

Top Ten Pearls for Successful Hip Arthroscopy for Femoroacetabular Impingement



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Abstract: Hip arthroscopy is an increasingly popular procedure used to treat femoroacetabular impingement. However, the procedure is technically challenging with a steep learning curve. To prevent complications and to optimize patient outcomes, proper patient positioning, correct portal placement, and adequate capsular closure are necessary. For central compartment procedures, creation of a minimal interportal capsulotomy, placement of traction stitches, adequate rim trimming, and balanced labral repair are recommended. For peripheral compartment procedures, adequate osteochondroplasty should be performed and assessed intraoperatively. The purpose of this technical note is to describe the senior author's top 10 pearls for a successful hip arthroscopy procedure to treat femoroacetabular impingement.

Femoroacetabular impingement (FAI) is a pathologic interaction that occurs due to abnormal bone morphology between the femoral head–neck junction and the acetabulum.¹ While pincer impingement is caused by an excessive covering of the acetabular rim, cam deformity is caused by an aspherical femoral head shape that leads to early contact with the acetabular surface during hip flexion and rotation.¹ Hip arthroscopy is a viable and successful operative treatment for FAI to prevent further damage to the labrum and cartilage.¹⁻⁴ Since Ganz et al.⁵ first described FAI, hip arthroscopy procedures have been increasing exponentially.⁶

Hip arthroscopy is considered to be a technically demanding procedure due to the time constraint required due to the traction applied to the joint, the

need for 3-dimensional spatial skills during surgery, the need for special instrumentation, and the relative novelty of the procedure.^{3,7} For these reasons, hip arthroscopy is thought to have a steep learning curve. Cases performed by surgeons with large case volumes have been reported to have a significantly lower risk of subsequent hip surgery than those performed by surgeons with lower volumes.⁸ Moreover, 5% to 10% of all patients who undergo hip arthroscopy require revision surgery, with the most common cause of revision being inadequate cam resection.⁹ Overall, incomplete or inappropriate surgical procedures are the leading causes of an unsuccessful hip arthroscopy.^{10,11} The purpose of this article is to detail a straightforward checklist of the surgical technique for arthroscopic treatment of FAI by revealing the senior author's top 10

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pearls for successful hip arthroscopy for management of FAI.

Surgical Technique (With Video Illustration)

Set-Up

Pearl 1. Proper Positioning

Proper positioning is the first step in ensuring a successful hip arthroscopy case. The patient is placed supine on a standard hip arthroscopy table. A perineal post may be used to prevent movement of the patient during the case, but our preferred technique is use of the pink pad positioning device (Fig 1A), which secures the patient's position through creation of friction between the patient, the pad, and the bed (Smith & Nephew, Andover, MA), allowing for post-free distraction. Upon moving the patient to the proper position on the bed (matching the anterior superior iliac spine [ASIS] to the widest part of the bed attachment), the patient's legs are secured in padded traction boots with Coban wrap. Distraction is achieved through placing the patient in a slight Trendelenburg position, adducting the leg, and internally rotating the foot (Fig 1B, Video 1). After confirming a clear fluoroscopic field with a C-arm, the patient is prepped and draped in a sterile fashion. An air arthrogram is then performed under fluoroscopy to disrupt the suction seal, followed by adjustment of the distal traction arm to provide adequate distraction (Video 1).

Access

Pearl 2: Perfect Portals

Establishment of perfect portals is crucial in setting the surgeon up for success. Improper portal placement can lead to poor visualization and inability to adequately instrument the joint throughout the remainder of the procedure. Superficial surgical landmarks (the ASIS and the greater trochanter) are

identified. Lines are drawn as a reminder to not stray medial to the ASIS. After identification of the ASIS and the greater trochanter, portal placements are marked (Fig 2A). We prefer a 3-portal technique. The anterolateral (AL) portal is made at or just superior to and slightly anterior to the greater trochanter, allowing for entry to parallel the sourcil at the 12-o'clock position (Fig 2B). The modified mid-anterior portal (mMAP) is made at the 2-o'clock position under direct visualization to ensure atraumatic entry into the joint into the arthroscopic triangle. Care needs to be taken to not go overly medial, which will result in an excessively large capsulotomy. The distal anterolateral accessory (DALA) portal is also marked at the beginning of the case but will not be used until labral repair from 1 to 3 o'clock. This portal will be created via an outside-in technique within the interportal capsulotomy.

Central Compartment Arthroscopy

Pearl 3: Minimal Interportal Capsulotomy

Periportal and interportal capsulotomies are created using an arthroscopic blade (Video 1) (Samurai; Stryker, Kalamazoo, MI). Viewing from the mMAP, the location of the AL portal is verified, with the ideal portal occurring at the 12-o'clock position. The AL portal should be an equal distance between the acetabulum and femoral head to allow for enough capsule on either side of the portal for eventual closure. The position of the AL portal should be checked to confirm that placement is not too posterior as the capsule thins out in this area. The arthroscopic blade is inserted, the arthroscopic cannula is withdrawn, and a minimal 5-mm periportal capsulotomy is created by dropping one's hand, aiming to create a centered and balanced cut between the acetabulum and femoral head (Fig 3A). The camera is then moved back to the AL portal, and the arthroscopic blade is introduced via the mMAP to connect and complete the capsulotomy (Fig 3B,

