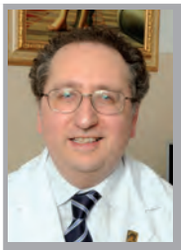
Ultrasound-guided joint injection in difficult locations

"*Ultrasound, if performed by skilled professionals, has become the most commonly used guidance technique for reasons of cost–effectiveness, availability, real-time imaging capability and ease to use.*"

KEYWORDS: hip ■ intra-articular injections ■ sacroiliac joint ■ ultrasound guidance



Alberto Migliore

Author for correspondence:
OU of Rheumatology & Research Center Ospedale San Pietro Fatebenefratelli, Rome, Italy
alberto.migliore@tin.it

Sandro Tormenta

Department of Diagnostic Imaging, Ospedale San Pietro Fatebenefratelli, Rome, Italy

Intra-articular (IA) therapy is used for many joint diseases and is included among the recognized treatments in several guidelines. The knee joint is mostly treated in this way because the injection can be inserted into the joint more easily with a very high, although not complete, success rate [1].

The IA injection is used less frequently for the treatment of other joints, such as the hip and the sacroiliac joint, where the injection is difficult to perform.

The IA injections of the hip without imaging guidance have a significant risk of failure (~40%) to reach the articular cavity [2].

Until recently the imaging guidance to perform these injections was fluoroscopic or computed tomography (CT) [3]. These methods show important disadvantages. First, they expose both the patient and the operator to radiation and this, among other things, makes the cyclic repetition of the therapy ethically unacceptable.

Moreover, the use of iodinated contrast material – which is needed to confirm that the IA compound is injected into the exact site – causes a drug dilution and, thus, an alteration of its optimal concentration required for the therapeutic action.

Furthermore, the fluoroscopic guidance does not allow a perfect view of the position of the IA needle because it can only properly assess the bone components and not soft tissues, such as the joint capsule. Finally, the fluoroscopic and CT scans involve relatively high costs.

It is worth recalling the Euratom directive (97/43), according to which techniques not involving ionizing radiation should be preferred, when there is equal effectiveness [4].

In addition, for this reason, in recent years, the progressive technological development of ultrasound (US) imaging has increased the potential applications of US-guided procedures, especially regarding the muscular and skeletal systems.

Ultrasound has been used as a guide to drain collections and joint effusions, for injection therapies and for biopsies [5–12]. US, if performed by skilled professionals, has become the most commonly used guidance technique for reasons of cost–effectiveness, availability, real-time imaging capability and ease to use.

There are different techniques of US-guided infiltration of the hip [13–15]. We conceived and used a technique [16,17], especially for the injection of hyaluronic acid, with an antero-superior approach.

The patient was examined supine with the hip in externalrotation of 15–20°. A linear or convex multifrequency transducer was used with a sterile biopsy guide attached. The hip joint was scanned by means of an anterior parasagittal approach, lateral to the femoral vessels. Using US imaging, we easily recognized the joint capsule, with its hyperechoic concave course that is located between the hypoechoic iliopsoas muscle and the hyperechoic profile of the femoral articulation.

In order to guide the injection, the probe was centered on the femoral epiphysis, slightly oriented along the axis of the femoral neck. The IA injection was performed by inserting a 20–21-gauge (9–11 cm) spinal needle through the biopsy guide, using an antero-superior approach. Using biopsy real-time guidance software, the needle was advanced into the anterior capsular recess, at the level of the femoral head. The hyaluronan preparation was injected into the hip joint and verification of IA placement was evident with real-time direct visualization of the hyperechoic viscous fluid, as well as by using a power Doppler imaging (flow signals in the IA recess). The color Doppler vision allowed us to avoid injecting blood vessels.

future medicine part of fsg

Ultrasound, therefore, can show findings that are unable to be identified or are poorly identified by other imaging techniques, such as the finding of joint effusion, synovial joint hypertrophy and/or para-articular bursal collections (especially of iliopsoas). In these cases the US guidance recommends draining the effusion or bursal collections, and a possibly a steroid injection in the inflamed cavities.

