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Operative Techniques in
Orthopaedics

Direct Anterior Approach for Total Hip Arthroplasty: Implant, Instrument, and Approach

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The goal of total hip arthroplasty is to restore native biomechanics and function to the diseased joint while preserving the soft tissue envelope and muscular attachments. The direct anterior approach (DAA) for total hip arthroplasty has seen a significant increase in popularity for both surgeon and patient alike, based on the reported ability to access the joint with less insult to the soft tissue and musculature structures about the hip. In light of this popularity, the development of approach-specific implants, instruments, and operating table setup has also accelerated. Decreased tissue damage, shortened hospital stays, and faster recovery with return to function have been described following the DAA. However, concerns have been expressed regarding a steep learning curve and a host of unique approach-specific complications have been described. The goal of this article is to present the surgical technique, implants, and instruments that aid in successful completion of the DAA for hip arthroplasty, while addressing the early outcomes and difficulties associated with this surgical exposure.
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KEYWORDS hip, arthroplasty, direct anterior approach, surgical technique, instruments

Introduction

History of the Approach

The direct anterior approach (DAA) to the hip has been described for operative procedures as far back as 1881. Originally described by German academic surgeon, Carl Hueter, the approach was further popularized by Marius Nygaard Smith-Petersen in 1917 for use with his mold arthroplasty.[1,2] The approach was again used and described in the 1950s by Judet and also O'Brien,[3,4] but fell out of favor with the introduction of the low-friction arthroplasty and the transtrochanteric approach described by Charnley. Well described in recent review article, a modified version of the original Smith-Petersen (or Hueter) approach has more recently gained popularity among surgeons and patients alike for its muscle sparing characteristics that may allow for earlier patient recovery.[5] With increased usage of the DAA, specialized surgical tools, implants, and techniques have been developed to facilitate successful component implantation and minimize surgical complications.

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Surgical Technique

DAA (table-less)

In this approach, patients are placed supine on a standard operating room table. A 3-in gel bump is placed under the pelvis. This allows lateral soft tissues to fall posteriorly and adds slight extension to the hip. An extra arm-board is placed on the contralateral side at the end of the bed to allow for abduction of the nonoperative leg during femur preparation. The hip crease is identified and marked. Attempts to keep the incision distal to the hip crease are made for wound healing considerations. A longitudinal incision is made roughly 3 cm distal and lateral to the anterior superior iliac spine (ASIS), heading toward the lateral epicondyle. The incision is initially made roughly 5 cm and extended as necessary. Electrocautery is used to dissect through the subcutaneous tissue. The tensor muscle belly is identified by its purple hue and lateral position to the ASIS. The fascia is split in line with the muscle belly. The tensor muscle belly is retracted laterally and the interval between the tensor and sartorious is entered. Using an index finger, blunt dissection is used to place a retractor superior to the femoral neck. The subfascia of the tensor is cut with electrocautery. It is important to identify and coagulate the crossing lateral femoral circumflex vessels. The anterior hip capsule is then identified. Care is taken when placing a retractor inferior to the femoral

http://dx.doi.org/10.1053/j.oto.2017.05.008

Figure 1 Dual-offset broach handle. The anterior and lateral offset moves the strike plate of the broach away from the patients ASIS and abdomen, decreasing the risk of soft tissue interference and damage. (Color version of figure is available online.)

neck so as to not place it within the vastus lateralis muscle, causing bleeding. Under direct visualization, a cobb elevator is used to separate the capsule from the overlying rectus femoris. A retractor is then placed in this space under the rectus femoris and above the anterior column. The senior author prefers to perform an anterior capsulectomy; however, the capsule can be split and preserved. First, a subcapital femoral neck cut is made with an oscillating saw then a cut at the desired neck resection level is made. The napkin ring of bone is removed and then the femoral head is removed with a corkscrew. Three retractors are placed around the acetabulum and the surrounding labrum is removed. The anterior column retractor is placed under the capsule anteriorly. A sharp retractor is placed behind the posterior wall and retracts the femur. Lastly, a retractor is placed in the obturator foramen under the teardrop. The cotyloid fossa is cleared of tissue and osteophytes. The teardrop is identified and is used to establish the inferior extent for cup placement. Reaming commences with a standard straight shaft reamer. The final shell is impacted in place and, if desired, the final liner is impacted.

Attention is then turned to the femur. The contralateral leg is abducted onto the extra arm-board placed on the lateral end of the table. The operative leg is adducted and externally rotated. A double-footed Müeller retractor is placed between the remaining superior hip capsule and the abductors. The remaining superior hip capsule is resected toward the acetabulum to the posterior boarder of the femoral neck. The obturator internus tendon is released while the femur is elevated with a bone hook. The Muller retractor is replaced between the greater trochanter and the abductors. The femur is elevated out of the wound for broaching. A curved currete is used to identify the femoral canal. Broaching begins with a duel-offset (anterior and lateral) broach handle. The appropriately sized broach is left within the femur for trialing. Once satisfied with the stability and leg lengths, the trial components are then removed. The femoral stem is implanted by hand and then tapped to final location with an inserter handle. The trunnion is dried and final head impacted in place. Before the closure, care is taken to ensure hemostasis of the lateral femoral circumflex vessels. The tensor fascia is closed with a barbed running suture and the skin is closed in standard fashion. In general, patients are allowed to weight-bear as tolerated without hip precautions.

Instruments

Offset Broaches and Reamers

A perceived challenge of the DAA is accessing the femoral canal for broaching and implant placement. As described earlier, appropriate patient and limb positioning, retractor placement, as well as capsular releases are important to deliver the femur anteriorly. Additionally, the use of specialized surgical tools can make access to the femoral canal easier and more reproducible. Specifically, offset broaches and reamers allow for preparation of the femoral canal for the implant with less limb manipulation and improved soft tissue clearance. Multiple varieties exist, including solid straight, single-offset curved, and double-offset broach handles. The authors prefer a double-offset broach as the anterior and lateral offset (Fig. 1), moves the strike plate of the broach away from the patient's ASIS and abdomen, decreasing risk of soft tissue interference and damage.

It has been shown that dual-offset broaches reduce the need for leverage of the proximal femur, likely decreasing the stress to the proximal bone stock.[6] However, the offset may affect the force transmission from the strike plate to the broach. In comparing single vs double-offset, the highest values of force transfer have been observed in the use of single-offset broach handle, whereas double-offset broach handles transmit less energy to the broach tip.[7] This decreased energy transfer to the broach tip can instead be transmitted to the cortical bone, increasing the risk of fracture and split propagation during seating of the implant. Recent experimental and computer modeling, using finite element analysis, demonstrate that larger offset handles increase moment-to-force ratios up to 163%-235%, thus rotating the proximal and distal ends of the