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Review Article

SURGICAL DIRECT ANTERIOR APPROACH IN TOTAL HIP ARTHROPLASTY (TAH), (ANATOMY, TECHNIQUE, CLINICAL OUTCOME): A REVIEW

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ABSTRACT

Total Hip arthroplasty (THA) has revolutionized the treatment of hip arthritis. In general, proponents belive that, compared with other approach, the direct anterior approach to THA is associated with less muscle damage and pain, quick recovery and better gait mechanics post-operatively. However, the incidence of these complication decreases with greater surgeon experience. The dislocation, abductor insufficiency, facture and nerve injury are complication and risk factor has been well described. Some author claims that this approach results are less muscle damage and pain as well as rapaid recovery. New surgical instrument and operating tables designed especially for direct anterior approach of TAH have made more accessible to orthopaedic surgeon.

Keywords: Anatomy and surgical approach to direct anterior THA, Abductor insufficiency, fracture, nerve injury.

INTRODUCTION

The direct anterior approach to the hip was first described by Smith-Peterson in 1940s and later modified by Heuter in 1950[1].Internationally, this approach is gaining popularity in the hip arthroplasty community[2]. THA has been shown to be cost-effective treatment for osteoarthritis of hip and offers patients relief of pain, improved function and substantial improvement in quality of life[3-5]. There are several surgical approaches that are used in primary THA. Advocates of this approach consider it's advantage to be the muscle-sparing nature of its internervous interval, earlier restoration of gait kinematics and low dislocation rate[6-10]. Currently the posterior approach is the most commonly approach utilized in the Department of Orthopaedics "The first affiliated people's number 1 Hospital" of Yangtze University, Jingzhou, Hubei, P.R, China.

Recently, however there has been increased intrest in the anterior (Hueter)approach for THA in orthopaedic community and public due the belief that the inter-muscular anterior approach may result in decreased pain, faster recovery, improved hip stability and decreased risk of dislocation following surgery when compared to the more commonly used, muscle splitting, posterior approach. In 1980, Light and Keggi published the experience on the direct anterior approach for modern THA in a series of 104 procedure, the mean surgical time was 66 minutes and the procedure required a transfusion of an average of 1.9 units of blood. No intra-operative compication were reported. The mean length of hospital stay was 12.8 days. In addition, Since the patient is placed supine on operating table, the anterior approach allows the use of fluoroscopic image intensification allowing intra-operative assessment and correction of component position. Preliminary series of patient who have undergone THA using the anterior approach have suggested decreased length of hospital stay, decreased 30days re-admission, higher percent discharged to home vs. Rehabilitation facility, earlier independent mobilization and improved radiographic component positioning[6-8, 11]. The direct anterior approach to the hip has greater longevity in terms of its popularity. Making use of the Hueter interval between the tensor fascia late (TFL) and Sartorius muscle to expose the hip, the direct anterior approach uses a true inter-nervous, inter muscular plane.

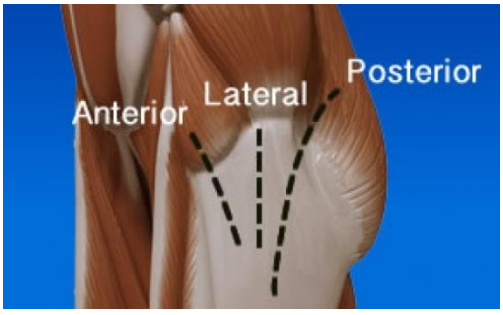

Figure 1: Showing different approach of TAH.

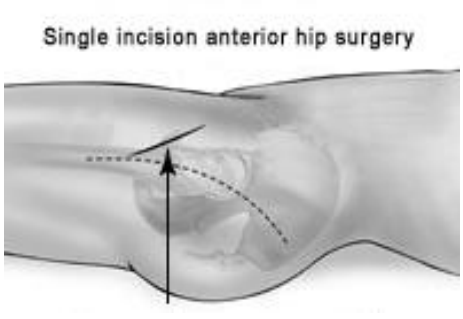

Figure 2: Incision anterior hip surgery.

