MENTORS IN ORTHOPEDICS

HIP ARTHROSCOPY ON THE ORTHOPAEDIC TABLE: TECHNIQUE, TIPS AND TRICKS TO AVOID POTENTIAL COMPLICATIONS

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SUMMARY

Background: Hip arthroscopy has evolved significantly since 1931, with expanding indications for intra-articular and extra-articular pathologies. The procedure involves a demanding learning curve and specialized instrumentation, while training is often limited by the scarcity of anatomical specimens and specialized centers.

Objective: This article provides a comprehensive review of hip arthroscopy, detailing surgical anatomy, clinical indications, potential complications, and standardized technical approaches for accessing the various arthroscopic compartments.

Key Points: The hip is categorized into central, peripheral, peritrochanteric, and posterior compartments. Accessing the central compartment requires approximately 1 cm of joint distraction under fluoroscopic guidance, typically performed in the supine position. Standard portals—anterolateral, anterior, and posterolateral—must be established within safe zones to avoid neurovascular structures like the femoral and sciatic nerves. Complication rates currently range from 0.5% to 7.9%, primarily involving traction-related neuropraxia, iatrogenic chondral injury, and fluid extravasation. For the peripheral compartment, traction is released and the hip flexed to 20°–45° to visualize the femoral head-neck junction. Peritrochanteric access enables management of extra-articular conditions, including gluteus medius tears and bursitis. Technical success relies on precise portal placement and sequential exploration of the joint spaces.

Conclusion: Hip arthroscopy is a technically complex procedure requiring precise anatomical knowledge and adherence to safety protocols. Standardized portal placement and careful patient selection are essential to minimize complications and optimize outcomes in the management of coxofemoral pathology.

KEYWORDS

Arthroscopy; Hip Joint; Femoracetabular Impingement; Orthopedic Procedures; Postoperative Complications

INTRODUCTION

The first hip arthroscopy was performed in a cadaver by Michael Burman in 1931, and use of this technique is currently booming, with an increasing number of indications. Training in the technique is long, difficult, and requires specialised equipment including a traction table, image intensifier, 70° arthroscope, trocars (e.g. switching stick), and an open cannula (Half Pipe) for instrument changes.

Furthermore, providing the training is a problem owing to a lack of equipped training centres, most of which are not linked to universities. Training on anatomical specimens is the best way to learn, but these are rare and expensive.

Before describing the surgical technique, I think it is important to review the different arthroscopic compartments of the hip, and to give a brief description of the pathologies in question, as well as potential complications.

ANATOMY

From an anatomical perspective, the hip can be subdivided into four distinct arthroscopic compartments:

- A central compartment delimited on one side by the cartilaginous surface of the acetabulum, to the back by the round ligament, the transverse ligament and the deep surface of the labrum, and on the other side by the cartilage of the femoral head;
- A peripheral, extra-articular compartment situated between the capsule and the femoral neck;
- A peritrochanteric compartment located between the greater trochanter (with the vastus lateralis distally and the gluteus medius proximally) and the fascia lata;
- A posterior compartment containing the proximal tendons of the hamstrings and the sciatic nerve.

INDICATIONS

Literature now describes numerous indications for hip arthroscopy (2-9). These can be divided into intra- and extra-articular pathologies.

Intra-articular pathologies comprise labral defects, pincer-type femoroacetabular impingement, acetabular chondral defects, synovial pathologies, round ligament injuries, iliopsoas tendonitis refractory to conservative treatment, coxa saltans interna, trapped synovial fringe, traumatic foreign bodies, metaplasias and plica syndrome.

Extra-articular pathologies comprise Cam-type femoroacetabular impingement, synovial pathologies, iliopsoas tendonitis, hypertrophic and fibrous pectineofovial fold, traumatic foreign bodies, metaplasias, periarticular cysts, heterotropic ossification, atraumatic instability, chronic bursitis of the greater trochanter, coxa saltans

externa, gluteus medius detachment, sciatic nerve compression, hamstring tear and chronic hamstring tendonitis.

COMPLICATIONS

In a review of the literature from 1968 to 2008 (10) the rate of complications due to arthroscopy of the hip ranges from 1.3% to 23.3%. It is currently 0.5%–7.9% (11-14).

The complication rate reflects the long learning curve of the surgeon, reducing as the the surgeon gains experience. It also declines with better patient selection and compliance with technical guidelines (14). However, the complication rate remains stable over time even if increasingly complicated operations are being performed (12).

Complications can be divided into three categories: traction-related complications, specific complications and nonspecific complications.

Traction-related complications can be further divided into "distraction" or "compression" injuries.

Distraction injuries are the most frequent (15,16). They are neurological, neuropraxic and often temporary injuries, accounting for up to 7% of complications (17,18). They affect the sciatic, pudendal and femoral nerves, and are due to traction times of more than 2 hours. Two cases of femoral head osteonecrosis due to traction have been described (10,19).

"Compression" type injuries are caused by hip supports and traction boots. They affect the soft tissues of the perineum, scrotum or labia majora (oedema, haematoma (20) or necrosis (21-23)) as well as the feet. They can also be neurological, affecting the pudendal nerve at the pubic bone and the superficial peroneal nerve in the feet.

Specific complications can be linked to the surgical approach and infusion leakage. Two other specific complications are femoral neck fractures after femoroplasty and hip instability.

When creating an arthroscopy portal, the nearby anatomic structures can be damaged, leading to iatrogenic injuries of the labrum, femoral head and acetabulum cartilage (most frequently observed with inexperienced surgeons (24,25)), damage to the femoral vessels or posterior circumflex artery (theoretical risk) or direct nerve damage (lateral cutaneous nerve of the thigh (most common), femoral nerve (rare) and sciatic nerve). Bleeding and trochanteric bursitis can also occur.

Extravasation is the most dangerous complication affecting the anatomical spaces near the coxofemoral joint (quadriceps and abdominal space) (13). This often occurs after a long operation and arises through capsular incisions, especially after extracapsular arthroscopy (psoas tenotomy (26,27)) or after a recent fracture of the acetabulum (28). The accumulation of 2–3 litres of liquid in the retroperitoneum can lead to compartment syndrome and death unless an emergency laparotomy is performed. The diagnosis is even more difficult when the patient has received a general anaesthetic or is unable for any other reason to make the surgeon aware of abdominal pains.

Excessive femoroplasty, in the treatment of Cam-type femoroacetabular impingement (bony excrescence at the femoral head–neck junction) can lead to a fracture of the femoral neck (29,30).

Hip instability can arise after arthroscopy, but it is rare, and can take the form of dislocation or subluxation. It can be due to excessive resection of a pincer-type lesion (acetabular overcoverage), a large capsulotomy or an aggressive labrectomy (13).

Nonspecific complications include equipment breakage, heterotropic ossification, infection (rare), thromboembolic phenomena and complex regional pain syndrome (rare).

A few cases of heterotropic ossification have been described in the literature, especially after femoroplasty (19,21,31).

I will purposely not describe the approach into the posterior compartment because I have insufficient experience and the setup is different (in the prone position).

TECHNIQUE

To perform a hip arthroscopy correctly and safely, you need an orthopaedic table, an image intensifier and specific ancillary equipment including extra-long, 17-gauge spinal needles, nitinol guide wires, long cannulas, half-open insertion aid (Half Pipe) for instrument changes while maintaining the portal, a switching stick, an extra-long 70° arthroscope for exploring the central compartment and various long instruments (spacer, electric lancet, curettes, 45° and 90° claw graspers, clamps, etc.). For exploring the peripheral and peritrochanteric compartments, a 30° scope is sufficient.

