Original Article With Video Illustration

The Anterior Approach for a Non–Image-Guided Intra-articular Hip Injection

Omer Mei-Dan, M.D., Mark O. McConkey, M.D., Brian Petersen, M.D., Eric McCarty, M.D., Brett Moreira, F.R.C.S., and David A. Young, F.R.C.S.

Purpose: The purpose of this study was to investigate and validate the accuracy and safety of a technique using an anterior approach for non–image-guided intra-articular injection of the hip by use of anatomic landmarks. **Methods:** We enrolled 55 patients. Injections were performed before supine hip arthroscopy after landmarking and before application of traction. After the needle insertion, success was confirmed with an air arthrogram and by direct visualization after arthroscope insertion. Accuracy and difficulty achieving correct needle placement were correlated with age, weight, height, body mass index, body type, gender, and surgical indication, as well as femoral and pelvic morphology. Forty-five patients who underwent injection in the office were followed up separately to document injection side effects. Needle placement accuracy was correlated to patients' demographics. All statistical tests with *P* values were 2 sided, with the level of significance set at $P < .05$. **Results:** There were 51 correct needle placements and 4 misses, yielding a 93% success rate. The most common location for needle placement was the upper medial head-neck junction. Female gender was correlated with a more difficult needle placement and misses in relation to group size ($P = .06$). The reasons for misplacements of the needle were a high-riding trochanter, increased femoral version, thick adipose tissue over the landmarks, and variant of ilium morphology. Of 45 patients in the side effect study arm, 3 reported sensory changes of the lateral femoral cutaneous nerve that resolved within 24 hours. **Conclusions:** Hip injections by use of the direct anterior approach, from the intersection of the lines drawn from the anterior superior iliac spine and 1 cm distal to the tip of the greater trochanter, are safe and reproducible. Patient characteristics, such as increased subcutaneous adipose tissue or osseous anatomic variants, can lead to difficulty in placing the needle successfully. These characteristics can be predicted with the aid of physical examination and careful study of the pelvic radiographs. **Level of Evidence:** Level IV, therapeutic case series.

Non–image-guided intra-articular injections, performed by use of anatomic landmarks, are common and accurate for a number of joints such as the ankle, knee, shoulder, and elbow.[1,2] This allows immediate, in-office information gathering and treatment of patients with intra-articular pathology. Diagnostic and therapeutic hip injection is an important step in the workup and management of young adults with nonarthritic groin pain or symptomatic patients after arthroplasty. The ability to access the hip reproducibly without the use of imaging would allow for more timely and cost-effective management of patients presenting to the treating health care provider. Furthermore, achieving timely access to the joint during hip arthroscopy is improved by breaking the suction seal of the hip with a needle as traction is applied. The ability to accurately place a needle before hip distraction may expedite surgery and decrease exposure of the operating room staff to radiation. Early studies, both clinical and cadaveric, using various anatomic approaches suggested that the rate of successful blind intra-articular injection of the hip was unsatisfactorily low.[3-6]

The purpose of this study was to investigate and validate the accuracy and safety of a technique using an anterior approach for non–image-guided intra-articular injection of the hip by use of anatomic landmarks. Our hypothesis was that the anterior approach, using the

From the Department of Orthopaedics, Division of Sports Medicine and Hip Preservation (O.M-D., M.O.M., E.M.), and Musculoskeletal Radiology Section, Department of Radiology and Orthopaedics (B.P.), University of Colorado, Denver, Colorado, U.S.A.; and the Melbourne Orthopaedic Group (B.M., D.A.Y.), Melbourne, Australia.

The authors report that they have no conflicts of interest in the authorship and publication of this article.

Received August 20, 2012; accepted February 12, 2013.

Address correspondence to Omer Mei-Dan, M.D., Department of Orthopaedics, Division of Sports Medicine and Hip Preservation, University of Colorado School of Medicine, 12631 E 17th Ave, Mailstop B202, Academic Office 1, Room 4602, Aurora, CO 80045, U.S.A. E-mail: omer.meidan@ucdenver.edu

0749-8063/12549/$36.00

http://dx.doi.org/10.1016/j.arthro.2013.02.014

described technique, would be an accurate, reproducible, and safe way to access the hip for intra-articular puncture, aspiration, and delivery of substances.

Methods

Before the start of data collection, the study protocol was approved by the institutional review board (trial registration No. ACTRN12612000873820). A total of 55 patients were enrolled in this study based on a group of patients previously consented for hip arthroscopy for treatment of a variety of intra-articular pathologies. All patients presenting with painful intact or resurfaced hips were eligible for enrollment. Exclusion criteria included patients with prior total hip replacement or a history of previous ipsilateral open hip or pelvic surgical procedures.

