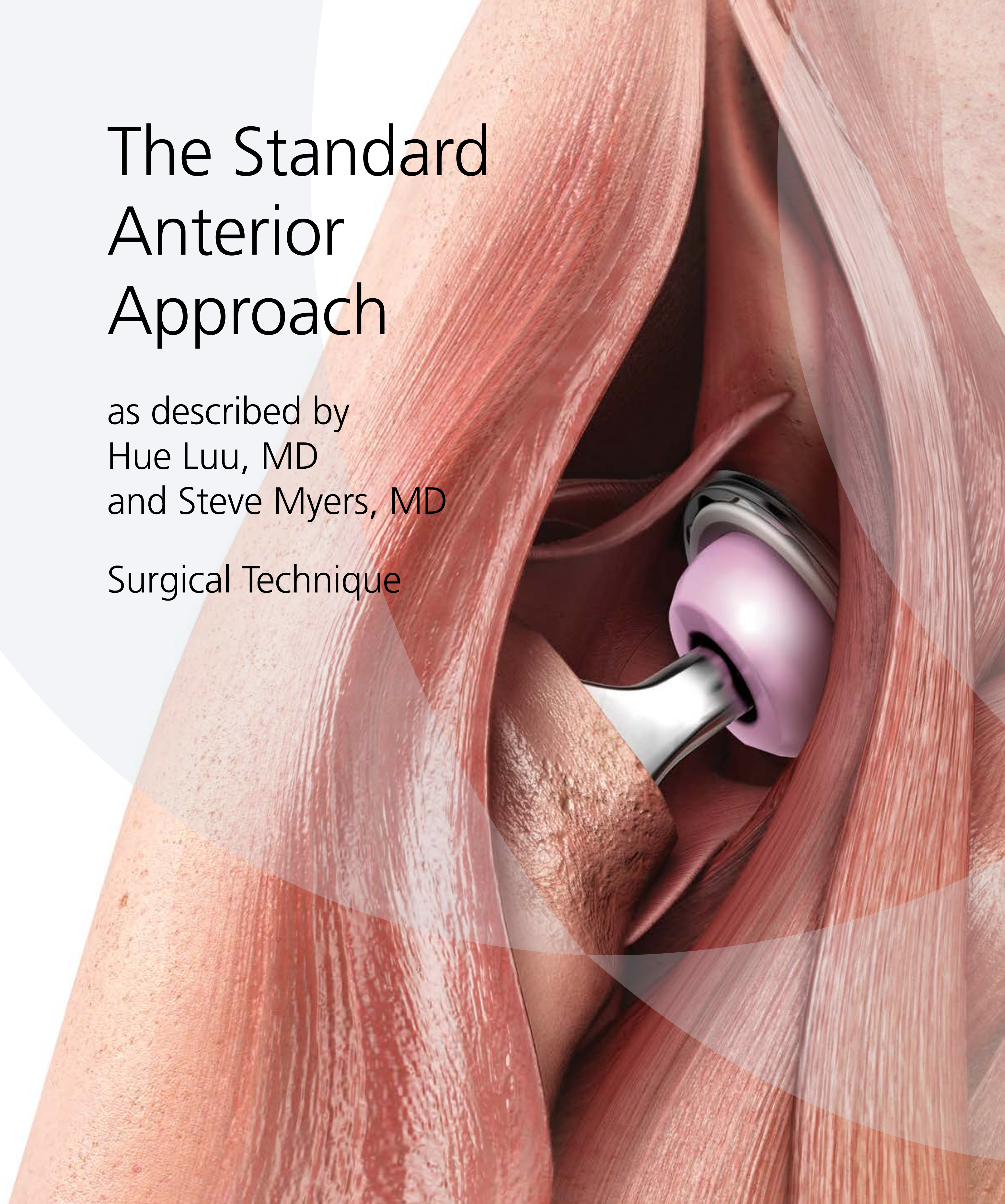
The Standard Anterior Approach

as described by
Hue Luu, MD
and Steve Myers, MD

Surgical Technique



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Introduction

Anterior Approach Philosophy
Minimally invasive or tissue-sparing orthopedic procedures have gained attention as patients demand shortened recovery time and accelerated rehabilitation. One of the more popularized surgical techniques is the Anterior Approach. This technique does not require any large muscles to be cut, but separates them to allow access into the hip joint. The result is that muscles are spared during surgery. This approach provides the potential for a quicker recovery compared to traditional hip replacement surgery.[1-6]

Similar to other surgical approaches for total hip arthroplasty, the development of efficient and repeatable surgical steps is important.

This surgical technique describes the patient supine on a standardized OR table with a table extension. Fluoroscopy is used to check for proper placement of the components.

In standard Anterior Approach surgeries, a standard OR table where you can remove the head section and place it at the foot end of the table to extend the length of the lower body operating table can be used. The Anterior Approach allows for use of a C-Arm to check for proper placement of the final components, which is especially useful in the positioning of acetabular cups.

Anterior Approach Resources
Additional resources for surgeons, patients and OR Staff can be found at *www.DePuySynthes.com/AnteriorApproach including an interactive 3D animation for surgeon and OR staff education.

VuMedi (*www.vumedi.com)
VuMedi has a large amount of orthopedic surgeons and other physicians that visit their community to watch expert videos, interactive discussions, participate in live webinars.

Introduction to surgeon authors

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Pre-Operative Set-up

Room Set-up
The OR is set up such that the instruments are on the operative side or at the foot of the patient. Generally, the use of 2 back tables (A), 2 Mayo stands (B) and 1 basin stand (C) is sufficient.

The C-Arm (D) is positioned on the non-operative side, perpendicular to the patient. A typical OR team will consist of the surgeon, 2 physician's assistants, anesthesiologist, scrub nurse, circulating nurse and X-ray technician.

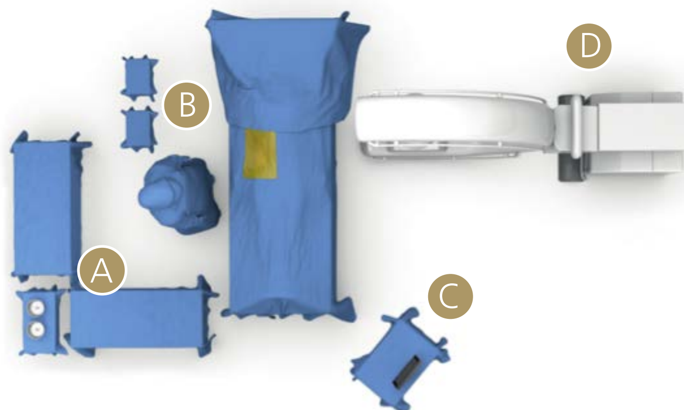


Table Set UP
It is recommended to utilize a standard OR Table where the head extension (A) can be removed and placed at the foot end of the table (Figure 1). This will allow for more radiolucency in the lower limb area. An extender at the foot of the table may be needed to allow unobstructed C-Arm access under the patient's pelvic area. Attach arm boards on both sides with the patient's arms abducted 90°.

Tip: Some surgeons start the case with the hip in slight flexion, which can help to relax the rectus. Simply placing a "bump" of sterile surgical towels under the ipsilateral knee will achieve this goal.

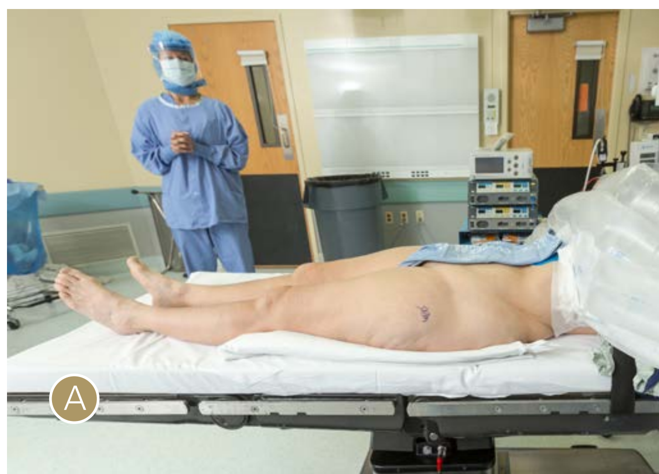
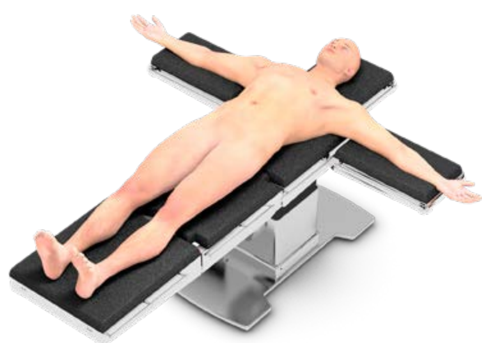


Figure 1



Draping

Prep hips, legs, and perineum prior to applying sterile drapes. Reference and mark the ASIS and incision location.

