LFCN, was reported on by Goulding et al. [10] with 81 % of patients reporting symptoms

of neurapraxia after THA using the direct anterior approach and only 6 % having complete resolution at 1 year. Barton et al. [5] reviewed reported complication rates after direct anterior THA including femoral canal perforation in 0.5 %, femoral fracture of up to 2.2 %, and dislocation rates ranging between 0.6 and 1.5 %. As with the adoption of any new surgical technique or approach, challenges may be expected. Many authors have reported on the “learning curve” associated with the use of the direct anterior approach to the hip for THA during which time complications including increased operative time and femoral fractures have been reported at higher rates, particularly during the first 100 cases [11].

### Watson-Jones

Often referred to as the anterolateral approach to the hip, this approach, popularized by Watson-Jones [12] and modified later by others such as Charnley, Muller, and Harris, is primarily used for THA and open reduction and internal fixation of femoral neck fractures. This approach utilizes the intermuscular, intraneurvous plane between the tensor fascia lata (superior gluteal nerve) and the gluteus medius (superior gluteal nerve). Traditionally combined with a trochanteric osteotomy or the release of the abductor musculature from the greater trochanter, the use of specialized surgical tables, instruments, and variations in surgical technique allows total hip replacement through this approach without disruption of the abductor complex. The patient can be positioned supine or lateral for this approach.

### Anatomic Considerations

The most common complications are problems associated with the abductor muscle complex. Nonunion and malunion of the trochanteric osteotomy, if performed, can occur. Prominent fixation devices used for the osteotomy may cause pain. Limping or, in severe cases, hip instability can occur from failure to reconstitute the abductor complex, whether from failed fixation of osteotomy or failed repair of the abductor muscle tendons to the greater trochanter [13]. Other complications relate to neurapraxias of the femoral nerve due to aggressive retraction. Injury to the superior gluteal vessels and nerve may also occur if this approach is extended proximally into the tensor fascia lata. The ability to convert this approach to a more extensile one is quite limited [14].

### Clinical Considerations

Early encouraging reports for this approach for THA are related to its abductor sparing approach and early postoperative function. In a multicenter prospective randomized clinical trial of this approach for THA compared to direct lateral

or posterior [15], there was no difference in patient-reported quality of life or satisfaction. However, the complications related to femoral-sided fracture and subsidence were significantly higher in the Watson-Jones group compared to the others, and the authors of this study have abandoned this technique. Other authors have also reported problems related to femoral component malalignment [16], with no difference in clinical outcomes in terms of gait [17] or patient-reported outcome measures [18].

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## Direct Lateral

The direct lateral approach, often referred to as the Hardinge approach due to his popularization of it [19], is an extensile approach used largely for hip arthroplasty. This approach uses an intramuscular, intranervous plane through the gluteus medius (superior gluteal nerve) superiorly and the vastus lateralis (femoral nerve) distally. The tendinous insertion of the gluteus medius onto the greater trochanter is partially elevated anteriorly (usually the anterior one third), while the muscles of the gluteus medius and vastus lateralis are split in line with their muscle fibers to create a large anterior-based sleeve of tissue. The patient is most often positioned laterally for this approach but can also be positioned supine.

## Anatomic Considerations

Potential complications with this approach include injury to the superior gluteal nerve, which innervates the gluteus medius proximal to the greater trochanter in line with the dissection [20]. Care must be taken not to carry the dissection too far proximally (3–5 cm) as denervation of the abductor complex may lead to limp and hip instability. These problems may also arise if the abductor tendon repair fails to heal or trochanteric fracture occurs through drill holes often made through the trochanter and used to repair the tendon [21]. The transverse branch of the lateral circumflex artery of the thigh is also at risk of injury as the vastus lateralis is split and should be cauterized to avoid excessive bleeding. This approach can be extended distally if needed, but proximal extension is limited by the superior gluteal nerve.