Study Injection Technique and Accuracy Evaluation

Patients were positioned supine on a fracture-traction table with the hip in a neutral position (0° of flexion/abduction/adduction) and the foot in a neutral position (toes pointing to the ceiling and feet parallel; not a relaxed position, which is usually slight external rotation of the foot). Care was taken to ensure that both anterior superior iliac spines (ASISs) were aligned so that the pelvis was not rotated, which would result in relative abduction of the femur. Relative abduction can occur because of the slight traction placed with the foot locked in the traction boot even without placement of formal traction on the leg. A point was marked by the respective crossing lines coming distally from the medial aspect of the ASIS and horizontally (lateral to medial) from 1 cm distal to the tip of the greater trochanter (GT) (or midway between the tip and the vastus ridge of the GT). The tip itself can be assessed but cannot be felt because it is deeper and proximal (Fig 1). The vastus ridge, the most prominent part of the GT, is easily localized by internally and externally rotating the hip with the patient lying supine. A 19-gauge spinal needle was inserted directly from anterior to posterior toward the femoral neck from the previously marked starting point (Fig 1). Figure 2 elucidates the typical bony anatomy in relation to the landmarks and needle direction, as well as the anterior femoral neck ridge, which can cause the needle to slide posteriorly. Once bony resistance was felt, the inner needle was removed and air was injected with a 20-mL Luer-Lok syringe to produce an air arthrogram. Using a Luer-Lok syringe is important to avoid dissociation of the needle and syringe upon injection. If bony resistance was not felt on the first attempt, the needle was angled slightly medially for the second attempt. The position of the needle and presence of air inside the joint were confirmed with fluoroscopy in both anteroposterior and lateral views. The needle position was reconfirmed by backflow of fluid from the

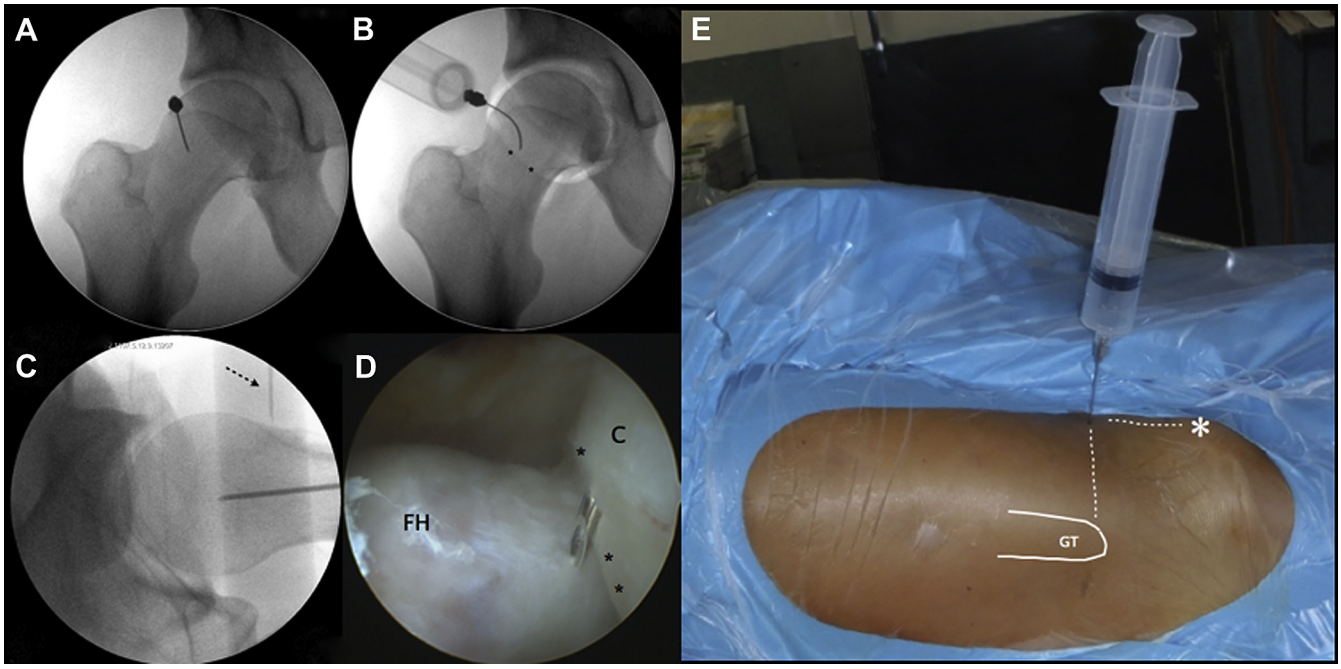

Fig 1. Non-guided intra-articular placement of spinal needle. (A) The needle is positioned by use of anatomic landmarks. (B) Once the needle is on bone, air is injected with a 20-mL syringe. The position is then confirmed by fluoroscopy. The air arthrogram, confined laterally by the zona orbicularis (marked by 2 asterisks), should be noted. (C) The position is confirmed by use of a lateral view. The arrow points to the needle that was placed blindly. (D) The position of the needle is confirmed with direct visualization once the arthroscope is introduced into the joint. In this case the capsule is retracted laterally to expose the needle just medial to the zona orbicularis (asterisks). (C, capsule; FH, femoral head.) (E) Needle position in relation to anatomic landmarks: GT and ASIS (asterisk).