With the legs elevated by a gowned assistant, apply sterile towels around the operative site, and then place sterile U-drapes above and below to create a sterile field (Figure 2).

Unroll an impervious sterile stockinette on both legs up to the upper thigh. While a sterile assistant elevates both legs, the surgeon applies Self-Adherent wrap (Coban™) to each leg covering the stockinette (Figure 3).

A double limb drape is then pulled over both legs up to the proximal thigh (Figure 4).

Cut a rectangular window out of the drape, to expose the previously marked ASIS and planned incision site. Secure the drape window to the skin with an ioban drape (Figure 5).

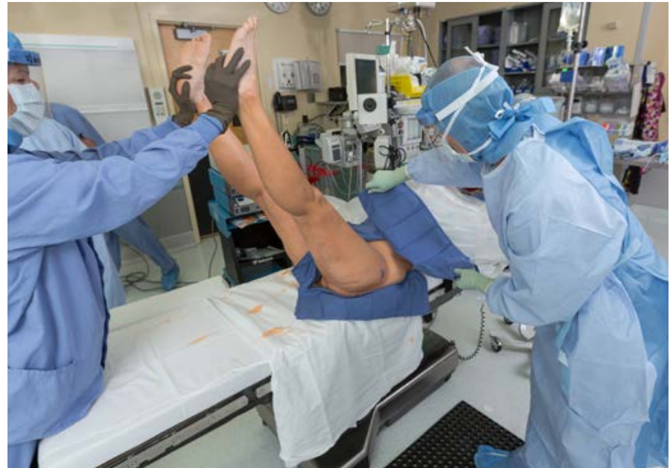


Figure 2

Figure 3

Figure 4

Figure 5

Incision and Initial Exposure

Start the incision approximately 2 cm lateral to the ASIS and extend distally, somewhat obliquely laterally over the Tensor Fascia Lata (TFL) muscle. The incision length varies from 8 to 14 cm (Figure 6).

Palpate the ASIS under the skin to reconfirm location. Utilize Volkmann's or Army Navy Retractors (A) to retract the anterior incision medially for visualization of the TFL (Figure 7).

Incise the fascia of the TFL in the mid-portion of the muscle belly, parallel to the fibers (Figure 8).

Note: Fascial incision is typically between the anterior two thirds and posterior one-third of the tensor muscle. The TFL should be lateral to the incision while the rectus femoris is medial to the incision.

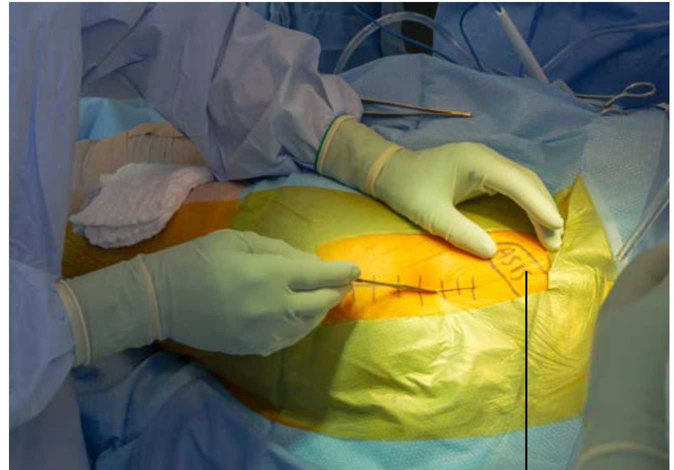


Figure 6

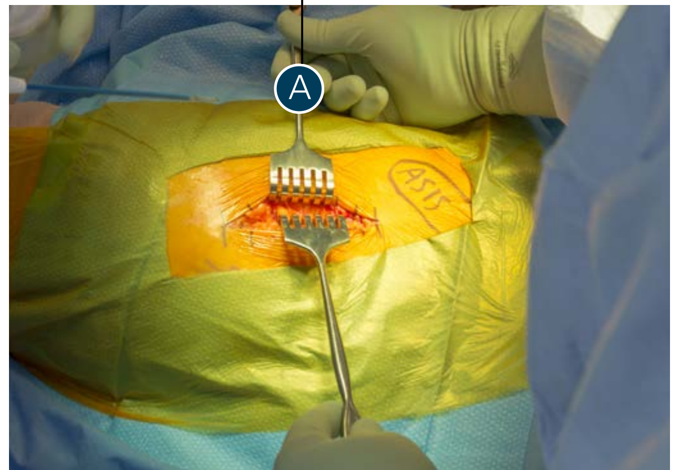


Figure 7

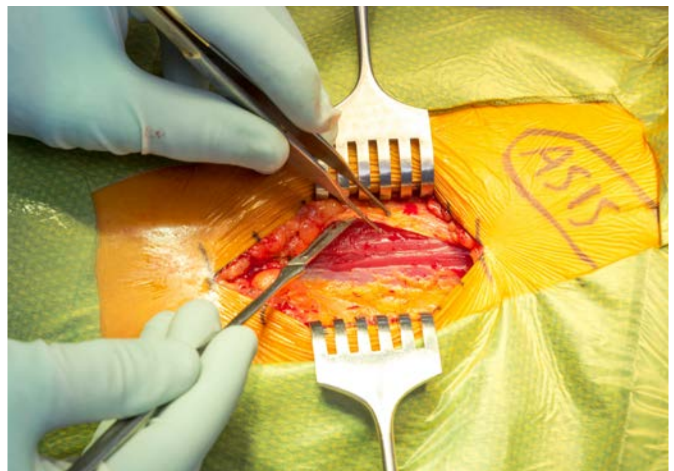


Figure 8

Exposure

Using an Allis Clamp or Pickups (A), lift the anterior medial fascia and finger dissect the TFL away to mobilize it. Dissect all the way up to its origin on the pelvis, then distally to its insertion of the iliotibial band (IT band). This step “loosens” the muscle from its fascial attachments, making it more pliable and easier to retract without damaging the TFL (Figure 9).

Place a Blunt Tipped Cobra (B) (Cat. No. 37-4106) superior-laterally over the hip capsule, retracting the TFL and gluteus minimus (Figure 10).

Visualize the lateral circumflex vessels usually located under the posterior fascia of the TFL. Dissect around the vessels, clamp, divide, or tie them off and cauterize the lateal femoral circumflex vessels (Figure 11/11a).

Description using a pointed cobra lateral and medial
Develop the space between the reflected tendon of the rectus and anterior capsule by using a Key, Cobb or Periosteal Elevator (Figure 12). Place the tip of the MI Narrow Curved Hohmann Retractor (Cat. No. 2598–07–190) on the antero-medial hip capsule (anterior pelvic rim) and retract the rectus femoris and illeocapsularis muscles medially, to expose the anterior capsule (Figure 13).

The capsule is always covered with a layer of adipose tissue anteriorly. Debride the tissue over the capsule to delineate the anatomy, which will also simplify repair during closure.

