



# Modifications to the Hip Arthroscopy Technique When Performing Combined Hip Arthroscopy and Periacetabular Osteotomy

Andrea M. Spiker, M.D., Kate R. Gumersell, P.A.-C., Ernest L. Sink, M.D., and Bryan T. Kelly, M.D.

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**Abstract:** In the realm of hip preservation, hip arthroscopy is often used to address intra-articular impingement pathology, whereas periacetabular osteotomy (PAO) is used to address dysplasia and instability. Indications to combine these 2 procedures include hip dysplasia and symptomatic instability with a concomitant symptomatic labral tear or the other symptomatic intra-articular pathology (i.e., loose body, chondral flap). The arthroscopic portion of the procedure allows repair of the injured labrum and close inspection of the hip joint, and the PAO addresses undercoverage and/or inappropriate version of the acetabulum. The open approach used in PAO also allows access to the peripheral compartment to debride a cam lesion, if present, and the subspine region is accessible to perform subspine decompression, if needed. In this technique, we highlight special considerations pertaining to hip arthroscopy that is performed in combination with a PAO. Hip arthroscopy is the first procedure that takes place in this combined case, and modifications to the standard hip arthroscopic technique can prevent unnecessary difficulty during the PAO that follows.

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**H**ip preservation procedures can be classified as arthroscopic or open surgeries. Hip arthroscopy has evolved into a very effective procedure to address intra-articular pathology such as femoroacetabular impingement, allowing surgeons to directly address and correct bony malformation that causes hip impingement and resultant chondral damage, while repairing the sequelae of the altered hip mechanics, such as labral tears. Open procedures include surgical hip dislocation, derotational osteotomies, and periacetabular osteotomy (PAO). With technical advances in arthroscopic surgery, the need for surgical hip dislocation has decreased, save for cases in which complete access to

the joint is required or arthroscopic instrumentation cannot easily access the location of hip pathology. Derotational osteotomies have a role in patients who present with significant symptomatic femoral version abnormalities. The PAO was described by Ganz et al.<sup>1</sup> in 1998 as a procedure used to improve “congruency and containment” of the hip, and has successfully been used to treat dysplasia.

There are patients who present with hip pathology that may benefit from a combined procedure of hip arthroscopy and a PAO. One such example is hip pain due to both symptomatic intra-articular cartilage damage and dysplasia. If the patient is symptomatic of both a labral tear (due to the hip mechanics associated with impingement) and/or instability (from undercoverage or inadequate version of the acetabulum), and has failed an appropriate trial of conservative management (physical therapy, nonsteroidal anti-inflammatory drugs, and intra-articular injection), the combined hip arthroscopy and PAO can be a very effective procedure to address all aspects of the patient’s hip pathology. Although there is evidence that patients with borderline dysplasia (center edge angle of 20°-25°) can do well after hip arthroscopy alone,<sup>2,3</sup> if patients present with clear symptoms of instability in addition to a symptomatic labral tear, a PAO is the preferred treatment for dysplasia and the combined hip

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*From the Department of Orthopaedic Surgery, Hospital for Special Surgery, New York, New York, U.S.A.*

