



## Air arthrograms for intra-articular injections of the hip

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An intra-articular injection of the hip joint is a commonly used procedure for diagnostic purposes in a young adult with hip and groin pain and a therapeutic modality in patients with degenerative changes in the hip joint.

We describe our surgical technique and experience in performing intra-articular hip injections using a lateral approach with the use of an air arthrogram instead of a contrast medium to confirm accurate placement of the needle in the joint. This technique is a simple, safe, and accurate alternative to the other methods based on the using an iodine contrast arthrogram, that can cause possible severe allergic reactions.

**Keywords:** hip joint.

### INTRODUCTION

Intra-articular injection of the hip joint is an essential diagnostic and therapeutic tool in the management of disorders of the young adult hip. In patients with morphological abnormalities such as Femoroacetabular Impingement (FAI) (1) with extra-articular pathologies like gluteus medius tendinopathy and / or iliopsoas impingement (2,3), the diagnostic hip injection plays an essential part in elucidating whether the pain is intra or extra-articular in origin (3). Intra-articular injections are also used as a therapeutic measure for injection of steroids, PRP or viscosupplementation agents

for patients with varying degrees of degenerative change in their hip (3).

The aim of this article is to describe our technique of performing an intra-articular injection of the hip joint using the lateral approach with the use of an air arthrogram to confirm accurate placement of the needle position inside the hip joint.

### TECHNIQUE

The procedure is performed under general anaesthesia to ensure that the pain generated during needle insertion is sufficiently reduced in order to ascertain the efficacy of the injection.

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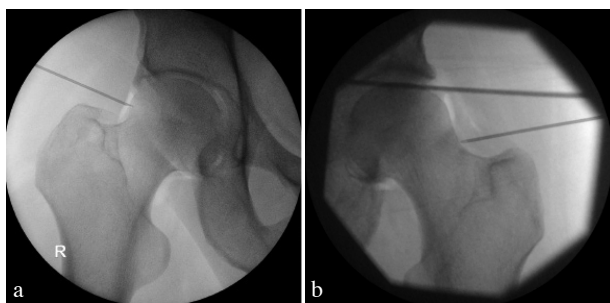
*This study was carried out at Addenbrookes Hospital, Cambridge, United Kingdom.*

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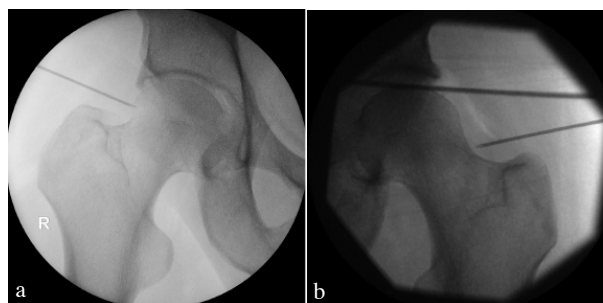
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**Fig. 1.** — Intra-operative fluoroscopy image of right hip (a) and left hip (b) showing air arthrogram – halo around femoral neck

The patient is placed supine on a radiolucent table, standard skin preparation with Chlorhexidine and standard draping are carried out.

The hip is then positioned in slight internal rotation to enable easier palpation of the greater trochanter. In addition, with the hip in internal rotation, the femoral head-neck junction is more parallel to the floor and the anteversion is neutralised. An image is obtained on the fluoroscope to view the hip joint with the needle used as a marker to give an idea of the trajectory for accurate needle placement. The tip of greater trochanter (GT) is identified and an 18-gauge needle is inserted just anterior to the posterior edge of GT and advanced along the lateral side of the neck until the needle hits the femoral head-neck junction. The needle is then withdrawn by about 1-2mm and the joint is aspirated to confirm that the needle is not in a vascular structure. 2-5 ml of air is then injected into the joint and an air arthrogram is obtained to confirm the intra-articular entry of the needle. The air should envelop the intra-articular capsule creating an air ring sign (Fig. 1a and 1b). In case of extra-articular position of the needle, the air is diffusely spread in the surrounding tissue and the procedure needs to be repeated. Following confirmation of accurate needle placement, the hip joint is injected with the chosen agent. The authors' choice of local anaesthetic is 10ml of 0.25% levobupivacaine along with 10 mg of triamcinolone. In cases where the injection is performed for therapeutic purposes, in patients with arthritis a higher dose steroid may be used. The procedure is easy to perform and quick via this technique and can consistently achieve safe



**Fig. 2.** — Intra-operative fluoroscopy image right hip (a) and left hip (b) post injection of local anaesthetic and steroid. Note the disappearance of the halo around the femoral neck.

intra-articular injection. Following the injection of the local anaesthetic and steroid a check image on fluoroscope is performed to ensure accurate injection of material (Fig 2a and 2b) and the hip is moved through a full range of movement and an impingement test is performed under fluoroscopic guidance.

## DISCUSSION

There seems to be no consensus in the literature on the method that should be utilised for intra-articular injections of the hip. The approach utilised varies depending on the surgeon's preference. Due to the fact that the hip joint is a deeply seated joint and surrounded by neurovascular structures, the accurate placement of the needle in the hip joint is strongly operator dependent. The needle has to be inserted accurately in the minimum number of attempts not only to avoid multiple holes in the capsule, but also to avoid iatrogenic injury to the articular cartilage and the labrum.

