Peripheral Versus Central Compartment Starting Point in Hip Arthroscopy for Femoroacetabular Impingement

ROBERT RUPP, MD; BRIAN DUGGAN, MD

abstract

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The purpose of this study was to compare the perioperative complications and traction times in femoroacetabular impingement hip arthroscopy with either a peripheral or central compartment starting point. Sixty patients with femoroacetabular impingement were treated with hip arthroscopy. Thirty patients had a peripheral compartment starting point and 30 had a central compartment starting point. Intra- and postoperative complications were documented along with traction times. The peripheral compartment starting group experienced 6 minor chondral injuries and 1 case of postoperative paresthesias. The central compartment starting group experienced 8 minor and 3 moderate chondral injuries, 2 labral penetrations, and 3 cases of postoperative paresthesias. Traction time averaged 46 minutes in the peripheral compartment starting group and 73 minutes in the central compartment starting group.

Iatrogenic injury and traction times are decreased with peripheral vs central compartment starting in hip arthroscopy for femoroacetabular impingement. Consideration should be given for peripheral compartment starting in hip arthroscopy for the treatment of femoroacetabular impingement.

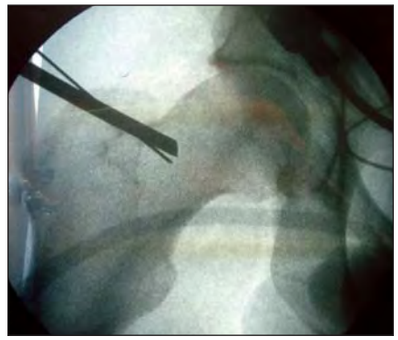

Figure: Intraoperative fluoroscopy showing the arthroscope and 16-gauge needle placed along the anterior femoral neck capsule.

Drs Rupp and Duggan are from Tahoe Orthopedic and Sports Medicine, Zephyr Cove, Nevada.

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Correspondence should be addressed to: Robert Rupp, MD, Tahoe Orthopedic and Sports Medicine, 212 Elks Point Rd, Ste 200, Zephyr Cove, NV 89448 (robertruppmd@aol.com).

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Hip arthroscopy for the treatment of femoroacetabular impingement is a common procedure. The procedure usually starts in the central compartment, and this technique has been well described.[1,2] One concern of a central compartment starting point is the potential for iatrogenic chondral or labral injury. Byrd[3] reported that "iatrogenic intra-articular damage to the joint (scope trauma), although largely unreported, is likely the most common complication associated with hip arthroscopy."

Access to the central compartment is essentially blind, even with fluoroscopic guidance. Because the hip capsulotomy has not been performed initially, a tight hip joint increases the risk of chondral scuffing or labral penetration and the potential for increased traction. Dienst et al[4] described a peripheral compartment starting point in hip arthroscopy with the advantage of safe entry into the central compartment. A peripheral starting point is attractive because the arthroscopic instrumentation is introduced along the anterior femoral neck region, which is devoid of articular cartilage and is a safe distance from the labrum. Another concern with hip arthroscopy is the risk of neuropraxia and skin damage associated with prolonged traction. No traction is used during the arthroscopic access to the peripheral compartment or during the capsulectomy or capsulotomy. Traction is applied only for access into the central compartment.

The purpose of this study was to compare the amount of iatrogenic injury, traction time, and perioperative complications during femoroacetabular impingement hip arthroscopy based on initially starting in the peripheral or central hip compartment. We hypothesized that a peripheral starting point in hip arthroscopy for femoroacetabular impingement would be associated with a decreased risk of central compartment iatrogenic chondral or labral injury and a decreased traction time compared with a central compartment starting point.

MATERIALS AND METHODS

This study was designed to evaluate 2 cohort series of 60 consecutive patients who underwent hip arthroscopy for femoroacetabular impingement between 2008 and 2010. The patients were nonrandomized and selected consecutively with prospective data collection. Convenience was used for sample size selection. All patients were diagnosed with femoroacetabular impingement and met the following criteria: radiographic findings of a cam, pincer, or combined bone lesions and clinically significant anterior hip pain aggravated with hip flexion and rotation (positive impingement signs). Exclusion criteria included femoroacetabular impingement with associated arthroscopic treatment of acetabular cysts with bone grafting, snapping hip releases, bursal debridements, or advanced arthritic changes with radiographic hip joint space narrowing. All patients were evaluated clinically and treated operatively by the senior author (R.R.), who was experienced in both peripheral and central compartment starting points prior to this study. Institutional Review Board approval was obtained to perform this study.