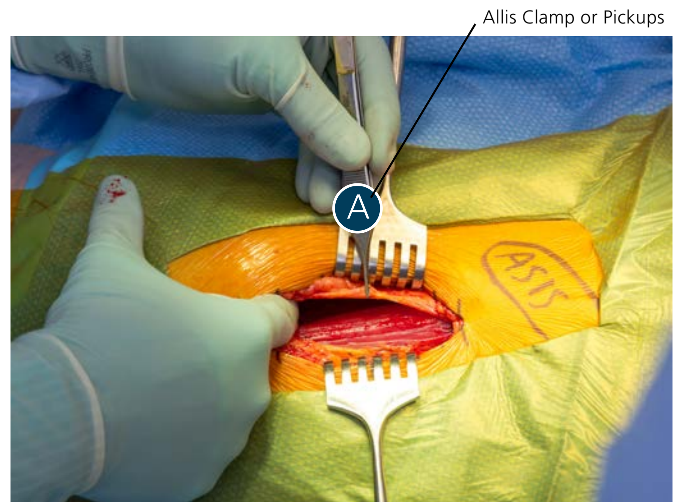


Figure 9

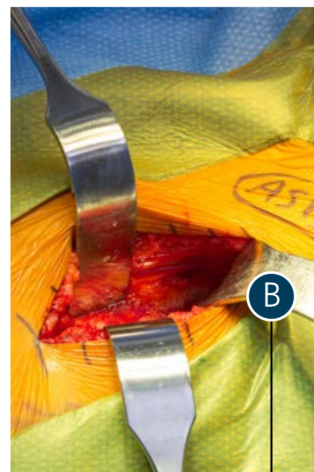


Figure 10

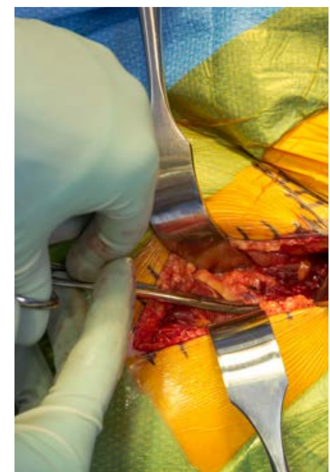


Figure 11

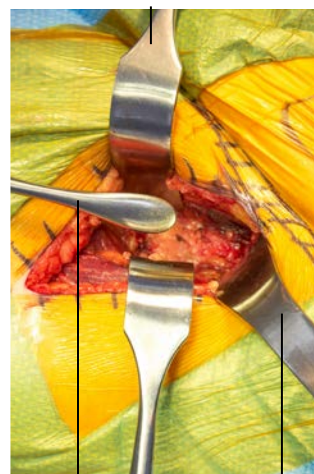


Figure 12

Figure 13

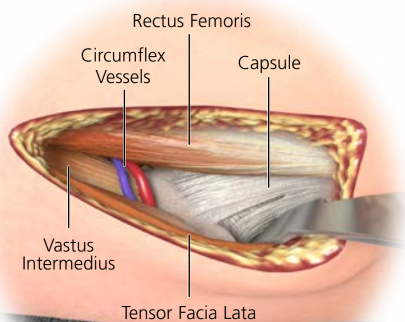


Figure 11a

Capsular Exposure

The capsule, now fully exposed, will be opened in an inverted “T” fashion (Figure 14/14a).

T flap for the capsule
With the leg in slight external rotation, incise the capsule in line with the femoral neck, from the anterior acetabulum to the intertrochanteric ridge. The “T” is then extended medially to the calcar and laterally to the saddle (Figure 15).

Tagging the corners of the capsular flaps is optional.

Note: Although preserving the capsule is optional, there are benefits to maintaining the capsule. The medial capsule, for example, helps protect the psoas tendon on removal of the femoral head.

Reposition the Lateral Cobra Retractor intra-capsular above the superior neck of the femur, then place a second Cobra medially around the neck, thus exposing the femoral neck and protecting the soft tissues (Figure 16).

At this point the capsule can be partially excised to improve visualization and mobilization.

To visualize the remaining attached medial capsule, for release, place the patient’s leg in a frog leg position (Figure 17). This is later referred to as the figure-of-Four position.

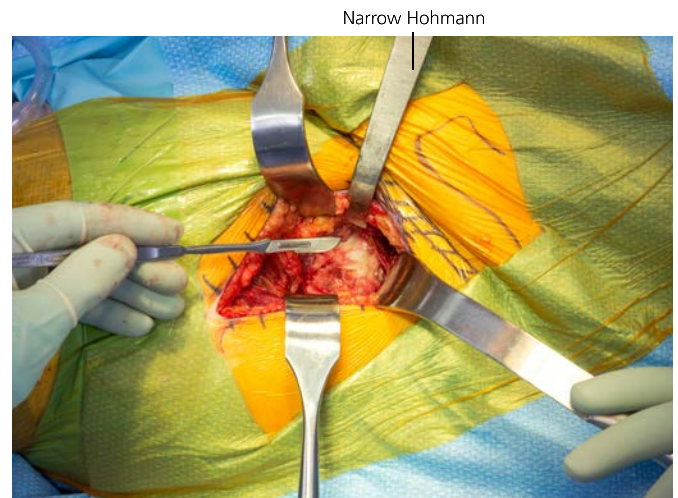


Figure 14

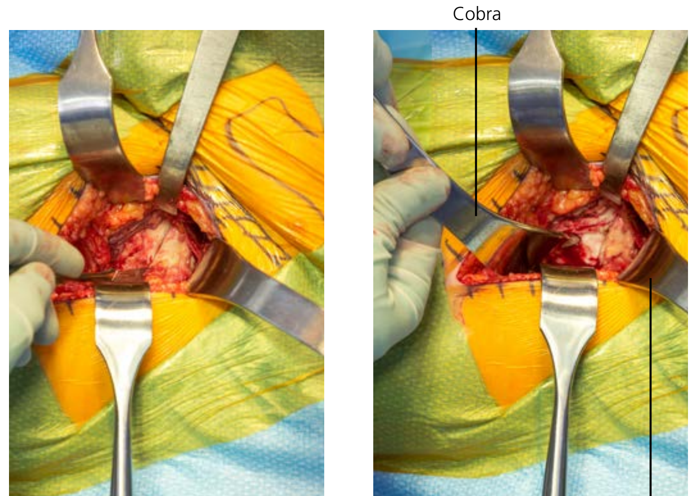


Figure 15

Figure 16

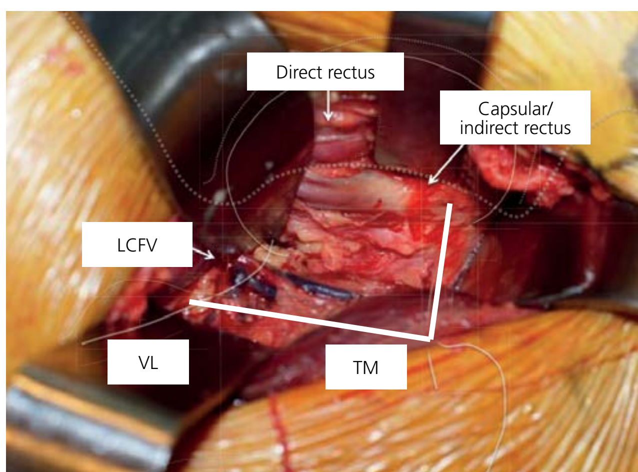


Figure 14a

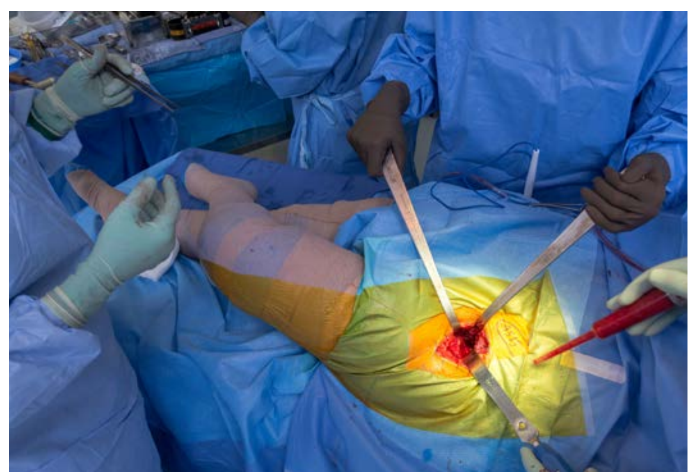


Figure 17

It is vital that the capsule is released properly to ensure that there are not complications later in the procedure. Proper release of the capsule is key to having proper visibility and access to the femur (Figure 18).

Note: If you're having problems exposing the neck, you need to make sure your Capsular cut is proximal enough to expose the acetabular rim, and distal enough to see the base of the Lesser Trochanter.

Tip: Early in the learning curve, the main difficulty is mobilization of the femur. Some surgeons recommend excising the anterior capsule, which may help with a large patient. Some surgeons will do this routinely and it may help early in the learning curve.

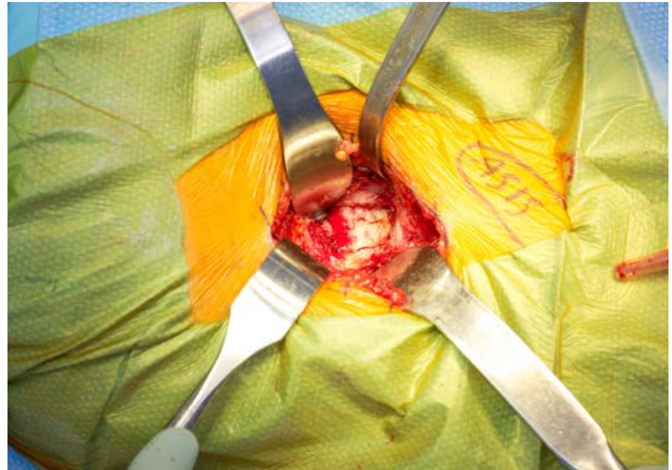


Figure 18

Femoral Head Resection (In-Situ)

In preparation for the femoral head resection, bring the leg back to neutral postion.

Removal of the femoral neck as a "napkin ring" facilitates removal of the femoral head. Locate and remove the anterior labrum to visualize the bony rim of the acetabulum. The labrum is often ossified (acetabular osteophyte), and can be excised with an Osteotome, Electrocautery Tool or Rongeur (Figure 19).

Most often, the lateral portion of the neck cut comes near the lateral shoulder of the neck, by the junction of the greater trochanter. This can be used as an indicator for the neck cut. Start the neck cut as low as possible according to pre-operative templating (Anterior neck cuts tend to be longer than perceived). Aim in a slightly medial direction so the excursion of the saw does not come into contact with the posterior greater trochanter (Figure 20).

