# Ultrasound-Guided Portal Placement for Hip Arthroscopy

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**Abstract:** Over the past 2 decades, hip arthroscopy has developed as a surgical technique, with more orthopaedic surgeons attempting to become proficient in performing this surgical procedure as indications and surgical skills evolve. The hip joint presents unique arthroscopic challenges because of its anatomic location, and it can be challenging to safely and confidently establish portal sites. Ultrasound-guided hip arthroscopy portal placement is not yet common practice for orthopaedic surgeons. The potential advantages of ultrasound-guided hip arthroscopy portal placement are the lack of radiation exposure to the patient and operating room personnel, direct visualization of the hip joint and surrounding soft-tissue structures, and lack of bulky fluoroscopic equipment in the operative field. We describe a detailed technique incorporating video examples using ultrasound guidance to establish appropriate portal sites for hip arthroscopy with the aim to improve safety and overall operator competence.

Hip pathology occurs from both acute injuries and chronic processes. It is well known that hip arthroscopy is less invasive than open procedures for the diagnosis and treatment of hip injuries. Indications for this procedure include (but are not inclusive to) loose bodies, intractable hip pain, degenerative injuries, femoroacetabular impingement, labral lesions, and acute articular injuries.[1]

To safely perform hip arthroscopy, image guidance is required for initial portal placement to minimize the risk of iatrogenic injury or complications in the articular cartilage, acetabular labrum, or other periarticular structures that may take place because of poor visualization.[2] An alternative visual tool that can ease hip arthroscopy is the use of ultrasound. A particular advantage of ultrasound is the lack of radiation exposure to personnel in the operating room. Hip arthroscopy relies heavily on visual imaging for portal placement, and an operator who performs multiple arthroscopic procedures on the hip, or who performs more complex cases, can potentially spend prolonged periods ensuring portal placement is adequate. Although operating room personnel can protect themselves with lead aprons or screening if fluoroscopy is used, fatigue ensues over time when wearing heavy materials and the use of lead screens can increase the time a patient remains under traction.[3]

Ultrasound guidance also enables full visualization of the hip joint and is inclusive of soft-tissue structures that are adjacent to the hip joint itself.[3,4] There is no added congestion in the operating room needed for a radiologist, and the operator is in control of ultrasound image guidance while inserting the portals, potentially resulting in improved efficiency in the operating room.[3] Ultrasound-guided hip arthroscopy has been described for supine positioning in the past[3,4]; however, the development of arthroscopic portals with the patient in the lateral position is technically easier.

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**Table 1.** Pearls and Pitfalls

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|---|
| The surgeon should ensure that adequate visualization can be achieved before needle insertion. |
| Anterior and posterior translation of the ultrasound probe can be very useful in achieving an optimal view of the hip. |
| Visualization of the air arthrogram has a distinctive appearance on ultrasound and provides confirmation of needle placement. |
| The surgeon should study preoperative imaging and have a detailed surgical plan before surgery to ensure that accurate bony resections can be achieved. |
| Visualization of the labrum is key to avoiding injury on needle placement. |

**Table 2.** Advantages and Disadvantages

| |
|---|
| Advantages |
| Fluoroscopy is not required. |
| No bulky equipment |
| No technologist |
| No radiation |
| Visualization of the periacetabular soft tissues is possible. |
| Disadvantages |
| Resections cannot be radiographically assessed. |
| An ultrasound unit is required. |
| Some basic ultrasound training is required. |

The technique for using ultrasound-guided portal placement in hip arthroscopy is detailed in this report (Video 1, Tables 1 and 2).

## Technique

### Preoperative Assessment

The patient is assessed in an outpatient clinic, undergoing a standard history and physical examination. Important preoperative imaging includes anteroposterior pelvis views (weight bearing) and 45° Dunn, frog-leg lateral, and false-profile radiographs. A 3-dimensional computed tomography scan of the pelvis is also recommended to optimize preoperative planning and relations of bony structures.

### Positioning and Preparation

The Terason Ultrasound machine (Terason, Burlington, MA) is adjacent to the arthroscopy tower and display screen and is positioned on the nonoperative side so that the surgeon has an adequate view of the computer imaging for portal placement. A Mayo stand is positioned on the nonoperative side of the patient between the ultrasound machine and operating table, where the assistant is also placed for the duration of the case. The scrub nurse assists the operator on the same side of the patient, between the operator and the foot of the patient (Fig 1).