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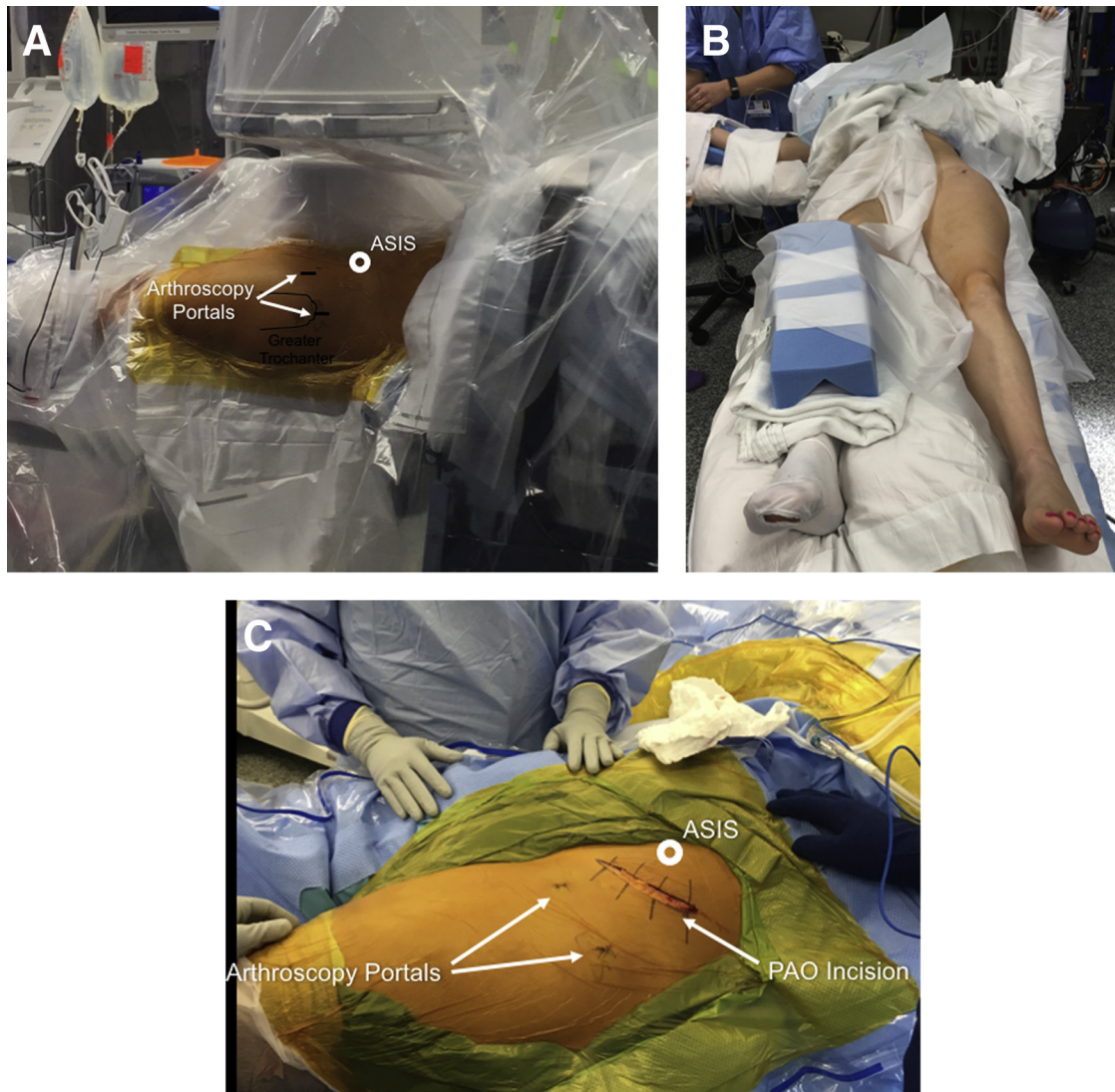
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*Address correspondence to Andrea M. Spiker, M.D., Department of Orthopaedic Surgery, Hip Preservation Service, Hospital for Special Surgery, 535 E. 70th St., New York, NY 10021, U.S.A. E-mail: [AndreaSpikerMD@gmail.com](mailto:AndreaSpikerMD@gmail.com)*

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**Fig 1.** On the left hip, (A) supine positioning on a traction table and landmarks for the hip arthroscopy. Standard anterolateral and modified anteromedial portals are marked showing the relation to the outlined greater trochanter and anterosuperior iliac spine (ASIS). (B) Positioning for the periacetabular osteotomy (PAO)—the patient is transferred to a flat, radiolucent table. The patient is positioned supine, with the right leg secured and the left arm positioned in abduction and external rotation to allow space to operate. (C) When draping for the PAO, the operative leg is prepped so that full passive hip range of motion is possible. The incision for PAO (marked) is just distal to the ASIS and proximal to the portals used for hip arthroscopy.