The first cohort of 30 consecutive patients had a peripheral starting point during hip arthroscopy, and the next cohort of 30 consecutive patients had a central starting point. All femoroacetabular impingement lesions were treated regardless of the starting compartment. The peripheral compartment starting group comprised 13 men and 17 women with an average age of 48.4 years (range, 20-72 years). The types of femoroacetabular impingement in this group included cam lesion (18 patients), pincer lesion (1 patient), and combined lesions (11 patients). The central compartment starting group comprised 15 men and 15 women with an average age of 46.2 years (range, 21-68 years). The types of femoroacetabular impingement in this group included cam lesion (13 patients) and combined cam and pincer lesions (17 patients). All 60 patients had labral tears.

At the completion of the central compartment treatment, any iatrogenic chondral or labral injury was documented with careful arthroscopic inspection of all articular cartilage and labral structures. Iatrogenic injury was defined as any trauma to the articular cartilage or labral structures from the arthroscope or the working instrumentation. The size of the iatrogenic injuries was measured with a calibrated probe. The total traction time and any perioperative complications were recorded in each case. Perioperative complications that were considered included neuropraxia or paresthesias, excessive fluid extravasation or compartment syndrome, vascular injury, skin slough or ulceration from traction, and clinically significant deep venous thrombosis.

SURGICAL TECHNIQUE

All patients were placed in the supine position under general anesthesia, and their lower extremities were padded for eventual traction. Lower-extremity holders were applied to a standard operating table with a large, well-padded perineal post. The hip was positioned in 15° to 20° of flexion and neutral abduction.

For arthroscopy starting in the central compartment, traction was applied after the surgical preparation and drape, and fluoroscopy was used to guide portal and instrument placement. A standard anterolateral portal was created using a 16-guage spinal needle with guide wire and dilators for cannula placement.[5] A 70° arthroscope was inserted through the anterolateral portal, and a mid-anterior portal was placed while viewing through the anterolateral portal. The arthroscope was then switched to the mid-anterior portal to assess the anterolateral portal for any iatrogenic labral injury. A capsulotomy was performed between the portals to improve mobility of the arthroscope and instrumentation in the joint. After treatment of any central compartment injury, including labral repair/debridement, chondroplasty, and acetabuloplasty, the articular surfaces were

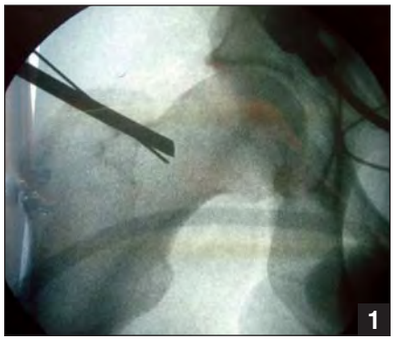

Figure 1: Intraoperative fluoroscopy showing the arthroscope and 16-gauge needle placed along the anterior femoral neck capsule.

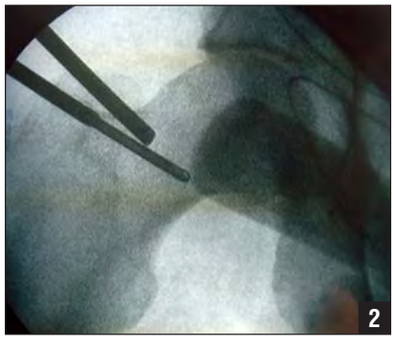

Figure 2: Intraoperative fluoroscopy showing the arthroscope and shaver starting in the peripheral compartment.

Figure 3: Arthroscopic view of the shaver positioned on the anterior capsule outside of the peripheral compartment prior to capsulotomy.

assessed for iatrogenic injury. Chondral injury was graded as minor if it involved an area <3 mm^2, moderate if the area was 3 to 5 mm^2, and severe if the area was >5 mm^2. Traction was released, and a 30° arthroscope was used to evaluate the peripheral compartment and treat any cam lesion.

