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Review Article

Total Hip Replacement Using the Direct Anterior Approach: Review

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Abstract

Worldwide, the Direct Anterior Approach (DA) for Total Hip Arthroplasty (THA) has been gaining popularity. In the past years, there has been increasing interest in this approach given its early recovery rates. Advocates for this technique claim that its intermuscular and internervous nature offer patients a better and more anatomical management of soft tissues leading to better functional results and less pain. This review exhibits the anatomic and surgical considerations of the procedures as well as its main advantages and potential complications.

Keywords: Direct Anterior Approach; Total Hip Arthroplasty

Introduction

Total Hip Arthroplasty (THA) is one of the most successful orthopedic procedures performed currently worldwide. It is estimated that by the year 2030, around 570,000 of these procedures are to be performed yearly in the United States [1]. It has become a highly effective procedure in terms of pain relief and quality of life improvement for patients with hip osteoarthrosis with high rates of patient satisfaction [2-5]. Several surgical approaches have been described for THA, each with its own advantages and disadvantages. The most popular approaches are the posterior approach, the lateral approach and the direct anterior approach, in that order [6]. The Direct Anterior Approach (DAA) was initially described by Carl Heuter in 1881, but became popular after its realization by Marius N. Smith-Petersen in 1917 [7]. Although the most commonly used approach in the United States is the posterolateral approach [6], recently the use of DAA has gained popularity among orthopedic surgeons, given that some authors claim less soft tissue damage and faster recovery [8-11]. There is little evidence that suggests long term superiority in the outcomes of the procedure but it has widely shown faster recovery.

Anatomic Considerations

The DAA is the only approach for THA that is performed through an intermuscular and an internervous approach [8,12]. The superficial muscle plane is found between the Tensor Fascia Latae Muscle (TFL), which is innervated by the superior gluteal nerve, and the Sartorius muscle, which is innervated by the femoral nerve. The deep interval lies between the gluteus medius and the rectus femoris muscles. Given its nature, it is the only surgical approach that is inter muscular and internervous. In theory it could provide less damage to soft tissues, which could lead to better functional outcomes, less pain and better gait kinematics [11,13-15].

An important anatomic consideration when performing the DAA is the origin of the Sartorius muscle in the Anterior Superior Iliac Spine (ASIS), which is the anatomical landmark for the incision. Caution is deemed to avoid going medial to the ASIS at the time of the incision. The femoral neurovascular bundle lies medial to the Sartorius muscle. The Lateral Femoral Cutaneous Nerve (LFCN) provides innervation to the skin of the anterior and lateral thigh, under the inguinal ligament and over the Sartorious and the TFL muscles. Although anatomic variations are common [16] a potential complication of this procedure is injury to this nerve [17].

Surgical Technique

The patient is positioned in supine on the operating table. Initially the DAA was described with the use of a traction table [7]. Nevertheless, a conventional OR table that allows flexion to ex-

tend the hip can be used [18,19]. An arm board or table extension is deemed necessary to allows abduction of the contralateral lower limb and adduction of the operative side during femoral exposure (Figure 1).

Figure 1: Conventional operating table with bump under de gluteal area to allow femoral exposure and extension for contralateral lower limb.

The starting point of the incision in performed 2cm medial and 2cm distal to the ASIS about 6- to 8cm following the direction of the TFL [19] (Figure 2).

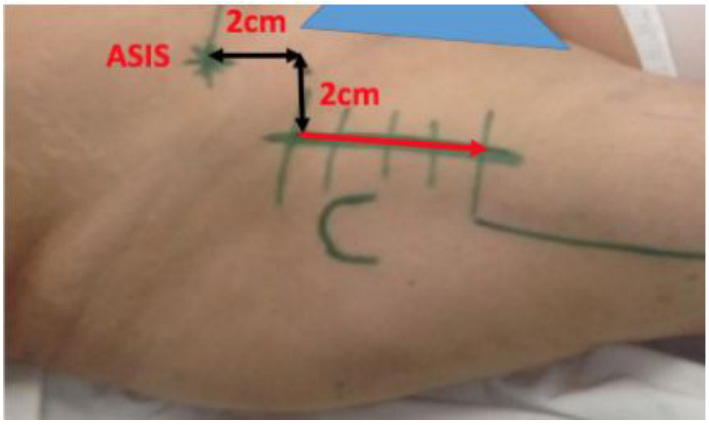

Figure 2: Anatomic landmark for incision 2cm distal and 2cm medial to the anterior superior iliac spine.

It is critical to correctly identify the TFL muscle in order to avoid neuromuscular injury and achieve correct exposure [20]. This can be done by identifying the perforating vessels which enter the muscle belly or by careful evaluation of the ASIS. After identifying the TFL, the fascia is split and the muscle is retracted laterally, thus protecting the LFCN fibers. Then, the Heuter interval, which lies between the Sartorius muscle and the TFN is identified and split, the interval between the rectus and the gluteus medius is retracted in order to expose the anterior capsule of the hip (Figure 3).