Setup

Arthroscopy of the hip can be performed in a patient in the dorsal or lateral decubitus position to approach the central, peripheral and peritrochanteric compartments, depending on the surgeon's preference.

Most surgeons prefer to set up the patient in the dorsal decubitus position on an orthopaedic table (32,33).

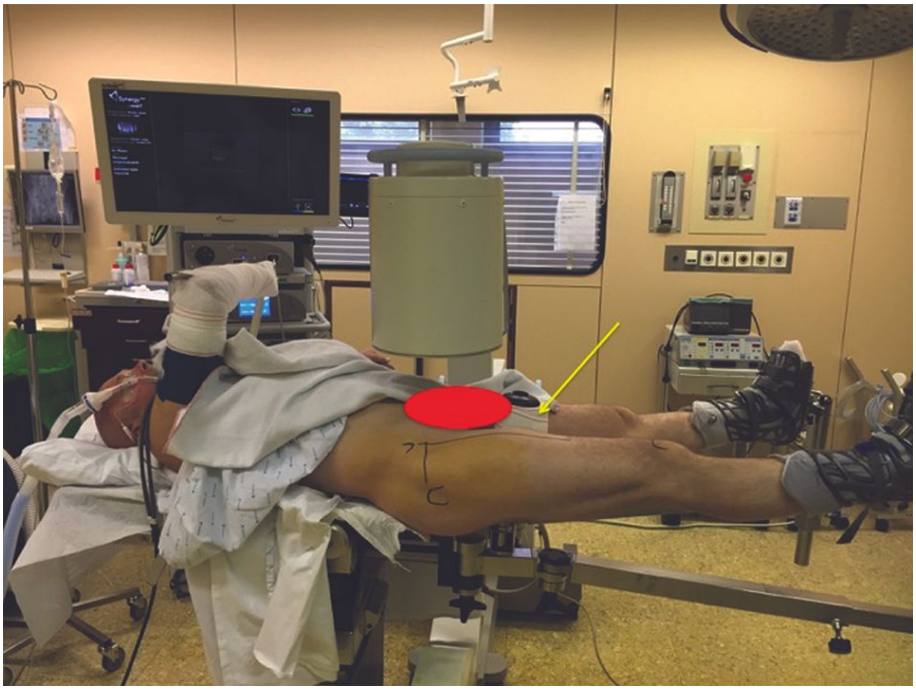
The hip is a deep and strongly coapted joint. To access the central compartment, the coxofemoral joint must be separated to at least 1 cm to avoid iatrogenic damage to the cartilage and labrum.

I will now describe in detail the technique for hip arthroscopy in the dorsal decubitus position on the orthopaedic table with initial exploration of the central compartment using an image intensifier, as this is the technique I use and the most widely practiced in the literature (32,33).

Dorsal decubitus position

The patient is set up on the orthopaedic table in the dorsal decubitus position (Fig. 1). A general anaesthetic is administered with a neuromuscular blocking agent; improved muscle relaxation reduces the required traction force on the lower limb for separating the coxofemoral joint.

A large perineal counter-support, 20 cm in diameter, is used to reduce the risk of damage to the perineal and pudendal nerves (Fig. 1). This is placed alongside the leg which is to be operated on, to slightly offset the femoral head for optimal distraction.



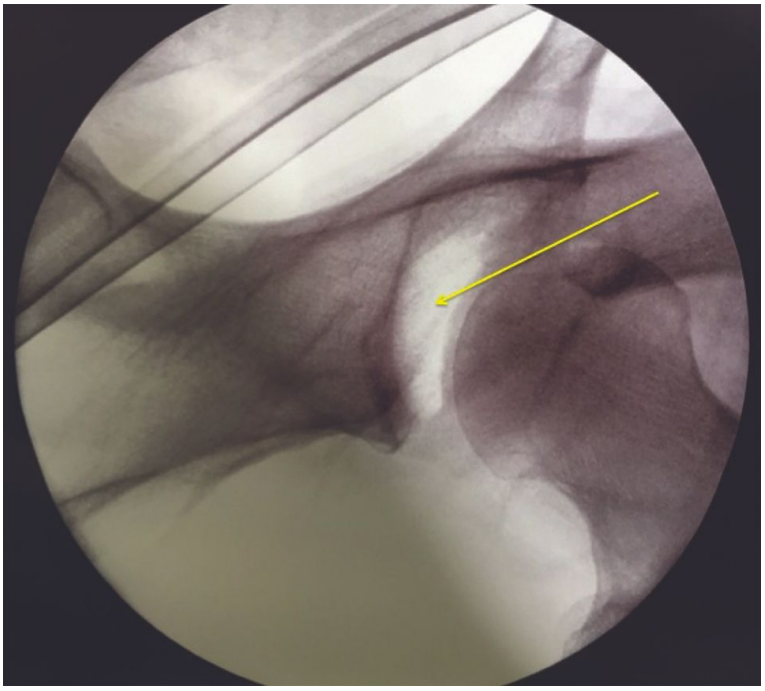
The hip to be operated on is positioned in approximately 10° of flexion and 15–20° of abduction with the patella facing up. This relaxes the anterior capsule and anterior iliofemoral ligament. The other leg is positioned slightly in abduction.

Gentle traction is applied to the other leg first, and then on the leg that is to be operated on, to distribute the force on the perineum and avoid tilting the pelvis.

I always begin the procedure in the central compartment followed by the peripheral compartment, using the image intensifier; certain teams, such as in Paris (34,35) do the opposite, without image intensification.

The image intensifier, used on a pulsing setting to reduce irradiation exposure, allows optimal portal creation and reduces the risk of iatrogenic damage to the labrum and cartilage.

It makes it possible to view a sufficient space between the apex of the femoral head and the roof of the acetabulum to facilitate the insertion of the different trocars. The traction is deemed effective when a light-coloured crescent at least 10 mm thick appears in the coxofemoral joint (Fig. 2).



Arthroscopy portals

The portal depends on which arthroscopic compartment is to be explored.

To create the different portals, anatomical markers must first be drawn on the skin for the best reproducibility: the anterior superior iliac spine (ASIS), the patella and the greater trochanter (Fig. 1). Next, two lines are drawn: one connecting the ASIS to the centre of the patella, and the other perpendicular to the first, passing over the apex of the greater trochanter (Fig. 1).

The different portals are described with respect to these two perpendicular lines. We start by describing the portals used for the central (first) compartment, then the peripheral (second) compartment, and finally the peritrochanteric (third) compartment.