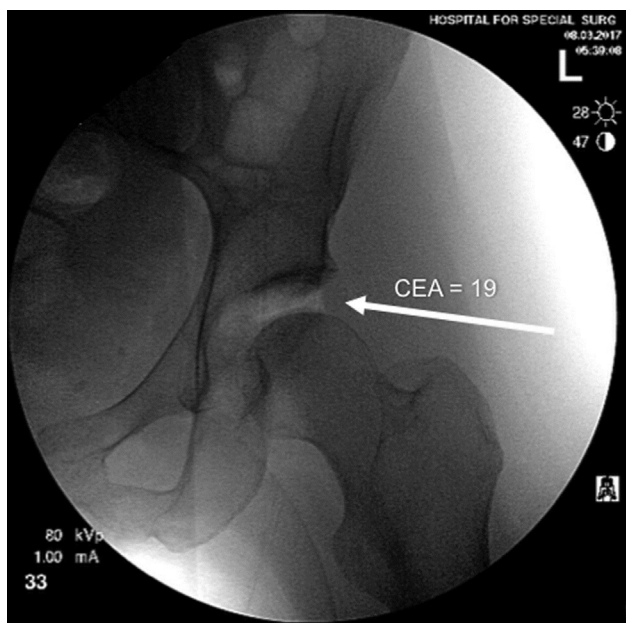
arthroscopy can concurrently address intra-articular pathology.

The combined hip arthroscopy and PAO procedure has been described previously.<sup>4,5</sup> In this Technical Note, we focus on alterations in the standard hip arthroscopy technique that can be applied to the arthroscopic procedure used in conjunction with a simultaneous PAO. The PAO is a technically challenging procedure that relies on careful anatomic dissection before precise bone cuts around the acetabulum. The anatomy can be significantly distorted after the capsulotomies used in arthroscopy and subsequent fluid infiltration of the pericapsular musculature and fascial structures. As such, we describe our preferred

techniques to minimize challenges encountered during the PAO immediately after hip arthroscopy.

### Technique

In this combined hip arthroscopy and PAO procedure, hip arthroscopy is the first surgery to take place. The patient is placed supine on a traction table (Smith & Nephew, London, England) in a standard hip arthroscopy setup (Fig 1A). Traction is applied with care, because the dysplastic hip may not require as much force to acquire appropriate traction as a nondysplastic hip. Once traction is applied, the surgeon should be cognizant that although there is less lateral acetabular coverage (allowing for what appears to be greater



**Fig 2.** Fluoroscopic image of traction applied to the left dysplastic hip (CEA = 19° based on preoperative imaging). Although there appears to be ample space to access the joint laterally (noted by the arrow), the labrum is often hypertrophic in dysplastic hips and may be occupying more space than is typical in a nondysplastic hip. (CEA, center edge angle.)

accessibility to the joint on a fluoroscopic image), the labrum may be hypertrophic and occupying more space than expected (Fig 2).

### Entering the Joint

The standard anterolateral and modified anterior portals are made. These are typically the only portals required to perform the arthroscopy that is used in the combined hip arthroscopy and PAO (Fig 3). Although the next step in standard hip arthroscopy is to create an interportal capsulotomy to connect these 2 portals under direct visualization, in the combined arthroscopy/PAO, we attempt to address the intra-articular pathology without interportal capsulotomy (Video 1). If visualization is too difficult to obtain, or the arthroscopic instruments are too difficult to maneuver, a small interportal capsulotomy is made with a beaver blade (Pivot Samurai blade, Pivot Medical, Greenwood Village, CO). It is preferable that the interportal capsulotomy is as lateral as possible, so that during the PAO portion of the case, the plane between the capsule and iliocapsularis can more easily be developed. If the interportal capsulotomy is too medial, it is more difficult to maintain the necessary laterally directed tension on the capsule to place instruments in this plane beneath the iliocapsularis muscle, around the medial neck of the femur, and eventually on the ischium to perform the ischial cut of the PAO.