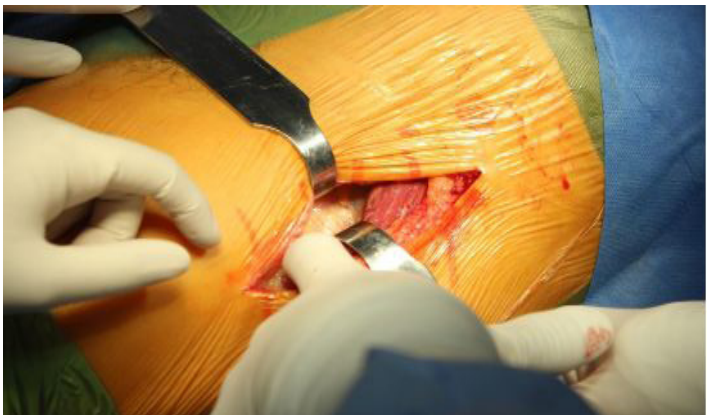

Figure 3: Incision with identification of the TFL which is retracted laterally to identify the deep intermuscular interval and then the anterior capsule

Then, the ascending circumflex femoral artery is identified and either coagulated of ligated and the capsule is exposed. Retractors are placed on the femoral neck medially and laterally. A third retractor is placed on the anterior wall of the acetabulum and a fourth on the lateral aspect of the femur, below the greater trochanter. Next, either a capsulotomy or capsulectomy is performed and then a double neck osteotomy is performed. Femoral head extraction follows. Once the femoral head has been removed, a Muller or double footed retractor is placed posteriorly over the ischium. The acetabular preparation is performed, by removing the labrum and osteophytes and by progressive reaming. A critical step of the surgery and one with perhaps the most technical challenge is the femoral exposure and release. This will allow proper femoral exposure and metaphyseal visualization for broaching [20,21] (Figure 4).

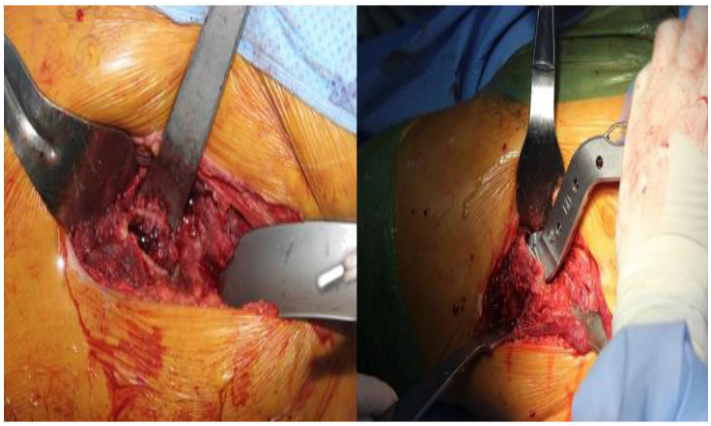

Figure 4: Femoral exposure with retractors and progressive broaching of the femoral canal.

To achieve this, the limb is brought to adduction and external rotation. It is crucial to achieve a careful dissection of soft tissues as well as to have a correct anatomic understanding of the insertion of the abductors on the greater trochanter.

Advantages

The DAA has recently gained popularity in orthopedic reconstructive surgery for its intermuscular and internervous nature that is a less invasive and makes it a soft-tissue sparing approach. According to some authors, this leads to a faster recovery of the patients, a decrease in length of hospital stay and a better functional outcome [10,22,23]. In some studies, although most are retrospective and evaluate a relatively small sample of patients, DAA resulted in less pain and less opioid consumption [8,14]. Some studies have evaluated gait kinematics showing that when evaluating cadence, range of motion, speed and timed up and go have a better performance that patients with a posterolateral or lateral approach [11,13]. Nonetheless, this difference seems to match after 6 months of the surgery [24,25]. Dislocation rates have also been less in DAA patients [26]. As hip muscles are preserved, inherent stability to the prosthesis is thought to be superior. Some studies have shown lower dislocation rates in DAA compared to posterior or lateral approaches [27,28]. On the other hand, the soft tissue management has also been evaluated by measuring CK as a marker for muscle damage, as well as inflammatory markers such as IL-1 or IL-6. CK has been found to be 5 times higher in serum after posterolateral approach compared to DAA [11,29]. MRI images in cadaveric analysis have shown less damage to the hip abductors, less fat atrophy and less tendinitis [30,31]. Nonetheless there is not a clear clinical or functional correlation with these test results [32].