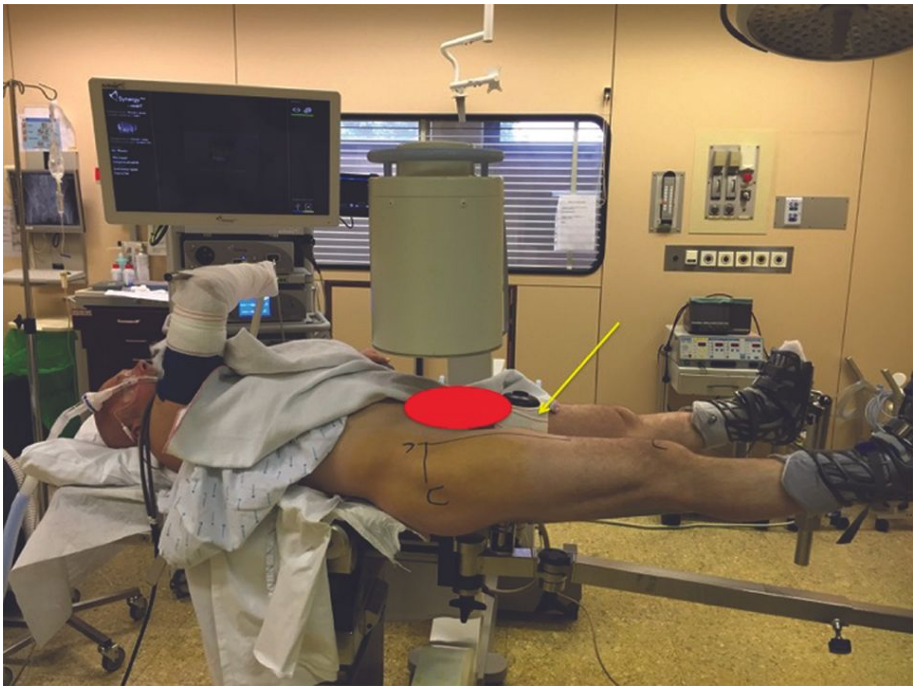
Portals for the central (first) compartment

The three most commonly used portals are, in order, the anterior paratrochanteric portal, the anterior portal and the posterior (posterolateral) paratrochanteric portal.

Before describing the three main portals and accessory portals, it is important to understand where the safe zones lie and which danger zones are to be avoided (Fig. 1).

Two safe zones are advised: the anterolateral zone and the lateral zone. The anterolateral zone is situated between the vertical line connecting the ASIS to the centre of the patella, and the anterior edge of the greater trochanter. The lateral zone lies between the anterior and posterior edges of the greater trochanter.

There are also two danger zones, anterior and posterior (Fig. 1).



The anterior zone is situated medial to the vertical line linking the ASIS to the centre of the patella. It contains the femoral vessels, the femoral nerve and the lymphatic vessels. The posterior zone is behind the greater trochanter and contains the sciatic nerve and the medial circumflex artery.

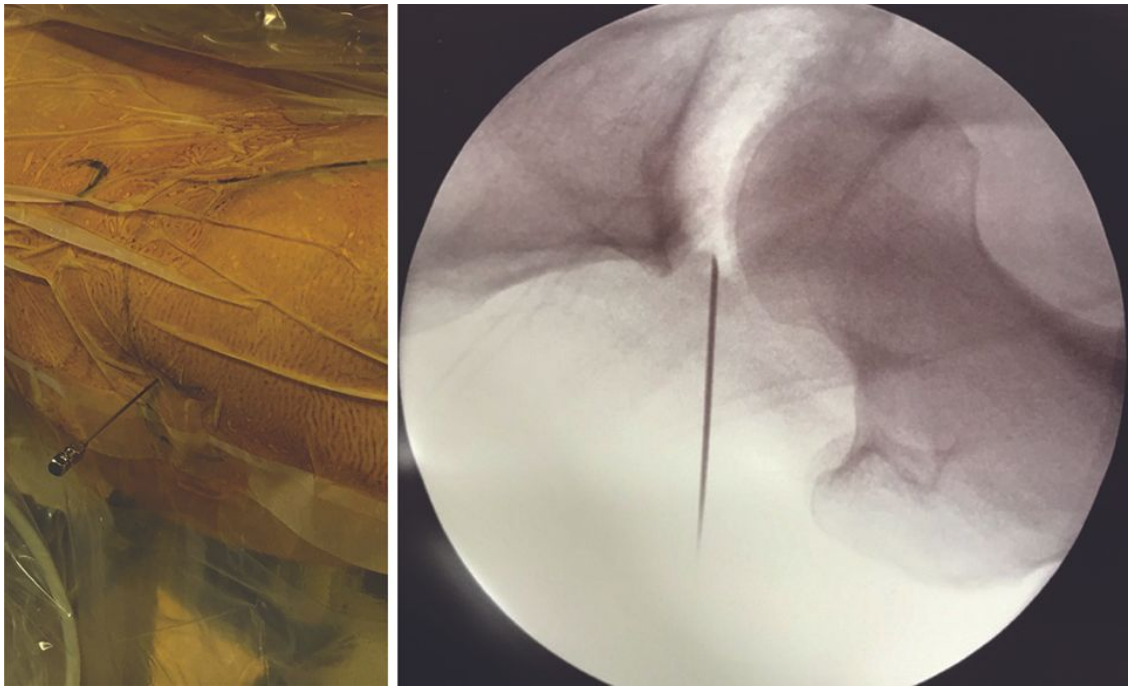
Three main portals

All the portals are created using an extra-long, hollow, 17-gauge spinal needle into which a fine metal (nitinol) guide is inserted. The trocar is introduced on this guide after withdrawing the hollow needle.

The anterolateral, anterior and posterolateral portals are created in sequence.

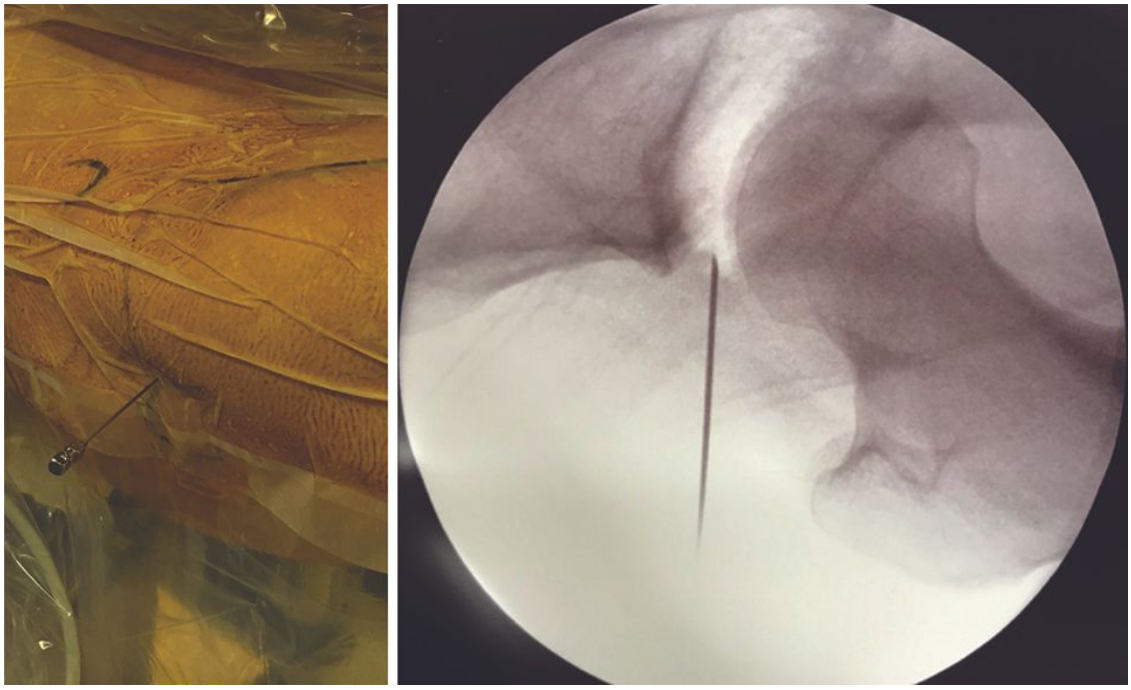
Anterolateral or anterior paratrochanteric portal