**Fig 2.** Pre-tensioning of right hip. With the patient positioned laterally on the table by use of the hip positioning system and distractor, the operator pre-tensions the hip in an abducted position before distraction of the hip is performed through adduction.

General anesthesia and antibiotic prophylaxis are administered. The patient is positioned in the lateral decubitus position with the operative hip up. A bolster is placed at the level of the patient's shoulder posteriorly for safety. The Smith & Nephew Hip Positioning System with Active Heel Technology (Smith & Nephew, London, England) is attached to the table. The affected limb is placed in the Smith & Nephew Universal Hip Distractor. The genitalia are well padded with a perineal post, and the foot is placed flat and snug in the Active Heel Traction Boot (Smith & Nephew) in neutral alignment. The affected limb is kept in neutral alignment, with the hip joint in a slightly flexed position and at 15° of abduction. The leg is then moved to

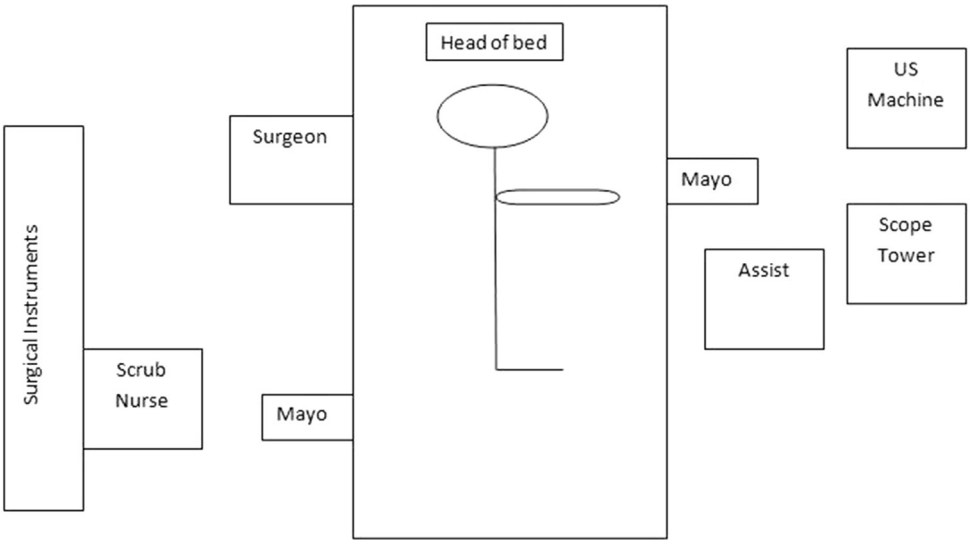


**Fig 1.** Room setup for surgery: bird's-eye view. The positioning is shown for a right hip. The patient is positioned laterally, facing the ultrasound (US) machine, and the operator is positioned at the patient's back, facing the ultrasound machine. The positioning of the arthroscopic tower can be changed as necessary depending on room design.

**Fig 3.** Positioning of patient and right hip. With the hip pre-tensioned, the operative limb is draped; the surgeon should ensure that drape material is not placed over the planned viewing areas because this will result in poor image quality.

approximately 45° of hip abduction for pre-tensioning. Once adequate pre-tensioning is achieved, the foot boot is unlocked in rotation and the hip is then adducted to neutral abduction to subluxate the joint and obtain approximately 1 cm of joint distraction (Fig 2). This is confirmed on ultrasound.

The skin is prepared with antiseptic solution, and drapes are placed along the iliac crest superiorly, medial to the anterior superior iliac spine (ASIS), inferiorly 6 inches below the greater trochanter and the sciatic notch posteriorly. This open window enables an area free of draping to allow image-guided ultrasound portal placement to take place. It is important that the skin overlying the planned portals is not covered with any draping material (including transparent occlusive material) because it will compromise the ultrasound view (Figs 3 and 4). The ultrasound transducer is prepared using nonsterile gel and then placed in a sterile ultrasound bag.

