

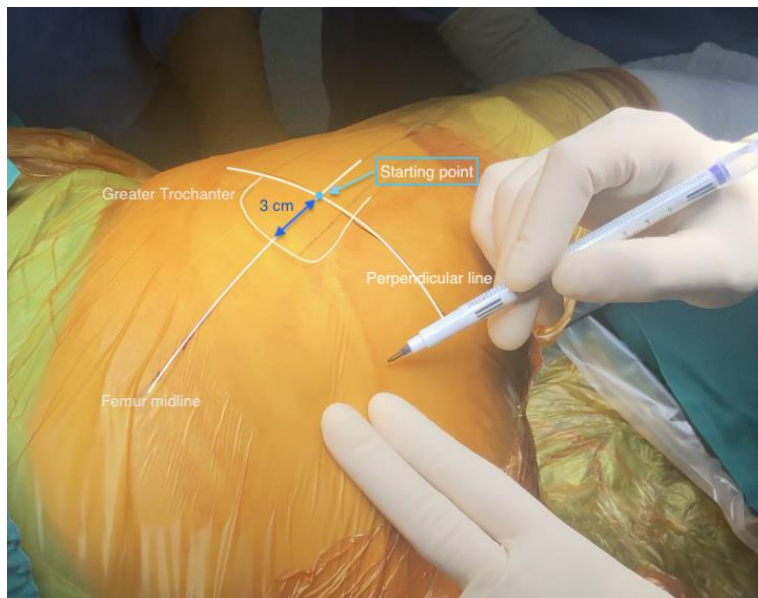
# 5 steps of the STAR surgical technique

## 1. Position of the patient

The patient is placed in the lateral decubitus position. Standard positioners are placed on pubic symphysis and lower lumbar spine to support the patient and allow for the joint's maximum mobility in flexion, extension, internal and external rotation. The skin is prepared and draped reliably to allow so the whole gluteal area to be accessible.

## 2. Anatomical landmarks

The greater trochanter's tip and the femur's proximal shaft are palpated and drawn with the marker pen to indicate the anterior and posterior cortex. We aim to identify the piriformis fossa level, which lies approximately two to three centimeters below the greater trochanter's tip and towards the femur's posterior aspect. To determine this anatomical location, we divide the greater trochanter and proximal femoral area into halves. Then, we mark a point three centimeters below the trochanter's tip on the femur's midline, and at this level, we draw a perpendicular line. The crossing of the two lines indicates the starting point of our approach (Figure 1). The initial incision is directed 45 degrees posteriorly and upwards from the incision's starting point at the greater trochanter's posterosuperior corner (Figure 2). The STAR approach goes parallel to the muscle fibers of the gluteus maximus muscle. It is also in line with the skin's Langerhans lines, which presumably leads to better healing without excessive scarring.



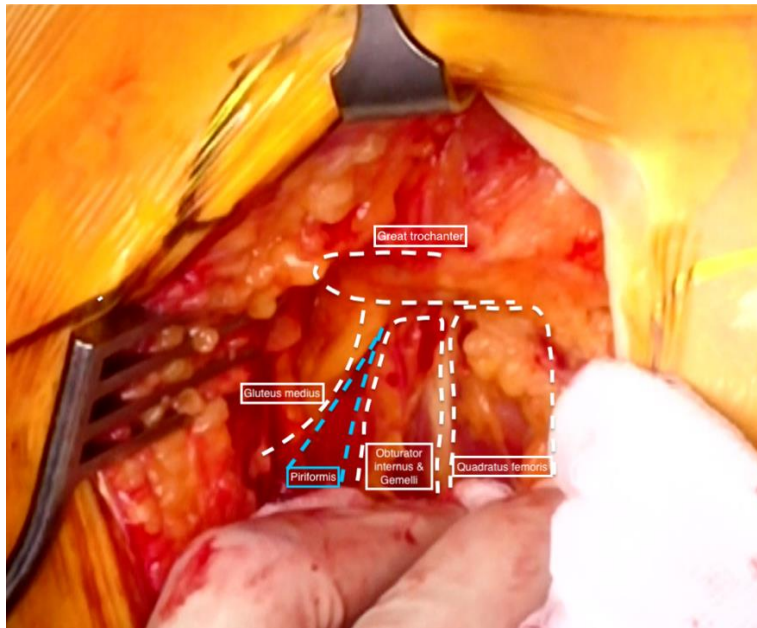
*Figure 1: Starting point of the incision at the crossing of the femur's midline with a perpendicular line 3cm below the trochanter's tip.*