For arthroscopy starting in the peripheral compartment, no initial traction was applied to the hip. An anterolateral portal was created with a 16-guage needle directed at the anterior femoral neck and confirmed with fluoroscopy. A guide wire and dilator were used to place a cannula along the capsule overlying the anterior femoral neck. Typically, the joint capsule was not penetrated at this time. A 30° arthroscope was inserted and used to view needle placement through a mid-anterior portal adjacent to the arthroscope along the anterior capsule (Figure 1). The steps for cannula placement were performed, and a shaver was introduced through the mid-anterior portal and brought into view with the arthroscope (Figure 2).

After confirming the shaver blade was directed at the capsule overlying the anterior femoral neck, a capsulotomy was performed, and the arthroscope and shaver entered the peripheral compartment. Care was taken to confirm shaver placement directly on the capsule with no intervening musculature (Figure 3). The capsular release was directed proximal along the femoral neck toward the femoral head (Figure 4). The labrum was easily identified by elevating and retracting the capsule anterior with the closed end of the shaver point used as a probe (Figure 5). Fluoroscopy was used to identify the anterior acetabular wall relative to the instrumentation if there was any question about the location of the labrum. Once the labrum was identified, the capsulolabral junction was debrided for improved labrum visualization. At this point, traction was applied, and the femoral head was viewed arthroscopically to distract from the acetabulum. The 70° arthroscope was used to assess the central compartment, and any labral or pincer lesion was treated. The articular surfaces were then assessed for any iatrogenic injury. Traction was released, and the peripheral compartment cam lesion was treated.

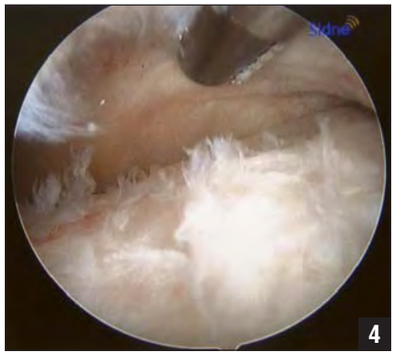

Figure 4: Arthroscopic view of the shaver entering the peripheral compartment. The cam lesion is at the bottom of the image, and the capsule is above the shaver.

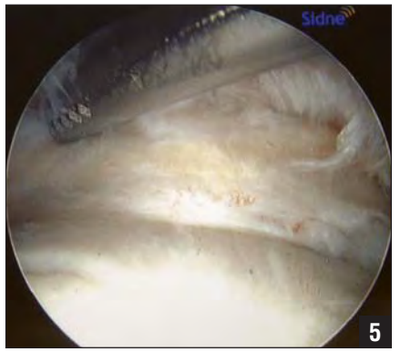

Figure 5: Arthroscopic view of the shaver at the capsulolabral junction. The labrum is below the shaver, and the femoral head is at the bottom of the image.

All patients were instructed to use crutches and bear weight as tolerated for the first 4 weeks. Each patient was evaluated at 1 week, 1 month, and 3 months postoperatively to assess for any complications. Physical therapy was routinely started between 2 and 4 weeks postoperatively.

Statistics were performed using standard methods, including frequencies, means, standard deviations, and ranges, when appropriate. Mann-Whitney *U* and Student's *t* tests were used to compare the length of surgery, iatrogenic injury, and complications between the cohorts with Prism software (GraphPad Software, La Jolla, California). Statistical significance was set at $P<.05$.

