BR 2022; 4 (2): e392
DOI: 10.53238/br_20228_392

INTRA-ARTICULAR ULTRASOUND-GUIDED INJECTIONS, DESCRIPTION OF THE CAPSULAR ULTRASOUND REFERENCE LINE, CURL: A NEW ULTRASOUND LANDMARK FOR INTRA-ARTICULAR INFILTRATIVE THERAPY OF THE KNEE AND THE HIP

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ABSTRACT – *Objective:* The intra-articular infiltrations concern the direct inoculation of substances in the joint, avoiding effects related to general administration and acting directly at the site of the pathology. Injections can be guided by palpation of anatomical landmarks or by imaging. This scientific paper describes an ultrasound landmark, so-called CURL, for precise injections in the joint.

Materials and Methods: Identification of an ultrasound reference line of the capsule of large joints to perform ultrasound-guided infiltrations and comparison with results in the literature of anatomical landmark-guided infiltrations.

Results: The comparison study shows that ultrasound guidance and the ultrasound reference line of the joint capsule improve the accuracy of the procedure. The ultrasound guidance and the ultrasound landmark of the capsule, CURL, allow the precise introduction of medicinal substances into the joint, regardless of the condition of the joint cavity, "dry" arthritis or hydrarthrosis.

Conclusions: The definition of an original ultrasound reference for hip and knee joints, the routine ultrasound study and the ultrasound guidance make the infiltrative technique a high-quality orthopedic practice.

KEYWORDS: Articular sonography, Capsular reference ultrasound line, Hip and knee, Intra-articular infiltrations.

INTRODUCTION

Intra-articular injections are recommended in osteoarthritis (OA) and inflammatory joint diseases. The utility of the treatment is acknowledged by the guidelines [1] in the event of ineffectiveness of conservative treatments in patients with comorbidities and in severe OA, when replacement surgery is not executed. This manuscript emphasises the importance of ultrasound guidance in intra-articular injections for high quality orthopaedic practice. It describes, in the large joints, specifically hip and knee, an ultrasound landmark, so-called CURL, in order to make precise injections into the joint cavity. The infiltrative technique is ambulatory, and injections can be guided by palpation of anatomical landmarks or by imaging. This study proves the validity of ultrasound guidance.

Intra-articular injections of corticosteroids and hyaluronic acid provide short to medium-term symptom improvement for arthritic conditions involving structural damage or degenerative joint changes. A variety of substances and drugs can be used, so therapeutic proposals can be made. The goal of the procedure is the introduction of the substance into the joint cavity, but the procedure must be accurate and precise.

The hip and knee are the two large joints considered in this study. Injections into the coxo-femoral joint became an important part of the treatment algorithm in hip osteoarthritis. The deep position of the coxo-femoral joint, the lack of palpable and reliable anatomical landmarks and the proximity to important neurovascular structures imposed the regular use of ultrasound guidance, so there is a unanimous consensus in the practice of infiltrative, ultrasound-guided therapy of the hip.

In this way, some prerogatives are the systematic, pre-infiltrative analysis of the hip, the visualisation of the anatomical structures, the possibility of following the different stages of the procedure in real time and dynamic imaging. The ultrasound technique ensures that the objective is achieved.

For the knee, although intra-articular injection is not a complicated procedure using anatomical landmarks, it could be difficult to assess whether the needle tip is loose in the joint or inadvertently injected into the synovium or other intra-articular soft tissue. Inoculation into extra-articular tissue defeats the effectiveness of the procedure when using hyaluronic acid and it causes pain in patients. There are many studies in the literature treating the accuracy and precision of intra-articular knee injection. A cadaver study [2] evaluated the accuracy rate of intra-articular knee injection using anteromedial (AM), anterolateral (AL), lateral mid-patellar (LMP) and medial mid-patellar (MMP) portals. The highest accuracy rate (85%) was recorded in the AL injection portal, instead the lowest in the MMP portal (56%). A prospective study [3] examined twenty-two patients suffering from knee osteoarthritis and treated with intra-articular injection of hyaluronic acid; using three approaches, anteromedial (AM), anterolateral (AL) and lateral patellar medial (LMP), accuracy rates were confirmed by arthroscopy. The accuracy rate of intra-articular needle placement was highest (77.3%) using the LMP approach, followed by AL (63.6%); the lowest accuracy rate was found for the AM portal (31.8%). The authors said that the medium lateral patellar approach, with 77.3%, had the highest accuracy rate.

Contrast medium fluoroscopy [4] was used in a further study conducted to determine the correct positioning of the needle within the knee joint prior to viscosupplementation. Accurate needle placement was evaluated in a prospective series of 94 consecutive injections in patients with 'dry' knee arthritis. All injections were performed by a single orthopaedic surgeon through anterolateral and lateral midpatellar portals. Needle placement in the knee joint was confirmed with fluoroscopy. It was found that the highest accuracy of needle placement was achieved through the lateral mid-patellar (91.5%) compared to the anterolateral portal (87.4%).

MATERIALS AND METHODS

Using ultrasound during the examination also allows the acquisition of a series of useful data for more accurate diagnoses. Ultrasound becomes an extension of the clinical examination and the osteoarticular specialist can integrate clinical tests with ultrasound images for quality clinical and decision-making. Osteoarticular ultrasound must be performed with rigor and follow a precise methodology. We start by studying the anatomy of the region and proceed with systematic analysis; with ultrasound, we can identify the site of the lesion and decide on the most appropriate therapy. Dynamic images can be acquired, and the needle can be seen during the infiltrative procedure.