Complications

Among the most frequent complications in THA performed by DAA are LFCN injury and proximal femoral fractures [33]. About 5.7% of the patients have been shown to have LFCN injury [34]. Most of the patients presenting with paresthesia usually resolve with few long-term complaints. Meralgia paresthesica can occur in less than 1% of the patients [20,35]. Proximal femora fracture has also been seen, specially of the greater trochanter and the calcar [36]. Nevertheless, most of the studies show that these can be reduced as the surgeon experience increases. Critics have had a concern with wound complications arguing the location of the incision. Several studies recommend avoiding this approach in obese patients, given that the overhanging fat can increase the risk of infection [11,20]. Most of the complications in these surgeries are related to the steep learning curve of the DAA. Some authors suggest that in orthopedic surgeons who have performed less than 100 cases [26] the complication rate can almost double [37]. Furthermore, with less surgical experience, the rates of intraoperative bleeding, operative time, nerve lesion and fractures increases [36,38]. These complication rate may be deemed too high for a surgeon to modify their surgical THA approach.

Conclusion

The DAA is an alternative for performing hip arthroplasty that has gained popularity. It may offer a better soft tissue management resulting perhaps in better functional result for the patients and reduced postoperative pain. Strong evidence to support this is still lacking. The learning curve for this procedure can be very steep, but complications lessen once the surgeon gains familiarity with the approach, and it can become a suitable alternative to improve results in hip reconstructive surgery.

References

1. Kurtz S, Ong K, Lau E, Mowat F, Halpern M (2007) Projections of primary and revision hip and knee arthroplasty in the United States from 2005 to 2030. J Bone Joint Surg Am 89: 780-785.

2. Ethgen O, Bruyère O, Richy F, Dardennes C, Reginster J-Y (2004) Health-related quality of life in total hip and total knee arthroplasty. A qualitative and systematic review of the literature. J Bone Joint Surg Am 86: 963-974.

3. Fitzgerald JD, Orav EJ, Lee TH, Marcantonio ER, Poss R, et al. (2004) Patient quality of life during the 12 months following joint replacement surgery. Arthritis Rheum 51: 100-109.

4. Mariconda M, Galasso O, Costa GG, Recano P, Cerbasi S (2011) Quality of life and functionality after total hip arthroplasty: a long-term follow-up study. BMC Musculoskelet Disord 12: 222.

5. Lenguerrand E, Wylde V, Gooberman-Hill R, Sayers A, Brunton L, et al. (2016) Trajectories of Pain and Function after Primary Hip and Knee Arthroplasty: The ADAPT Cohort Study. PLoS ONE 11: e0149306.

6. Rachbauer F, Kain MSH, Leunig M (2009) The history of the anterior approach to the hip. Orthop Clin North Am 40: 311-320.

7. Berry DJ and Bozic KJ (2010) Current practice patterns in primary hip and knee arthroplasty among members of the American Association of Hip and Knee Surgeons. J Arthroplasty 25: 2-4.

8. Kennon R, Keggi J, Zatorski LE, Keggi KJ (2004) Anterior approach for total hip arthroplasty: beyond the minimally invasive technique. J Bone Joint Surg Am 2: 91-97.

9. Vail TP and Callaghan JJ (2007) Minimal incision total hip arthroplasty. J Am Acad Orthop Surg 15: 707-15.

10. Goebel S, Steinert AF, Schillinger J, Eulert J, Broscheit J, et al. (2012) Reduced postoperative pain in total hip arthroplasty after minimal-invasive anterior approach. Int Orthop 36: 491-498.

11. Zhao HY, Kang PD, Xia YY, Shi XJ, Nie Y, et al. (2017) Comparison of Early Functional Recovery After Total Hip Arthroplasty Using a Direct Anterior or Posterolateral Approach: A Randomized Controlled Trial. J Arthroplasty 2017.

12. Hozack WJ and Heller S (2015) Direct Anterior Hip Exposure for Total Hip Arthroplasty. JBJS Essent Surg Tech 5: e22.

13. Lugade V, Wu A, Jewett B, Collis D, Chou L-S (2010) Gait asymmetry following an anterior and anterolateral approach to total hip arthroplasty. Clin Biomech Bristol Avon 25: 675-680.

14. Zawadsky MW, Paulus MC, Murray PJ, Johansen MA (2014) Early outcome comparison between the direct anterior approach and the mini-incision posterior approach for primary total hip arthroplasty: 150 consecutive cases. J Arthroplasty 29: 1256-1260.

15. Rodriguez JA, Deshmukh AJ, Rathod PA, Greiz ML, et al. (2014) Does the direct anterior approach in THA offer faster rehabilitation and comparable safety to the posterior approach? Clin Orthop 472: 455-463.

16. Tomaszewski KA, Popieluszko P, Henry BM, Roy J, Sanna B, et al. (2016) The surgical anatomy of the lateral femoral cutaneous nerve in the inguinal region: a meta-analysis. Hernia 20: 649-657.