Table 1

Patient Data

Patient No./ Sex/Age, y	Starting Compartment	Femoro	Acetab	Lab Debride	Lab Repair	Iatro Injury	Traction Time, min	Complications
1/F/68	Central	x		x		None	60	None
2/M/67	Central	x		x		None	30	None
3/M/48	Central	x		x		Minor	70	None
4/F/42	Central	x		x		Minor	60	Paresthesia
5/F/51	Central	x		x		Lab penetration	60	None
6/M/38	Central	x		x		Moderate	60	None
7/F/54	Central	x		x		None	60	None
8/M/46	Central	x		x		Minor	60	None
9/F/21	Central	x		x		None	30	None
10/M/41	Central	x		x		Moderate	120	Paresthesia
11/F/32	Central	x		x		None	30	None
12/F/35	Central	x		x		None	45	None
13/M/34	Central	x	x		x	Moderate	120	None
14/F/23	Central	x			x	None	90	None
15/F/59	Central	x	x		x	None	70	None
16/F/46	Central	x		x		Minor	60	None
17/F/47	Central	x	x		x	Minor	90	None
18/M/57	Central	x	x	x		None	90	None
19/M/57	Central	x	x	x		None	90	Paresthesia
20/F/63	Central	x		x		None	70	None
21/F/54	Central	x	x		x	Lab penetration	120	None
22/F/28	Central	x	x		x	None	120	None
23/F/32	Central	x	x		x	Minor	120	None
24/M/50	Central		x		x	None	120	None
25/M/58	Central	x		x		None	45	None
26/M/22	Central	x	x	x		Minor	50	None
27/M/24	Central	x	x		x	None	75	None
28/M/54	Central	x	x		x	None	50	None
29/M/32	Central	x		x		Minor	45	None
30/M/43	Central	x		x		None	90	None
31/M/25	Peripheral	x	x		x	None	50	None
32/M/52	Peripheral	x	x		x	Minor	60	None
33/M/70	Peripheral	x		x		None	15	None
34/M/46	Peripheral	x	x		x	None	75	None
35/M/72	Peripheral	x		x		None	30	None
36/F/20	Peripheral	x			x	None	60	Paresthesia
37/M/34	Peripheral	x	x		x	Minor	45	None
38/F/60	Peripheral	x	x	x		None	30	None
39/F/60	Peripheral	x	x	x		None	45	None
40/F/53	Peripheral	x	x		x	None	70	None
41/F/55	Peripheral	x	x		x	Minor	60	None
42/F/52	Peripheral	x		x		None	45	None
43/F/34	Peripheral	x	x		x	None	60	None
44/M/42	Peripheral	x		x		None	45	None
45/M/42	Peripheral	x	x		x	None	40	None
46/F/25	Peripheral	x	x		x	None	45	None
47/F/53	Peripheral	x	x		x	None	70	None
48/M/59	Peripheral	x	x		x	Minor	120	None
49/M/62	Peripheral	x		x		None	30	None
50/M/48	Peripheral	x	x	x		None	45	None
51/F/53	Peripheral	x		x		None	20	None
52/F/43	Peripheral	x		x		None	30	None
53/M/28	Peripheral	x		x		Minor	40	None
54/F/43	Peripheral	x		x		None	25	None
55/F/38	Peripheral	x		x		None	20	None
56/F/46	Peripheral	x	x		x	Minor	60	None
57/F/55	Peripheral	x	x		x	None	50	None
58/F/53	Peripheral	x	x		x	None	60	None
59/M/61	Peripheral	x		x		None	20	None
60/F/68	Peripheral	x		x		None	15	None

Abbreviations: Acetab, acetabuloplasty; Femoro, femoroplasty; Iatro, iatrogenic; Lab, labral.

RESULTS

No statistically significant differences were noted in the patient populations. Patient data are shown in Table 1. Treatment of the femoroacetabular impingement involved labral debridement and femoroplasty (12 peripheral starting, 17 central starting); labral repair, femoroplasty, and acetabuloplasty (14 peripheral starting, 8 central starting); labral debridement, femoroplasty, and acetabuloplasty (3 peripheral starting, 3 central starting); labral repair and femoroplasty (1 peripheral starting, 1 central starting); and labral repair and acetabuloplasty (1 central starting). The iatrogenic injuries are summarized in Table 2.

In the central starting group, the iatrogenic injuries included 8 minor and 3 moderate chondral injuries and 2 instances of labral penetration. The labral penetration was not significant enough to require further treatment. Traction time in this group averaged 73 minutes (range, 30-120 minutes) (Table 3). Three patients experienced postoperative paresthesias thought to be related to traction, and all resolved by 1 month postoperatively. The paresthesias were altered sensory perceptions in the anterior thigh without associated motor deficits.

In the peripheral starting group, the iatrogenic injuries included 6 minor chondral injuries and no instances of labral penetration. Traction time in the peripheral starting group averaged 46 minutes (range, 15-120 minutes) (Table 3). One patient developed postoperative paresthesias that resolved by 1 month postoperatively. No other complications were found in any patient.

The total number of iatrogenic injuries and complications was 16 in the central starting group and 7 in the peripheral starting group (Table 2). The group differences in iatrogenic injury were statistically significant ($P=.049$), as was the difference in traction times ($P=.002$). No statistical difference was found in the complications (paresthesias) between the groups ($P=.31$).

