SURGICAL TECHNIQUES

Non invasive modified anterolateral approach in total hip arthroplasty

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Introduction

Total hip replacements requires dislocating the joint either posteriorly using a posterior approach or anteriorly using an approach variously termed anterior, direct lateral, anterolateral, transgluteal, etc.

Both types of approach have their well-known advantages and drawbacks, and the choice is a question of the operator’s habits. Minimally invasive techniques have recently been developed. Some, such as mini-posterior or mini-lateral approaches, merely reduce incision size, whereas truly minimally invasive techniques seek to respect the musculature in its entirety. Such is the case of the Watson-Jones approach, modified by Heinz Röttinger, which passes between the tensor fasciae latae and the gluteal muscles (gluteus medius and minimus), conserving the entire musculature by placing the lower limb in external adduction-rotation and, above all, in extension.

The classic position for an anterolateral approach is in adduction, external rotation and flexion, but flexion brings the gluteals forward, masking femoral access.

In Röttinger’s modified approach, hip extension removes the gluteal barrier by passing the gluteal muscles behind and thereby providing perfect exposure of the superior extremity of the femur and the cup of the neck.

Anesthesia

Anesthesia may be general or spinal; on condition of muscle relaxation is achieved.

Patient positioning

The patient is positioned in lateral decubitus, ideally on a pediatric vacuum mattress, which equalizes pressure distribution and provides perfect patient support during the various maneuvers (Fig. 1).

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The lower limb to be operated on is placed horizontally on a leg support.
As the surgeon operates from the ventral side, the patient should be installed as close as possible to surgeon.
The contralateral greater trochanter, on which the patient is lying, should be about 20 cm from the edge of the table, so as not to end up overhanging when the posterior leg support is removed to allow the leg to be positioned for the femoral preparation phase.

**Anatomic landmarks and incisions**

Limb position: neutral, on leg support, in slight external rotation.
The anterosuperior iliac spine and the tip of the greater trochanter are located and marked with a marking pen.
The surgeon uses internal and external rotation movements to palpate cutaneously the space between the relatively flat tensor fasciae latae and the more oval gluteal muscles and mark the incision line.
The incision is oblique, running from a point 3 to 4 cm below the tip of the greater trochanter to a point about two finger-widths beyond the anterosuperior iliac spine. The direction of the line is determined by palpation of the orientation of the space and also by the angle of inclination of the femoral neck: it is more horizontal in case of coxa vara and more vertical in coxa valga.

**Exploration for the intermuscular space**

Limb position: neutral, on leg support, in slight external rotation (Fig. 2).
The incision is extended directly over the aponeurosis, which is opened along the axis of the incision: the muscle seen bulging in the aponeurosis is the gluteus medius. The space is located by finger dissection against the bone up to the anterior intertrochanteric line, which provides an excellent landmark for separating the gluteals and the tensor fasciae latae (Fig. 3). Care must be taken to avoid inward or upward medial dissection, which would lead into the contraction area between the two, causing pointless difficulty and muscle damage.
anatomic variants, that it seems possible to section without any functional risk; it is indeed probably systematically damaged on transtrochanteric and Hardinge approaches.

Capsule exposure and arthotomy

Limb position: neutral, on leg support, in slight external rotation (Fig. 4).

Using a Cobb elevator, the capsule is released and the vastus lateralis is located on the outside and the indirect head of the rectus femoris above and within, enabling positioning of a Hohman retractor on the superior edge of the acetabulum.

A Z or H-shaped window is created in the capsule. It is useful to incise the capsule parallel to the superior border of the femoral neck, to expose the femoral neck and locate two anatomic structures:

- the femoral head, toward which the capsular incision is extended up to the edge of the acetabulum and then along the edge, somewhat anteriorly and posteriorly;
- the "saddle" of the femoral neck and base of the greater trochanter, toward which the capsular incision is extended parallel to the vastus lateralis.

The entire capsule may be left to be closed at end of surgery. However, this may impair postoperative flexion, and the capsular flaps may hinder exposure; it is therefore often useful, and without harmful impact, to resect part of the anterior capsule.

At this point, the inferior Cobra retractor must be moved from outside to inside the capsule, not under the neck but under the femoral head: traction exerted on the retractor tenses the inferior capsule, facilitating capsule release along the inferior edge of the neck, with the limb in slight external rotation, providing excellent exposure. The superior retractor, after limited capsule release along the greater trochanter, is likewise positioned inside the capsule, to expose the femoral neck and head.

Femoral neck osteotomy and femoral head extraction

Limb position: neutral, on leg support, in slight external rotation.

The first osteotomy is performed with the limb in slight external rotation, depending obviously on the individual degree of ankylosis. It is performed immediately superior to the equator of the femoral head (Fig. 5), using a thin 8–10 mm blade, not perpendicular to the neck axis, in the frontal plane but slightly inclined (15–20°) downward and backward to enable the femoral neck to slide over the remaining part of the head after osteotomy release, with 90° external rotation.

Limb position: lower limb in extension and 90° external rotation (leg hanging behind patient).

At this point, the lower limb is in 90° external rotation, zero abduction and slight extension. The retractors are put back in position on the femur: one Cobra on the inferior side of the femoral neck, and one Hohman on the greater trochanter to expose the saddle of the femoral neck, which can be further released with a small capsulotomy using electrocautery.

The saddle of the femoral neck and the origin of the medial aspect of the greater trochanter can now be palpated, guiding the second osteotomy (Fig. 6). This is performed using an oscillating saw, with the lower limb in strictly frontal 90° external rotation.