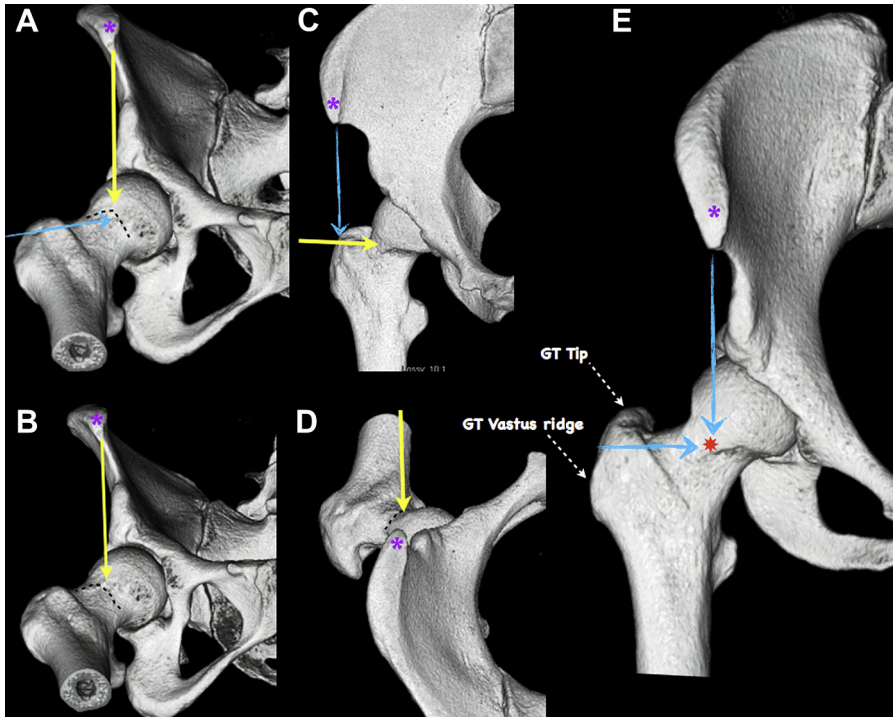

Fig 2. (A-E) Three-dimensional computed tomography views of landmarks and needle placements. The purple asterisks indicate the ASIS. The red star indicates the point at which the needle touches bone. The yellow arrows indicate the needle entry direction. The blue arrows indicate landmark directions. The black dashed lines outline the ridged shape of the anterior femoral neck. A needle inserted at an angle can slide down this slope, even if placed correctly. Because of the ridged shape and femoral anteversion, the needle should be aimed slightly medially, to increase the angle toward the bony contact.

joint, after portals were established and irrigation was introduced, and then by direct vision once the arthroscope was introduced. If the needle was properly located in the joint on fluoroscopic evaluation but air was seen outside of the capsule after it was injected, the needle was considered misplaced.

Correlations

Accuracy and difficulty in achieving correct needle placement were correlated with age, weight, height, body mass index (BMI), body type (muscular, somewhat overweight, overweight, thin, normal), gender, and surgical indication, as well as femoral and pelvic morphology and alignment. The subjective body type classification was added because of the limitations that BMI has when describing muscular individuals.[7] A high BMI in those individuals does not necessarily mean increased subcutaneous adiposity and therefore difficulty with landmark palpation. The location of needle entry into the joint was also documented by dividing the femoral head/neck into zones (Fig 2). Parameters that could influence the accuracy of needle placement with regard to joint anatomy, such as proximity to the zona orbicularis or the existence of large cam lesions, were also analyzed.

Possible Side Effects

To document possible side effects of the described injection technique (e.g., lateral femoral cutaneous nerve [LFCN] irritation, infection, or local pain), a separate group of patients treated with intra-articular hip injection by the same anterior approach was followed. This group consisted of patients treated in our clinic in the past 16 months who required intra-articular hip injection or hip joint aspiration. These patients received injections with 1 of the following: hyaluronic acid, platelet-rich plasma (PRP) (plasma rich in growth factors), steroids, and/or local anesthetic.

Outpatient Injection Technique

Patients who underwent injection in the outpatient department were injected by use of the exact same position and technique used for the active study group, who underwent needle cannulation before hip arthroscopy in the operating room (Fig 3 and Video 1, available at www.arthroscopyjournal.org). An assistant should be present to hold the patient's feet parallel and ensure that the patient is positioned appropriately and is immobile. It is important to make sure that the pelvis is even on the table (i.e., both ASISs are level so that no pelvic rotation is present) and that the patient does not lean toward any particular side (i.e., 1 ASIS is higher than the other). Once the patient is covered with a sterile sheet, it will be impossible to appreciate the asymmetric position, which can result in needle misplacement. Once the landmarks are drawn and the patient is draped in a sterile fashion, local anesthetic is infused into the entry point and subcutaneous tissues. If PRP is to be injected, care must be taken not to infiltrate local anesthetic in close proximity to the joint because it may have deleterious effects on the activity of PRP.[8] After cannulation of the hip joint in the outpatient department, if too much resistance is felt at the onset of injection, the assistant flexes the knee

Fig 3. Outpatient setup for a non-guided intra-articular injection. (A) An X is marked by the respective crossing lines coming distally from the medial aspect of the ASIS and horizontally (lateral to medial) from 1 cm distal to the tip of the GT (or midway between the tip and the vastus ridge of the GT). The tip cannot actually be felt because the GT curves in proximally, away from the skin. The skin is sterilized, and local anesthetic is infiltrated at the entry site in the skin and subcutaneous tissues. (B) Both feet are passively moved to a neutral position (feet parallel). (C) The area is draped in a sterile manner, and a 19-gauge spinal needle is inserted directly from anterior to posterior toward the femoral neck from the previously marked starting point. Once bony resistance is felt, the inner needle is removed and air is injected with a 20-mL syringe. (D) A Luer-Lok syringe with plasma rich in growth factors (PRP) is used to inject the concentrate into the hip joint. If much resistance is felt, the assistant would flex the knee/hip slowly to open the needle bore facing the bony neck of the femur.

slightly, causing slight hip flexion; this allows the needle to slide along the femoral neck to change the location of the needle tip relative to the bone or cartilaginous tissue and open the needle bore.