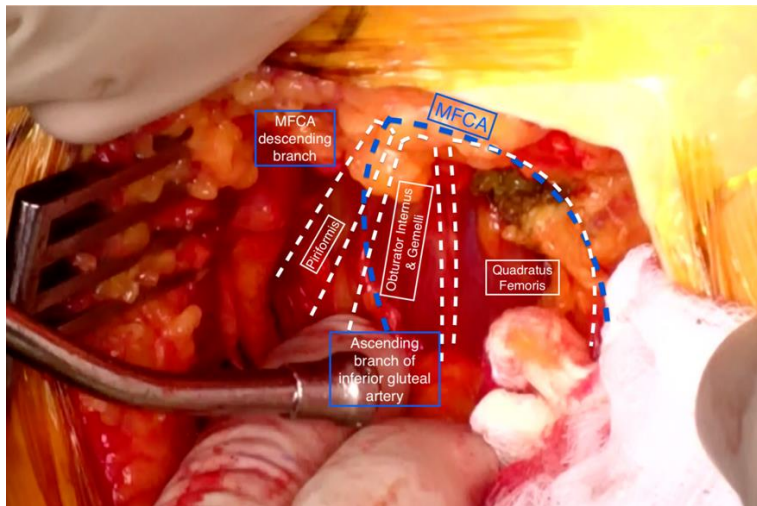
*Figure 2: Incision line from starting point, going 45° posteriorly and upwards of the perpendicular line.*

### 3. Main steps- acetabular approach

The subcutaneous tissue is incised in line with the skin incision down to the fascia of the gluteus maximus. This fascia is incised sharply to allow the gluteus maximus muscle fibers' blunt division, preserving the iliotibial band. The fat around the hip capsule is pushed down to expose the short external rotators (SER) and sciatic nerve (Figure 3). Meticulous hemostasis is performed at this stage at the femoral insertion of SER. The primary vascular supply of the area comes from the medial circumflex femoral artery (MCFA) ascending along the inferior border of the obturator externus, crosses the middle of the quadratus femoris anteriorly, and then turns almost 90 degrees parallel to the posterior femoral neck leaving at the turning point a short trochanteric branch [3]. It then passes anteriorly to the SER's insertion and then crosses the interval between the PF and the upper border of the superior gemelli. It then anastomoses with a vertical branch of the inferior gluteal artery that descends over the PF, the latter branch usually acting as an indicator of the PF [3] (Figure 4).



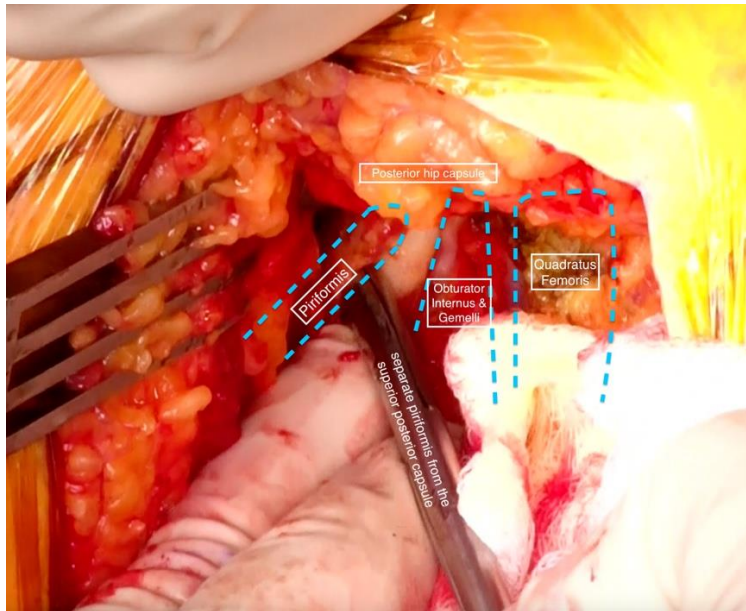
*Figure 3: Exposed Gluteus Medius and Short external rotators*