The segment of femoral neck is then removed, and the retractors on the neck should now be taken off (Fig. 7).

Limb position: neutral, on leg support.

The lower limb is repositioned in neutral posture, and the Cobra retractors are repositioned on the acetabulum, one anteriorly and one posteriorly.

The femoral head can thus be directly removed with a bone nibbler or a corkscrew (Fig. 8), which should penetrate...
via the cartilage rather than via the cut itself so as to have a favorable extraction arc (180° downwards). At this point, the lower limb may be positioned in pure external rotation and the lesser trochanter palpated as a purely tactile rather than visual landmark to assess the section level of the femoral cut. A third cut may be made according to peroperative observations.

**Acetabular exposure**

Limb position: neutral, on leg support, in slight external rotation (Fig. 9).

One double-spike Cobra retractor is positioned at 4-o’clock (or 8-o’clock, depending on the side) to recline the femur backward; the second is positioned at 8-o’clock (or 4-o’clock) to retract the anterior capsule and musculature, facilitated by positioning the hip in flexion so as to relax the capsule. In flexion, it is easy to palpate the labrum and the space with the capsule in which the retractor tip is positioned. A third Hohman retractor may be positioned on the superior edge of the acetabulum.

Now all of the procedures of capsule preparation, osteophyte resection and acetabular preparation are performed in the usual manner. It is important to have an offset reamer handle and especially an offset shell inserter for the final implant positioning, to ensure optimal positioning of the acetabular component. Thisoffset shell inserter should be as small as possible to facilitate the introduction and especially the removal of instruments once the acetabulum is in place.
The acetabular component is positioned purely according to the anatomic landmarks.

**Femoral exposure**

Limb position: the lower limb is placed in 20° extension (i.e., posteriorly), about 20° adduction toward the ground, and 90° external rotation (Fig. 10). The leg is placed in a sterile pocket attached to the surgical drapes, with the tibia vertical to the ground. This position allows joint capsule release from the neck cut along the medial aspect of the greater trochanter, where the capsule is very thick. Bone contact needs to be made with the electrocauter, providing a perfect guide to reach the summit of the greater trochanter (Fig. 11).

There is no tendinomuscular insertion at the summit of the greater trochanter but only connective fibers, the greater trochanter acting as a pulley for the gluteus medius.

This capsule release allows the femur to “rise” in the incision, avoiding fracture of the tip of the greater trochanter and especially providing perfect exposure. This is the essential and difficult step of the procedure.

A simple maneuver consists, after initial capsule release, in returning to neutral position, introducing a hook in the cup of the neck to pull it upward, and repositioning the limb. This maneuver releases the femur from the posterior wall of the acetabulum, turning it above the acetabulum to improve femoral exposure. Exposure is further improved by progressively extending capsule sectioning to the medial side of the greater trochanter, bearing in mind that the greater trochanter is very posterior.

In stiff hips or muscular patients, it may be necessary to extend capsule resection downwards to the femoral neck cut or beyond, thus releasing the piriformis muscle along with the posterior capsule, like a sleeve. A Hohman retractor is positioned at the tip of the greater trochanter to retract the gluteal muscles and another at the posteromedial part of the neck cut. The assistant at this point brings the knee as far down toward the ground as possible, exposing the neck cut in the intermuscular space and the incision. Femoral preparation then proceeds as usual (Figs. 12 and 13), although care must be taken to perform trepanation using a curette and blunt instruments as any sharp instrument could result in perforation, which would systematically be posterior, above the origin of the linea aspera. An offset rasp-holder facilitates access to the femur and avoids this pitfall, while protecting the skin. The retractors should be moved following the mobile window technique, not forward and outward but inward and backward.

The distance between the summit of the greater trochanter and the shoulder of the rasp or of the prosthesis, which is the best landmark for implanting the femoral component, is measured peroperatively. This new way of measuring the length requires radiographic control at first to ensure good femoral implant positioning.

Reduction maneuvers are facilitated by a slight flexion of the hip during traction and complete muscular relaxation.
Implant fixation

The positioning of the acetabular and femoral components is assessed as usual. Fixation may be performed with or without cement.

Closure

The joint capsule may be fixed by a few sutures, or simply "repositioned". Hemostasis in the venous plexus anterior to the gluteus medius muscle must be ensured. Closure is very quick: it is enough to close the aponeurosis and superficial tissue.

Conclusion

This approach enables genuine muscle-sparing surgery, as demonstrated by a postoperative course exactly equivalent to what can be expected from non-invasive surgery in terms of speed of functional recovery, short hospital stay and autonomy. Conservation of the gluteal muscles and tensor of the fascia lata has been demonstrated by MRI analysis in patients operated through this approach.

The learning curve is demanding, but clinical results show a low rate of complications, at least comparable to classical techniques, with reliable implant positioning.

The approach may be used systematically in well-centered osteoarthritic hips, apart from specific indications as for a posterior approach in case of presence of material following posterior wall fracture. It is not, however, suitable when more than 2 cm lengthening of the hip is required, as in case of subluxation.

In a centered hip, the technique involves no limits in terms of age, osteoporosis or ankylosis. Obesity is an excellent indication: the abdominal pendulum remains further from the incision than on a Huerter approach; the incision needs to be enlarged, simply to facilitate the introduction of instruments in the femoral phase; postoperative course is spectacular in these patients, compared to a classical approach.

All types of acetabular and femoral component can be implanted through this approach.

Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

Further reading


J. Aebi, M. Giraud. Finding the THA procedure to "Fit" the surgeon: which MIS technique works for all? 75th annual meeting of the AAOS. San Francisco, March 5—9, 2008.