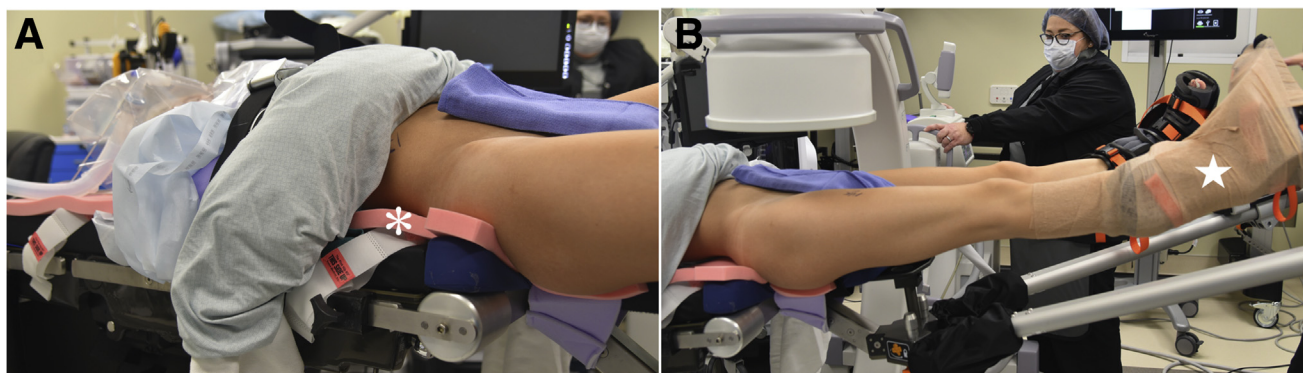


Fig 1. Patient positioning. As seen in this patient before right-sided hip arthroscopy, through direct contact with patient's skin, the pink pad (*) allows for post-free distraction through the creation of friction between the patient, the pad, and the bed (A). Initial traction is created by placing the patient in 10-15° Trendelenburg, securing the foot on the operative side with Coban wrap (star), adducting the leg, and internally rotating the foot (B).

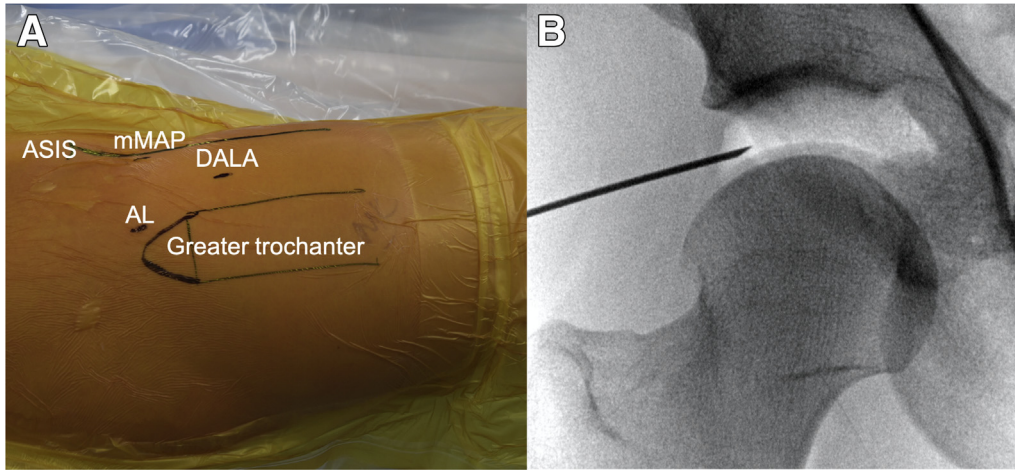


Fig 2. Portal creation. Before the incision, superficial surgical landmarks (the anterior superior iliac spine [ASIS] and the greater trochanter) are identified and marked with a skin marker (A), as demonstrated on a right hip. The anterolateral (AL), distal anterolateral accessory (DALA), and modified mid-anterior portal (mMAP) locations are then marked accordingly. Before creating the AL portal, the location is confirmed with fluoroscopy to ensure the needle is positioned close to the femoral head to avoid iatrogenic labral damage (B).

Video 1). To avoid disruption of the iliofemoral ligament while allowing adequate room for instrumentation, the capsulotomy should be 2 cm or less in length, allowing for access only in the zone of labral pathology. An excessively large capsulotomy can lead to long-term microinstability and scarring requiring revision arthroscopy, particularly if thinner posterior capsule is violated.

Pearl 4: Traction Stitches

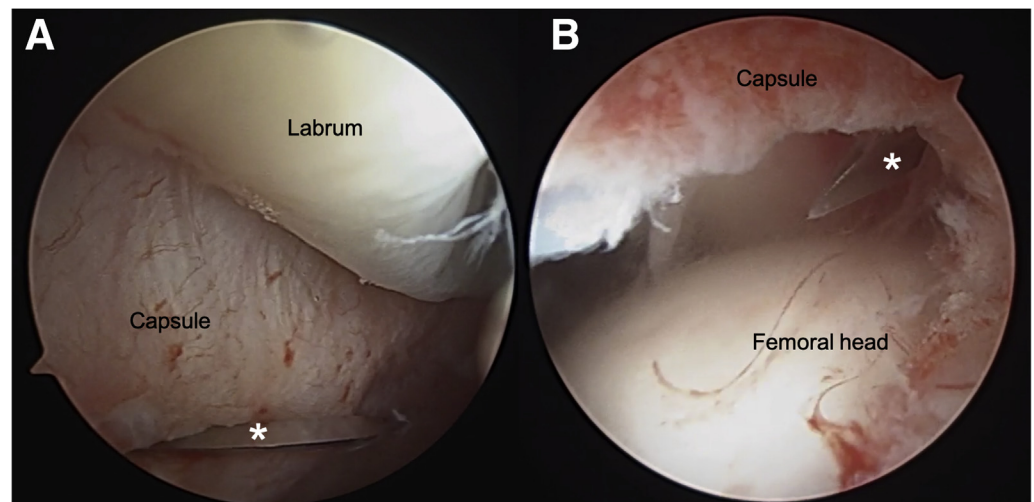
Traction stitches are placed using a suture passer (Pivot Injector II; Stryker, Kalamazoo, MI), allowing for creation of a defined plane between the capsule and labrum and for preservation of capsular tissue during closure (Fig 4). It is the senior author's practice to place one traction stitch from the mMAP and one from the