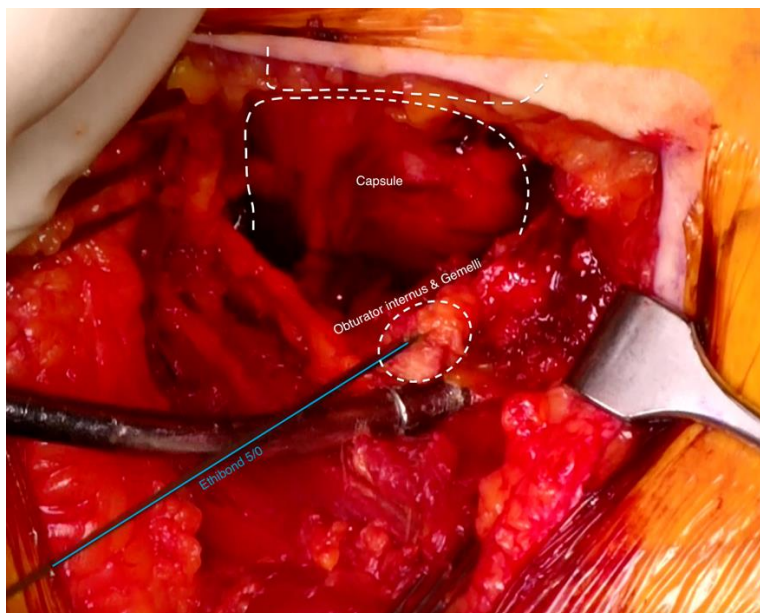
*Figure 4: The ascending branch of inferior gluteal artery as an indicator of the Piriformis, with its anastomosis with the medial circumflex femoral artery.*

The gluteus medius (GMed) is then identified, and a Langenbeck retractor is placed under the GMed to expose better the PF and gluteus minimus (GMin) muscles. The plane between PF and the other SER is identified; the PF is bluntly separated from the superior gemellus and obturator internus (OI) and retracted with a small retractor (Figure 5). The hip is then flexed and internally rotated to fully expose OI and gemelli tendons that are tenotomised close to their femoral insertion. These tendons are stripped off the posterior capsule, tagged with an Ethibond suture, and retracted posteriorly to keep the sciatic nerve safe (Figure 6). Obturator externus and quadratus femoris

remain intact. The capsule is then exposed and incised from distally starting at the lower border of the posterior neck, parallel to the intertrochanteric line and up towards the PF fossa. It then crosses vertically down to the posterior acetabular rim in line with the PF's inferior border, protected by a slim retractor (Figure 7). The capsular flap that is formed is tagged with a running Ethibond suture and pulled back (Figure 8).