Statistical Analysis

Needle placement accuracy in relation to the patients' demographics was assessed by use of Spearman correlations. All statistical tests with P values were 2 sided, with the level of significance set at $P < .05$. SPSS statistical software, version 12.0 (SPSS, Chicago, IL), was used for data analysis.

Results

Efficacy

We enrolled 55 patients in the study. There were 36 male and 19 female patients. Patient demographics are outlined in Table 1. Three of the enrolled patients had an artificial joint (Birmingham Hip Resurfacing). The mean age was 34 years (range, 16 to 66 years). The mean weight was 76 kg (range, 57 to 106 kg), and the mean height was 175 cm (range, 155 to 190 cm).

There were 51 correct placements of the needle and 4 misplacements (needle considered by us not to be definitively located within the hip), yielding a 93% success rate. Of the 51 correct placements, 47 were defined as easy (1 to 2 attempts) and 4 as difficult (3 to 4 attempts). Of the 47 easy correct placements, 35 required a single attempt and 12 required 2 attempts. The most common location for needle placement was the upper medial head-neck junction (Fig 4). Female gender was correlated with more difficult needle placement and misses in relation to group size ($P = .06$).

Every missed injection had an explanation in terms of anatomy and bony landmarks (Figs 5 and 6). The reasons for misplacements of the needle were a high-riding trochanter (short articular trochanteric distance), increased femoral version, thick adipose tissue over the landmarks, and lateral ASIS variant (ilium morphology).

We subjectively classified patient body morphology into 1 of 5 groups: 14.5% of patients were considered thin, 16.5% were considered normal, 45% were considered muscular, 22% presented with some increased adiposity and were considered somewhat overweight, and 2% were considered overweight. Because of the

Table 1. Demographics of Enrolled Patients, Ease of Placement, and Location of Needle Placement

	No.	Minimum	Maximum	Mean	SD
Age (yr)		16	66	34.0	13.2
Weight (kg)		56	106	77	11.5
Height (cm)		155	190	175	7.82
Gender (male/female)	36/19				
BMI		19.4	31.6	24.6	2.62
Attempts needed to place needle correctly		1	4	1.43	0.742
Surgery indication					
FAI	45				
Before PAO	5				
Diagnostic	2				
Treatment of resurfaced hip	3				
Reported difficulty level					
Easy	47 (1 attempt in 35 and 2 attempts in 12)				
Medium (3-4 attempts)	4				
Missed	4				
Needle placement distribution (Fig 2)					
Upper neck	13				
Mid neck	8				
Lower neck	1				
Upper medial to HNJ	17				
Mid medial to HNJ	9				
Lower medial to HNJ	1				
Mid head	2				

FAI, femoroacetabular impingement; HNJ, head-neck junction; PAO, periacetabular osteotomy.