Ultrasound guidance made the IA injection of hyaluronic acid in the hip safe, simple (if performed by skilled professionals) and relatively inexpensive. In a few short years this technique has been extended to the treatment of hip osteoarthrititis in order to achieve the results that had already been obtained in the IA therapy of knee osteoarthritis with hyaluronic acid.

Ultrasound guidance can also be used for injections of steroids or for the treatment of inflammatory coxitis [18,19], to aspirate joint effusion or bursal collections [20,21]. We used this technique recently to perform diagnostic examinations (particularly arthro-MRI for the diagnosis of femoral-acetabular impingement) [22]. Thus, we believe that US guidance is the gold standard technique when performing injection therapy of the hip.

Sacroiliac joint (SIJ) injections are rarely performed, due to the difficulty in reaching the joint site. Correct needle placement is difficult to execute without imaging guidance, owing to the complexity and heterogeneity of the SIJ anatomy. Moreover, anatomical modifications induced by some diseases, such as bony spurs and joint space narrowing, often make the injection more difficult, especially in patients with a long-term disease.

> *"...we believe that ultrasound guidance is the gold standard technique when performing injection therapy of the hip."*

A double-blind study by Rosenberg *et al.* demonstrated an IA success rate of only 22% in the case of SIJ injections without imaging guidance [23]. Many studies demonstrated that CT or fluoroscopic guidance may be helpful in IA injections of the SIJ [24–28]; however, in this case there are also the same limitations we discussed previously regarding the IA injection of the hip, such as radiation load and costs.

In 2003, Pekkafahli *et al.* assessed the value of US guidance for SIJ injection, reporting a success rate of 76.7% when controlled with fluoroscopic imaging [29]. Klauser *et al.* also reported similar findings when analyzing via CT on human cadavers whether US guidance on needle placement was correct [30]. Therefore, US guidance for SIJ injection may represent a safe and repeatable option for patients needing a local approach for their joint disease, as it spares irradiation and still grants a direct visualization of the needle and of the injected compound.

> *"Ultrasound guidance for sacroiliac joint injection may represent a safe and repeatable option for patients needing a local approach for their joint disease..."*

All patients were placed in prone position. Unlike other studies [30,31], we used a linear transducer and, regardless of the side to inject, the operator was placed at the left of the patient. A medium–high frequency (7 MHz) linear transducer may be employed for this procedure. The US transducer is oriented in a transverse position on the sacral hiatus and the sacral cornae are identified. Subsequently, by shifting the transducer laterally, we were able to identify the lateral edge of the sacrum. By always maintaining the transducer in transverse position, we followed the edge cephalically, identifying the bony contour of the ileum.

The space observed between the two bony contours represents the posterior aspect of the SIJ. Consequently, the rotation of the transducer caudally made the posterior cauda of the SIJ identifiable, this being the site where the injection should be performed. Tilting the transducer in a cephalic direction allowed us to identify the posterior cephalad of the SIJ. A 20–22 gauge cutting edge spinal needle was inserted into the middle of the caudal, long side of the transducer, with an inclination of 10° with respect to the sagittal orientation of the transducer. The needle was strictly followed by US guidance until the edge of the needle reached the SIJ. This kind of orientation and needle placement grants a shorter insertion of the needle for reaching the joint space. When the needle reached the cleft, another needle insertion of approximately 1 cm was effectuated. US guidance not only allowed for correct needle placement but, once the injection started, US imaging allowed the detection of an eventual extra-articular placement of the compound. Power Doppler may also be useful in this phase, as it shows the movements of the injected compound.

