

# The influence of surgical approach on outcomes of total hip arthroplasty

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## Abstract

The vast majority of total hip arthroplasty (THA) performed in the United Kingdom are undertaken using either a posterior or direct lateral approach. This review describes the functional outcomes of these approaches. Functional outcome can be assessed through motion capture of function, strength testing of muscle groups around the hip, and imaging of anatomical structures. Regardless of surgical approach, THA patients rarely return to the 'normal' gait exhibited by healthy age-matched controls. The direct lateral approach is associated with abductor deficiencies whilst the posterior approach may introduce extension and rotation deficits. How long functional differences persist between surgical approaches is unclear. The emergence of improved imaging technologies as well as isokinetic dynamometry (muscle strength testing) and 3D biomechanical modelling provide more comprehensive evaluations than traditional post-operative assessments such as radiology or couch examination. Targeted physiotherapy has been suggested as a possible intervention to counter lasting functional deficits. This review provides a foundation to inform surgeons of the impact of each approach to justify their surgical practice and may inform physical rehabilitation regimens post-surgery.

**Keywords** direct lateral approach; educational review; functional outcome; posterior approach; total hip arthroplasty

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## Introduction

Total hip arthroplasty (THA) is the gold-standard treatment for symptomatic hip osteoarthritis and relieves patients of the burden of daily pain and immobility. Despite the success of THA, there remains no consensus on which surgical approach produces superior functional outcomes.<sup>1</sup> To date, few studies have measured outcomes based on surgical approach, which is thought to potentially influence post-operative function in the hip joint.<sup>2</sup> As a result, surgeons generally adopt the techniques they were trained in often justifications for practice are grounded in anecdotal experience rather than following an evidence-based approach.

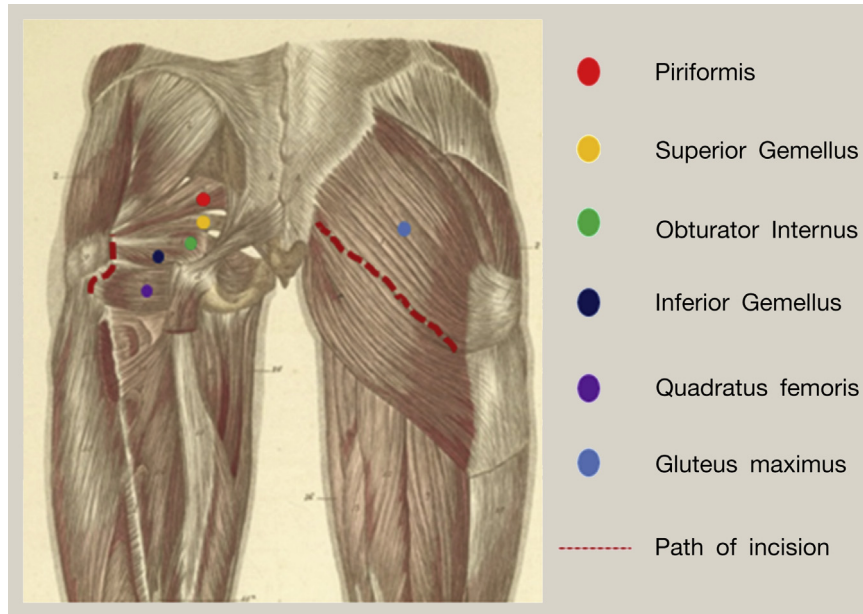
In the UK, 96% of THAs performed in 2014 were reported as utilizing either the posterior or direct lateral surgical approach.<sup>3</sup> Other approaches prominent in the literature are the muscle-sparing direct anterior approach (DAA) and anterolateral approach, which is known to disrupt the abductor compartment. This educational review focuses on the surgical advantages and disadvantages of the posterior and direct lateral approaches to THA, in addition to identifying the effects of these surgical approaches on global function describing post-operative gait and activities of daily living (ADLs), local function describing muscle strength around the hip, and iatrogenic damage of soft tissue hip structures.

