



OPTIONS FOR TOTAL HIP ARTHROPLASTY SURGICAL APPROACHES

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ABSTRACT

Total hip arthroplasty (THA) is a highly successful surgical technique that greatly reduces pain and improves general well-being in people with hip osteoarthritis. Total hip arthroplasty can be performed using one of several surgical approaches. The most common approaches are the Direct Anterior Approach (DAA), Lateral Approach (LA), and Posterior Approach (PA). Each approach has its own set of advantages and disadvantages. Even though the Posterior Approach is the most commonly used, it is crucial to highlight that other techniques have drawbacks in terms of infection rates, bone loss, and ease of access. This article highlights the methodology for each surgical approach and provides a full examination of outcomes and associated complications.

INTRODUCTION

Total hip arthroplasty (THA) is a highly successful surgical technique that greatly reduces pain and improves general well-being in people with hip osteoarthritis [1]. According to extensive studies, this surgery has a 10-year survival rate of more than 95% [2]. The annual number of total hip arthroplasty surgeries now exceeds more than one million and is expected to reach two million by 2030. This type of surgery can be performed via a variety of surgical approaches, including the Lateral Approach (LA), Direct Anterior Approach (DAA), and Posterior Approach (PA), each with its own set of benefits and drawbacks [3].

When using the posterior approach, the gluteus maximus muscle is cut in half to get to the femur and acetabulum without affecting the hip abductors. This method, however, has a higher dislocation rate than the other methods. The lateral approach, on the other hand, entails separating the gluteus medius

muscle to get access to the hip from the anterolateral side. Although this surgical method has the lowest risk of dislocation, it is associated with potential complications such as superior gluteal nerve injury, reduced abductor function, and heterotopic ossification [4].

The Direct Anterior Approach is distinguished by the intermuscular and inter-nervous separation of the tensor fascia lata and sartorius. The advantages of this approach include lower dislocation risks, quicker recovery, and shorter hospitalization [5]. However, there are certain disadvantages, such as a steeper learning curve, a higher risk of periprosthetic fractures, and an increased risk of Lateral Femoral Cutaneous Nerve (LFCN) injury. This highlights the methodology for each surgical strategy, as well as a full examination of outcomes and associated complications.

DIRECT ANTERIOR APPROACH

The Direct Anterior Approach (DAA) enters the hip via the intermuscular plane between the tensor fasciae lata and gluteus medius on the sides and the sartorius muscle and rectus fascia in the center [6]. In comparison to the posterior approach, this method is recognized for preserving hip joint stability, making it a soft tissue-sparing treatment. With the DAA, patients have shown rapid recovery in terms of functionality and activity, indicating its potential advantages over alternative therapies [7]. Furthermore, when compared to other surgical procedures, the Direct Anterior Approach dramatically reduces the use of narcotics after the operation [8]. Hospital stays are shorter, and more patients are discharged directly rather than being transported to postoperative care facilities. Recovery of motor function is faster, and the time required to ambulate without assistance is shorter. Moreover, patients stopped using walkers or canes in 21 days on average [9].

In contrast to another surgical approach called the posterior approach, the Direct Anterior Approach is more accurate in positioning a hip component called the acetabular cup [10]. The acetabular cup has a modest tendency to be placed in a specific direction, but difficulties with it were less probable in the DAA than in the posterior approach. A nerve known as the LFCN (lateral femoral cutaneous nerve) may occasionally become damaged during hip surgery using the Direct Anterior Approach (DAA) [11]. This nerve, which originates from certain regions of the spine, is purely sensory. It follows a large muscle in the hip, crosses across to another muscle, and then passes beneath a bony area at the front of the hip [12].