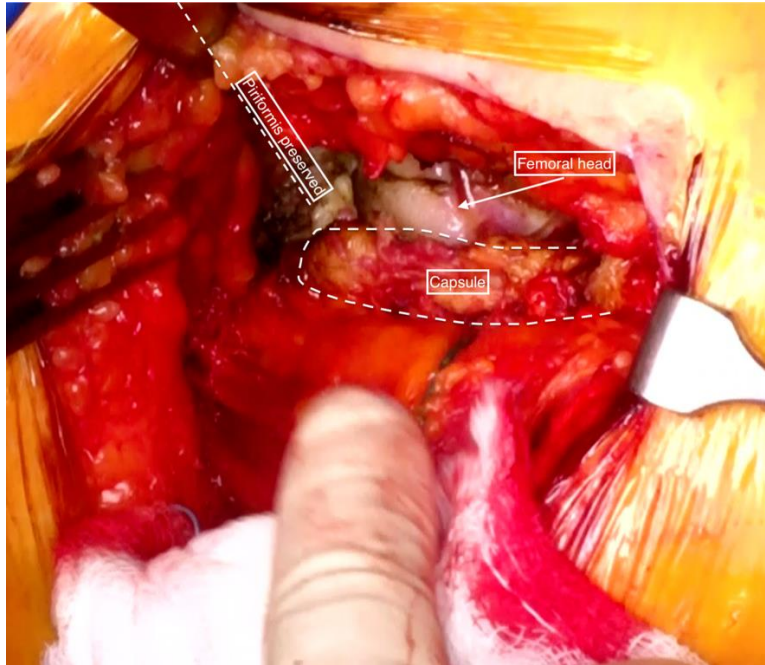


*Figure 5: Separation of Piriformis from superior posterior capsule.*

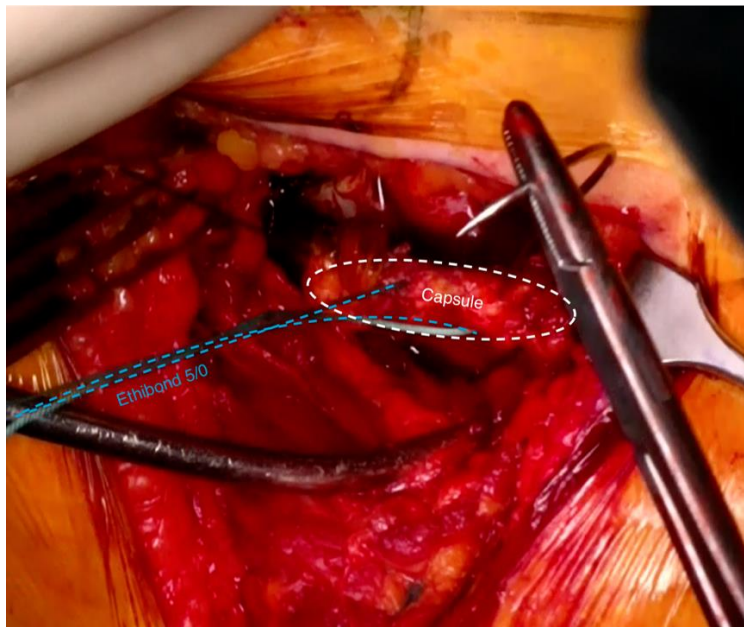


*Figure 6: Obturator internus and Gemelli tenotomised and tagged with an Ethibond 5/0 suture*





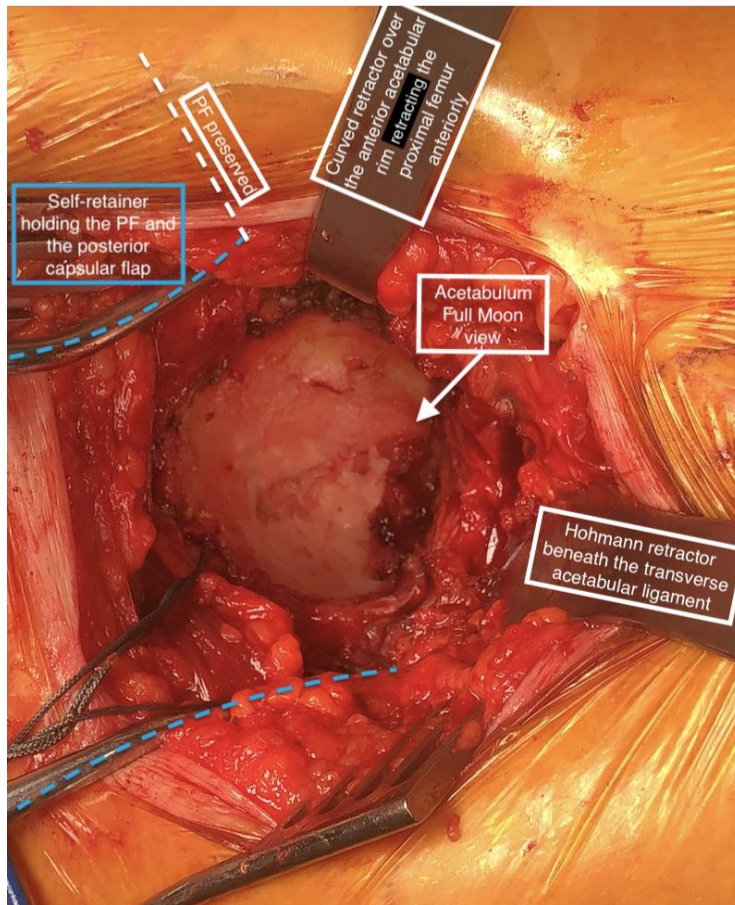
*Figure 7: Incised capsule and exposed femoral head*



*Figure 8: Tagged capsule with Ethibond 5/0 suture*

The hip is then flexed and internally rotated; the hip is dislocated, and the femoral head is removed. The leg remains in adduction and internal rotation to give the surgeon access to the anterior neck osteophytes and anterior capsule. A curved retractor is placed over the anterior acetabular rim to retract the proximal femur anteriorly while the leg is flat on the table (Figure 9). The surgeon is then free to remove the anterior labrum and, if necessary, to pie crust the rectus femoris' reflected

head. Access to the acetabulum is facilitated with a Hohmann retractor positioned beneath the transverse acetabular ligament (Figure 9). A small self-retainer is placed superoposteriorly to hold the PF above and the posterior capsular flap away during reaming (Figure 9). We used straight reamers and other instruments for cup preparation and implantation.