## Arthroscopic Portals

Once positioning and draping have taken place, arthroscopic portals are marked on the skin. Important skin landmarks include the ASIS and greater trochanter (Fig 4). The hip joint is then visualized with a curved abdominal ultrasound probe. The ultrasound probe should be aligned longitudinally to the body such that the needle used for portal placement can be visualized through the entire entry. To obtain an optimal view, the operator can move the probe anteriorly and posteriorly (Fig 5). Starting with the anterolateral portal, the operator slowly inserts a long 17-gauge needle under direct ultrasound guidance and observes this needle on the screen as it passes between the acetabulum and just above the head of the femur with the bevel toward the head, ensuring not to puncture the labrum and cause iatrogenic injury (Fig 6). The hip capsule will be felt as a distinct firm layer by the surgeon. Once the capsule is punctured, an immediate change in resistance will take place. With the needle in the hip joint, the inner trocar is removed and air is released into the joint, producing an air arthrogram easily visualized using the ultrasound and confirming intra-articular placement of the needle (Fig 7).

The midanterior portal site is then developed. The skin entry point is approximately 3 cm distal and halfway between the lateral portal and a line drawn down from the ASIS. The needed depth of the needle can be approximated using the first portal (Fig 8). By use of a similar ultrasound technique, the needle is then taken to the level of the hip capsule and left until it can be visualized entering the hip joint from the lateral portal (Fig 9).

The lateral portal is completed by passing a nitinol wire, making a small skin incision, and introducing an arthroscopic cannula with a trocar. The arthroscopic camera is then introduced into the hip joint dry, and the midanterior needle is introduced into the hip joint under direct visualization to avoid damage to the labrum. Once the guide needle for the midanterior portal is confirmed to be in appropriate position, the portal can be completed in the usual fashion. Fluid may then be introduced into the joint and the procedure begun. We have found it advantageous to roll the bed 30° posteriorly during the procedure so that the operator does not have to reach as far across the patient to operate through the midanterior portal.

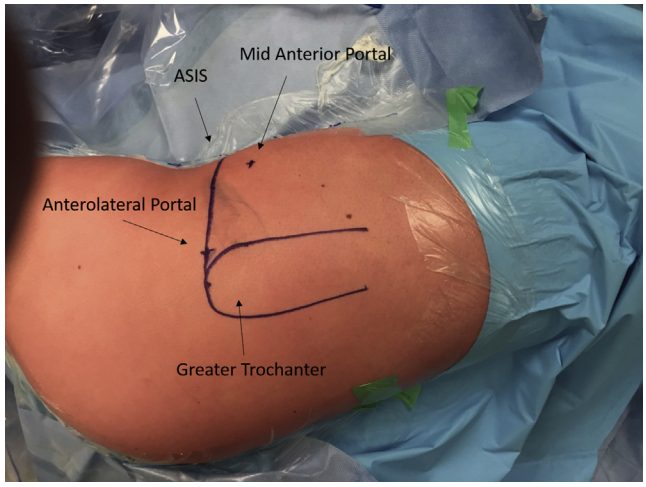


**Fig 4.** Draping of patient with an area free for ultrasound of right hip. Skin landmarks include the greater trochanter and anterior superior iliac spine (ASIS), as well as a line drawn between these 2 points. The anterolateral portal entry site is just anterior to the tip of the greater trochanter. The midanterior portal is midway between the ASIS and anterolateral portal and 2 cm inferior to the anterolateral portal.