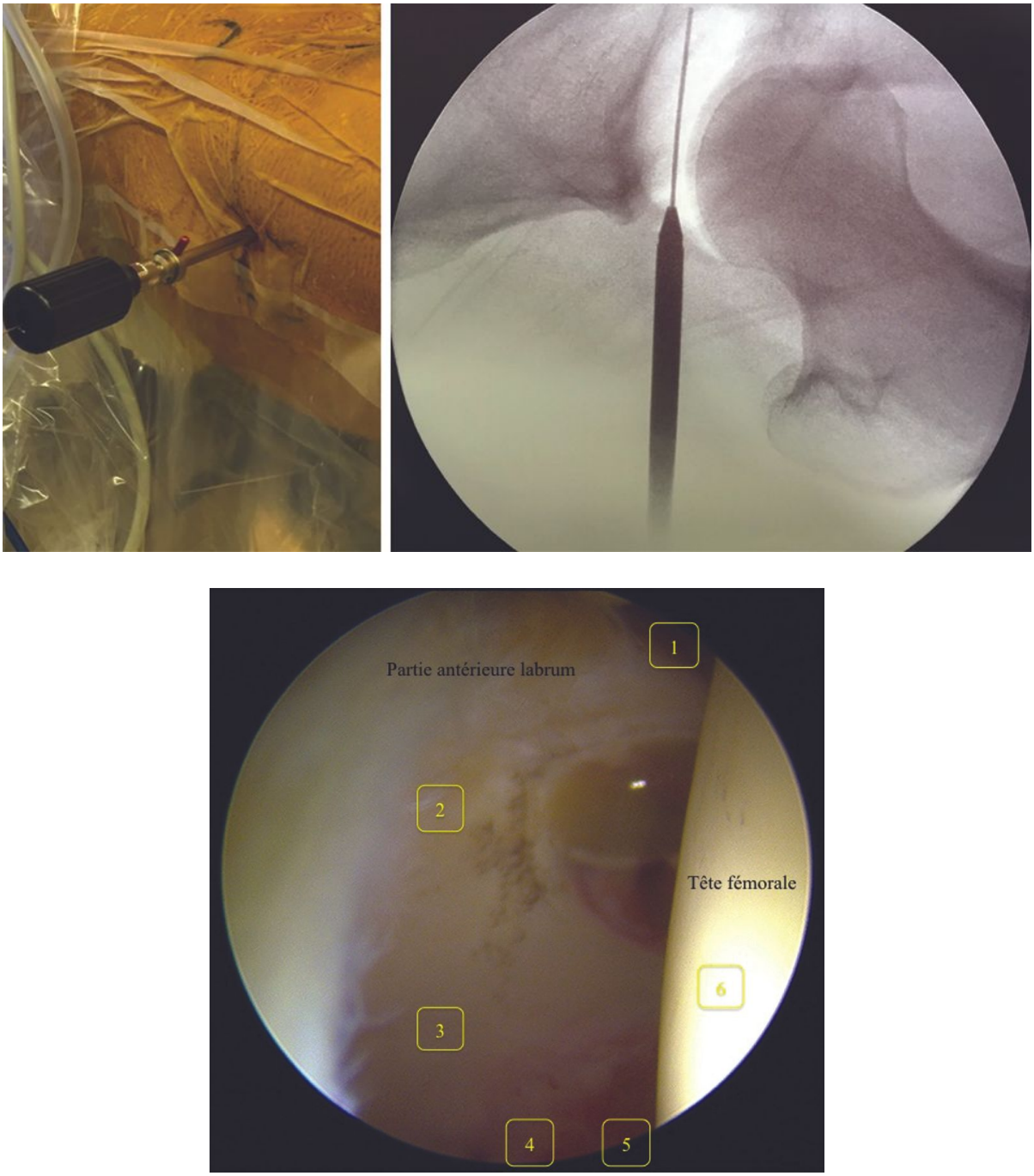
The entry point in the skin is made where the line passing over apex of the greater trochanter (perpendicular to the ASIS–patella line) intersects with the line mapping the anterior edge of the femur. This point is situated approximately 1 cm above and 1 cm in front of the greater trochanter (Fig. 3, left). Using the image intensifier, if the patella is facing up, the needle will be parallel to the floor and pointed towards the clear space in the separated joint (Fig. 3, right).



Intra-articular infusion of 10–20 ml of physiological serum negates the retentive effect of the labrum (36,37).

This technique, coupled with general anaesthesia and a neuromuscular blocker to aid the relaxation of the anterior iliofemoral ligament, allows a reduction in traction force (joint separation) from 500 N to 230–300 N (38,39), thus reducing the risks of potential complications (see “Complications”, above). Next, the nitinol guide is inserted into the spinal needle (Fig. 4). After withdrawing the spinal needle, the hollow trocar is introduced on the nitinol guide (Fig. 5) and the arthroscope is inserted. The arthroscopic view is shown in Figure 6.

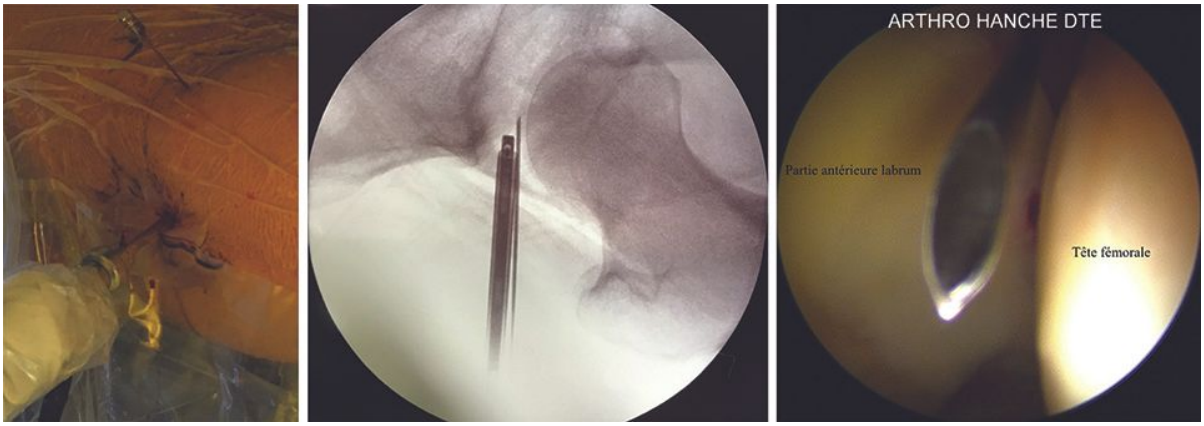




As regards anatomic structures, the portal passes through the fascia lata and the gluteus medius.