Anatomy and direct anterior surgical approach (THA):

Anatomy:

The anterior aspect of hip has few palpable landmarks, and many critical palpable landmarks and many critical structures must be noted. The Anterior superior iliac spine (ASIS) is the most easily identified structure. Typically, this bony prominence is palpable at the lateral aspect of the abdomen, superior to the level of the pubis. The ASIS is the anterior most tip of the iliac crest and is the origin for the Sartorius muscle and the inguinal ligament. The pubis is typically palpable at the midline. The origin of the TFL muscles and the anterior origin of the gluteus medius muscles ere lateral to the ASIS. The lateral femoral Cutaneous nerve (LFCN) runs under the inguinal ligament and over the surface of the Sartorius and TFL muscles. The Neurovascular bundle containing the femoral artery and vein as well as the femoral nerves lies medial to the Sartorius muscles. During direct anterior approach to TAH, knowledge of the neurovascular bundle's location is critical during all portions of the direct anterior approach to TAH. The rectus femorius muscles lies deep to the Sartorius and TFL muscles and is divided proximally into two heads:Direct and Reflected.

The Direct head orginates from anterior inferior iliac spine, whereas the reflected head orginates from the anterior lips of the acetabulum. The gluteus minimus muscles orginates from the iliac wings and rest along the antero-lateral aspect of the hip capsule. The muscles insert on the lateral aspect of the greater trochanter with the gluteus medius, making up the aductor complex. The vastus lateralis and vastus intermedius muscles lies deeper still, originating from the anterior aspect of the femur at the intertrochanteric line. The iliopsoas muscles and tendon initially lie anterior to the hip capsule but then pass to the medial side of the femoral neck and insert on the lesser trochanter.

Surgical approach to direct anterior TAH:

The procedure begins by positioning the patient supine on a specialized traction table, both feet are firmly secured to boots attached to lever arms that permits positioning of each lower extremity and applying traction to either limb. The perineal post located between the legs stabilizes the patients on the operating room tables and provides a paints of counter-traction[12].(as shown in Figure 3 and 4)

Figure 3: specialized traction table.

Figure 4: of counter-traction.

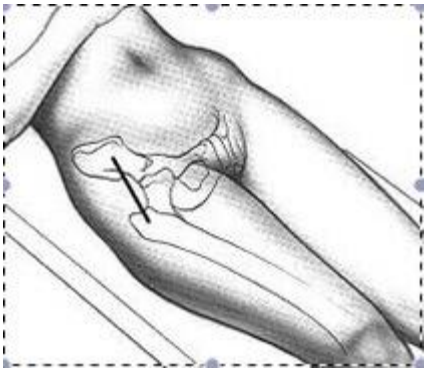

Figure 5: Anterior approach incision.

Figure 6: Anterior approach incision.

The Surgical incisions begins 2-4cm lateral to anterior superior iliac spine of the pelvis .it is then carried distally and laterally for about 8-12cm at 20 degree from the sagittal plane of the patient towards the lateral aspect of patient's ipsilateral knee. The Lateral femoral cutaneous nerves (LFCN)is identified, transposed medially and protected. After protecting the LFCN, the fasia overlying the tensor fascia late (TFL) is incised, and a plane is then developed between the TFL and Sartorius. Then encounter the interval between the rectus femoris and gluteus medius. A charnley hip retractor displace the rectus femoris medially and the gluteus medius laterally to expose the anterior joint capsule of hip. After coagulating or suture ligating the ascending branch of the lateral femoral circumflex artery, a Mueller retractor is placed inferior to the femoral neck, and a capsulotomy is perfomed. The joint capsule is incised along the length of femoral neck from the acetabulum to the inter-trochanteric line.

Gentle traction is then applied to the operative limb, Mueller and Hohmann retractor are placed intracapsularly around the femoral neck.A reciprocating saw is used to make a femoral neck osteotomy. The femoral head is then removed with a corkscrew. The osteotomy can be repeated and the resultant napkin ring of bone removed to increase the ease of removing the femoral[12].