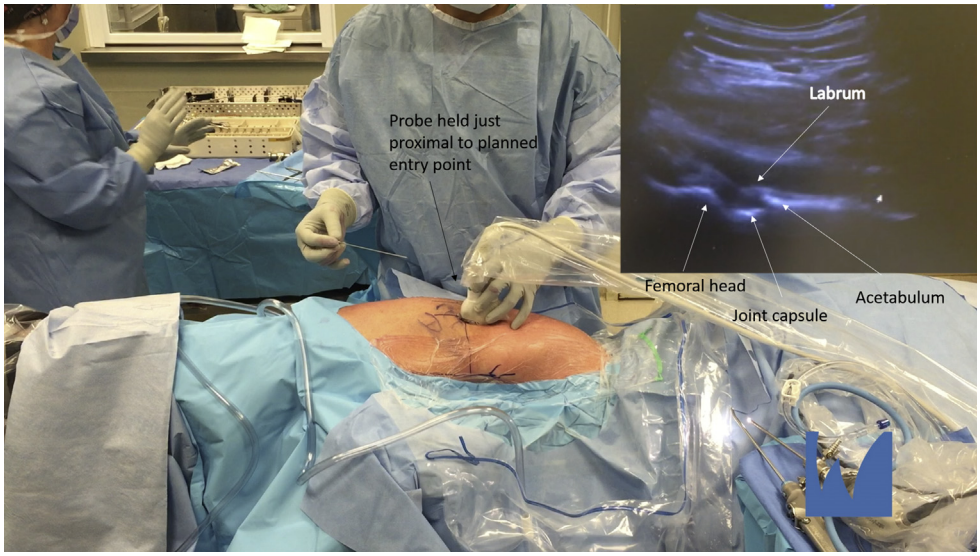


**Fig 5.** Initial positioning of ultrasound probe on right hip. The probe is placed just above the tip of the greater trochanter and moved in an anterior-posterior direction until a view can be obtained that clearly visualizes the femoral head, joint capsule, labrum, and acetabulum.

## Discussion

This report presents the technique for developing hip arthroscopy portals under ultrasound guidance in a safe and reproducible way. Previous authors have described this technique.[3,4] Video 1 clearly demonstrates the technique with a number of tips and tricks being shown. It is suggested that surgeons wanting to adopt this technique first become proficient with ultrasound examination of the hip. Achieving good visualization is essential for safe and accurate placement of the guide needles. Use of this technique may be unfavorable in certain cases—specifically, in patients with morbid obesity, when the penetration depth of the ultrasound is inadequate, and in cases of extensive heterotopic ossification because it will significantly compromise the view.

The most significant limitation of this technique is the loss of intraoperative imaging. Specifically, when performing femoroplasty and acetabuloplasty, the surgeon loses the ability to judge resection with imaging. In our experience high-quality preoperative imaging and increasing experience judging resection arthroscopically have negated this limitation; however, when one is learning this technique, it may be advisable to have fluoroscopy available if unsure of resection. It is our hope that this presentation will aid surgeons in using this effective technique for developing hip arthroscopy portals.

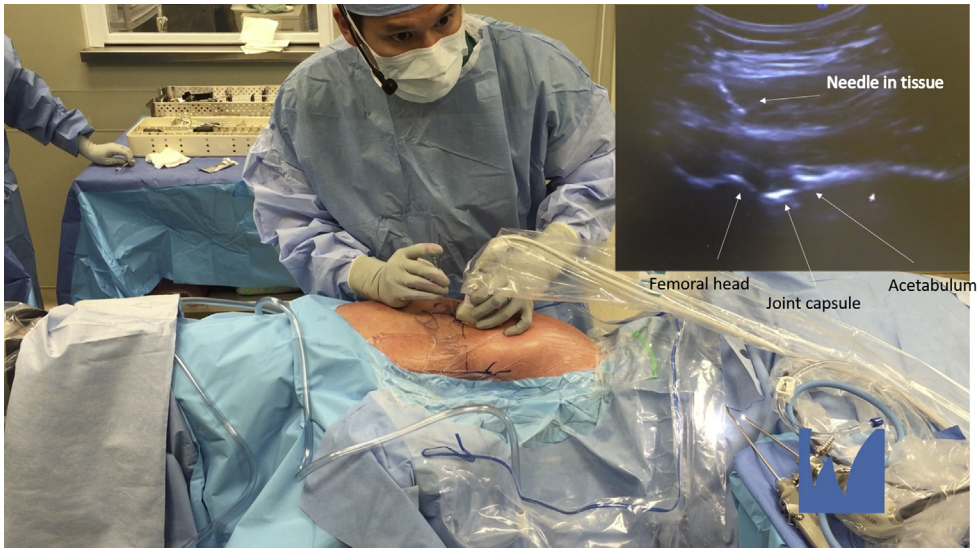


**Fig 6.** Needle insertion through anterolateral portal in right hip. After visualization of the right hip has been achieved, the needle is inserted at the entry point for the anterolateral portal and visualized passing through tissue toward the inferior aspect of the hip capsule. Care must be taken to insert the needle directly in line with the ultrasound probe so that its path through the tissue can be observed and optimized.