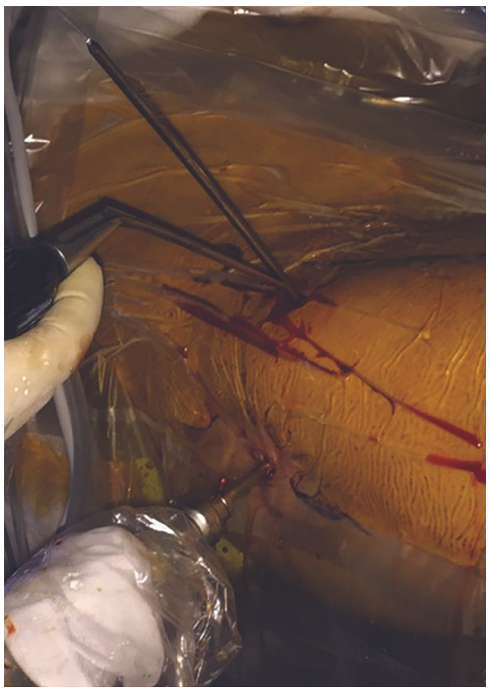
Anterior portal

The entry point in the skin is situated beside the intersection of the ASIS–patella line and the perpendicular line that passes over the apex of the greater trochanter, either over or slightly distal to it (Fig. 7, left). The needle is inserted obliquely, approximately 45° superiorly and 30° posteriorly, guided at first by the image intensifier (Fig. 7, centre) and subsequently by the arthroscope, to arrive in the triangular zone formed by the labrum and the femoral head (Fig. 7, right).



To avoid damaging the labrum and cartilage of the femoral head, the needle is pressed gently to observe the depression of the articular capsule before perforating it; this predicts the point of penetration of the anterior articular capsule.

The nitinol guide is introduced into the spinal needle, then the switching stick is inserted, and then the Half Pipe so as not to lose the portal (Fig. 8). Finally, the different instruments such as the spacer and electric lancet can be inserted.



The portal passes through the sartorius muscle, the tendinous part of the rectus femoris, and the anterior joint capsule.

The anatomic structures at risk of damage are the lateral cutaneous nerve of the thigh, the lateral circumflex artery of the thigh and the femoral nerve.

Arthroscopic exploration of the central compartment

I have described this arthroscopic exploration into quadrants, beginning with the anterior view and moving anticlockwise (for the right hip):

1. Anterior view;
2. Superior view;

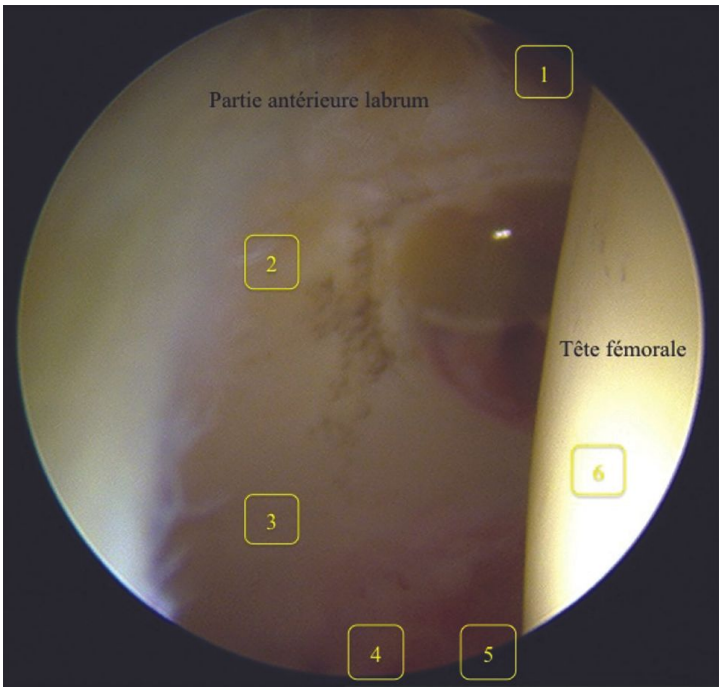
3. Central cartilaginous view;
4. Central view;
5. Posteroinferior view;
6. Femoral head view

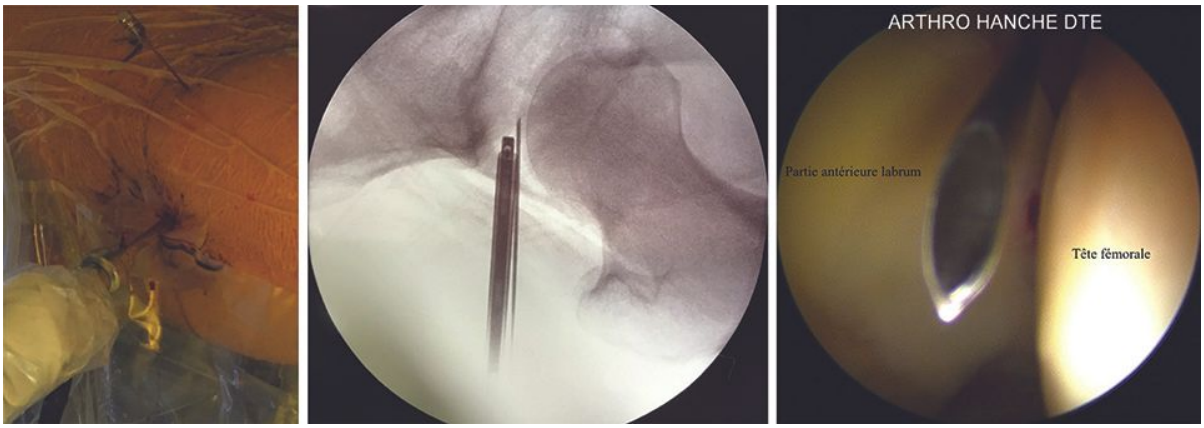
Anterior view

Once inside the coxofemoral joint, the joint is inflated with physiological saline using an Arthropump at a pressure of 40–50 mmHg. The exploration can begin. A wash may be necessary upon withdrawing the arthroscope from the trocar.

What can be seen is the round femoral head, which faces the acetabulum (Fig. 6). Check that the camera is positioned perpendicular to the floor and that the scope is pointed upwards to show the triangular zone between the femoral head and the anterior part of the labrum (Fig. 7, right).

The second portal, created using the image intensifier and the arthroscope, is the anterior portal. The 17-gauge needle arrives into the triangular zone between the labrum and the femoral head (Fig. 7, right). This second portal allows the insertion of different instruments such as the spacer and electric lancet.

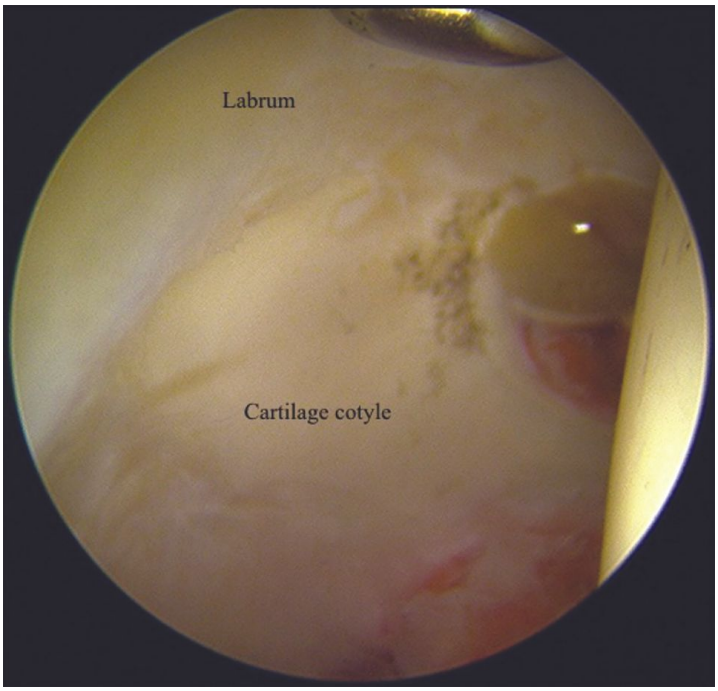




The exploration then continues through the remaining "quadrants", turning the arthroscope anticlockwise for the right hip.