### Addressing Labral Pathology and the Acetabular Rim

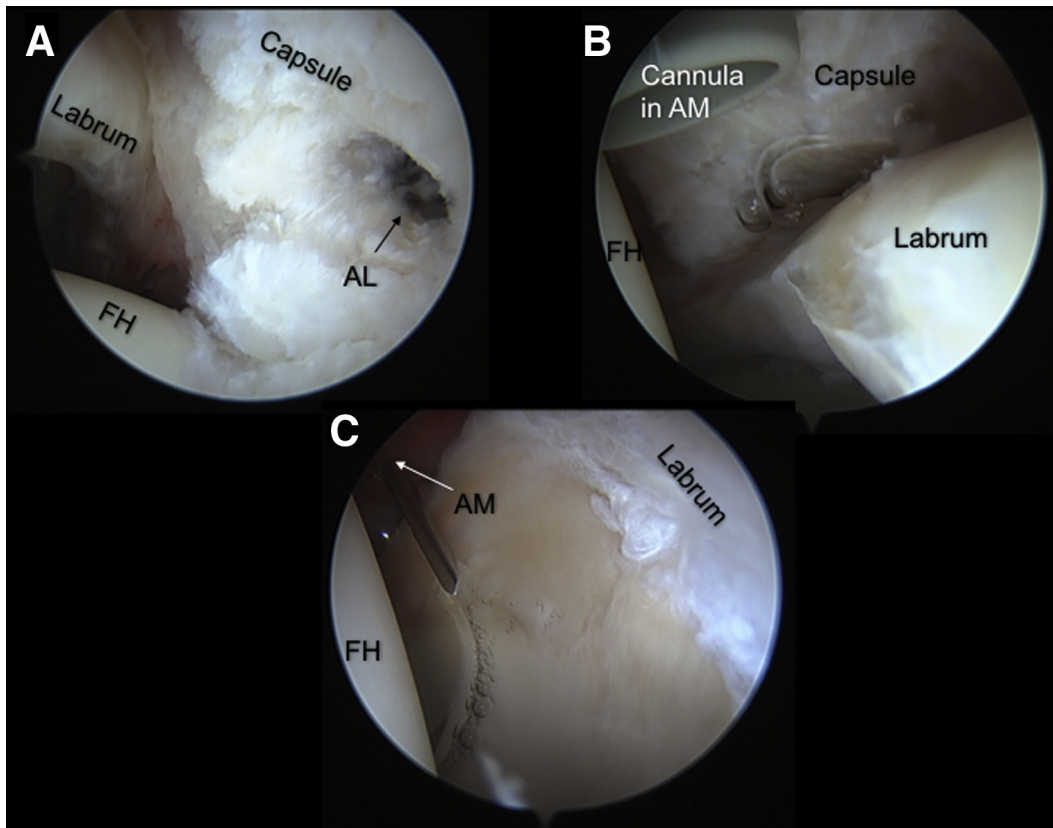
The labrum in the dysplastic hip is often hypertrophic, which can impede visualization, especially if the labrum is torn and reflected into the joint. If the labrum is torn and requires labral repair, we prepare the acetabular rim for suture anchors with a shaver (Dyonics, Smith & Nephew) (Video 1). In standard hip arthroscopy, a burr may be used to perform this step of the procedure. However, in a dysplastic hip, there is already insufficient acetabular coverage and we avoid removing any more bone than is necessary. In addition, we do not remove more soft tissue than is necessary to minimize fluid extravasation. When labral repair is performed, we place suture anchors (Nanotack, Pivot Medical) in the standard fashion (Fig 4B) and pass the suture through the labrum (Nanopass suture passer, Pivot Medical) (Fig 5). The decision to use a simple suture versus mattress suture is based on tissue quality and quantity.