AL portal, with snaps placed on the skin to provide distraction. Diagnostic arthroscopy of the central compartment is then performed easily using a 70° arthroscope (Arthrex, Naples, FL).

Pearl 5: Acetabuloplasty

Rim trimming and subspinal decompression should occur where labral pathology exists using a 5.5-mm arthroscopic burr (Arthrex). During this step, the chondrolabral junction should be kept intact (Video 1). It is the senior author's preferred technique to begin acetabuloplasty at the 2- to 3-o'clock position while viewing from the AL portal (Fig 5). Once adequate acetabular preparation has been performed, the camera is moved to the mMAP portal, and the region from 12- to 2-o'clock is prepared via instrumentation

Fig 3. Periportal and interportal capsulotomy creation. While viewing from the modified mid-anterior portal (mMAP), a periportal capsulotomy is first created through the anterolateral (AL) portal using an arthroscopic blade (*) (A), as demonstrated in a right hip. A second periportal capsulotomy is created through mMAP while viewing from the AL portal. The interportal capsulotomy is then performed through the mMAP toward the previously created AL portal (B).



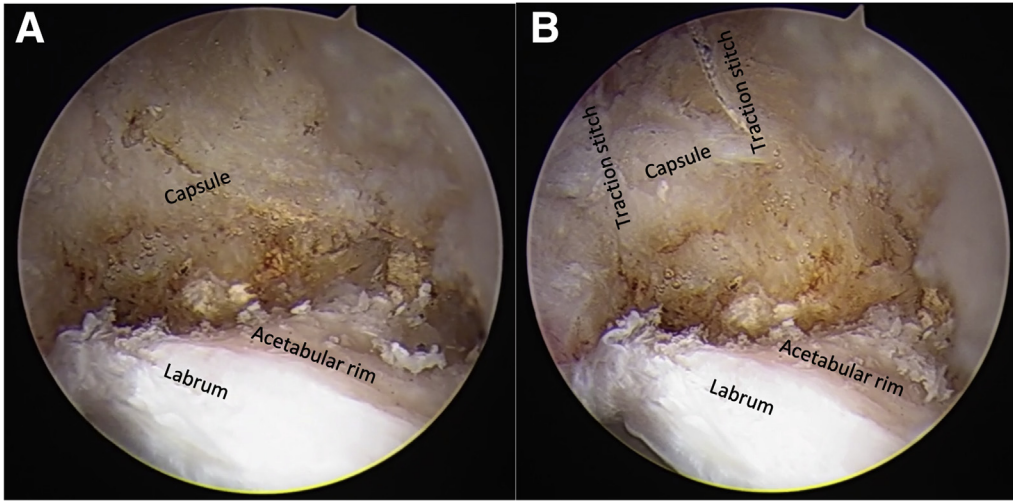


Fig 4. Traction stitches. Traction stitches allow for improved visualization and access of the central compartment during rim trimming and labral repair by increasing the working space within the capsule. In this left hip, viewing from the anterolateral portal, (A) represents the central compartment working space prior to applying tension to traction stitches in a left hip, and (B) represents the increase in working space after tensioning traction stitches.