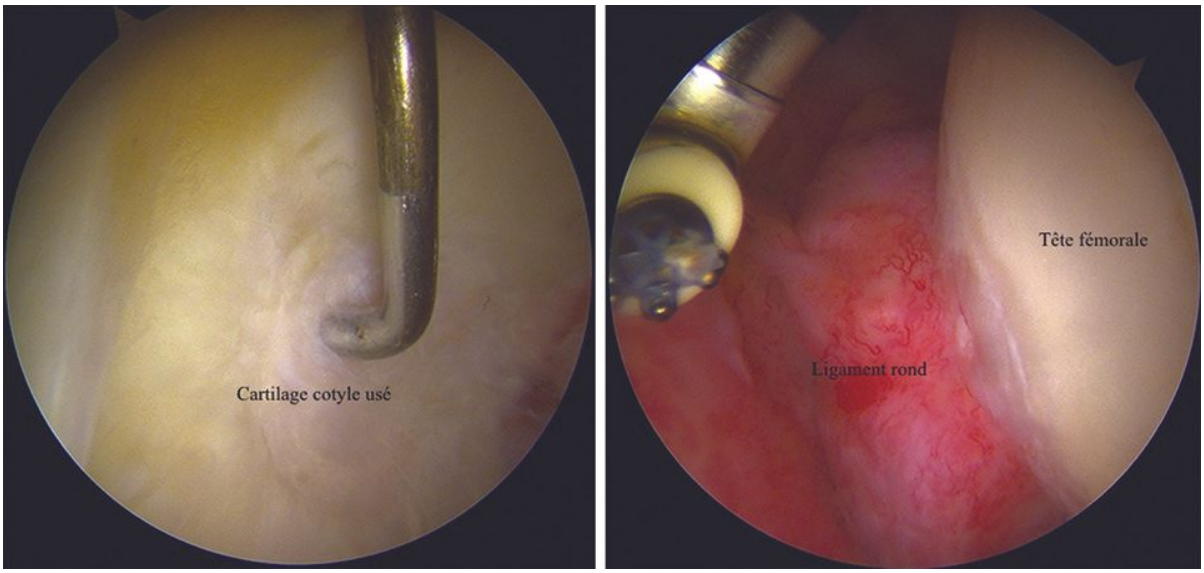
2. Superior view

In the superior quadrant, the superior part of the labrum can be seen with the adjacent acetabulum cartilage and the brow of the acetabulum (Fig. 9).



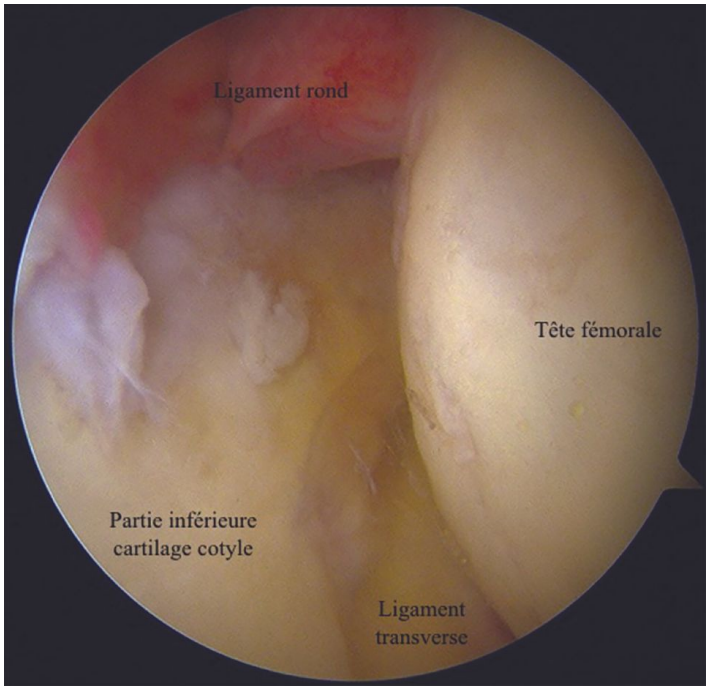
3, 4. Central views

In the central quadrant, the exploration covers the floor of the acetabulum, the round ligament and part of the femoral head (Fig. 10).



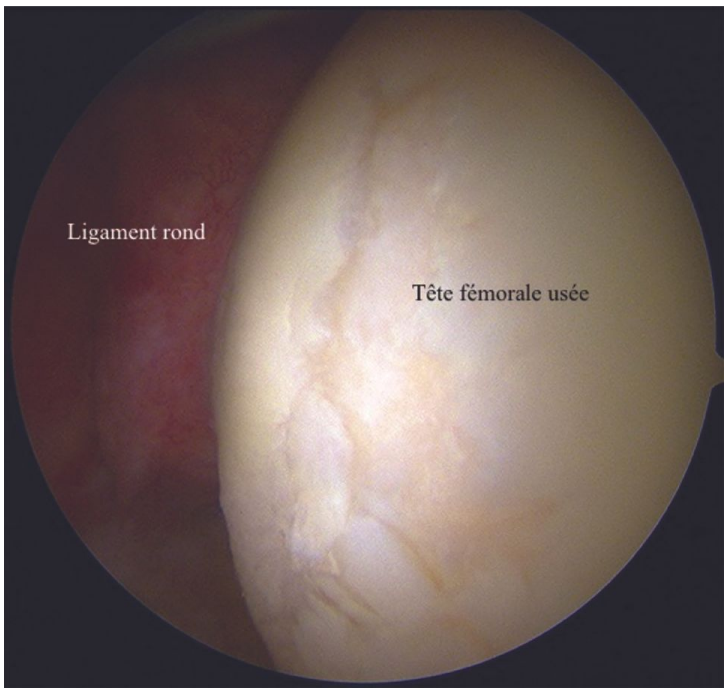
5. Posteroinferior view

This view allows the exploration of the inferior cartilaginous part of the acetabulum, the transverse ligament and its junction with the posterior portion of the labrum, and a part of the femoral head (Fig. 11).



6. Femoral head view

This view enables the exploration of a large part, but not all, of the cartilage of the femoral head (Fig. 12).



Posterolateral or posterior paratrochanteric view

The point of entry is situated where the line passing over the apex of the greater trochanter, perpendicular to the ASIS–patella line, intersects with the line over the posterior edge of the greater trochanter. It lies 1 cm above and behind the apex of the greater trochanter.

The portal passes through the gluteus maximus, medius and minimus, and the postero-supero-lateral part of the articular capsule.

The anatomic structures at risk of damage are the sciatic nerve and the medial circumflex artery of the thigh.

Two accessory portals provide additional access to the central compartment: the medial proximal anterior and medial distal anterior portals.

Accessory portals to the central compartment

Proximal anterior medial portal: The point of entry on the skin is the superior tip of an equilateral triangle that has at its base the line connecting the anterior and anterolateral portals.

Distal medial portal: The point of entry on the skin is the inferior tip of an equilateral triangle that has at its base the line connecting the anterior and anterolateral portals.