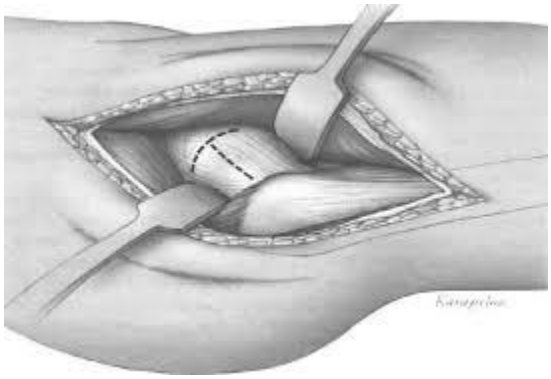

Figure 7: Mueller and Hohmann retractor placed intracapsularly.

Once the femoral head is removed, traction is relased and leg is externally ratated to improved exposure for acetabular prepration. The charnley hip retractor maintains exposure medially, placement of the final acetabular component is facilitated by the use of an offset inserter handle to minimize soft tissue injury. Intra-operative fluoroscopy is used to optimize component anteversion and inclination. Femoral preparation can be difficult owing to limited proximal femoral exposure with this approach. The operative limbs is carefully placed in a position of extension, adduction and external rotation to improve the accessibility of the proximal femur. overly forceful external rotation can result in soft tissue injuries to the knee and ankle as well as intra-operative fracture. A specialized bone hook is then inserted around the posterior aspect of the femur just proximal to the insertion of gluteus maximus tendon.This bone hook can be used manually to elevate the proximal femur anteriorly. In the subset of patient in whom the femur cann't be sufficiently mobilized anteriorly, sequential release of the conjoint tendon and piriformis can also improve mobilization of the femur. Rarely, a release of the anterior 1-2cm of the origin of the TFL off the iliac wing may be required. An offset femoral branch handle eases access to the proximal femur during prepration. Trialing can be combined with intra-operative fluoroscopy to ascess leg length and offset. Femoral anterversion is identified based on the posterior cortex of the proximal femur or by using the femoral epicondyles as reference point, once the final implant are in situ and the hip is reduced, implant positioning is verified with fluoroscopy and stability of the construct can be assessed out of traction[12, 13].

Figure 8: Direct anterior TAHs.

Risk and complication:

Dislocation:

Post-operative dislocation following THA has a deleterious effect on patient outcomes and when required, revision surgery incurs tremendous cost to the health care system[14, 15].

Dislocation rates for the posterior approach reported in the literatures vary from 1% to 5% [16-20]careful reconstruction of the capsule and short external rotators may decrease the risk of post-operative dislocation [16, 21].

Abductor insufficiency:

Abductor muscles insufficiency is a common clinical scenario following a direct lateral approach. It can cause abductor muscle weakness, a trendelenburg gait or sign insufficient gait mechanics and peritrochanteric pain[22-25]. The insufficiency likely result from failure of the repaired tenotomy following a direct lateral approach, chronic degeneration of the gluteus medius tendons pre-operatively or irreparable, tear at the time of THA in up to 20% of patients undergoing the procedure[26, 27]. The latter point,as well as technical pitfalls such as inadequate restoration of femoral offset, may explain why some patients undergoing primary THA through a posterior or anterior approach may still exhibits abductor insufficiency post-operatively[28]. M asonis and Bourne[22] reviewed more than 2400 THAs involving a direct lateral approach and reported an incidence of 4% - 20% for abductor in sufficiency post-operatively.

Fracture:

Intra-operative fracture can be devasting complication resulting in increased duration of surgery, difficult post-operative mobilization due to weight bearing modifications, prolonged functional recovery and poor patient outcomes. Jewett and collis[29] reviewed their experience with the direct anterior approach in 800 patience who underwent primary THA. The authors reported 19 (2-3%) intra-operative tronchanteric fracture and no ankle fracture, most fracture occurred during femoral elevation with a bone hook and soft tissue avulsion.