### Subspine and Peripheral Compartment Pathology

Although in standard hip arthroscopy we can address subspine impingement by clearing soft tissue from the acetabular rim to the subspine region and then removing excess bone with a burr, in the dysplastic hip we do not address this during the arthroscopic portion of the case. Minimizing soft tissue dissection will prevent excessive fluid extravasation into the pericapsular region (Fig 6). In addition, because the subspine can be clearly seen and treated after completion of the PAO, we do not need to spend the extra time required to perform subspine excision during arthroscopy (Fig 4A). We also do not enter the peripheral compartment during a combined arthroscopy/PAO case. If a cam lesion is present, this can be directly visualized by opening the capsule after completion of the PAO. Arthroscopic peripheral compartment access often requires a T-capsulotomy, which would compromise the capsular integrity that is important for developing appropriate anatomic planes during the PAO. By treating peripheral compartment pathology after completing the PAO, we also decrease the time required to perform hip arthroscopy, again minimizing fluid extravasation.

### Completion of Hip Arthroscopy

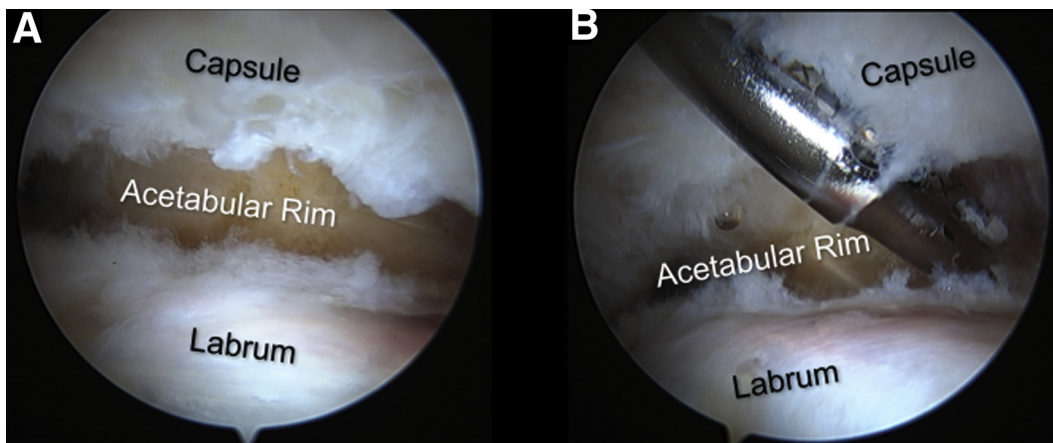
Once the labrum and intra-articular pathology has been addressed (i.e., chondral flaps, loose bodies, synovitis), the arthroscopic instruments can be removed. No capsular repair is required if the surgeon is successful in avoiding an interportal capsulotomy. In the event, a small interportal capsulotomy is created; capsular repair is still not required, because this can be sutured when the capsule is exposed during the PAO. Of note, if the interportal capsulotomy is made lateral enough, it may not be seen during the PAO because it is