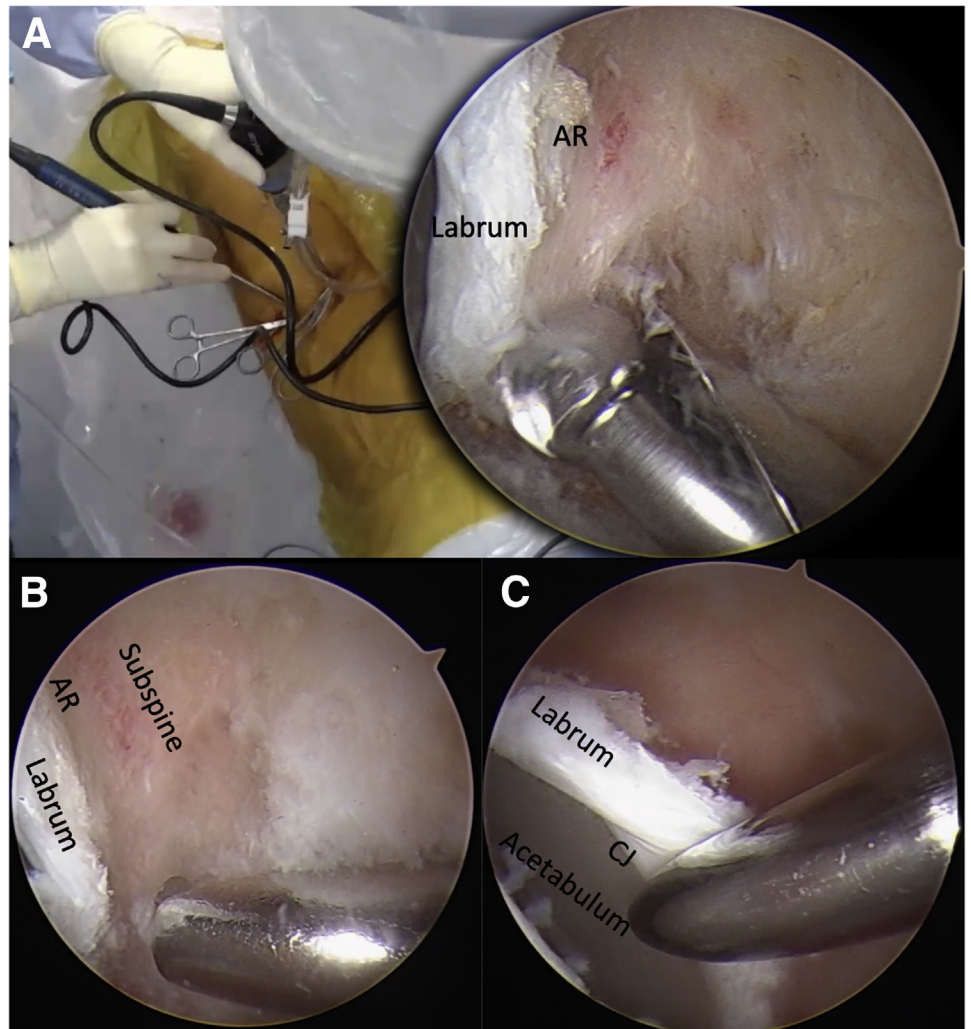


Fig 5. Acetabuloplasty. When performing acetabuloplasty, trimming of the acetabular rim (AR) should be performed only in the areas of labral damage (A), as seen in this left hip. Subspinal decompression (B) is then performed following acetabular rim trimming. The integrity of the chondrolabral junction (CJ) should be checked following acetabuloplasty (C).

introduced from the AL portal, ensuring a complete and balanced acetabuloplasty and rim preparation before labral fixation. In dysplastic patients, care is taken to perform minimal to no rim trimming to avoid exacerbation of any potential under coverage.

Pearl 6: Balanced Labral Repair

Our preferred technique for labral repair is to begin with anchor placement at 12 o'clock while viewing from the mMAP (the position where acetabular preparation has just finished). An arthroscopic cannula (8.5 × 110; Smith & Nephew) is inserted into the AL portal to avoid suture bridge creation. During labral repair, anchors should be evenly spaced. The drill guide is then introduced, and fluoroscopy is used to confirm trajectory (Fig 6). The anchor is subsequently drilled and inserted, and a suture passage device of the surgeon's choosing is used to repair the labrum. The camera is then moved to the AL portal, the arthroscopic cannula is moved to the mMAP, and the DALA portal is created within the interportal capsulotomy for placement of 1 to 3 anchors from 1 to 3 o'clock as needed. Use of the proper portal for anchor placement aids in trajectory and in avoidance of intra-articular anchor placement.

Pearl 7: Atraumatic Labral Repair

While drilling and placing the anchors, the cartilage should be visualized, ensuring that the anchors are placed as close to the rim as possible without cartilage violation (Video 1, Fig 7A). During anchor placement, small instrumentation is used to prevent unnecessary trauma to the labrum (Fig 7 B and C).

Peripheral Compartment Arthroscopy

Pearl 8: Osteochondroplasty

Following labral repair, the peripheral space is entered while viewing from the AL portal and is

defined with a combination of arthroscopic shaving and radiofrequency ablation. The arthroscope is then placed in the mMAP. Adequate access to the peripheral compartment for osteochondroplasty is achieved through fat pad debridement and dissection of the gluteus minimus and iliocapsularis off of the capsule (Video 1; Fig 8 A and B). The intra-articular soft tissue is retracted by placing the arthroscope against the zona orbicularis. Identification of the medial femoral circumflex artery and retinacular vessels through internal rotation and extension of the hip is important in the step to determine the safe zone for osteochondroplasty (typically between the 12- and 6-o'clock positions).^{10,12} Once the capsule is visualized, a T-capsulotomy can be created with a radiofrequency probe (DYONICS RF SYSTEM; Smith & Nephew Endoscopy) or arthroscopic blade using the "fifty-yard line" or mid-point of the interportal capsulotomy as a starting point (Video 1, Fig 8C). Capsular tagging stitches can then be placed within each limb of the T capsulotomy to provide enhanced retraction and visualization during cam lesion resection (Fig 8D). In addition, traction stitches can be placed before capsulotomy to allow for counter traction while the surgeon "splits the uprights" of the 2 traction stitches. It is our preference to view from the mMAP while placing one traction stitch from the DALA and a second from the AL.