In addition to anatomical joints with difficult access, we can consider as difficult locations all the joints where, for intrinsic articular changes, the IA access is still difficult. Especially in the case of those joints which, although accessible from the cutaneous plane, present deformities of

the articular heads, often arthritis, making the IA access uncertain (e.g., the trapezio-metacarpal joint). In the presence of rizoarthrosis, the articular heads are very irregular; US imaging can easily assess the safest entrance point in order to avoid insertion into vascular structures and tendons, and also to reduce the manipulations of the needle, which is painful for the patient. Most importantly, US guidance enables real-time visualization and control of the amount of liquid introduced into the articulation and also helps avoid the introduction of a volume greater than that contained by the joint space. The continued monitoring of the injection enables us to prevent the introduction of the medical fluid if the distension of the capsule is excessive or when a leak is observed from the injection point.

We believe that any joint with an alteration of the joint profiles is potentially difficult to infiltrate and that using US to guide the injection in these situations is highly advisable.

Finally, from our experience and the increasing amount of corresponding literature [32] we conclude that US guidance influences the accuracy and, therefore, the outcome of IA therapy. US guidance makes the therapy accessible and repeatable and improves patient compliance and the effectiveness of therapy.

Financial & competing interests disclosure

A Migliore has received research support from Abbott, Merck, Novartis, Wyeth, Roche and Chiesi, and has acted as a consultant on the advisory boards for Servier, Genzyme and Fidia. S Tormenta acted as a consultant and received grants from Fidia and Genzyme. The authors have no other relevant affiliations or financial involvement with any organization or entity with a financial interest in or financial conflict with the subject matter or materials discussed in the manuscript apart from those disclosed.

No writing assistance was utilized in the production of this manuscript.

Bibliography

1 Jones A, Regan M, Ledingham J *et al.*: Importance of placement of intra-articular steroid injections. *BMJ* 307(6915), 1329–1330 (1993).

2 Leopold SS, Battista V, Oliverio JA: Safety and efficacy of intra-articular hip injection using anatomic landmarks. *Clin. Orthop.* 391, 192–197 (2001).

3 Duracoglu D, Alptekin K, Dikici F *et al.*: Evaluation of needle positioning during blind intra-articular hip injections for osteoarthritis: fluoroscopy versus arthrography. *Arch. Phys. Med. Rehabil.* 90(12), 2112–2115 (2009).

4 Council Directive 97/43 Euratom of health protection of individuals against the danger of ionizing radiations in relation to medical exposure and repeating directive 84/466/Euratom. *Euratom Official Journal* no. L 180 of 09.07.1997, 22 (1997).

5 Grassi W, Farina A, Filippucci E *et al.*: Sonographically guided procedures in rheumatology. *Semin. Arthritis Rheum.* 30(5), 347–353 (2001).

6 Craig JG: Infection: ultrasound-guided procedures. *Radiol. Clin. North Am.* 37, 669–678 (1999).

7 Dodd GD 3rd, Esola CC, Memel DS *et al.*: Sonography: the undiscovered jewel of interventional radiology. *Radiographics* 16, 1271–1288 (1996).

8 Koski JM: Ultrasound guided injections in rheumatology. *J. Rheumatol.* 27, 2131–2138 (2000).

9 Fessell DP, Jacobson JA, Craig J *et al.*: Using sonography to reveal and aspirate joint effusions. *AJR* 174, 1353–1362 (2000).

10 Cardinal E, Chhem RK, Beauregard CG: Ultrasound-guided interventional procedures in the musculoskeletal system. *Radiol. Clin. North Am.* 36, 597–604 (1998).

11 Smith J, Hurdle MFB, Weingarten TN: Accuracy of sonographically guided intra-articular injections in the native adult hip. *J. Ultrasound Med.* 28(3), 329–335 (2009).

12 Qvistgaard E, Kristoffersen H, Terslev L *et al.*: Guidance by ultrasound of intra-articular injections in the knee and hip joints. *Osteoarthritis Cartilage* 9(6), 512–517 (2001).

13 Carson BW, Wong A: Ultrasonographic guidance for injections of local steroids in the native hip. *J. Ultrasound Med.* 18, 159–160 (1999).

14 Bliddal H, Torp-Pedersen S: Use of small amounts of ultrasound guided air for injections. *Ann. Rheum. Dis.* 59, 926–927 (2000).