Fluoroscopy may be used to verify the proper neck cut location. Start a partial cut into the neck, remove the blade from the Saw Handle while holding in place with a hemostat. After determining the correct neck cut, finish the cut with the Saw.

If the femoral head cannot be removed at this point, a second cut (as shown) can be made distally on the neck (Figure 21) and the ring of bone removed with a Kocher (Figure 23).

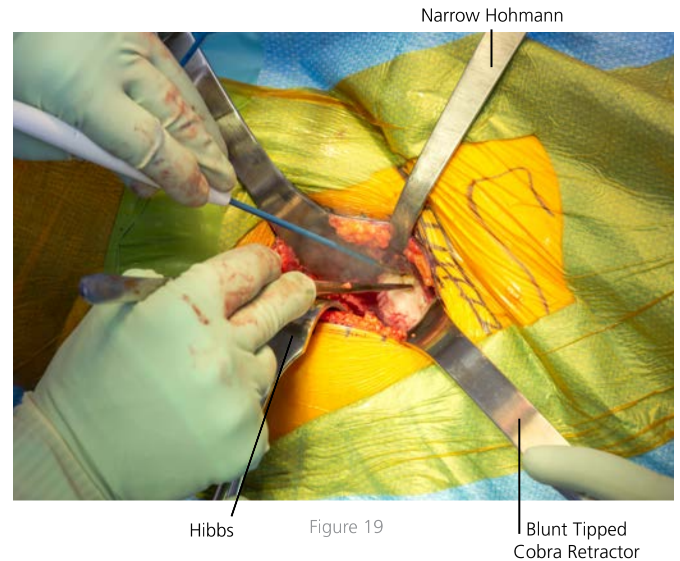


Figure 19

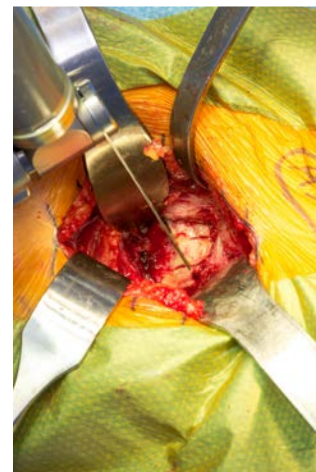


Figure 20

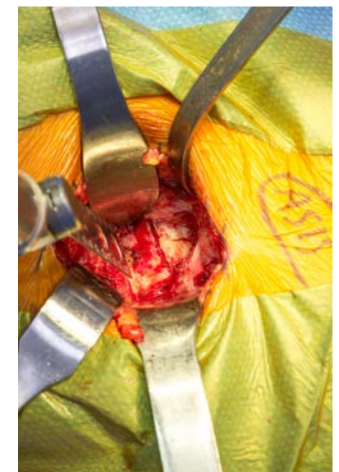
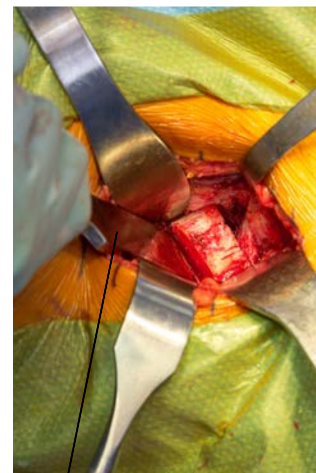


Figure 21



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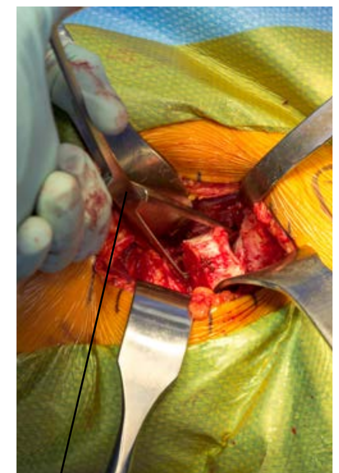

Figure 23

Drive a Power Cork Screw / T-Handle Cork Screw (A) (Cat. No. 2125–00–600) through the femoral neck into the center of the head (Figure 24).

Attach the Excel T-Handle (Cat. No. 2001–42–000) to the Power Cork Screw Attachment.

Spin the femoral head (clockwise to keep the corkscrew threads engaged) to avulse the ligamentum teres. Remove the femoral head taking care not to damage the tensor with the sharp edge on the femoral head from the neck cut (Figure 25).

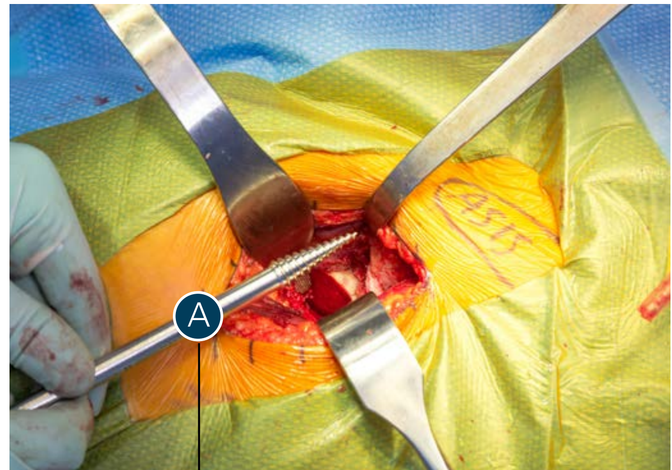

Figure 24

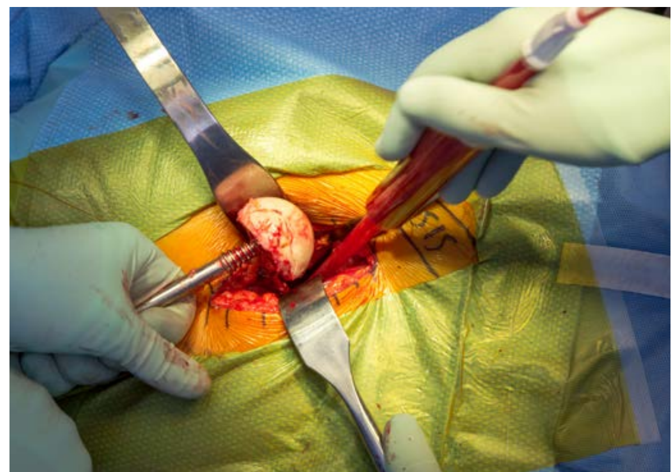
Figure 25

Acetabular Exposure and Reaming

Place a 90 Degree Hohmann (A) (Cat. No. 2598–07–190) on the anterior lip of the acetabulum to initiate exposure. Place a Bent Hohmann on the posterior lateral lip of the acetabulum (Figures 26–28).

Return the operative leg to the figure-of-four position (Figure 27). Full external rotation will expose the medial femoral neck and allow the release of the medial capsule, inferiorly, as before. Using an Electrocautery, dissect along the medial neck to expose the lesser trochanter, completing the capsular release inferiorly. This is critical for femoral mobilization to achieve both acetabular and femoral component exposure. Use caution and don't release the psoas tendon from the lesser trochanter (Figure 29).

Return the operative leg to the neutral position.

Place the single prong, Muller type retractor or Cobra, under the posterior lip of the acetabulum. This will retract the femur laterally and posteriorly (Figure 30).

Excise all residual labrum, peripheral osteophytes, and ligamentum teres.

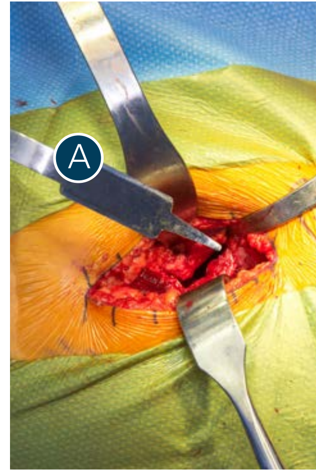

Figure 26

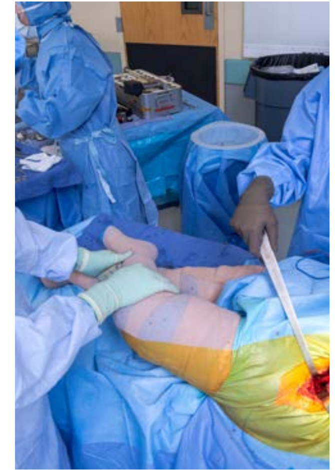

Figure 27

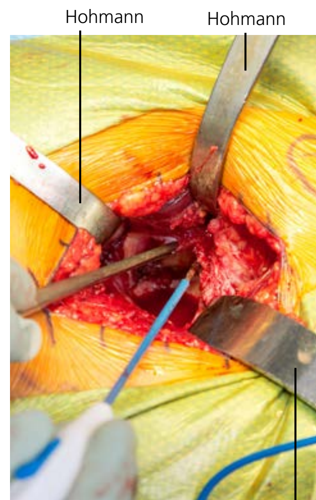

Figure 28

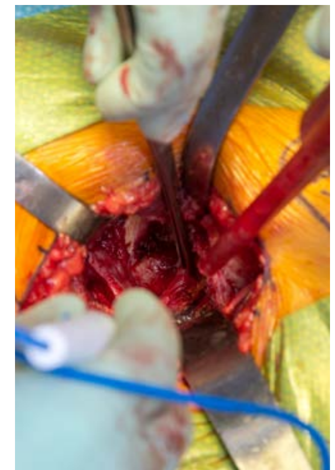

Figure 29

Figure 30

The patient should be positioned with the legs in neutral position and the operative leg slightly externally rotated for acetabular reaming (Figure 31).