Pearl 9: Proper Cam Resection

Surgeons early on their learning curves may choose to use commercial tools, such as the Stryker HipCheck, to ensure proper resection in real time. When using the HipCheck tool, preresection fluoroscopic images are compared with postresection images in 6 different positions (30° internal rotation with neutral flexion [FL], neutral rotation and flexion, 30° external rotation [ER] with neutral flexion, neutral rotation with 50° FL, 40°

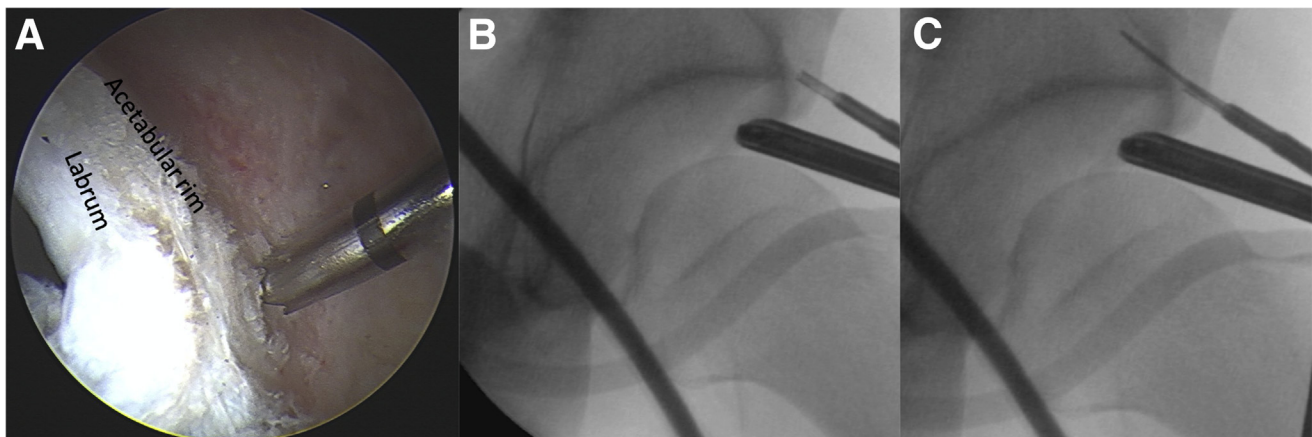


Fig 6. Confirming proper labral repair anchor location. After introducing the drill guide (A), fluoroscopy is used to confirm proper positioning before (B) and after (C) drilling the anchor, as demonstrated in a left hip.