15 Sofka CM, Saboeiro G, Adler RS: Ultrasound-guided adult hip injections. *J. Vasc. Intervent. Radiol.* 16, 1121–1123 (2005).

16 Migliore A, Martin LS, Alimonti A, Valente C, Tormenta S: Efficacy and safety of viscosupplementation by ultrasound-guided intra-articular injection in osteoarthritis of the hip. *Osteoarthritis Cartilage* 11, 305–306 (2003).

17 Migliore A, Massafra U, Bizzi E *et al.*: Comparative, double-blind, controlled study of intra-articular hyaluronic acid (Hyalubrix®) injections versus local anesthetic in osteoarthritis of the hip. *Arthritis Res. Ther.* 11, R183 (2009).

18 Micu MC, Bogdan GD, Fodor D: Steroid injection for hip osteoarthritis: efficacy under ultrasound guidance. *Rheumatology* 49(8), 1490–1494 (2010).

19 Neidel J, Boenhke M, Kuste RM: The efficacy and safety of intra-articular corticosteroid therapy for coxitis in juvenile rheumatoid arthritis. *Arthritis Rheum.* 46 (6), 1620–1628 (2002).

20 Zawin JK, Hoffer FA, Rand FF *et al.*: Joint effusion in children with an irritable hip: US diagnosis and aspiration. *Radiology* 187, 459–463 (1993).

21 Mayekawa DS, Ralls PW, Kerr RM *et al.*: Sonographically guided arthrocentesis of the hip. *J. Ultrasound Med.* 8, 665–667 (1989).

22 Tormenta S, Iannessi F, Migliore A *et al.*: Efficacy of ultrasound guide to perform hip arthro-MR imaging. Presented at: *EPOS, ESSR 16th Annual Congress of the European Society of Musculoskeletal Radiology. Refresher Course on the Hip and Bone Pelvis.* Genoa, Italy, 11–13 June 2009.

23 Rosenberg JM, Quint TJ, de Rosayro AM: Computerized tomographic localization of clinically-guided sacroiliac joint injections. *Clin. J. Pain* 16(1), 18–21 (2000).

24 Slipman CW, Lipetz JS, Plastaras CT *et al.*: Fluoroscopically guided therapeutic sacroiliac joint injections for sacroiliac joint syndrome. *Am. J. Phys. Med. Rehabil.* 80, 425–432 (2001).

25 Pulisetti D, Ebraheim NA: CT-guided sacroiliac joint injections. *J. Spinal Disord.* 12, 310–312 (1999).

26 Gunaydin I, Pereira PL, Daikeler T *et al.*: Magnetic resonance imaging guided corticosteroid injection of the sacroiliac joints in patients with therapy resistant spondyloarthropathy: a pilot study. *J. Rheumatol.* 127, 424–428 (2000).

27 Dussault RG, Kaplan PA, Anderson MW: Fluoroscopy-guided sacroiliac joint injections. *Radiology* 214, 273–277 (2000).

28 Hartung W, Ross CJ, Straub R *et al.*: Ultrasound-guided sacroiliac joint injection in patients with established sacroiliitis: precise IA injection verified by MRI scanning does not predict clinical outcome. *Rheumatology* 49 (8), 1479–1482 (2010).

29 Pekkafahli MZ, Kiralp MZ, Basekim CC *et al.*: Sacroiliac joint injections performed with sonographic guidance. *J. Ultrasound Med.* 22, 553–559 (2003).

30 Klauser A, De Zordo T, Feuchtner G *et al.*: Feasibility of ultrasound-guided sacroiliac joint injection considering sonoanatomic landmarks at two different levels in cadavers and patients. *Arthritis Rheum.* 59(11), 1618–1624 (2008).

31 Harmon D, O'Sullivan M: Ultrasound-guided sacroiliac joint injection technique. *Pain Physician* 11(4), 543–547 (2008).

32 Sibbitt WL, Peisajovich A, Michael AA *et al.*: Does sonographic needle guidance affect the clinical outcome of intra-articular injections? *J. Rheumatol.* 36, 1892–1902 (2009).