Begin reaming the acetabulum by aiming the reamer slightly anterior to posterior, and proximal. Medialize with the reamer aimed medial and slightly posterior and superior (Figure 32).

Be careful not to ream out the anterior wall, as leverage on the reamer handle by the posterior soft tissues can force the reamer head anteriorly.

Tip: A cup that is too large may lack purchase and an overhanging anterior edge may impinge on the iliopsoas tendon.

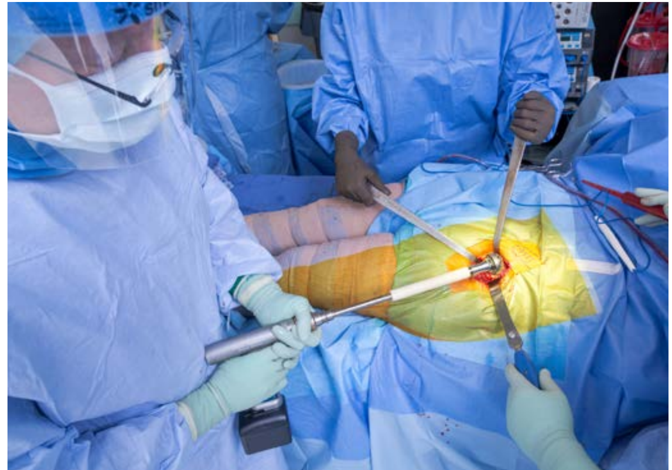

Figure 31

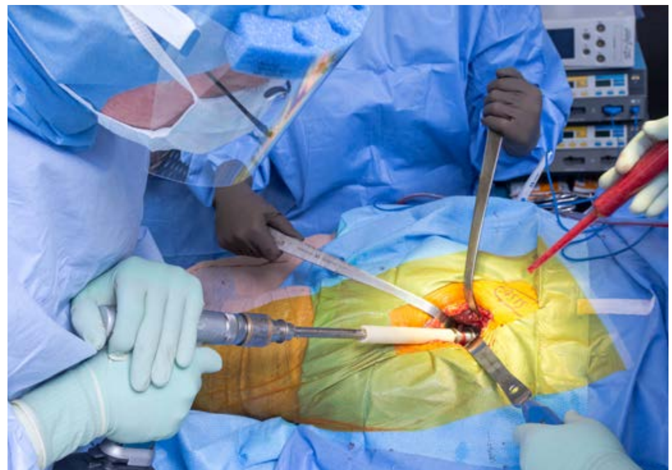

Figure 32

Acetabular Exposure and Reaming

Sequentially ream in 1–2 mm increments. Look for and control bleeding near the obturator foramen. Before reaming to the final templated size, it is recommended that the reamer position be checked with fluoroscopy. Rotate the C-Arm image (A/P view) on the screen until the pelvis image appears level (when the transverse anatomic line is horizontal). With the image centered over the midline, the coccyx should be pointing right at the symphysis, and the obturator foramina should look symmetrical. You may need to orbit and rainbow the C-Arm to accomplish this.

After leveling the image and pelvis, center the image over the operative acetabulum. The image of the reamer shows where the cup will be centered (Figure 33). Generally, the cup should be placed at the patient's anatomic center of rotation. The cup should have a good circumferential fit.

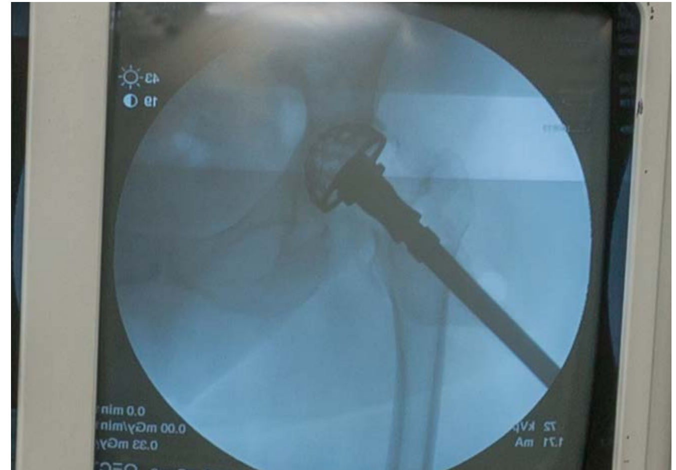

Figure 33

A trial cup may be used to verify fit and seating. Make sure the peripheral soft tissues do not fold in while the cup is placed.

Start to seat the cup, remove the retractors and bring in X-ray for verification of anteversion and abduction angle (Figure 34).

On the fluoroscopy screen the surgeon must be able to visualize the symphysis pubis to ascertain a proper horizontal pelvis and to properly abduct the cup angle (Figure 35). Once the pelvis position is confirmed to be similar to the pre-op film, an AP Hip image should be taken.

When you have reamed to the appropriate size, you can insert the PINNACLE® Trial or Cup (trial liner optional). After confirming alignment and position, remove the trial and insert the final prosthesis. For surgeons unaccustomed to the supine position, it is common to place the cup with too much inclination and anteversion. The correct insertion orientation is typically more parallel to the floor and long axis of the body than expected. Check for proper placement of the final component with the C-Arm. Aim for 40-45 degrees of inclination and 20-25 degrees of anteversion.

The angle and proportions of the image of the ellipse of the rim of the cup indicates inclination and anteversion.

Place the final component into position and impact the Cup. Before inserting the Cup Liner, check the Acetabular Retractors. A Cobra Retractor should be placed over the mid-portion of the posterior rim. Detach the Cup and insert the Liner into the Cup, seating it into the Cup. Impact the Liner and perform a final check of the Cup and Liner placement under X-ray (Figure 36).

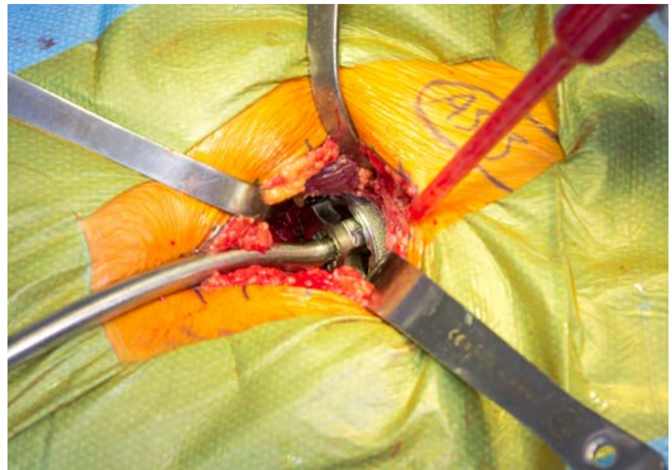

Figure 34

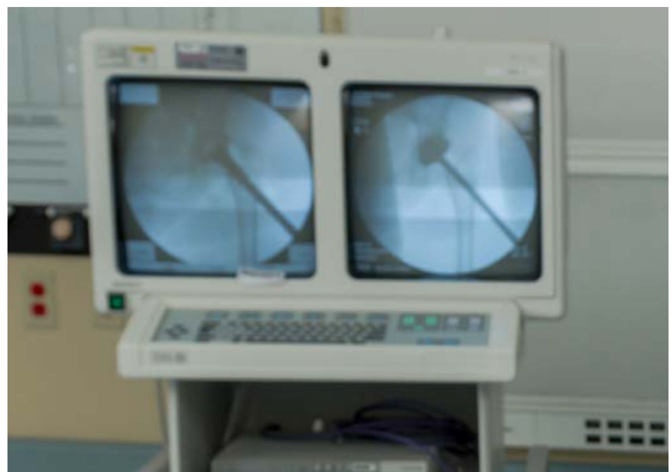

Figure 35

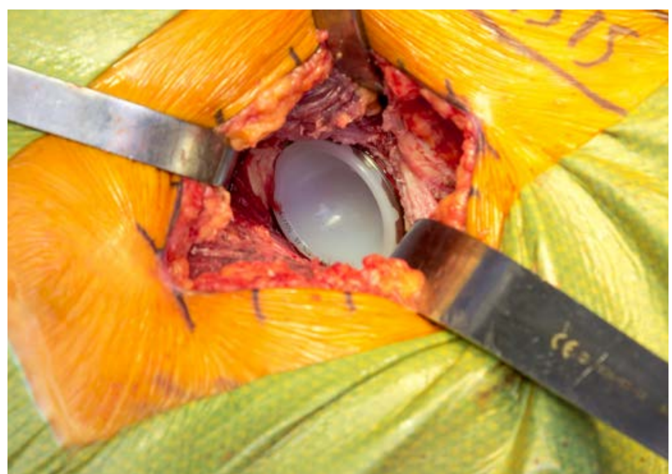

Figure 36

Femoral Preparation

Tip: If using a Mayo, place the non-operative leg up onto the Mayo Stand to prevent hyperextension.