Traditionally a contrast medium has been used to confirm intra-articular position of the needle in the hip joint. However, the contrast material can lead to an allergic reaction or other complications such as tightness in the chest, shortness of breath, hypotension, cardiac arrest and even sudden death (4). Complications following intravascular injection of iodinated contrast are seen in about 0.26 to 3% of the cases (5). Hugo et al., in their questionnaire study, reporting the experience of 134 radiologists who performed 262,000 arthrograms, reported a complication rate of 3.6% of which 0.03% were

considered severe (6). Acetabular labral injuries are known to occur while attempting to gain access to the hip joint at hip arthroscopy and Nakano et al., in their systematic review of 36, 761 hip arthroscopies reported a rate of 0.7% (7,8).

Sunil Kumar et al., have clearly described a technique of portal placement during hip arthroscopy to avoid iatrogenic acetabular labral injury (IALI) (9). The key step to avoid IALI is accurate insertion of the needle prior to insertion of the arthroscope. The same holds true for intra-articular hip joint injection with the junction between the femoral head and neck being the safest zone to avoid IALI.

In a recent prospective study, Shahid et al reported a 100% success rate with obtaining a positive air arthrogram with subsequent confirmation with a contrast-based dye arthrography in 40 consecutive cases using an anterolateral approach (10). Similarly, Wani et al showed excellent results using the same air arthrogram technique. There have been no reported serious complications in adults having hip arthrography using air as contrast (11). However, there are case reports of complications of air arthrogram involving neonates resulting in hypoxia, desaturation and even cardiac arrest (12-16). Some authors have described cases of air embolism after hip arthrography in babies or young children (17,18). Lamdan et al. hypothesized that due to their size, younger children are more sensitive to intravascular air (13). However, these problems have not been reported in adults.

Furthermore, Shahid et al demonstrated that the air arthrogram may also have a role in reducing cost as a result of avoiding contrast medium (10). Ten vials of Omnipaque™, the most common used contrast, cost £208.01 and air is certainly free. In the senior author's practice (VK), air arthrograms have been used for the past 13 years without any adverse events or complications.

The increasing indications of intra-articular hip injections have led authors to develop techniques which try to make it a routine step in the outpatient setting (19-21)

Ultrasound is also increasingly being used to perform intra-articular hip joint injections. Byrd et al. showed that ultrasound-guided injections were more convenient and less painful than fluoroscopy-

guided injections (19). Levi found 100% accuracy in 11 sonographically guided hip injections performed in the outpatient office setting (21). However, it is well known that the ultrasound technique is limited by the operator experience, requiring proper mentoring from an experienced practitioner and is also dependent upon the body mass index (BMI) and the size of the hip joint in each individual which may increase the difficulty of the procedure.

Masoud and Said demonstrated a 95% success in 40 patients (with a 95% confidence interval of 0.84 to 0.99) in needle placement inside the peripheral compartment of the hip joint, using the proximal anterolateral portal for hip arthroscopy as the needle insertion point without imaging guidance in the outpatient clinic (20). Mei-Dan et al., in another series, found a 93% success in needle positioning using an anterior approach for non-image-guided intra-articular injection of the hip joint rate in 55 patients (22). On the contrary in a cadaveric study, using anatomical landmarks, without fluoroscopic guidance, Leopold et al reported only 60% success in the anterior injection approach, and the needle pierced or contacted the femoral nerve in 27% of the cases (18). They found 80% success using the lateral injection approach and no cases of contact with the femoral nerve, so they recommended the lateral approach as safer for needle placement in the hip joint.

At the senior author's institution, in excess of 200 diagnostic and therapeutic intra-articular hip injections are performed per annum. The diagnostic hip injection is a fundamental tool to elucidate whether pain is intra or extra-articular in origin in the young adult with hip pain with evidence of intra-articular soft-tissue abnormalities such as labral or chondral lesions visible on MRI scans, especially when the history and examination do not support the MRI findings (23). Traditionally, we have relied more on the response to an intra-articular hip injection than the findings shown on the magnetic resonance imaging scans and this subsequently guides us in deciding which form of treatment should be offered to these patients.

The technique presented in this article, has been already described in previous studies (10,24). However, our technique slightly varies from the

others because we use a lateral approach for the air arthrogram and so far, we have achieved 100% accuracy without any complications as a result of the technique. When performed with the antero-lateral approach, it is sometimes possible to wrongly inject the psoas sheath that lies directly in front of the capsule of the hip joint. Bartlett et al., in a cadaveric study showed that lateral femoral cutaneous nerve (LFCN) is at risk during supine position hip arthroscopy, which in theory increases the risk of LFCN injury with the antero-lateral approach to hip injection (25). Virtual reality simulation has been shown to improve acquisition of hip arthroscopic skills (26). However, our method does not require a steep learning curve as with ultrasound or using only anatomical landmarks techniques, but on the contrary it can well be performed in every operating theatre without special equipment. At our institute, hip injection is generally performed by an orthopaedic specialist trainee, specialist nurse practitioner or the Consultant. We advocate the lateral approach for intra-articular hip injection with the air arthrogram as the technique of choice.

In conclusion, the described technique of using an air arthrogram as contrast during fluoroscopy guided intra-articular injection is a relative quick, cost-effective and reproducible procedure without significant complications and therefore should be the gold standard for performing these intra-articular hip joint injections.

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