## Clinical Considerations

One of the main potential advantages of the direct lateral approach is a lower dislocation rate reported in various studies. Krenzel et al. [22] reported a 0.37% dislocation rate with this approach compared to 3.6% in the posterior approach to the hip after THA. Many studies have reported on these types of findings; however, in a thorough literature review

using criteria set forth through the Cochrane review database, Jolles et al. [23] found no evidence to support the claim that this approach lowered the rate of postoperative dislocation compared to the posterior approach. Moreover these authors reported that the only difference between the direct lateral and the posterior approach was a higher rate of nerve injury in the direct lateral group as well as restricted motion in the direct lateral group, specifically internal rotation in extension. Using electrophysiological testing, Ramesh et al. [20] reported on 81 patients undergoing THA using the direct lateral approach and found that 23% showed evidence of superior gluteal nerve damage 2 weeks after surgery and that a stunning 11% (9/81) showed no evidence of recovery at 1 year. Demos et al. [24] reported an 11.6% rate of moderate to severe limp and a 2.5% rate of heterotopic ossification after direct lateral THA at a minimum of 1 year after surgery. Harwin et al. [25] reported a 14.8% rate of heterotopic ossification after this approach. Iorio et al. [26] reported a 4.9% rate of lateral trochanteric pain after lateral approach for THA compared to 1.2% after posterior approach.

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## Posterior

The posterior approach to the hip is the most widely used approach and can be used for hip arthroplasty, open reduction and internal fixation of posterior acetabular fractures, and hip irrigation and drainage for sepsis. It was first described by Langenbeck for drainage of infection in 1874 [27]. It has since acquired a variety of names, including “posterolateral,” “Southern” (for the point of the compass), Kocher-Langenbeck, and Moore. This approach uses an intranervous, intramuscular plane through the gluteus maximus (inferior gluteal nerve) superficially. The deep dissection is carried out posterior to the abductor muscle complex and requires the release of the short external rotators of the hip. Patients are usually positioned laterally.

## Anatomic Considerations

Complications from this approach are usually related to injury of the sciatic nerve. Though relatively rarely encountered in this approach, the sciatic nerve can be compressed by errant retraction or failure to release the gluteus maximus tendon which can compress the sciatic nerve as it travels below the tendon in the posterior thigh, particularly when the leg is rotated for femoral preparation in hip arthroplasty [28]. Other complications related to the posterior approach are those of hip instability, particularly if the procedure is performed without repair of the posterior capsule. This approach is extensile both proximally and distally and considered the workhorse approach for revision hip surgery.

## Clinical Considerations

The most commonly perceived complication after THA through a posterior approach is dislocation. This has been studied extensively and most authors have reported dislocation rates that are slightly higher, but comparable to those with other approaches, particularly with modern implants that appropriately restore offset and have larger heads and if a posterior capsular repair is performed [29–31]. As mentioned above, a Cochrane systematic review did not find any difference in dislocation rates between the posterior and direct lateral approaches to the hip [23].

However, uncommonly, the repair of the short external rotators may fail, despite adequate suturing, leading to frank instability, a fluid collection continuous with the joint, or subtle symptoms of weakness or discomfort. A good quality MRI may demonstrate the problem [32].

Multiple authors have investigated the rate of nerve palsy (particularly sciatic nerve) after posterior approach to the hip. In a large series of 1000 patients, Navarro et al. [33] reported a 0.6% rate of nerve injury. The authors of this study concluded that the most likely factor contributing to nerve injury after hip surgery was not the approach but rather the complexity of the surgical procedure. Hurd et al. reduced their rate of sciatic nerve injury to zero by releasing the gluteus maximus tendon [28]. Similarly Weale et al. [34] reported that although not clinically appreciated, subclinical nerve injuries may be detected by electrophysiology.

Though reported to be abductor and muscle sparing, muscle damage, as measured by serum creatinine kinase levels, appears to be greater with this approach compared to the direct anterior, but overall markers of systemic inflammation are no different [35]. Component positioning, one of the most important factors for long-term survival of any arthroplasty, is reported to be most accurate with the posterior approach compared to the direct lateral and two-incision THA [36].

## Conclusion

Open approaches to the hip continue to be necessary for the vast majority of treatments for diseases of the hip. Owing to its large size and multiple muscle and tissue planes, there exist many different modern surgical approaches. While in some cases the disease pathology dictates only one approach, many procedures can be safely accomplished through several different approaches. While each approach may have certain advantages and disadvantages, it is critical that the surgeon understand all of these in order to provide safe surgical care while optimizing clinical outcomes.

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