Place the operative leg in a "lazy" figure-of-four position with the operative leg behind the non-operative leg. This will apply less pressure to the joint. Do not over flex the knee, as this tightens the rectus and makes mobilization of the femur more difficult. An arm board placed on the non-operative side can help support the foot/ankle and assist in external rotation of the operative leg (Figure 37).

TIP: Flexing the knee will tighten the rectus femoris and adversely restricts femoral mobility. The goal is to allow the posterior edge of the trochanter to lateralize and avoid getting "locked" behind the acetabulum. Aim to position the leg in a figure-of-four position, flexing the knee as little as possible.

Place a Cobra or Muller Retractor (Cat. No. 2176–10–000) medially on the posterior neck of the femur (Figure 38).

Place a Trochanteric Retractor (Cat. No. 2598–07–240) over the lateral tip of the greater trochanter, adjacent to the proximal edge of the femur, between the gluteus medius tendon and the capsule. This retracts the TFL laterally exposing the lateral capsule (Figure 39).

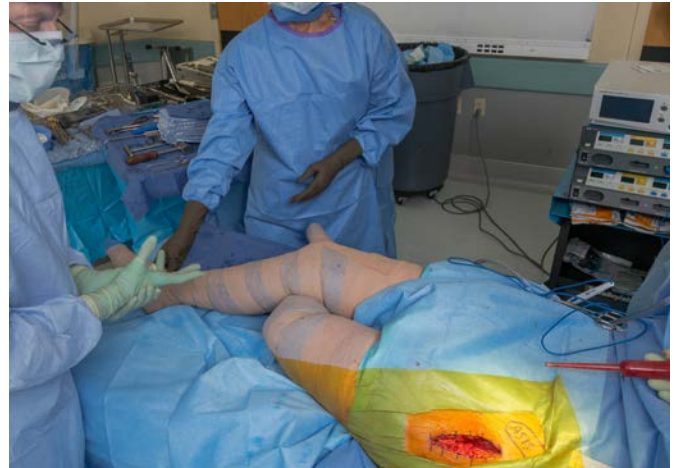

Figure 37

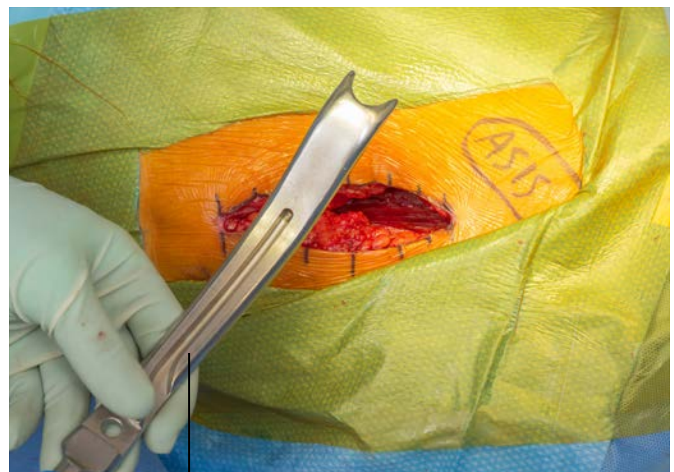

Figure 38

Figure 39

The lateral capsule can obstruct the view of the medial aspect of the greater trochanter. The lateral capsule must be elevated or resected from the medial aspect of the greater trochanter. Continue this dissection posteriorly, directly exposing the bone of the medial side of the greater trochanter (Figure 40).

TIP: This soft tissue release is sequential and must be continued further posteriorly and inferiorly where the hip has a contracture.

Place a Bone Hook into the cut edge of the femoral neck calcar and direct the assistant to provide lateral traction to the femur. With sequential soft tissue release of the lateral and posterior capsule, the femur can be pulled laterally, thus preventing the tip of the greater trochanter from being caught behind the posterior edge of the acetabulum (Figure 41).

Once released, the femur can be pulled anteriorly, allowing direct visualization of the femoral canal for broaching (Figure 42).

TIP: The medial edge of the TFL is a distinct thin white fascia and can be released from its origin off the iliac crest. This allows the TFL to become more pliable and thus more mobile in tight hips.

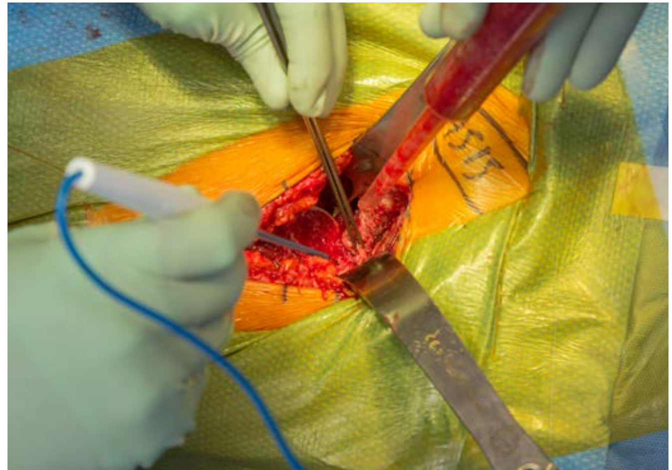

Figure 40

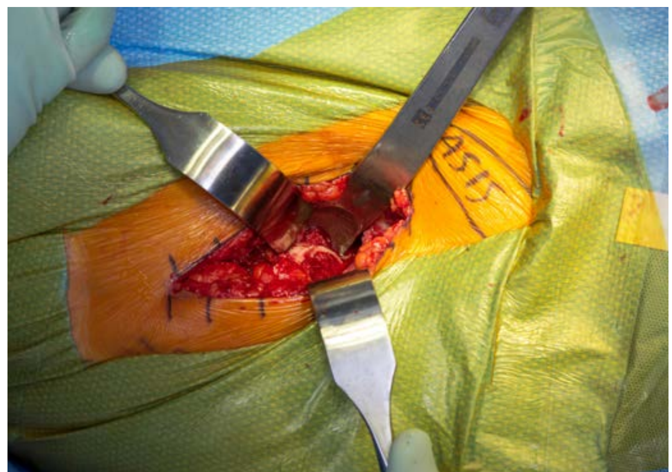

Figure 41

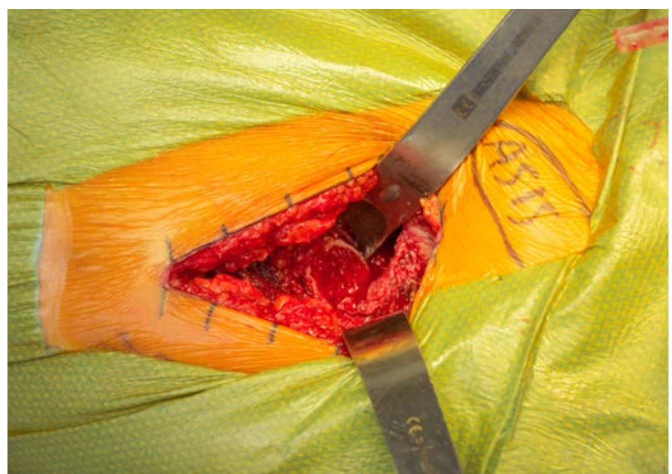

Figure 42

Femoral Preparation

Place the Single or Double-Curved Hohmann Retractor lateral to the tip of the greater trochanter, maintaining its lateral and anterior position. Be careful not to lever rigorously off the TFL muscle as it can be damaged.

Trendelenburg the patient on the table, elevating the patient's feet 5–10 degrees.

Tip: In contracted hips, the entire posterior capsule may need to be released as it may be contracted from the external rotation position of the hip. Additional Trendelenburg and hip extension can be utilized as needed. More adduction and external rotation can be applied to the knee/thigh by the first assistant to gain exposure for broaching.

Lower the leg portion of the table approximately 30 degrees to hyperextend the operative hip. Lift the contralateral leg, and place the operative leg underneath, in the adducted, extended, figure-of-four position. The operative leg/ankle should be resting on the arm board (Figure 43/43a).