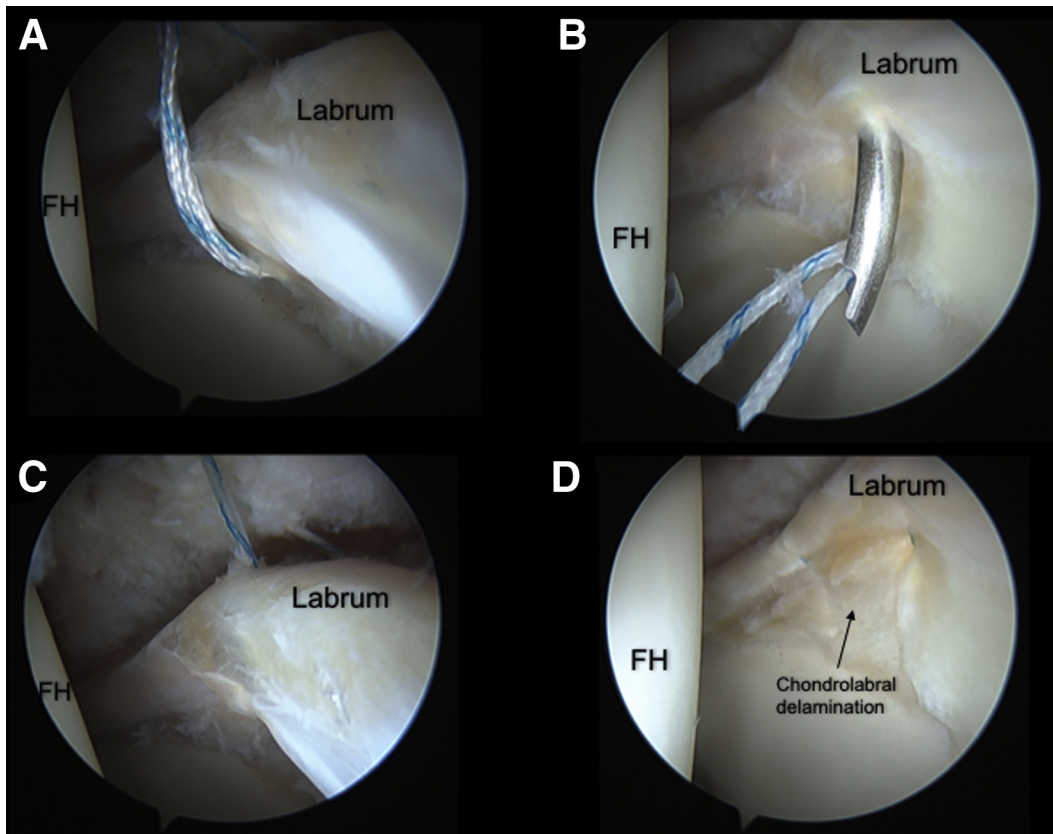
**Fig 3.** In the left hip, (A) antrolateral (AL) portal (as viewed from the anteromedial portal) is the first portal made in the standard fashion. After the antrolateral portal is made, the (B) anteromedial (AM) portal (as viewed from the antrolateral portal) is made. Ideally, there is no interportal capsulotomy made to maintain capsule integrity and minimize fluid extravasation. However, if a small interportal capsulotomy is required, (C) a beaver blade can be used to create a small interportal capsulotomy. This capsulotomy is kept as lateral as possible, as not to interfere with the dissection required in the periacetabular osteotomy portion of the procedure. The femoral head (FH) and capsule are also identified.

beneath the gluteus minimus and thus lateral to the area of the capsule that is exposed for the ischial osteotomy. In addition, because the peripheral

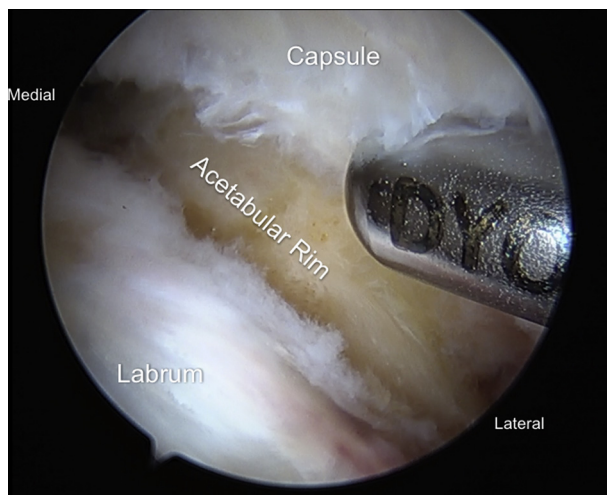
compartment is not entered during the arthroscopic portion of the case, there is no T-capsulotomy made and therefore no closure required.



**Fig 4.** In the left hip, as viewed through the anteromedial portal, (A) minimal resection of the bone and soft tissue is performed along the acetabular rim. Dysplastic hips already have acetabular undercoverage, so we are very careful not to resect more bone than necessary. Soft tissue dissection is kept to a minimum to minimize fluid extravasation in the periacetabular soft tissues. We will not expose and decompress the subspine during the arthroscopic portion of the case, because this can be done open after completion of the periacetabular osteotomy, if indicated. (B) A drill guide is used to place each suture anchor in the standard fashion.