The most crucial factor that can increase the likelihood of an LFCN injury is how the nerve divides into smaller branches. According to one study, the nerve can branch out in three ways: the anterior, posterior, and lateral branches of the lateral femoral cutaneous nerve [13]. Because of how it is positioned in relation to the cut made during surgery, the "lateral" branch is the most vulnerable to damage. It's difficult to predict the branching pattern before surgery, but understanding the various shapes the nerve can take can assist in preventing nerve damage. The risk of LFCN injury during surgery varies greatly between studies, ranging from extremely low to quite high. The good thing is that most nerve injuries do not result in major nerve disorders. People may have numbness or a burning sensation on the front and side of the leg, which is a painful condition but not life-threatening. There have been reports of an increasing number of cases where the surgery did not work well in the first few years after total hip arthroplasty, ranging from 24% to 50% [14]. This was frequently related to instability, alignment, or fractures in the artificial femur implant or hip socket. A study found that in these early cases, the Direct Anterior Approach (DAA) had more fractures close to the prosthetic femur and greater loosening than the Lateral and Posterior Approaches [15]. Furthermore, the DAA had a higher rate of early femoral component loosening than the other methods.

POSTERIOR APPROACH

The Posterior Approach can be traced back to 1874, when Bernhard Langenbeck used it to treat hip joint arthritis [16]. Adjustments were made over time to improve the view of the hip joint by removing tendons from the femur, such as the short external rotator tendons and the gluteus maximus tendon. Since then, the Posterior Approach has been the standard surgical approach for Total Hip Arthroplasty [17]. The patient remains lying on their side throughout this treatment. A cushioned board is used to support the pelvis in front of the pubic symphysis and chest, as well as behind the shoulder blades.

Furthermore, to reduce the occurrence of brachial plexopathy, a padded roll should be placed beneath the contralateral chest wall. A 10- to 15-cm cut is made that curves one inch behind the back edge of the greater trochanter (GT). The cut starts 7 cm above and behind the GT, curves behind the GT, and continues down the shaft of the femur [18]. The cut then goes down and twists towards the higher iliac spine. This separates the skin and fat layer all the way to the fascia lata and the iliotibial band (ITB). After that, the ITB and fascia lata are divided lengthwise through the gluteus maximus. Retractors are used to separate the gluteus maximus even further and allow a better view of the piriformis and short external rotators (SERs). These SERs are then detached from the larger hip bone and moved to the back for better visualisation of the posterior part of the hip capsule.

RISK OF DISLOCATION

It has previously been established that the posterior approach has higher dislocation rates than the lateral approach. According to research, adopting the posterior approach results in a nearly 10% dislocation rate, whereas other techniques result in fewer dislocations [19]. Similarly, a systematic review of over 10,000 Total Hip Arthroplasties revealed that the posterior technique had a six-fold higher dislocation rate than the lateral method. The enhanced repair of the soft tissue capsule at the end of the surgical procedure substantially reduced the occurrence of dislocations and was a significant factor in this. Zhou and colleagues observed that Total Hip Arthroplasties (THAs) with the soft tissue capsule were restored and had reduced rates of dislocation compared to those without this repair [20]. Kwon and colleagues, on the other hand, demonstrated that employing the posterior approach (PA) with such repair resulted in higher dislocation rates than the lateral approach (LA) [21]. Another study, conducted by Meneghini and colleagues, found that the risk of greater dislocations was not substantially associated with the posterior approach [22].

In this study, inflammatory indicators were measured from the first to the fourth day following surgery. Inflammatory markers showed that the Direct Anterior Approach (DAA) reduced muscle injury. However, when the Harris hip scores were compared 6 months after surgery, no significant functional difference was seen between the two groups [23]. According to existing evidence, different surgical methods result in varying degrees of muscle injury [24]. Nonetheless, most studies show comparable outcomes 6 weeks following surgery, highlighting the need for more study in this area.

LATERAL APPROACH

The description of a lateral route for Total Hip Arthroplasty involved navigating the area between the gluteus minimus and medius tendons, as well as the vastus lateralis muscle. The femoral head was revealed as a result of this method. In 1954, Osborne introduced the lateral decubitus posture, which involves positioning the patient on their side [25]. Hardinge wrote about one of the most famous lateral approaches. It involved cutting the tendons of the gluteus medius and minimus muscles along their length and then continuing this cut down into the vastus lateralis tendon [26].