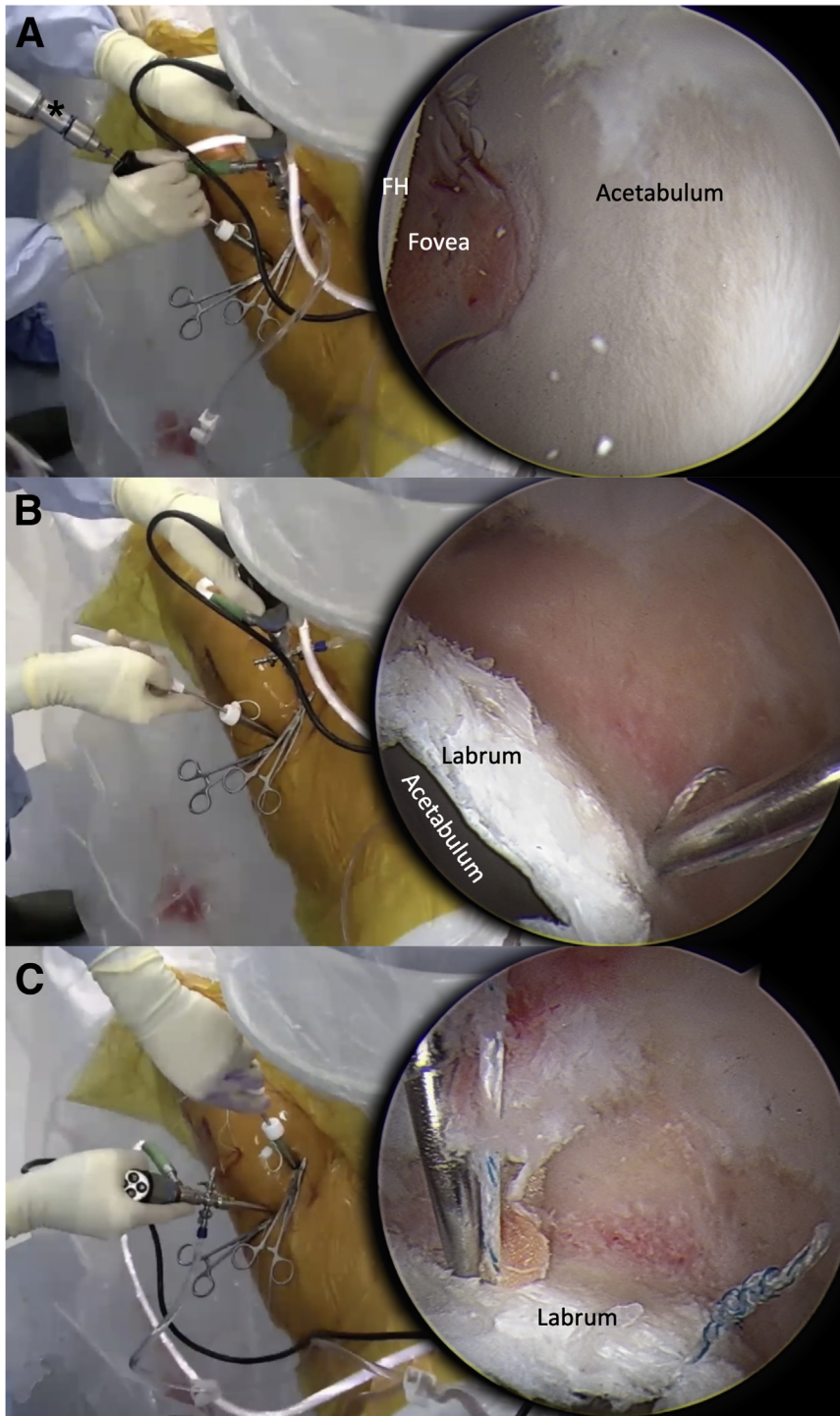


Fig 7. Atraumatic labral repair. When using a drill (*) to insert anchors for labral repair, the cartilage should be visualized to ensure anchors are placed as close to the rim as possible without violation of the cartilage (A), as demonstrated in a left hip. The arthroscopic view should include the acetabulum, fovea, and femoral head (FH). When passing suture through the labrum, small instrumentation should be used prevent unnecessary trauma to the labrum (B, C).

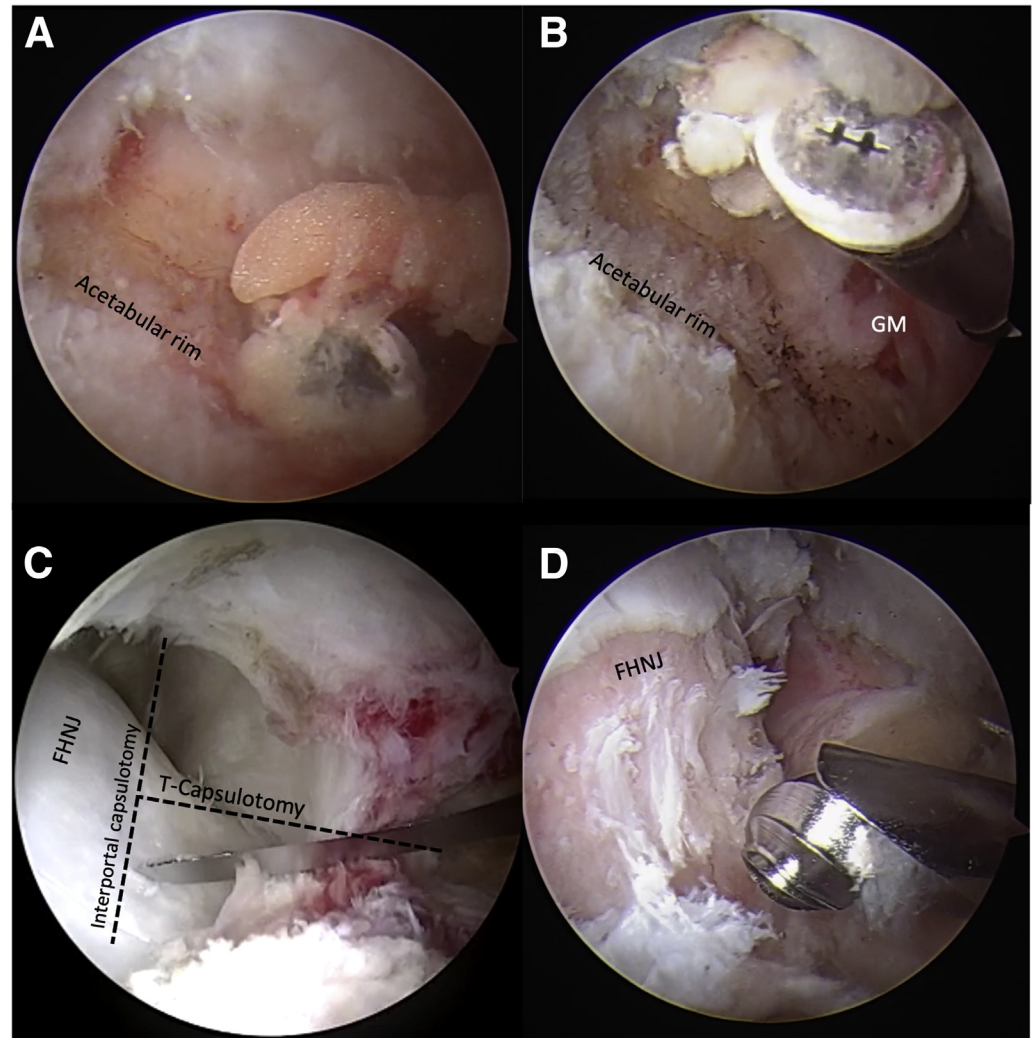
ER with 50° FL, and 60° ER with 50° FL). The surgeon can use the monitor to define the midpoint of the femoral head and neck on an image, allowing for calculation of the alpha angle at each position (Fig 9). The goal is for a balanced cam resection that restores a normal alpha angle and prevents impingement in extremes of motion. Dynamic examination in real time is

vital when assessing the final resection (Video 1). Care should also be taken to avoid over-resection, which can lead to ongoing instability.