**Fig 5.** In the left hip, viewed from the anteromedial portal, the labrum is repaired with a mattress suture. (A) One limb of the suture from the suture anchor is passed through the labrum at the chondrolabral junction. Here the labrum appears hypertrophied, which can be seen in dysplastic hips. (B) The suture retriever is then passed in the same direction (superior to inferior) more peripherally through labral tissue that is robust enough to hold the suture. (C) The suture is retrieved. (D) Completed labral repair shows restoration of the labral seal. Chondrolabral delamination resulting from the patient's cam impingement is visible here. (FH, femoral head.)



**Fig 6.** The arthroscopic view of the left hip, viewed from the anteromedial portal, shows the acetabular rim after preparation for suture anchors used in labral repair. A shaver is used instead of a burr to minimize removal of bone in this area given the pre-existing undercoverage of the acetabular rim. Soft tissue removal is also minimized to prevent fluid extravasation into the pericapsular tissues.

Before removing the camera cannula, suction can be applied to one of the outflow portals to remove any excess fluid from the joint space (Video 1).

The portals are then closed with interrupted nylon sutures. A sterile dressing is applied and the drapes are taken down. The patient is then transferred to a flat, radiolucent table and positioned, prepped, and draped for the PAO portion of the surgery (Fig 1 B and C).

## Discussion

Patients with hip dysplasia have a high incidence of intra-articular pathology,<sup>6</sup> and there is also a relatively high incidence of cam-type lesions present in dysplastic hips.<sup>7</sup> Although hip arthroscopy is the ideal procedure to treat straightforward femoroacetabular impingement, and PAO is an effective surgery to treat symptomatic hip dysplasia, patients who present with a combination of hip pathologies may require more than 1 surgical intervention. The combined hip arthroscopy and PAO is indicated in the patient with signs and symptoms of both intra-articular hip pathology, a detached labrum on magnetic resonance imaging examination, and symptomatic hip instability caused by

**Table 1.** Pearls and Pitfalls for Hip Arthroscopy Combined With PAO

## Pearls:

- Minimizing the capsular cut will prevent fluid extravasation, which allows for easier anatomic dissection during the PAO.
- Minimizing the capsular cut will also maintain capsule integrity, which makes identifying the plane between the iliocapsularis and capsule (required for the ischial cut) easier during the PAO.
- Minimizing the duration of the arthroscopic portion of the procedure will keep fluid extravasation to a minimum.
- The arthroscopy needs to address only central compartment intra-articular pathology. Peripheral compartment (cam lesion on the femoral neck) as well as subspine impingement can be addressed after the PAO has been completed with an anterior arthrotomy.
- At the conclusion of the hip arthroscopy, suction can be applied to the arthroscopic cannulas to remove any excess fluid.
- Once the PAO is completed, the surgeon can place a finger on the subspine and flex the hip to determine if subspine impingement is present. If there is subspine impingement, a burr can be used to remove the excess bone just beneath the insertion of the direct head of the rectus femoris without compromising the tendinous insertion.
- If the capsule is opened to remove a cam lesion after the PAO, a burr and/or osteotome can remove the cam lesion. The capsule should be repaired. A Dunn lateral radiograph can be obtained in the OR with fluoroscopy to view the femoral neck offset.
- If removing a cam lesion through an anterior arthrotomy, it is important to flex/externally rotate the hip to view the medial cam location and extend/internally rotate the hip to view the lateral/superior cam location.

## Pitfalls:

- The dysplastic hip may not require as much traction as a nondysplastic hip, so care should be taken during setup for the hip arthroscopy using the traction table.
- Without the standard-sized interportal capsulotomy, visualization of the central compartment can be more difficult, as can maneuvering the arthroscopic instruments.
- The labrum in a dysplastic hip can be hypertrophic, so visualization may be further compromised by excess labral tissue.
- Care must be taken when working on the acetabular rim not to remove too much bone in the already dysplastic patient. Although the surface needs to be prepared for the placement of suture anchors, we prefer to use a shaver instead of a burr in this area. Minimizing soft tissue debridement in this area will also minimize fluid extravasation into surrounding pericapsular tissues.
- There is a balance between keeping the arthroscopic portion of the case to a minimum (in both creating a small entry into the capsule and minimizing the duration of the case to prevent fluid extravasation) and successfully addressing intra-articular pathology.
- At the conclusion of the hip arthroscopy, the incisions are dressed, the drapes taken down, the patient is transferred to a flat, radiolucent table, and the limb repositioned and draped for the PAO portion of the surgery, adding additional time to this combined case.