The area between the tensor fasciae lata and the gluteus medius tendon was the focus of this approach. The gluteus medius tendon was removed to allow anterior hip dislocation. Over the years, the Lateral Approach has undergone several changes and modifications. Variations included repositioning and regenerating the abductor muscles in different ways. The Rottinger technique, for example, modified the Lateral technique by carefully maintaining and removing the abductors before exposing the joint capsule.

The Lateral Approach (LA) is being used in a minimally invasive manner. Approaches that preserve the abductors have gained popularity in recent years, resulting in early recovery and enabling outpatients to complete hip programs. Nearly 99% of patients were successfully discharged on the day of total Hip Arthroplasty using the minimally invasive anterolateral technique. Furthermore, a study compared the Lateral Approach (LA) to the Direct Anterior Approach (DAA), examining muscle injury using preoperative and postoperative laboratory evaluations, muscle atrophy via MRI, and hip outcome scores [27]. The study confirmed that preoperative patient characteristics were consistent, and laboratory indicators used to quantify muscle injury included erythrocyte sedimentation rate (ESR), C-reactive protein (CRP), and acute inflammatory cytokines. Creatine

kinase and CRP levels were greater in patients receiving LA on postoperative day 4, but all test values returned to normal one month following Total Hip Arthroplasty (THA). Furthermore, MRI scans taken six months after surgery revealed an increase in gluteal fatty atrophy in patients who had undergone LA.

COMPLICATIONS USING DIFFERENT APPROACHES

Regardless of the surgical approach utilized for Total Hip Arthroplasty (THA), patients frequently have postoperative problems. Its outcomes have improved as implant design has advanced, sophisticated infection control techniques have been implemented, and minimally invasive approaches have been adopted. However, factors that contribute to possible THA failures, such as dislocation, implant misalignment, periprosthetic joint infection, and iliopsoas impingement, remain serious issues that must be addressed to improve THA's outcomes.

DISLOCATION

Dislocation, in which the hip implant slips out of place, is a common issue after receiving a new hip. Different factors, such as the size of the implant and how the operation was performed, can increase the likelihood of this occurring. According to research, being extremely overweight or having a fused spine can enhance the likelihood of dislocation [28]. A dislocation occurs when the forces acting on the implant are greater than the soft tissues that normally hold it in place. To avoid this, using a larger implant head, such as a 32 mm or 36 mm head, is a simple solution.

When bones or artificial hip parts touch or collide during hip movement, impingement can result in dislocation. This can occur if the bones or implants are not properly positioned or if there are excessive bone growths. A posterior pelvic tilt, lumbar fusion, or particular spine disorders can all increase the risk of dislocation. Fixing the hip capsule (the tissue that surrounds the joint) is critical to preventing dislocation. How the surgery is performed might also influence the likelihood of dislocation, with some methods making dislocation more likely. However, studies have shown that repairing the capsule during surgery can lessen the chance of dislocation, particularly when using the posterior route.

INFECTION

Periprosthetic joint infection (PJI) is a serious condition that can occur at any time following hip replacement surgery and is the leading complication. According to a recent study that used a patient record database, 0.3% of people required revision surgery for infection within 90 days after the operation [29]. Another study that looked at several studies observed that approximately 0.4% of participants had PJI [30]. Being extremely overweight, having an infection at the surgical site, having diabetes, lung or heart problems, and receiving a blood transfusion during the surgery all increase the risk of PJI.

To reduce the likelihood of infection after a hip replacement, it is critical to screen for certain risks before surgery. Antibiotics should be given around the time of operation to assist in avoiding infection. Using a specific liquid solution called povidone-iodine during surgery reduces the chance of infection. If there is an infection and the hip pieces are in place, the initial treatment option is to clear out the infection and administer antibiotics. If done early, usually within a week of when the infection begins, and if any removable portions of the implant are replaced, this has the best chance of functioning properly.