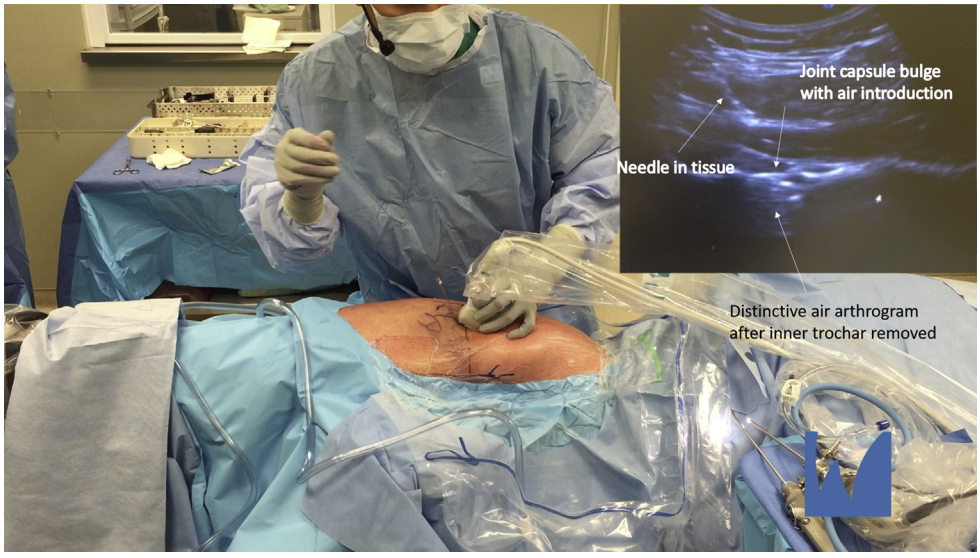


**Fig 7.** Confirmation of needle placement in right hip. After the needle is observed and felt to have passed through the hip capsule, the inner trocar is removed and an air arthrogram will be seen, confirming placement.


**Fig 8.** Approximation of depth and trajectory for midanterior portal in right hip. A second needle is taken freehand and lined up with the needle in the anterolateral portal to approximate the depth and trajectory required to reach the hip capsule from the midanterior portal.

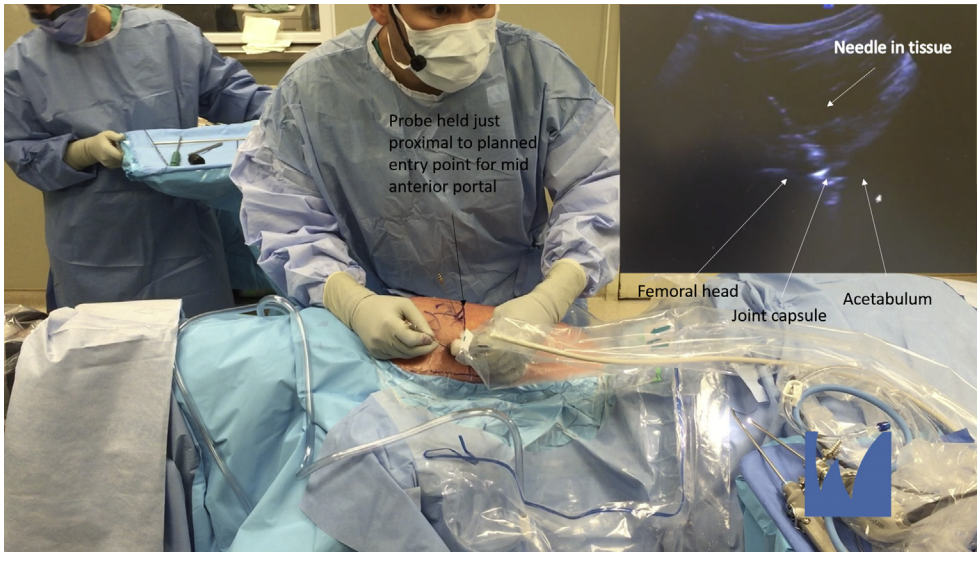


**Fig 9.** Needle insertion through midanterior portal in right hip. A view of the femoral head and acetabulum is achieved just proximal to the entry point for the midanterior portal, and the needle is observed passing through tissue toward the joint capsule. The needle is left positioned against the hip capsule, but not through it, until it can be observed from the completed anterolateral portal.

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