Pearl 10: Capsular Closure

Following osteochondroplasty, the capsule should be closed completely to minimize instability. The AL portal

Fig 8. Osteochondroplasty. Fat pad debridement (A) and gluteus minimus (GM) and iliocapsularis dissection (B) off of the capsule allows for adequate access to the capsule for T-capsulotomy (C) with an arthroscopic blade (pictured) or a radio-frequency probe, as demonstrated in a right hip. The T-capsulotomy cut should be made at the midpoint of the interportal capsulotomy and should be parallel to the femoral neck. Osteochondroplasty can then be performed with an arthroscopic burr (D). (FHNJ, femoral head–neck junction.)



will be the main working portal, and the viewing portal will be the mMAP. An arthroscopic cannula (Smith & Nephew) is once again placed in the AL portal to prevent soft-tissue bridges. Starting at the iliofemoral ligament, the portion of the T-capsulotomy parallel to the femoral neck is closed first using No. 1 VICRYL sutures and a suture passer (Pivot SlingShot; Stryker) or an injector (Pivot Injector II; Stryker). After closure of the T-capsulotomy, the horizontal component of the capsulotomy is closed (Video 1). Once watertight closure is confirmed visually and via probe (Fig 10), any remaining fluid is expressed from the portals, the portals are closed, and local anesthetic is injected intra- and periarticularly.

Discussion

This article describes the senior author's preferred method for arthroscopic treatment of FAI, detailing a straightforward checklist of technical pearls. Hip arthroscopy to treat FAI is growing in popularity owing

to excellent clinical outcomes, rapid rehabilitation, and low complication rates, regardless of age or sex.^{13,14} However, the procedure is technically demanding and recognized to have a steep learning curve.^{15,16} The pearls presented in this article aims to provide surgeons learning arthroscopy with a framework for successful hip arthroscopy for FAI (Table 1).^{11,17-21} Our recommendation when performing hip arthroscopy is to break the procedure down into the series of 10 steps outlined herein and to aim for mastery of each step before proceeding to the next.

Many aspects of hip arthroscopy for FAI are controversial and continue to be the subject of enthusiastic debate, including the use of postless traction, techniques for accessing the central compartment, capsular closure, labral management, and femoroplasty. To mitigate risks associated with iatrogenic pudendal nerve and groin complications, techniques and tables to achieve postless distraction have been proposed, although these methods come with their own set of

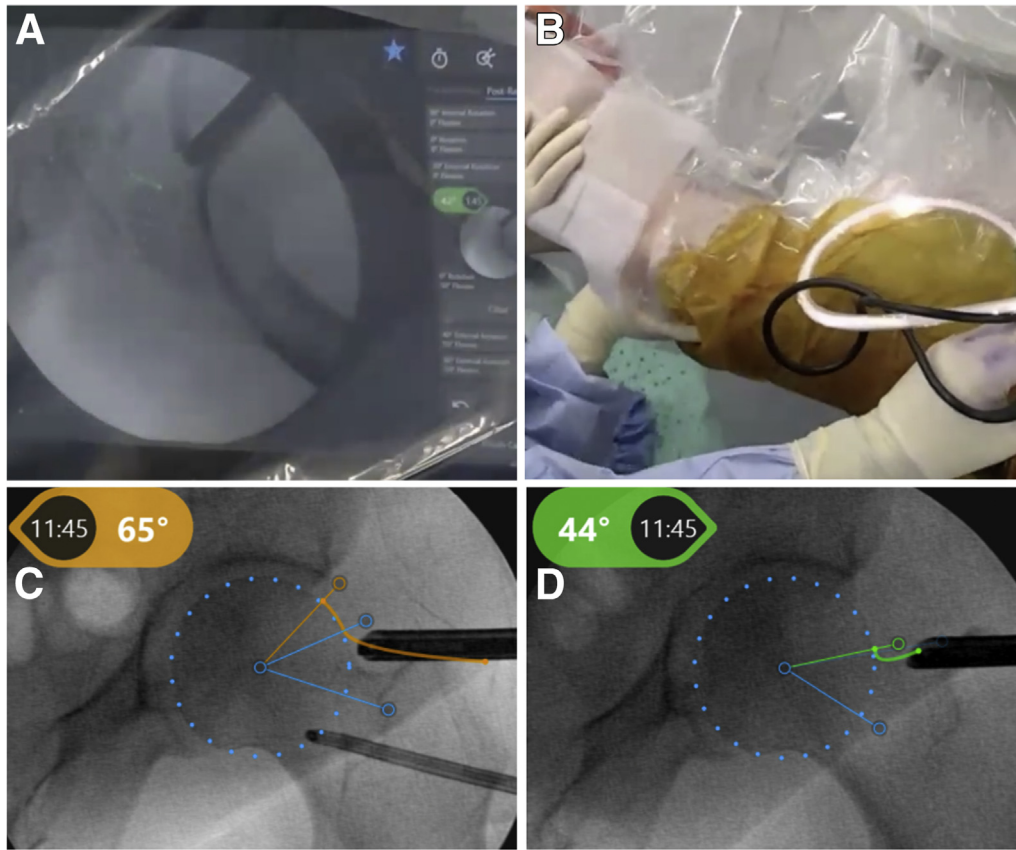


Fig 9. Ensuring proper resection using the Hip-Check tool. As demonstrated in a left hip, the adequacy of cam lesion resection can be assessed through measuring the alpha angle in 6 positions before and after resection through identification of the femoral head and neck on the HipCheck monitor (A) while adjusting the position of the leg (B). Pre- (C) and postresection (D) alpha angles when the leg is in 30° internal rotation with neutral flexion are shown.

limitations.²²⁻²⁴ Management of the hip joint capsule is also an area of considerable debate, with much of the controversy related to the extent of iatrogenic capsular injury required to appropriately access central and peripheral compartment pathology.²⁵ Strategies currently used to navigate this issue include

capsular-sparing approaches, a limited capsulectomy, an interportal capsulotomy, or a more extensive T-capsulotomy.²⁶ Regardless of the approach, capsulotomy closure has been shown to be beneficial following access to either compartment.^{21,27,28} The management of labral tears in FAI is also debated.