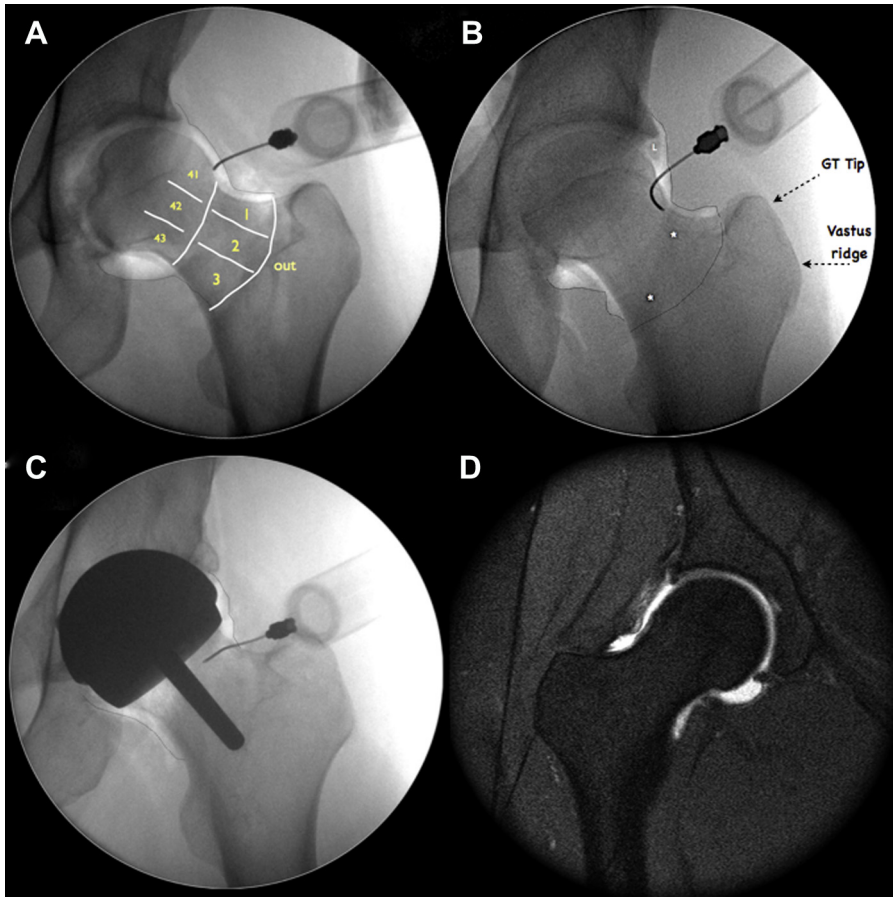

Fig 4. (A) Zones used to assess needle position accuracy. Zones 1, 2, and 3 indicate the anterior upper, mid, and lower neck, respectively, lateral to the head-neck junction line. Zones 41, 42, and 43 are medial to the head-neck junction line (i.e., lateral head) and are defined as anterior upper, mid, and lower, respectively. (B) Needle in zone 1 (bent "away" from the field to avoid radiation exposure to the surgeon's hand). The labrum (L) can be seen by the arthrogram. The capsule is outlined, and the zona orbicularis is marked with asterisks. The indentation seen in the capsule on the air arthrogram, in A and B, just lateral to the head-neck junction, is due to the zona orbicularis. (C) Non-guided needle introduced into resurfaced joint. It should be noted that the capsule margins are different from those of an un-resurfaced joint. (D) A coronal (T2 fat saturation) magnetic resonance arthrogram outlines the capsule and its far (superior and inferior) lateral extension of the peripheral compartment.

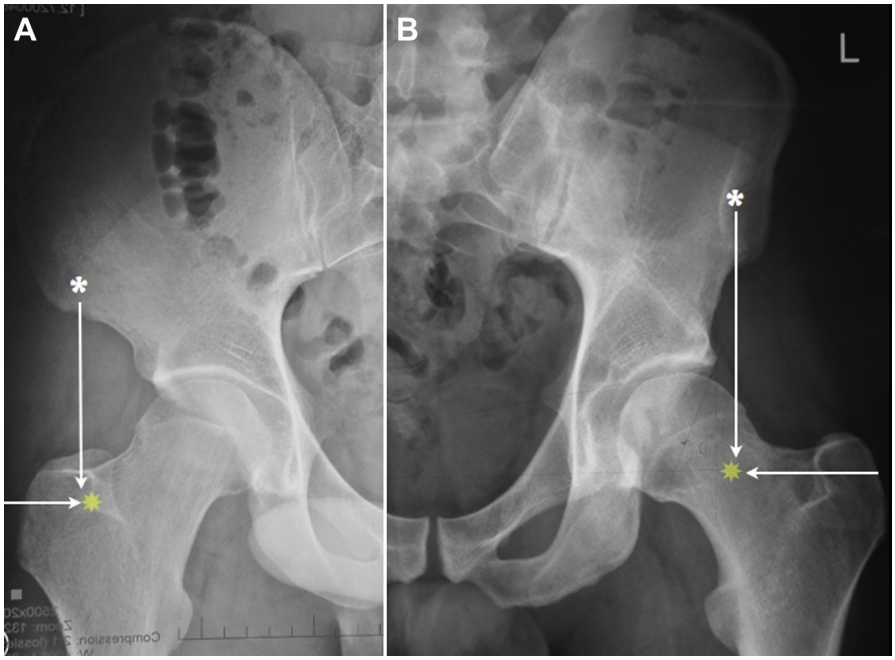

Fig 5. Variations in anatomy and bony landmarks can lead to a poor entry point and result in needle positioning out of the joint. (A) A "wide open" ilium wing with a lateral ASIS would result in an excessively lateral entry point. The clinician places the needle against bone but is unaware that he or she has placed the needle out of the joint. (B) A more typical hip variation. The white asterisks indicate the ASIS. The yellow stars indicate the point at which the needle would touch bone.

limited number of missed injections, no correlation could be made to body morphology. However, in 2 of the 4 needle placements requiring more than 2 attempts, the patients were considered overweight or somewhat overweight.

Side Effects

Forty-five patients were entered into the side effect arm of the study. These patients underwent 1 to 3 hip injections by 1 of the 2 senior authors (yielding 117 injections) and had a mean follow-up of 5 months (range, 3 to 16 months). There were 3 reported cases of LFCN irritation, and in all cases symptoms resolved within 1 day. No other side effects were reported by the patients.

Discussion

The purpose of this study was to investigate the safety and efficacy of non−image-guided intra-articular hip injections using the anterior approach. The results showed that the needle was successfully introduced into the hip 93% of the time. In each case of unsuccessful needle placement, anatomic reasons for the lack of success were identified, potentially allowing clinicians to predict which patients may be difficult to treat in the office. The technique was shown in this study to be safe, with no side effects lasting longer than a single day.