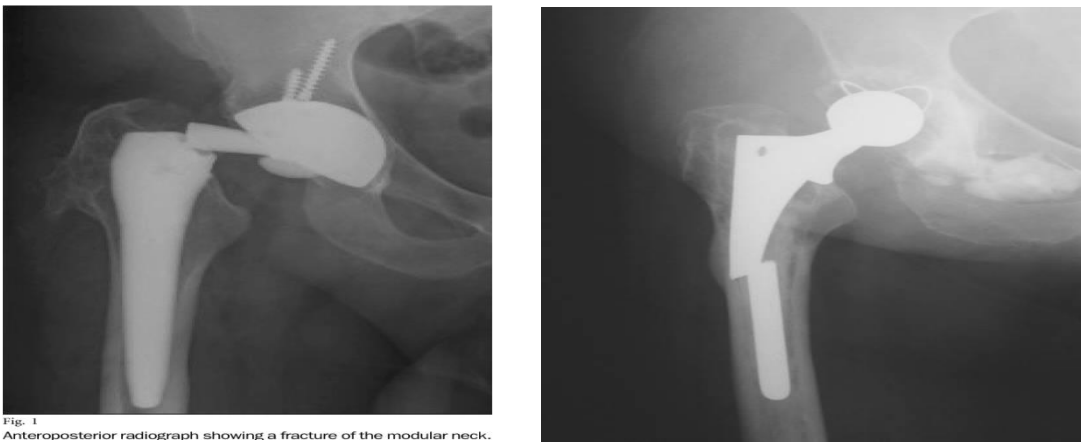

Fig. 1
Anteroposterior radiograph showing a fracture of the modular neck.

Figure 9: Intra-operative tronchanteric fracture.

Interestingly, Matta and colleagues[7] reviewed 494 direct anterior THAs reported 7(1.4%) intra-operative proximal femur fracture(4 fracture of the medial calcar during femoral broaching and 3 fracture of the greater trochanteric during bone hook elevation) 3(0.06%) non-displaced ankle fracture occurred when using isolated external rotation of the limb to dislocate the hip. There are some central tenets that can be applied in order to reduce the risk of inta-operative fracture. Examination of soft tissue tension before and after leg manipulation with any surgical approach can help reduce the rate of fracture. Finally, experience

surgeon with novel technique undoubtelly plays a role in reducing the incidence of inta-operative compication[29-31].

Nerve injury:

The prevalence of nerve injuries during THA has been reported to be around 1%[32]. Nerve injury can occur under several different circumference, including direct trauma during dissection or placement of devices, such as wires or acetabular screws, retraction, thermal injury from methyl methacyralate, compression due to hematoma, leg lengthening and component positioning[33]. Commonly injuried nerves included the superior gluteal, lateral femoral cutaneous, sciatic and femoral nerves. Neurapraxia of the lateral femoral cutaneous nerve can occur in 155- 80% of patient undergoing THA through direct anterior approach[34, 35]. Owing to the nerve's variable course around the anterior superior iliac spine and as it crosses the surgical plane at the sartorial TFL plane more distally[7, 36]. Most of these neuropraxic injuries resolve without any long-term sequelae[7, 9]. A post-operative neuroma is a potential complication leading to increased pain although this compication is raraly reported in the literature[35, 37].

The femoral nerves are at risk with over rigorous placement of soft tissue retractors over the anterior aspect of the acetabulum for all approaches. The rate of femoral nerve palsies for THA ranges from 0.1% to 2.4%[32, 38].

CONCLUSION

Surgical approach in THAs is an area of debute among orthopaedic surgeon. This review has demonstate thar direct anterior approach of THAs has less disadvantages than compaired to other approach for THAs. The surgical approach discussed all enable performance of a safe and clinically efficacious THA, therefore, we recommend that surgeon choose the approach with which they have the most experience and ease. Future research should elicit the long-term implication of surgical approach on clinical outcomes, restoration of function and health economics.

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