## Surgical approaches

### Posterior approach

The posterior approach (PA), pioneered by Moore in 1957<sup>4</sup> is the main approach used in the UK and USA.<sup>3,5</sup> The patient lies in a lateral decubitus position and a 10–15 cm curved incision is made, starting posterior to the greater trochanter running down the shaft of the femur. An incision is made in the tensor fascia latae (TFL) in order to expose gluteus maximus which is split (Figure 1). Having retracted the gluteus maximus, the short external rotators are identified and tagged for repair and then tenotomized from their insertion at the greater trochanter revealing the posterior capsule which is incised to reveal the femoral neck and head. The operative leg is internally rotated in order to dislocate the head and a femoral neck osteotomy is performed. Retractors are then placed to aid acetabular exposure and allow for acetabular preparation prior to cup insertion. The leg is flexed and adducted to improve exposure of the proximal femur allowing for femoral preparation and subsequent implant insertion. The short external rotators, and variably the posterior joint capsule, are then repaired to the posterior aspect of the greater trochanter.

The main advantage of the PA is the extensibility both proximally and distally allowing access for more complex surgeries such as hip revision. It is well documented that the PA is associated with a higher dislocation rate compared to other approaches.<sup>6</sup> It has been suggested however that where additional hip capsule repair is performed the rate is reduced.<sup>7,8</sup> Patients are often assigned hip precautions, limiting their post-operative activities in order to avoid dislocation after surgery and the PA has been associated with slower recovery rates.<sup>9</sup> The sciatic nerve is



**Figure 1 Anatomy of the muscles disrupted in posterior approach THA.** Gluteus maximus muscle (blue circle) is split in line with the muscle fibres in order to minimize muscle trauma as much as possible as indicated by the red dotted line. The external rotators highlighted by the circles (superiorly to inferiorly); piriformis (red), superior gemellus (yellow), obturator internus (green), inferior gemellus (navy), quadratus femoris (purple). Figure adapted from Atlas of Anatomy, Ernest et al (1841).

also liable to iatrogenic nerve damage in PA THA with only 36% of patients fully recovering if the sciatic nerve is damaged.<sup>10</sup>

### Direct lateral (modified Hardinge)

The patient is in the lateral decubitus position, although supine positioning is preferred by some surgeons, with an incision made over the greater trochanter extending 10 cm proximally and distally. The TFL and iliotibial band are incised and a retractor used to hold the fascia in place. On identification of gluteus medius and minimus, they are split running up to the vastus ridge at which point the joint capsule is also cut. This division is made in an M-shape to aid realignment of tissue for suture repair after implant placement (Figure 2). The femoral head is dislocated by externally rotating and flexing the hip and a femoral neck osteotomy is performed. The acetabulum is prepared with gaugers and reamers down to bleeding cancellous bone to which the cup is inserted.

A major advantage of the direct lateral approach is that the posterior soft tissues of the hip are spared whilst the preserved attachment of the superior aspect of gluteus medius to the femur is thought to maintain stability. The dislocation rate for direct lateral THA is almost negligible; rates of approximately 0.4% have been reported.<sup>11,12</sup> Superior gluteal nerve palsy is recognized and may be evident 4 weeks following direct lateral THA; however this often resolves spontaneously.<sup>13</sup>

### Surgical outcomes

Various measures can be used to assess hip function; some of these outcomes present an overall assessment of hip function whilst others are more specific and thus have value in explaining the capacity of the hip to fulfil local tasks. Objectively, global function encompasses the hip joint as part of the whole body as it

fulfils its main purpose in locomotion. The local function of the hip concerns the strength of major muscle groups and ranges of motion (ROM); which is indicative of the health of tissues around the implant. The implant can also be assessed by its positioning in situ, along with the structure of the soft tissue components surrounding the implant. Structural assessment has applications in explaining deficits found in local and global function. Subjectively, patient reported outcome measures (PROMs) provide a measure of success from the patient's perspective, encompassing their expectations and subsequently their ability to function according to the demands of everyday life.

### Global function

Motion capture of patients performing ADLs helps to establish a comprehensive understanding of post-operative function. From level-ground walking to higher demand activities such as squatting, information regarding the functional capacity of the hip joint to perform various tasks can be assessed. Gait is an important measure of function as it is the basic level of mobility required to preserve patient independence in everyday life, therefore establishing the functional impacts of the surgical approaches on gait for patients can help to account for and improve patient quality of life. Higher demand ADLs can accentuate the consequence of functional deficits and help to more clearly identify functional differences between surgical approaches.<sup>14</sup>

The direct lateral approach has been regularly linked to post-operative Trendelenburg gait in approximately 10% of cases when walking and climbing stairs<sup>15–18</sup> without signs of improvement. This Trendelenburg gait has been attributed to disruption of the abductor compartment (gluteus medius and minimus) during surgery.<sup>11,12,19</sup> Compared to the anterolateral approach, the gait of people undergoing surgery using a direct lateral approach appears to differ more from control participants

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