Previous studies have investigated the success rate of non−image-guided hip injections but have met with less success.[3-6,9-12] Leopold et al.,[11] in a cadaveric study, injected 15 hips through an anterior approach and 15 hips through the lateral approach. They found the success rate to be insufficient to recommend regular use, with only 60% of anterior and 80% of lateral injections finding the hip joint. The technique that they used differed significantly from the current technique. The needle was inserted at a 60° cephalad-medial angle, starting from a point 2.5 cm lateral and distal to the intersection of a line drawn from the ASIS and the symphysis pubis, as well as the simulated palpable femoral pulse. The multiple landmarks, the potential variability in femoral artery anatomy and pulse palpated, and the estimation of the angle of insertion may increase the likelihood of poor placement of the needle. Another group studied a lateral approach but only showed successful needle placement within the hip joint 51% of the time.[9] Kurup and Ward,[10] using an anterolateral approach, were successful on only 65.1% of attempts. Again, with this technique, we hypothesize the reason for the inaccuracy is the difficulty in choosing the entry point and trajectory of the needle. This group found no association between successful placement and grade of hip arthritis but did find, as with our study, a trend toward a lower success rate in patients with a BMI greater than 30. In 1 study of 20 attempted injections using the lateral approach, the authors found success in 95% of cases.[13] However, their study suffers from several significant limitations. There was no gold standard used to ensure needle placement within the hip. The authors used fluoroscopy without the use of contrast and suggested that cannulation was successful if the needle was seen adjacent to the femoral neck. Our study reports a high success rate of correct needle placement and confirms hip joint entry with an air arthrogram, ongoing fluid backflow, and direct visualization during the arthroscopic procedure.

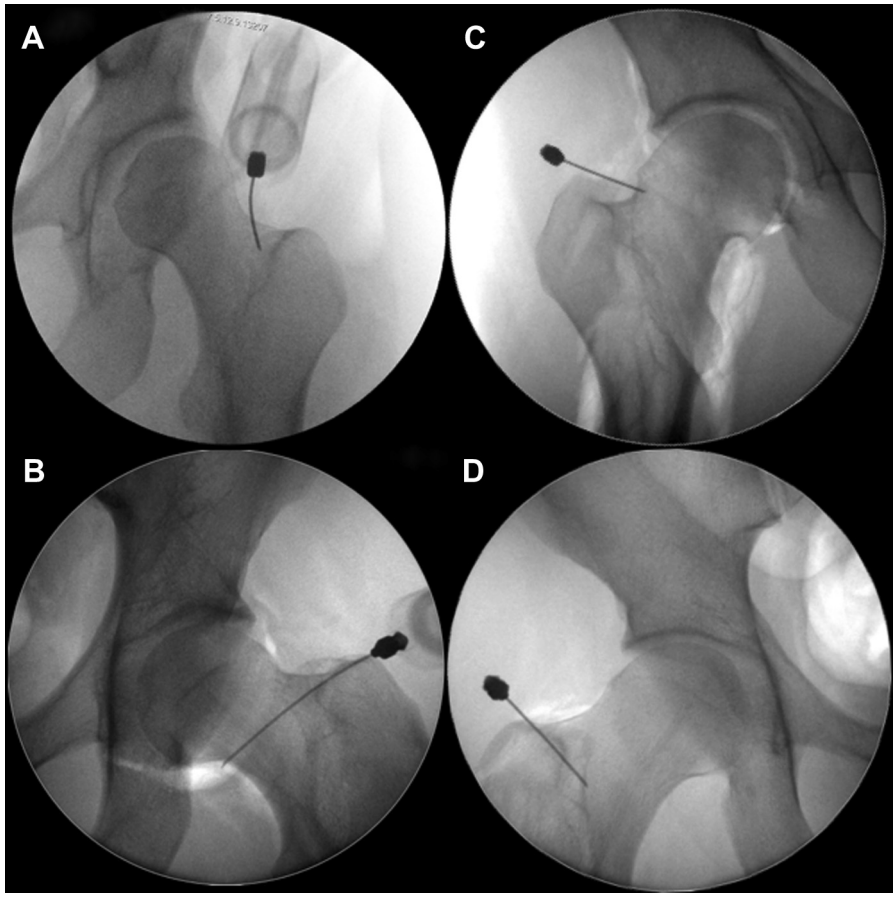

Fig 6. Four scenarios in which the needle was considered out of the joint and the respective reasons. These cases stress how important it is to assess the anteroposterior hip and pelvic radiographs of the patient before one uses this technique so that modifications can be made to the needle entry point in relation to the landmarks. (A) The patient has coxa valga with a short (medial to lateral) and thin femoral neck, as well as increased anteversion. Because of anteversion, the needle had to travel farther before coming in contact with bone and ended up too lateral. After contacting bone, the needle may slide farther laterally because of anteversion. This patient had increased BMI, and the landmarks were hard to appreciate. (B) The needle entered at a steep angle and came into contact with the bone, and air was introduced. During injection of air, the needle slid down the neck, because it was positioned on top of the "ridge line" and the pressure of the air propelled it off the bone and down the neck. (C) A patient with a relatively short articular trochanteric distance and a large cam lesion. The needle was positioned in the joint but was placed into the cam lesion's soft bone and fibrocartilage and resulted in backflow of air out of the joint (in addition to producing an arthrogram). In this patient an anteroposterior pelvic radiograph evaluation was (unintentionally) not made before needle placement. (D) Image of patient from Fig 5A with lateral ASIS variation. This resulted in positioning of the needle too lateral and outside of the joint.