17. Rudin D, Manestar M, Ullrich O, Erhardt J, Grob K (2016) The Anatomical Course of the Lateral Femoral Cutaneous Nerve with Special Attention to the Anterior Approach to the Hip Joint. J Bone Joint Surg Am 98: 561-567.

18. Mast NH and Laude F (2011) Revision total hip arthroplasty performed through the Hueter interval. J Bone Joint Surg Am 2: 143-148.

19. Bender B, Nogler M, Hozack WJ (2009) Direct anterior approach for total hip arthroplasty. Orthop Clin North Am 40: 321-328.

20. Post ZD, Orozco F, Diaz-Ledezma C, Hozack WJ, Ong A (2014) Direct anterior approach for total hip arthroplasty: indications, technique, and results. J Am Acad Orthop Surg 22: 595-603.

21. Chechik O, Khashan M, Lador R, Salai M, Amar E (2013) Surgical approach and prosthesis fixation in hip arthroplasty world wide. Arch Orthop Trauma Surg 133: 1595-600.

22. Higgins BT, Barlow DR, Heagerty NE, Lin TJ. Anterior vs (2015) Posterior Approach for Total Hip Arthroplasty, a Systematic Review and Meta-analysis. J Arthroplasty 30: 419-434.

23. Wenz JF, Gurkan I, Jibodh SR (2002) Mini-incision total hip arthroplasty: a comparative assessment of perioperative outcomes. Orthopedics 25: 1031-1043.

24. Barrett WP, Turner SE, Leopold JP (2013) Prospective randomized study of direct anterior vs postero-lateral approach for total hip arthroplasty. J Arthroplasty 28: 1634-1638.

25. Maffiuletti NA, Impellizzeri FM, Widler K, Bizzini M, Kain MSH, et al. (2009) Spatiotemporal parameters of gait after total hip replacement: anterior versus posterior approach. Orthop Clin North Am 40: 407-415.

26. Connolly KP and Kamath AF (2016) Direct anterior total hip arthroplasty: Comparative outcomes and contemporary results. World J Orthop 7: 94-101.

27. Siguier T, Siguier M, Brumpt B (2004) Mini-incision anterior approach does not increase dislocation rate: a study of 1037 total hip replacements. Clin Orthop 426: 164-173.

28. Barton C and Kim PR (2009) Complications of the direct anterior approach for total hip arthroplasty. Orthop Clin North Am 40: 371-375.

29. Bergin PF, Doppelt JD, Kephart CJ, Benke MT, Graeter JH, et al. (2011) Comparison of minimally invasive direct anterior versus posterior total hip arthroplasty based on inflammation and muscle damage markers. J Bone Joint Surg Am 93: 1392-1398.

30. Meneghini RM, Pagnano MW, Trousdale RT, Hozack WJ (2006) Muscle damage during MIS total hip arthroplasty: Smith-Petersen versus posterior approach. Clin Orthop 453: 293-298.

31. Bremer AK, Kalberer F, Pfirrmann CWA, Dora C (2011) Soft-tissue changes in hip abductor muscles and tendons after total hip replacement: comparison between the direct anterior and the transgluteal approaches. J Bone Joint Surg Br 93: 886-889.

32. Poehling-Monaghan KL, Taunton MJ, Kamath AF, Trousdale RT, Sierra RJ, et al. (2017) No Correlation Between Serum Markers and Early Functional Outcome After Contemporary THA. Clin Orthop 475: 452-62.

33. Lee G-C and Marconi D (2015) Complications Following Direct Anterior Hip Procedures: Costs to Both Patients and Surgeons. J Arthroplasty 30: 98-101.

34. Woolson ST, Pouliot MA, Huddleston JI (2009) Primary total hip arthroplasty using an anterior approach and a fracture table: short-term results from a community hospital. J Arthroplasty 24: 999-1005.

35. Goulding K, Beaulé PE, Kim PR, Fazekas A (2010) Incidence of lateral femoral cutaneous nerve neuropraxia after anterior approach hip arthroplasty. Clin Orthop 468: 2397-2404.

36. Jewett BA and Collis DK (2011) High complication rate with anterior total hip arthroplasties on a fracture table. Clin Orthop 469: 503-507.

37. Anterior Total Hip Arthroplasty Collaborative Investigators, Bhandari M, Matta JM, Dodgin D, Clark C, Kregor P, et al. (2009) Outcomes following the single-incision anterior approach to total hip arthroplasty: a multicenter observational study. Orthop Clin North Am 40: 329-342.

38. Wayne N and Stoewe R (2009) Primary total hip arthroplasty: a comparison of the lateral Hardinge approach to an anterior mini-invasive approach. Orthop Rev 1: e27.