Assess femoral stem version using the posterior neck cut. There typically is a flat area that parallels anteversion. Optionally you can flex the knee 90 degrees temporarily and look at the tibia to guide version.

Initiate femoral canal access using a canal finder (Figure 44) to find the femur axis and to asses if you have adequate exposure prior to broaching.

Use a box ostetome or long-handled Rongeur (Cat 2598-07-690) to remove the lateral neck reminant if necessary (Figure 45).

Also note the direction of the femoral canal for broaching. Avoid the tendency to direct the tip of the broach posteriorly, which is a common mistake in the first cases.

Figure 43a

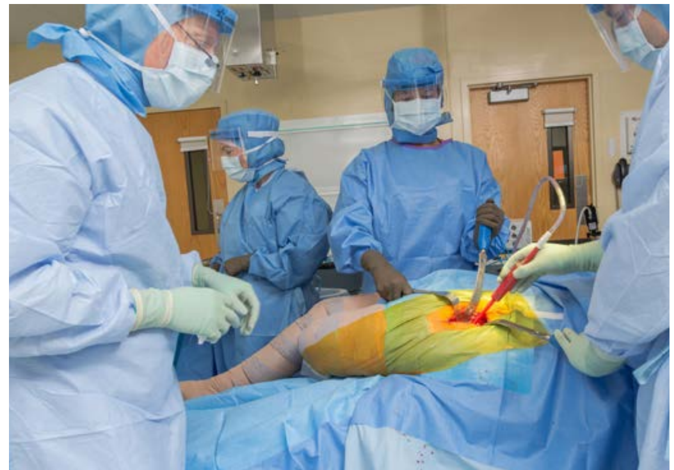

Figure 43

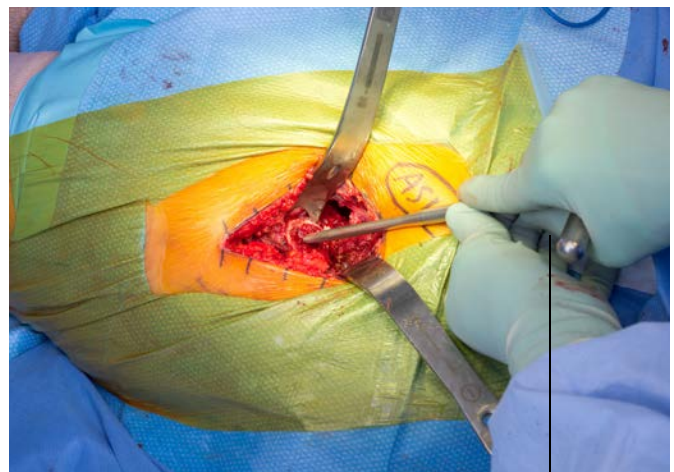

Figure 44

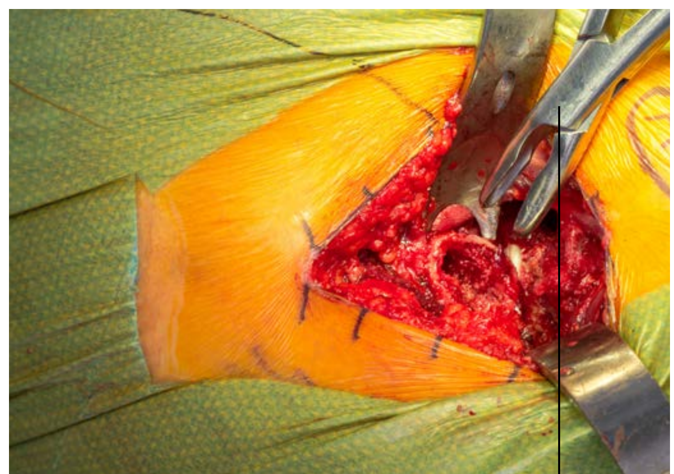

Figure 45

Femoral Broaching

Start with the TRI-LOCK® Bone Preserving Stem Starter broach (Figure 46) to clear bone laterally. Begin using a broach at least two sizes smaller than the stem size that was determined pre-operatively. While taking care to maintain proper alignment and version, sequentially advance the broaches down the femoral canal. Continue to increase broach size until intimate contact is made between the broach and the medial and lateral cortices. The final size is achieved when the broach maintains axial and rotational stability, and is at a seating level that recreates proper leg length (Figure 47).

Note: The TRI-LOCK Diamond Tooth broaches grow consistently 1.25 mm laterally and 2 mm distally between each increasing stem size. Initial medial cortical contact should be the goal in broaching this system since the broaches will only grow towards the lateral cortex as they increase in size.

Note: It is not recommended to rotate the broach into the anterior and posterior planes until it is time for the final rotation stability check. Rotating the broach prematurely can create open spaces between the final stem and the cancellous bone on the anterior and posterior sides.

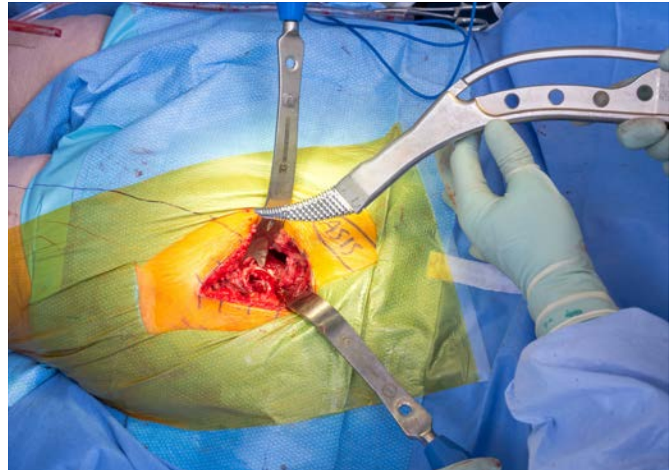

Figure 46

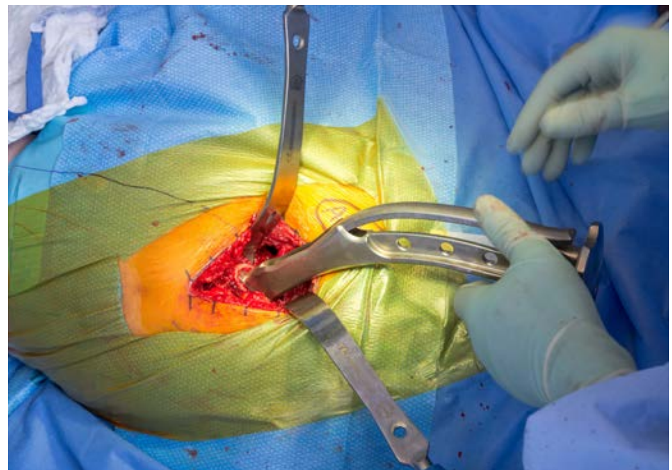

Figure 47

Femoral Trialing

Place a trial head and neck on the broach and perform trial reduction (Figure 48).

Return the table to the level position with the legs parallel with the floor.

To reduce the hip, use one finger to maintain the trial head and neck onto the broach, and another hand to lift the capsule anteriorly out of the way while the head is reduced (Figure 49).

Test for posterior/anterior stability. Check leg lengths at the feet, as both feet are accessible (Figure 50).