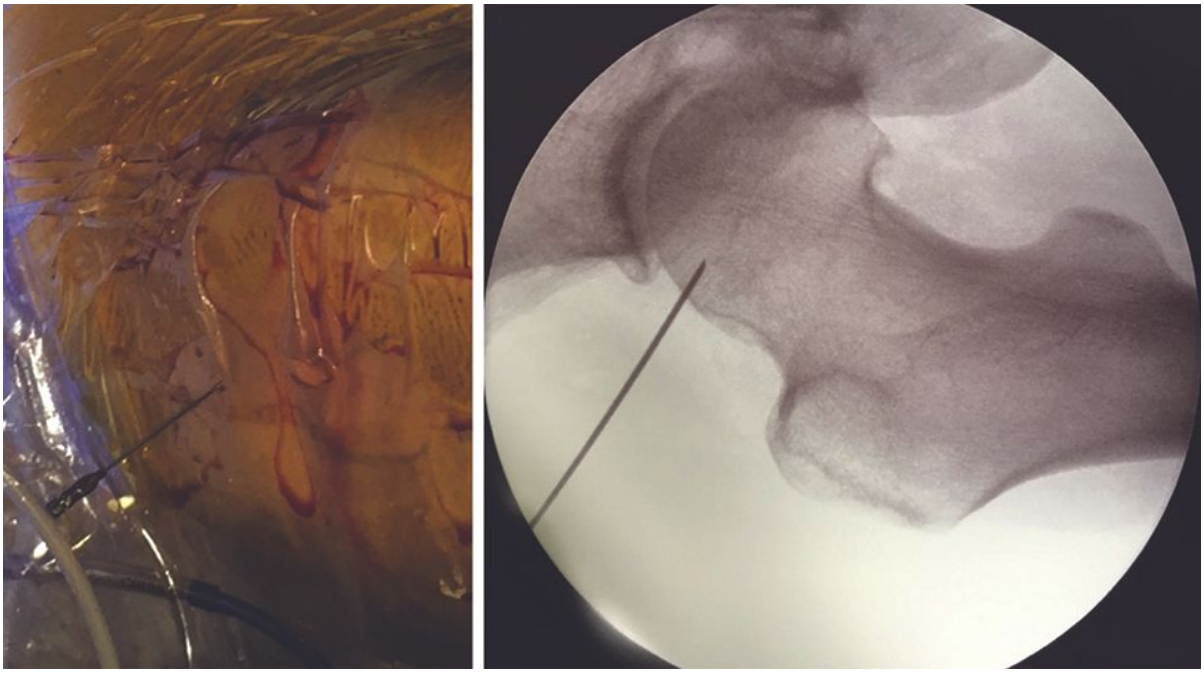
Portals for the peripheral (second) compartment

To approach the peripheral compartment, traction is released after withdrawing the instruments from the central compartment to avoid chondral injury or equipment damage. The hip is flexed between 20° and 45° with the patella facing up, allowing relaxation of the anterior articular capsule and creation of a workspace between this and the femoral neck; this facilitates the insertion of instruments.

Different techniques have been described in the literature for accessing this compartment.

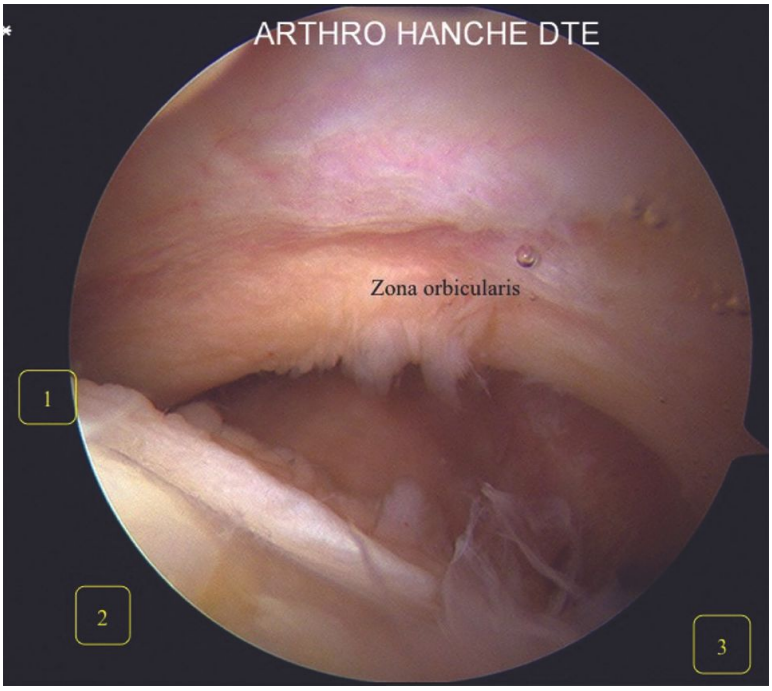
In my experience, the first point of entry is often situated mid-way between the ASIS and the apex of the greater trochanter (Fig. 13, left).

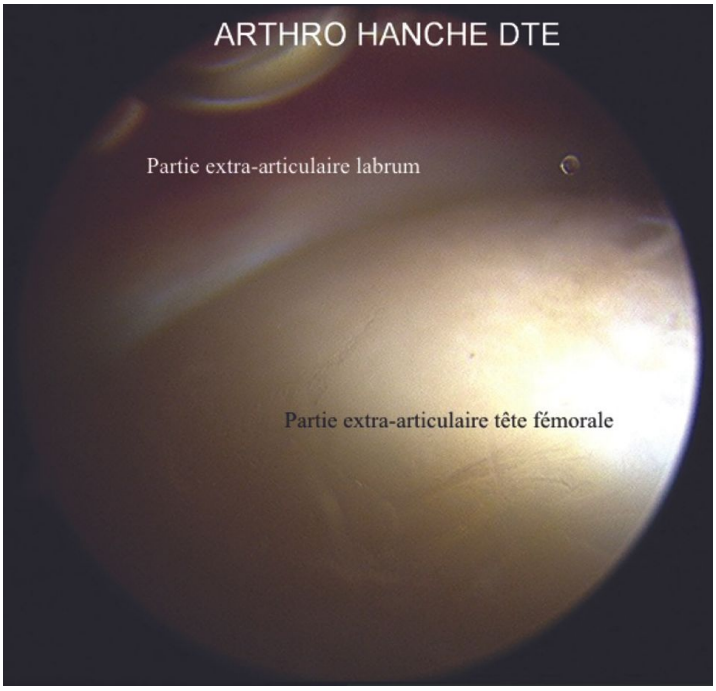
The needle is introduced, guided by the image intensifier, perpendicular to the superior part of the junction between the femoral head and neck (Fig. 13, right). Making small movements, the needle is used to probe along the lateral part of this junction to position it in the space between the anterior capsule and the anterior part of the junction between the femoral head and neck. Next, the nitinol guide is introduced, followed by the trocar for inserting the arthroscope.