Analysis of the failed injections has allowed for improved understanding of which patients are good candidates for non–image-guided injections. There were anatomic reasons noted on radiographs or physical examination that predicted a difficult arthrocentesis. Patients with increased subcutaneous adipose tissue were more difficult to inject, similar to the findings of Kurup and Ward.[10] Other features can predict a lower success rate, but the clinician may avoid poorly placed needles if adjustments are made. An ilium with a lateralized ASIS can cause lateral needle placement and failure to enter the hip (Fig 5). Angling the needle in a medial direction, if this is noted on radiographs, may improve the success rate. Variations in femoral neck anatomy, such as coxa valga or vara, can cause poor needle positioning with standard landmarks (Fig 6). A short articular trochanteric distance can make cannulation difficult because the line that runs medially from the tip of the more proximal GT can result in a needle entry point above the femoral neck. In the example shown in Fig 6C, the landmarks led the needle to enter adjacent to the cam lesion in the soft fibrocartilage tissue overlying the bony cam lesion. It was difficult to obtain an air arthrogram because of high

resistance from the semi-blocked needle bore. If the surgeon backs up the needle as little as 1 mm, the injectate can escape out of the joint. This issue is more likely if the needle enters the joint at the zona orbicularis, where the space between the bone and the capsule is smallest. A fluid injectate, used in most clinical scenarios, would likely be able to overcome the semi-blocked needle bore and fill the joint instead of escaping like the air seen in our study. Hip flexion deformity is also associated with a higher failure rate of injection, likely because of changes in landmark anatomy related to hip flexion, but this would be less common in the relatively young and active population visiting a hip-preservation surgeon.[10]

A physician undertaking non–image-guided hip injections must appreciate variations in anatomy. A natural ridge along the anterior femoral neck can lead to the needle sliding posteriorly, either superior or inferior to the neck. It may be helpful to obtain an anatomic Sawbones model (Pacific Research Laboratories, Vashon, WA) to better understand the femoral neck anatomy if this technique is to be tried. Furthermore, it has been noted that cannulation of a hip with advanced degeneration can be difficult because of limited joint space, as well as a thick capsule that is adherent to the femoral neck.[10] The same issues can arise when one is dealing with a previously operated or replaced joint (Fig 2C).

If a technique is to be adopted for general use, it must be proven safe and effective. In this clinical study, none of the patients injected in the office had side effects lasting longer than 24 hours. Of 45 patients in the side effect study arm, 3 (6.6%) reported LFCN irritation, but these symptoms were minor and temporary, supporting the safety of this technique. Leopold et al.[11] suggested that an anterior injection posed too great a risk to the neurovascular structures. They reported that the needle pierced or contacted a branch of the femoral nerve in 27% of cases and was found within 5 mm of the nerve in 60% of cases. The differences in findings between the 2 studies may be attributed to differences in technique and injection setup. Our technique places the needle close to the LFCN, but long-lasting clinical effects on the LFCN were not found in this study. It may be that fewer passes are required using this technique because of the simplicity of the landmarking and angulation. It may be that with the current technique, the needle does indeed pass close to the branches of the femoral nerve, as in the study of Leopold et al., but there simply are no lasting deleterious effects from a single needle injury to a peripheral branch of this nerve.

The described technique is a relatively easy and reproducible method of injecting the hip without the need for radiographically guided techniques that are time-consuming and expensive and often have limited availability (Table 2). Injecting the knee in the clinic is a common practice, and the literature on the accuracy of non-guided injections of the knee reports a lower success rate than the success rate of this study for hip injections.[1,14,15] A familiarity with the hip anatomy is necessary to allow for good results. The technique requires careful attention to landmarks but also requires "feel" that can only come with experience. In some patients repeated attempts are necessary, which may cause some discomfort. We have observed a reasonable learning curve in our practice for this technique, with only a handful of injections required to reach a reasonable level of comfort and high accuracy rate. We recommend that, during the first 5 to 10 anterior hip injections, the needle placement is confirmed with fluoroscopy after the needle is blindly inserted. This can be performed in the operating room, before arthroscopy of the hip, when the surgeon is aiming to break the hip joint suction seal, before application of traction. In this scenario it is important for the surgeon to appreciate the exact position of the patient and pelvic rotation.