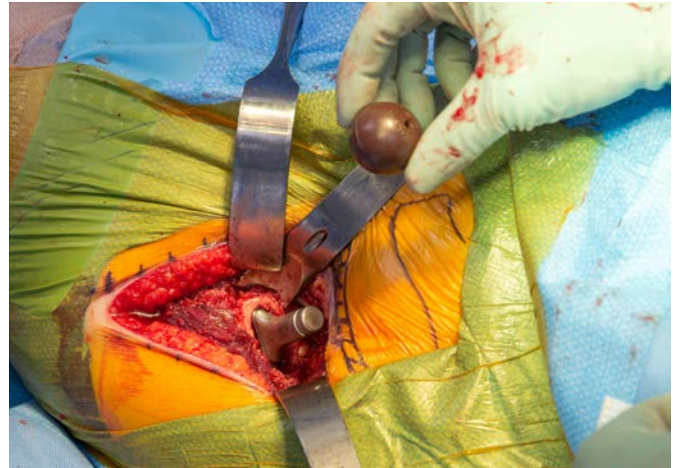

Figure 48

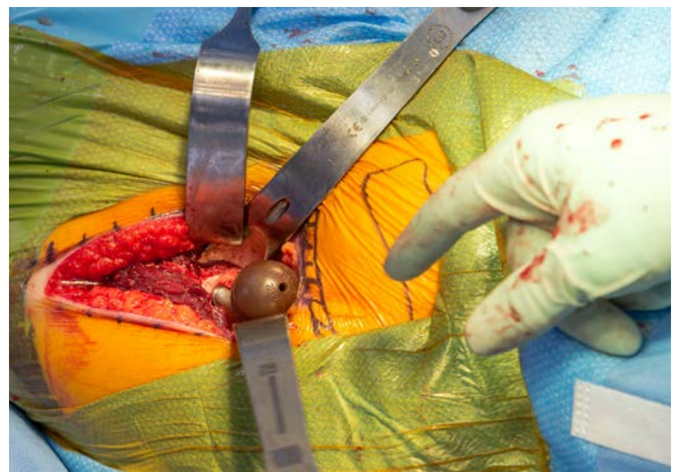

Figure 49

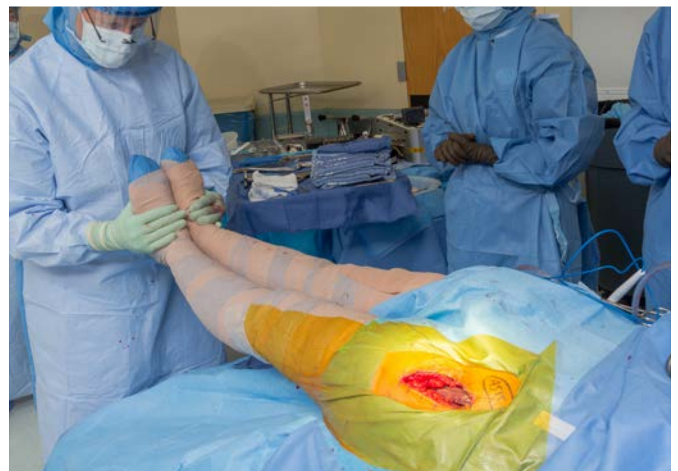

Figure 50

Femoral Broaching

Check the leg length and offset with the X-ray. Position the hips identically to get accurate comparison views. Take an X-ray of the non-operative hip to be used as a control. Then take a picture of the operative hip for comparison (Figure 51).

Print out the operative hip picture and overlay with a pre-operative X-ray then compare with the pre-operative plan (Figure 52-53).

Tip: Take a distal X-ray to check stem direction and correct sizing in the canal.

Figure 51

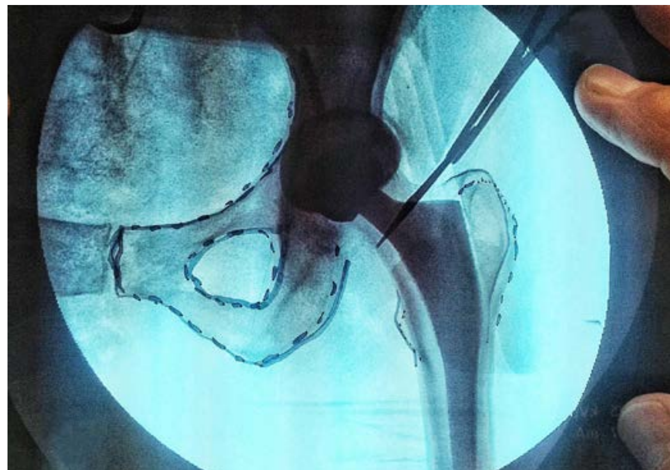

Figure 52

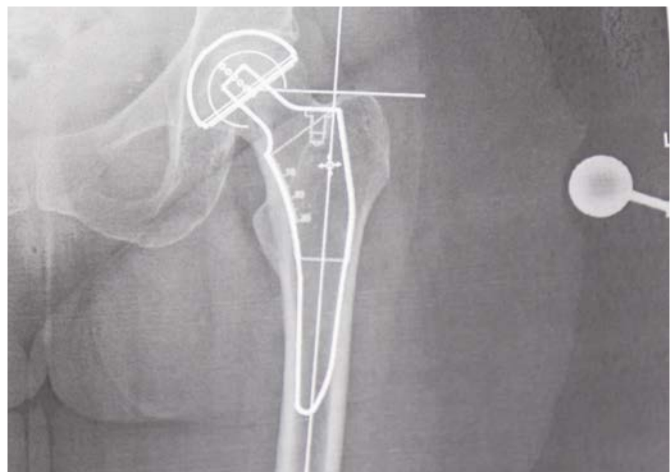

Figure 53

Final Implantation

Dislocate the hip; replace the same retractors to re-establish femoral exposure. If the trial reduction was satisfactory, with good broach size and position, and accurate length and offset, then plane the calcar if necessary. Place the MI Calcar Planer (Cat. 9400–80–007) onto the broach trunion and mill the calcar to the broach face. Make certain the calcar planer is rotating before engaging the calcar to prevent the planer from binding on the calcar.

If during trial reduction, it was determined that adjustments were needed, make the necessary adjustments to correct broach size, insertion depth, neck length or offset. Significant adjustments should be checked with another trial.

Remove trials and implant the final stem.

Impact the stem with light blows until it is seated using the Anterior Inserter (Cat. Nos. 2598–07–460 – Modular Inserter Handle and 2598–07–440 –CORAIL®/TRI-LOCK Bone Preservation Stem Anterior Inserter Shaft).

Final impaction with straight impaction handle
Select the stem size that corresponds to the final broach. In the medial and lateral areas of Gription coating, the implant is oversized by 0.25 mm per side relative to the broach. Introduce the implant into the femoral canal by hand as far as possible before engagement with the stem inserter. Take care to orient the implant with proper alignment and version (Figure 54).

Using moderate mallet blows (Figure 55), advance the stem into position. The implant is fully seated when the top of the Gription coating reaches the level where the face of the broach previously sat and the implant is stable. Excessive force should not be needed to seat the stem. Place the final head onto the stem and impact.

Take a final X-ray and perform wound closure. Close the anterior capsule with sutures and irrigate. Insert a drain and close the fascia subcutaneous tissue and skin (Figure 56).

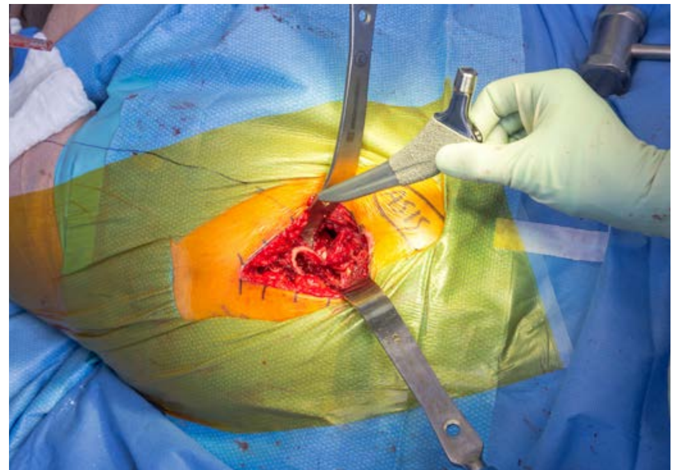

Figure 54

Figure 55

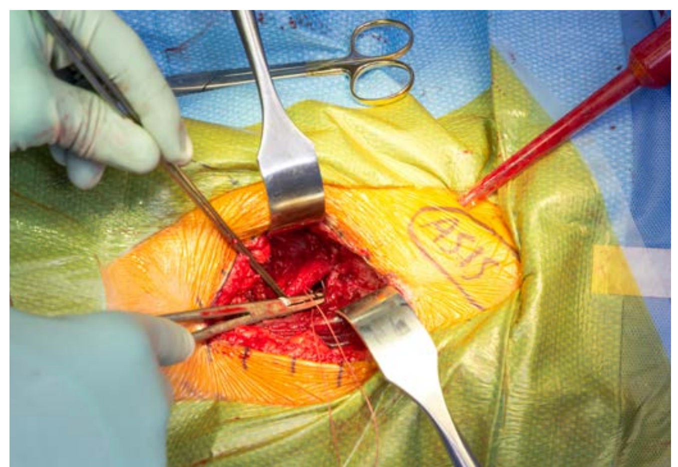

Figure 56

Approach Tips

For your first Anterior Approach cases, select your patients carefully. The most difficult patients are the heavy, muscular males that have short femoral necks, or morbidly obese patients. As you become more comfortable with the technique, you will find that you can expand your patient selection. Many surgeons use the Anterior Approach on all patients, once they are through the initial learning curve.

Orthopaedic surgeons are accustomed to palpating bone, cutting to the bone and following it. The Anterior Approach may produce some initial unfamiliarity because it is more of a pure soft tissue approach and relies on recognition of soft tissue landmarks.

Be meticulous with exposure of the lateral neck/top of the trochanter. It improves access to the femur and makes it easier to avoid varus implant placement.

Pain Management Tips

A peri-articular injection of long acting anesthetic has been found to be effective. Be sure to include the capsule which contains pain fibers.

During post-op rehab patients should avoid repetitive hip flexion exercises since this can cause pain.

Patients do not have protective gluteal pain and must be told to avoid squats and lunges for 6 weeks.

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