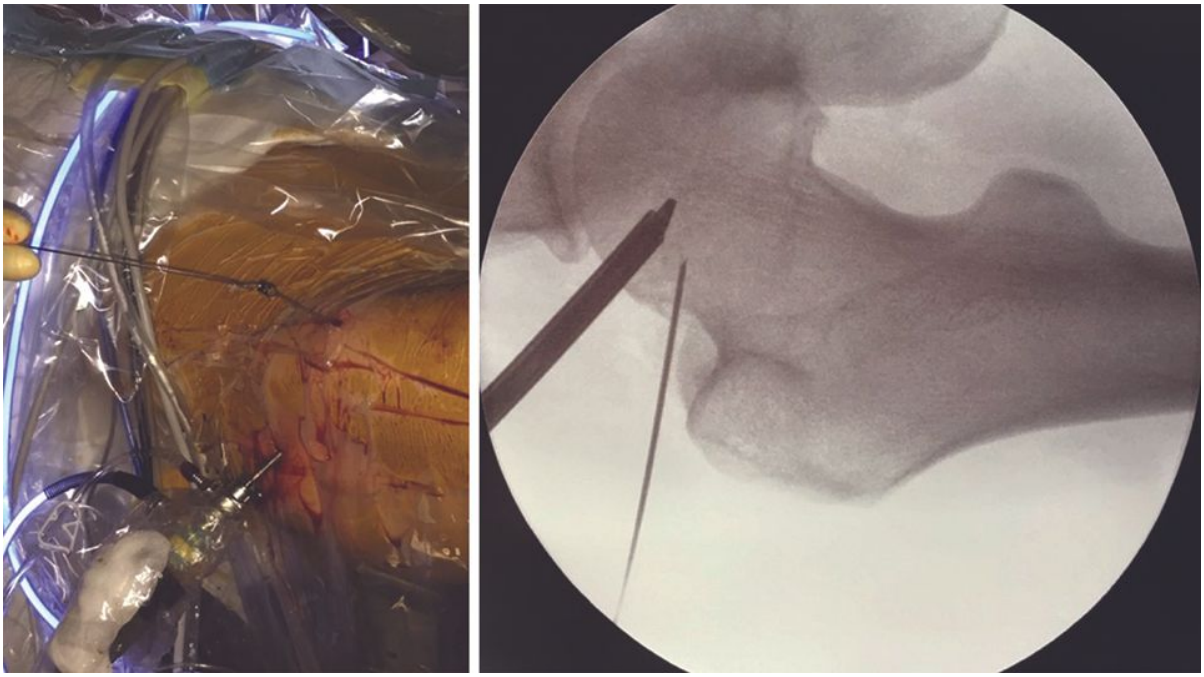
The peripheral compartment is explored (Fig. 14) noting the following anatomic structures: the endocapsular portion of the femoral neck, the zona orbicularis (capsular reflection zone separating the medial and lateral peripheral compartments), the non-weight bearing cartilaginous part of the femoral head and the lateral labrum

(Fig. 15), the anterolateral part of the femoral head–neck junction (Fig. 16) and the femoral neck (quadrant 3 in Fig. 14).





To create the second portal, one can either re-use one of the three portals through which the central compartment was explored (anterior paratrochanteric portal, anterior portal or medial anterior distal portal), or use the portal situated in the anterior and distal part of the femoral neck (Fig. 17).



When inserting the needle into the lateral zone relative to the zona orbicularis, it is important not to damage the femoral neurovascular bundle. This route first allows the medial face of the capsule to be thinned using the electric lancet.

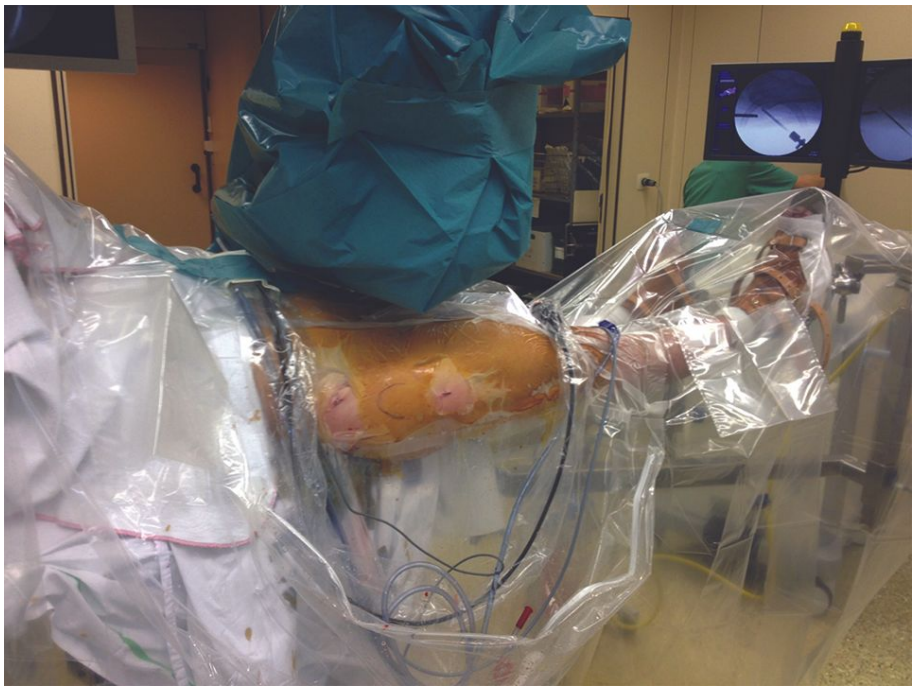
Next, the scope is inserted via the second portal (distal) and the electric lancet via the first portal (proximal) to perform a T-capsulotomy at the proximal base almost in line with the lateral face of the labrum; this facilitates entry of the burr to perform the excision of the bony excrescence situated at the supero-antero-lateral femoral head–neck junction in cases of Cam-type femoroacetabular impingement (Fig. 16).

To facilitate the introduction of the burr and improve the arthroscopic images, the pump pressure can be increased temporarily to 70 mmHg, which increases the "ballooning" effect in the articular capsule.

Portals for the peritrochanteric or lateral (third) compartment

The patient is set up in the dorsal decubitus position on an orthopaedic table without tractioning the limb. This allows 360° movement of the instruments around the greater trochanter. The hip to be operated on is extended with the knee positioned upwards. The greater trochanter is identified by palpation and/or using the image intensifier, and mapped with a dermographic pen.

The two portals are situated along the axis of the proximal femur, approximately 4-5 cm to either side of the greater trochanter for ease of movement of the arthroscope and electric lancet (Fig. 18). A 30° arthroscope is sufficient for this compartment.



Using an electric lancet, a workspace is created between the adipose tissue and the fascia lata opposite the greater trochanter.

Then the fascia lata is sectioned in the shape of a cross in line with the greater trochanter. The four corners of the cross are resected to obtain an elliptic resection, revealing the greater trochanter and the insertion of the vastus lateralis distally and the gluteus medius proximally.

In cases of a torn gluteus medius, it is possible to reinsert the muscle via this route as with rotator cuff tears in the shoulder.

Access to the ilio-psoas tendon

When performing a psoas tenotomy for tendinopathy refractory to conservative treatment, this can be done either at in the central compartment at the anteromedial rim of the acetabulum or in the peripheral compartment through an anterior-inferior window between the zona orbicularis and the anterior labrum, or by the lesser trochanter.

Tenotomy by the lesser trochanter is less risky than in the central compartment, especially if the patient has had a total hip replacement; the theoretical risk of infection is smaller and the intervention is performed without traction or risk of dislocation.

The hip is flexed at 20°–30° and in lateral rotation.

The position of the lesser trochanter is noted in the image intensifier and the two portals are created along a vertical line, a little in front of the anterior rim of the femur, 3 cm either side of the lesser trochanter (Fig. 19).

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