NERVE IMPINGEMENT

Iliopsoas impingement occurs when pain during hip bending is a concern after receiving a new hip joint. A study found that iliopsoas tendonitis (hip muscle inflammation) was diagnosed about 2.8 months following hip surgery [31]. Iliopsoas impingement symptoms appear after the patient has fully recovered, but not immediately after surgery. It was seen that iliopsoas impingement was more likely in women and people with a bigger acetabular to femoral head diameter.

Aside from hip muscle inflammation (iliopsoas tendonitis), the type of artificial hip utilized might occasionally cause other complications. Using metal parts and rubbing them against each other can cause complications more frequently. Nerve difficulties are another major complication that can arise after a hip replacement. Certain nerves in the hip area, such as the femoral and sciatic nerves, may be mistakenly injured during surgery.

Revision arthroplasty, dysplastic osteoarthritis, females, and limb elongation are all risk factors for nerve injury. Motor paralysis results from nerve injury, affecting patient activities and overall well-being following THA. Recovery from femoral nerve palsy is more predictable than recovery from a sciatic nerve injury.

FRACTURES

Other common complications following Total Hip Arthroplasty include discomfort and fractures surrounding the prosthetic joint. A comprehensive examination of 24 research articles on pain after surgery discovered various causes of discomfort, including adhesions, trochanteric bursitis, aberrant bone growth, neuropathic pain, and capsular fibrosis [32]. Out of these, aberrant bone development and bursitis were the easiest to diagnose using particular photographs of the joint, and they are frequently treatable with additional surgery. Furthermore, in elderly people with osteoporosis, periprosthetic fractures are a substantial issue after hip replacement surgery [33]. These fractures can occur at any time during or after surgery, including years later. FRAX scores, for example, aid in determining the risk of fractures caused by weak bones following hip surgery. Different drugs have been discovered and used to prevent bone loss and fractures following hip surgery in people with osteoporosis, but it is unclear how effective these treatments are in elderly people.

BONE AND BLOOD LOSS

There is frequent blood loss during a Total Hip Arthroplasty. This may necessitate a blood transfusion during the surgery, decreasing the chances of becoming ill or dying. According to one study, the anterolateral approach had the least amount of bleeding, while the posterolateral approach had the greatest amount of bleeding. Another study found that the anterolateral technique resulted in less estimated blood loss [34].

Another potential consequence of THA is bone loss, which must be considered when choosing any method. In one study, people with femoral neck fractures were given anterolateral and direct lateral approaches to see how they affected bone loss around the prosthesis [35]. Bone mineral density was used to measure bone loss. The study found that at 3 months, patients who had the direct lateral approach lost more bone than those who had not. This trend continued at 6 months. As a result, the surgical approach affects periprosthetic bone loss, and surgical procedures must be evaluated to reduce bone loss.

TRENDELENBURG SIGN

When a patient's hip abductors are weak, the Trendelenburg sign appears. Various surgical techniques in Total Hip Arthroplasty (THA) involve managing the gluteus medius differently—either dividing it, pushing it back, or leaving it undisturbed. The Trendelenburg gait is a documented long-term effect of THA, and surgeons should choose a technique that has the least impact on these muscles. A greater proportion of patients undergoing the LA displayed a favorable Trendelenburg sign in a controlled experiment comparing the Direct Anterior Approach (DAA) to the Lateral Approach (LA). Studies have shown that if individuals have not restored normal muscle strength after 24 months, they are unlikely to do so [36].

CONCLUSION

Total hip arthroplasty can be performed using one of several surgical methods. The most common approaches are the Direct Anterior Approach (DAA), Lateral Approach (LA), and Posterior Approach (PA). Each approach has its own set of advantages and disadvantages. Even though the Posterior Approach is the most commonly used, it is crucial to highlight that other techniques have drawbacks

in terms of infection rates, bone loss, and ease of access. As a result, surgeons must exercise caution when determining the best surgical strategy for each instance.

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Conflict in the Interest

The authors had no conflicts related to the interest in the execution of this study.

Permission

Prior to initiating the study, approval from the ethical committee was obtained to ensure adherence to ethical standards and guidelines.

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