Table 2

Iatrogenic Injuries and Complications

	No.					
Group	Minor Cartilage Injuries	Moderate Cartilage Injuries	Severe Cartilage Injuries	Labral Penetration	Paresthesias	Total
Central compartment start	8	3	0	2	3	16
Peripheral compartment start	6	0	0	0	1	7

DISCUSSION

Although hip arthroscopy is commonly used to treat femoroactabular impingement, the technique continues to evolve to treat the pathology and avoid iatrogenic injury. The constrained anatomy of the hip joint makes it less accessible to arthroscopic techniques compared with other joints, and traction is required to access the central compartment. The thick capsular ligaments and deep anatomic location of the hip joint add to the difficulty of safely entering the central compartment between the femoral head and labrum. Our personal communication with other hip arthroscopists indicates that chondral injury is not infrequent and probably under-reported in the literature. Many authors have described the risk of chondral scuffing and labral penetration, but the long-term implications of these iatrogenic injuries is not known.[2,6,7] Dienst et al[4,8] described initiating hip arthroscopy in the peripheral compartment and the general safety of this approach.

Traction during hip arthroscopy is a potential problem, and excessive traction has been associated with neuropraxias, skin breakdown, and compartment syndrome.[9] Traction complications are related to the time and amount of traction. The senior author's experience with both central and peripheral compartment starting points in hip arthroscopy indicate that hip distraction is easier and seems to require less traction force when the procedure is started in the peripheral compartment. It is possible that performing a capsulotomy while in the peripheral compartment decreases the tissue resistance to traction and allows disruption of the hip joint suction-seal mechanism to allow less traction force to distract the hip for central compartment access.

Table 3

Traction Time

	Traction Time, min	
Group	Mean	Range
Central compartment start	73	30-120
Peripheral compartment start	46	15-120

Without clear literature support showing an advantage of starting in the peripheral or central compartment in hip arthroscopy, we compared the 2 techniques while treating femoroactabular impingement. To our knowledge, this is the first report to compare iatrogenic injury, traction time, and perioperative complications between a peripheral and central compartment starting point in hip arthroscopy for femoroactabular impingement.

The results of our study demonstrate a higher incidence of chondral and labral injury with a central compartment starting procedure. These injuries occurred during initial anterolateral portal creation and with instrumentation use while treating the central compartment pathology. The

majority of the chondral injuries were minor, and the labral penetration required no further treatment. The chondral injury that occurred in the peripheral starting group was minor and occurred while treating the labral pathology in the central compartment. It is not known whether these chondral or labral injuries will affect the patient's long-term outcome.

The peripheral compartment starting point has the advantage of entry outside of the joint. Even if scuffing or abrasion to the anterior femoral neck occurs during portal creation, no injury occurs to the articular cartilage or labrum. Typically, a cam lesion on the anterior femoral neck will be treated with excision, so inadvertent bony injury by peripheral portal creation is moot. The labrum is easily identified when starting in the peripheral compartment as the capsulotomy proceeds along the anterior femoral neck. The capsulotomy is continued safely to the capsulolabral junction as needed for excellent labrum exposure prior to accessing the central compartment with traction.

Traction times were significantly decreased in the peripheral compartment starting group. We attribute this to the capsulotomy and capsulolabral debridement for labral exposure being performed without traction. It is only after the arthroscopic exposure with capsulotomy/capsulectomy is performed that traction is applied and the central compartment is entered. In contrast, when the central compartment is entered initially with traction applied, the capsulotomy and labral exposure are performed while traction is occurring. Although we did not have access to a tensionometer to compare the amount of traction required for adequate femoral head distraction, it was appreciated that less traction was required after the capsulectomy was performed in the peripheral compartment starting group.

The technique of starting in the peripheral compartment is comparable with shoulder arthroscopy in the subacromial space. Initial viewing outside of the anterior capsule may be obscured until the capsule is penetrated by the shaver. Just as subacromial shoulder debridement and bursectomy is safe with the shaver directed toward the acromion and away from the rotator cuff, the hip shaver is safely used if directed onto the femoral neck capsule and away from the more superficial thigh musculature.

Limitations of this study include the lack of patient randomization and data collection by the senior author, which could introduce bias. The long-term implications of these perioperative complications and iatrogenic injuries are not known.

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