Table 2. Tips and Pearls for Correct Needle Placement

1. Make sure landmarks can be assessed in an accurate manner and use imaging guidance in obese patients.
2. Review anteroposterior pelvic radiographs thoroughly to assess for direct and indirect signs of morphology and alignment variations. The physician can draw lines distally from the ASIS and medially from the GT to assess the crossing point in relation to the joint.
3. Once the patient is lying down, assess pelvic tilt and rotation (make sure the patient is not leaning on 1 buttock, resulting in 1 ASIS being positioned "higher" than the other). Once the patient's pelvis is covered with drapes, assessment will be impossible, and this may result in poor assessment of landmark position.
4. Mark the crossing point clearly after palpating the landmarks and only after the assistant is holding the patient's feet parallel (toes pointing straight up). Prepare the skin in a sterile fashion, place the local anesthetic (limit to the superficial soft tissue if PRP is to be injected), and drape the patient.
5. Make sure the patient is relaxed. Place the needle (19-gauge spinal) as planned, and remove the inner needle only once bony contact is felt.
6. A smaller-bore needle might bend on the way in and miss the target.
7. Connect a Luer-Lok syringe (preferred to avoid loss of injectate with a poor needle-syringe connection), and start injecting slowly. If significant resistance is felt (most probably because of the needle tip engaging the bone), ask the assistant to passively flex the knee 10° to 20°, which will result in a slight hip flexion, and move the needle bore away from bone. Do not withdraw or change the needle position yourself.
8. Before pulling the needle out, press the skin around the needle down firmly, with 2 fingers, and pull the needle out quickly. This will ensure minimal pain to the patient.

Limitations

We are aware of several limitations in this research. The patient population studied was relatively young, consistent with the practice of a hip-preservation surgeon, so the results and success rate may be different from those in

the older arthritic population. Two high-volume hip-preservation surgeons performed the injections. Their comfort with hip anatomy may allow accuracy that is difficult to obtain in a setting in which one has less familiarity with intra-articular and arthroscopic hip anatomy. A limitation to our technique is the reliance on symmetric positioning of the patient to allow for adequate landmarking and accurate needle positioning. The low number of missed cannulation attempts does not allow statistical comparison of patient variables affecting the success rate. A larger study with more patients may allow for enough power to detect statistically significant variables that predict difficult needle placement.

Conclusions

Hip injections by use of the direct anterior approach, from the intersection of the lines drawn from the ASIS and 1 cm distal to the tip of the GT, are safe and reproducible. Patient characteristics, such as increased subcutaneous adipose tissue or osseous anatomic variants, can lead to difficulty in placing the needle successfully. These characteristics can be predicted with the aid of physical examination and careful study of the pelvic radiographs.

References

1. Daley EL, Bajaj S, Bisson LJ, Cole BJ. Improving injection accuracy of the elbow, knee and shoulder: Does injection site and imaging make a difference? A systematic review. *Am J Sports Med* 2011;39:656-662.
2. Heidari N, Pichler W, Grechenig S, Grechenig W, Weinberg AM. Does the anteromedial or anterolateral approach alter the rate of joint puncture in injection of the ankle?: A cadaver study. *J Bone Joint Surg Br* 2010;92: 176-178.
3. Dobson MM. A check on the anatomical accuracy of intra-articular hip injections in relation to the therapy of cox-arthritis. *Ann Rheum Dis* 1948;7:172-174.
4. Dobson MM. A further anatomical check on the accuracy of intra-articular hip injections in relation to the therapy of coxarthritis. *Ann Rheum Dis* 1950;9:237-240.
5. Hollander JL. Intra-articular hydrocortisone in the treatment of arthritis. *Ann Intern Med* 1953;39:735-746.
6. Hollander JL, Brown EM, Jessar RA. Intra-articular hydrocortisone in the management of rheumatic diseases. *Med Clin North Am* 1954;38:349-357.
7. Lambert BS, Oliver JM, Katts GR, Green JS, Martin SE, Crouse SF. DEXA or BMI: Clinical considerations for evaluating obesity in collegiate division 1-A American football athletes. *Clin J Sports Med* 2012;22:436-438.
8. Carofino B, Chowaniec DM, McCarthy MB, et al. Corticosteroids and local anesthetics decrease positive effects of platelet-rich plasma: An in vitro study on human tendon cells. *Arthroscopy* 2012;28:711-719.
9. Diracoglu D, Alptekin K, Dikici F, Balci HI, Ozcakar L, Aksoy C. Evaluation of needle positioning during blind intra-articular hip injections for osteoarthritis: Fluoroscopy versus arthrography. *Arch Phys Med Rehabil* 2009;90: 2112-2115.
10. Kurup H, Ward P. Do we need radiological guidance for hip joint injections? *Acta Orthop Belg* 2010;76: 205-207.
11. Leopold SS, Battista V, Oliverio JA. Safety and efficacy of intraarticular hip injection using anatomic landmarks. *Clin Orthop Relat Res* 2001:192-197.
12. Ziv YB, Kardosh R, Debi R, Backstein D, Safir O, Kosashvili Y. An inexpensive and accurate method for hip injections without the use of imaging. *J Clin Rheumatol* 2009;15:103-105.
13. Mauffrey C, Pobbathy P. Hip joint injection technique using anatomic landmarks: Are we accurate? A prospective study. *Internet J Orthop Surg* 2006;3:1.
14. Bum Park Y, Ah Choi Y, Kim YK, Chul Lee S, Hae Lee J. Accuracy of blind versus ultrasound-guided suprapatellar bursal injection. *J Clin Ultrasound* 2012;40: 20-25.
15. McGarry JG, Daruwalla ZJ. The efficacy, accuracy and complications of corticosteroid injections of the knee joint. *Knee Surg Sports Traumatol Arthrosc* 2011;19: 1649-1654.