*Figure 9: Acetabular “Full Moon” view with two Hohmann retractors and two self-retainers*

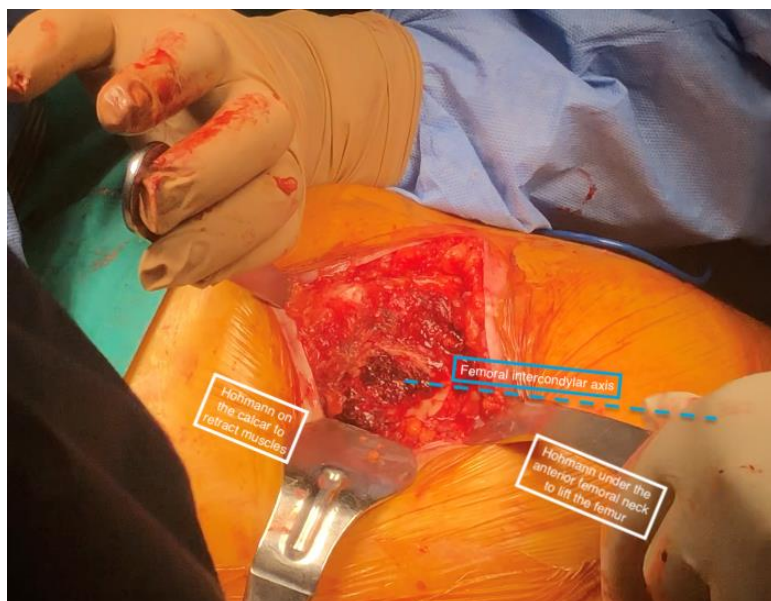
#### 4. Femoral preparation

During femoral preparation, the hip is placed in flexion, adduction, and internal rotation. The assisting surgeon holds the knee flexion of 90° with the tibia vertical, exerting longitudinal force to the leg to adequately expose the femur (Figure 10). Two blunt Hohmann retractors are needed at this step; the first curved Hohmann is positioned under the anterior femoral neck to lift the femur and the second on the calcar to retract muscles away. This way, anteversion of the femoral neck and ante-torsion of the proximal femur can be readily appreciated as the distal femoral intercondylar axis can be directly visualized, especially to the vertical proximal tibia that is held straight up (Figure 11).



*Figure 10: Hip position during femoral preparation. Knee at 90° flexion, hip in adduction and internal rotation*

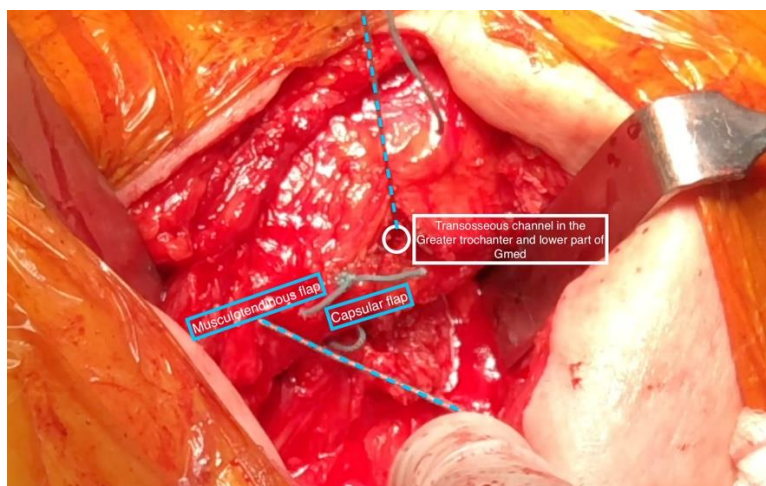




*Figure 11: Two Hohmann retractors placed for direct visualization of the femoral intercondylar axis*

## 5. Tendinous-capsular flap repair

Once the definite components are implanted, the tendinous-capsular flap is repaired. The capsular flap is repositioned first, followed by the musculotendinous flap. Reposition is mediated with tagging sutures passing through a transosseous channel made in the greater trochanter and lower part of Gmed (Figure 12). The other layers are closed with running absorbable suture. No deep drain is used.



*Figure 12: Tendinous-capsular flap repair with the tagging sutures passing through a transosseous channel in the greater trochanter and lower part of Gluteus medius*