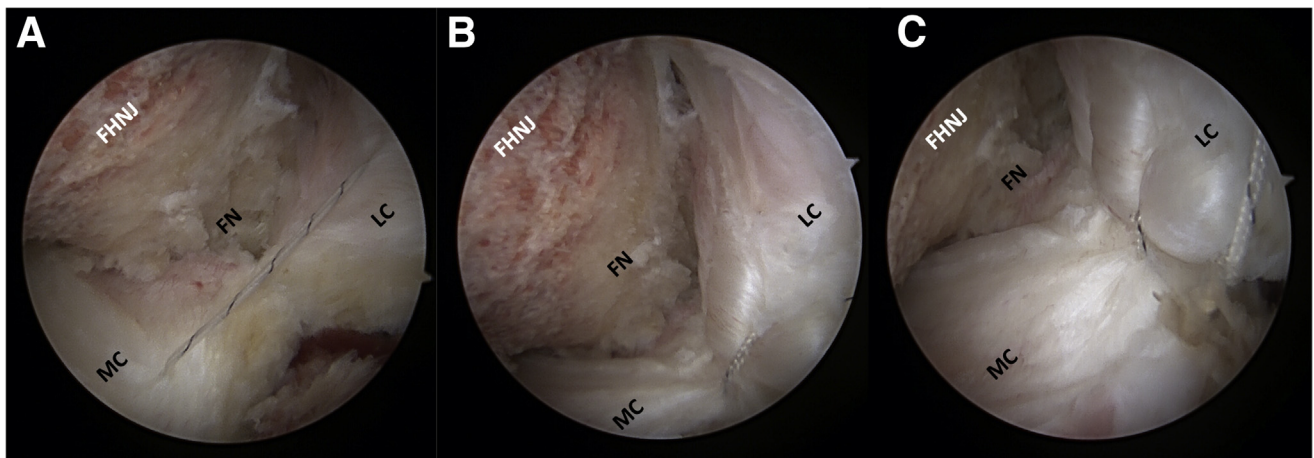


Fig 10. Capsular closure. As seen in this left hip through the modified mid-anterior portal, capsular closure is started at the portion of the T-capsulotomy parallel to the femoral neck (FN) (A). After tensioning the first suture (B), subsequent sutures are added (C) to bring together the medial capsule (MC) and lateral capsule (LC) until a watertight seal is achieved. (FHNJ, femoral head–neck junction.)

Table 1. Pearls and Pitfalls**Pearls**

- To achieve adequate distraction for visualization, patient should be positioned in slight Trendelenburg with the leg adducted and the foot internally rotated
- Portals should be created close to the femoral head to avoid iatrogenic labral damage
- A minimal interportal capsulotomy should be created, just large enough for instrumentation, to prevent microinstability and scarring
- Traction stitches should be placed before central compartment procedures to create a defined plane between the capsule and labrum and to preserve capsular tissue for closure
- During acetabuloplasty, care must be taken to maintain the integrity of the chondrolabral junction
- Use of the proper portal during labral repair (DALA for anchors from 1 to 3 o'clock, AL for anchors at 12 o'clock) aids in anchor trajectory and avoids intraarticular anchor placement
- Cartilage should be visualized when drilling anchors for labral repair, and small instrumentation should be used to avoid iatrogenic labral damage
- Adequate peripheral compartment access can be achieved through fat pad debridement, iliocapsularis and gluteus minimus dissection, and T-capsulotomy
- Adequacy of cam lesion resection can be assessed intraoperatively using commercial tools, such as the HipCheck
- Watertight capsular closure should be performed following peripheral compartment procedures and confirmed visually and with a probe

Pitfalls

- Improper padding of a pudendal post may lead to pudendal nerve and perineal skin injury
- Straying medial during creation of the mMAP can result in an overly large interportal capsulotomy, which can lead to long-term microinstability and scarring
- Failure to place traction stitches following the interportal capsulotomy may impede adequate visualization during central compartment procedures
- In dysplastic patients, rim trimming can result in undercoverage of the acetabulum
- Use of the incorrect working portal during labral repair can result in improper anchor trajectory
- Failure to visualize the cartilage while drilling anchors for labral repair may result in cartilage violation
- Over-resection of cam lesions can negatively impact hip joint biomechanics and predispose patients to femoral neck fractures¹⁷⁻¹⁹
- Under-resection of cam lesions may lead to the need for revision hip arthroscopy^{11,20}
- Failure to completely close the capsule may result in microinstability and worse clinical outcomes²¹

DALA, distal anterolateral accessory; mMAP, modified mid-anterior portal.

Options include labral debridement, repair, or reconstruction, but repair is associated with a lower risk of conversion to arthroplasty and greater patient-reported outcomes compared with debridement.^{29,30} With regards to femoroplasty, the proper amount of resection is crucial as under-resection is the most frequent etiology of revision hip arthroscopy^{11,20} and over-resection can affect hip joint biomechanics and predispose to femoral neck fractures.¹⁷⁻¹⁹ Both of these complications highlight the importance of intraoperative use commercial tools, such as the Stryker HipCheck, to ensure proper resection in real-time. In this Technical Note, we have described our preferred method for arthroscopic treatment of FAI, detailing a straightforward checklist of technical pearls that may be used to minimize complications and optimize patient outcomes.

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