OR, operating room; PAO, periacetabular osteotomy.

**Table 2.** Advantages, Risks, and Limitations

## Advantages:

- Hip arthroscopy combined with PAO allows for management of symptomatic intra-articular pathology in the same surgical setting as correction for symptomatic instability.
- Using these modifications to the standard hip arthroscopy can greatly decrease the difficulty in dissection and exposure required for the PAO that immediately follows the hip arthroscopy.
- If subspine impingement and/or cam-type impingement are present, these do not need to be addressed during the arthroscopic portion of the case and can be directly visualized and treated open after completion of the PAO.

## Risks:

- If the arthroscopic surgeon is not cognizant of the modifications required in a combined arthroscopy/PAO case, the PAO can be made significantly more difficult immediately after the arthroscopy.
- Specific challenge is minimizing the fluid extravasation that accompanies hip arthroscopy, because this distorts the anatomy and complicates soft tissue dissection during the PAO.
- It is also important that the capsule maintain its integrity so that appropriate supracapsular planes can be developed during the PAO to find the appropriate location for osteotomy insertion to perform the ischial cut.

## Limitations:

- Although the arthroscopy plus PAO address both intra-articular and acetabular coverage and version pathology, these procedures cannot alter the femoral version, which can be a contributing factor in the patient's hip pain.

PAO, periacetabular osteotomy.

insufficient acetabular coverage or version. The combined hip arthroscopy/PAO has been described previously,<sup>4,5</sup> and is advantageous in that it addresses both intra-articular pathology and instability in the same surgical setting. In this Technical Note, we focus on special considerations for hip arthroscopy in the dysplastic hip and modifications to the hip arthroscopy portion of the combined hip arthroscopy/PAO (Table 1). These modifications can minimize difficulty encountered during the PAO related to arthroscopic fluid extravasation and capsular compromise, which complicates surgical dissection and identification of appropriate soft tissue planes before bony osteotomies.

**Table 3.** Equipment Required for Hip Arthroscopy Portion of Combined Hip Arthroscopy and PAO

- Hip arthroscopy traction table (Smith & Nephew)
  - Beaver blade: Samurai blade (Pivot Medical)
  - Anchors: Nanotack Flex (Pivot Medical)
  - Suture passer: Nanopass (Pivot Medical)
  - Suture: Orthocord (DePuy Synthe, Raynham, MA)
  - Radiofrequency ablator: ArthroCare (Sunnyvale, CA)/Smith & Nephew
  - Shaver: 4-mm Dyonics (Smith & Nephew)
  - Cannula: Transport (Pivot Medical)
- For PAO Portion of Procedure
- Flat radiolucent table

PAO, periacetabular osteotomy.

While performing hip arthroscopy on the dysplastic hip, the surgeon may encounter a number of variations because of the patient's anatomy and pathomechanics. Decreased lateral acetabular coverage can translate to less traction required to obtain necessary access to the joint. Because of an often hypertrophic labrum seen in hip dysplasia,<sup>8,9</sup> care must be taken to place the cannula outside of the labrum.

In an attempt to minimize fluid extravasation and maintain capsule integrity for PAO soft tissue dissection, we avoid or significantly decrease the size of the interportal capsulotomy. This can make visualization more difficult and the arthroscopy technically more challenging. The duration of the arthroscopic portion of the combined procedure should be kept to a minimum, to both minimize fluid extravasation and decrease the overall length of the combined procedure, which requires patient repositioning, reprep, and redraping (Tables 2 and 3).

In our experience, using both arthroscopy and PAO, these modifications to the arthroscopic portion of the procedure allow appropriate treatment of intra-articular pathology while optimizing the environment for safe and effective surgical dissection during the subsequent PAO.

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