Real-time control of the needle allows the procedure to be performed safely and with maximum precision. In the hip and in the knee, joints of the subject under study, we can identify the limits of the joint capsule, checking for the presence of effusion, ascertaining a phlogistic overlap and proceeding with infiltrative therapy while achieving the goal.

In arthroscopy and on a cadaver, an anatomical landmark has been described as the Capsular Line Reference [5], corresponding to the ultrasound CURL shown in this study. The authors used two arthroscopic portals in their study, an anterolateral portal at the angle of the lateral border of the patellar tendon and patella and an anteromedial portal 1 cm above the medial joint line. It was used also a classic 30° angle optic.

The anterior cruciate ligament was cut with a shaver introduced from the anteromedial portal. The shaver was then used in order to remove soft tissue and bone from the posterior side of the wall; this resulted in a 'white line' (corresponding to the capsule) emerging from the posterior border of the medial side of the lateral femoral condyle, the arthroscopic reference point was identified as the Capsular Line Reference (CLR). The CLR is thus positioned on the posterior border of the medial side of the lateral condyle. This arthroscopic line, CRL, is the one that we intercept on ultrasound with the suprapatellar transverse scan and referred to as the CURL (Capsular Ultrasound Reference Line).

During the anterior ultrasound study of the hip, the capsular space (CS), measured at baseline, is the average of three measurements, one central and two laterals. This space is delimited by the bone profile of the femoral head (FH) distally, Joint Line (JL) and the line proximally delimiting the joint capsule, Capsular Line (CL) below the ilium psoas muscle. The transition zone, white line, between the joint capsule and the psoas muscle, with its tendon, is identified as the reference line of the joint capsule, called the Capsular Ultrasound Reference Line (Figure 1: CURL [6]).

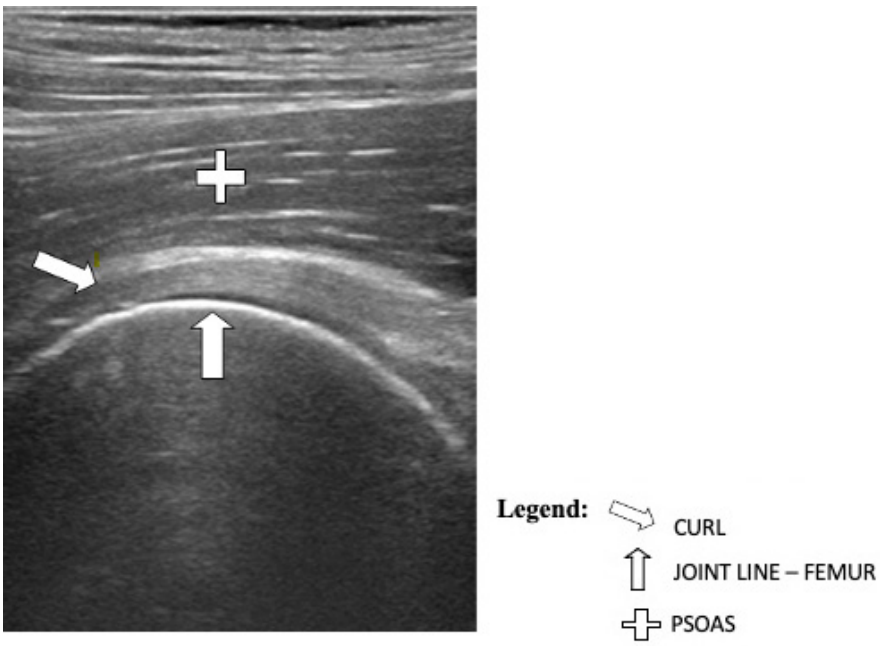

Figure 1. Hip, capsular ultrasound reference line.

When the infiltrative procedure is performed, the needle is ultrasound-monitored throughout its journey. Using direct anterior access, the needle tip passes through the capsule in the mid-cervical area. With the introduction of the substance, you can see the expansion of the capsule.

RESULTS

A systematic review [7] included nine studies on the different approaches of injection therapy. Injection through the superolateral portal with the leg in extension was the most studied (230 injections) and was the one with the highest accuracy rate, highest aggregate accuracy, 91%.

The literature shows that the precision of needle placement within the knee joint, when using anatomical landmarks for injection, is by no means taken for granted and can be a challenge in knees without effusion, which are dry. It is necessary to standardize injection procedures capable of guaranteeing precision, safety, and comfort for the patient by employing injection techniques as accurate as possible.

DISCUSSION

In the knee, the CURL is visible by performing a transverse ultrasound scan of the suprapatellar recess. Identifiable as a white line below the suprapatellar bursa, it delimits the capsular space inferiorly demarcated by the profile of the femur, at a higher level the quadriceps muscle can be identified (Figure 2).

The CURL represents a landmark, which, with the femoral profile, allows the identification of the capsular space, the 'safe zone' where the injection can be safely performed. The access ultrasound-guided is superolateral; it is useful in a dry knee, in dry arthritis, but also in cases of joint effusion. A systematic review [8] selected all controlled studies up to 2015 that reported the accuracy or clinical efficacy of arthrocentesis performed with ultrasound guidance (USG) compared to that with anatomical landmark in adult subjects. Ultrasound-guided knee joint arthrocentesis offers significantly greater accuracy and clinical improvement compared to the reference technique with anatomical landmark also in terms of greater aspiration volume.

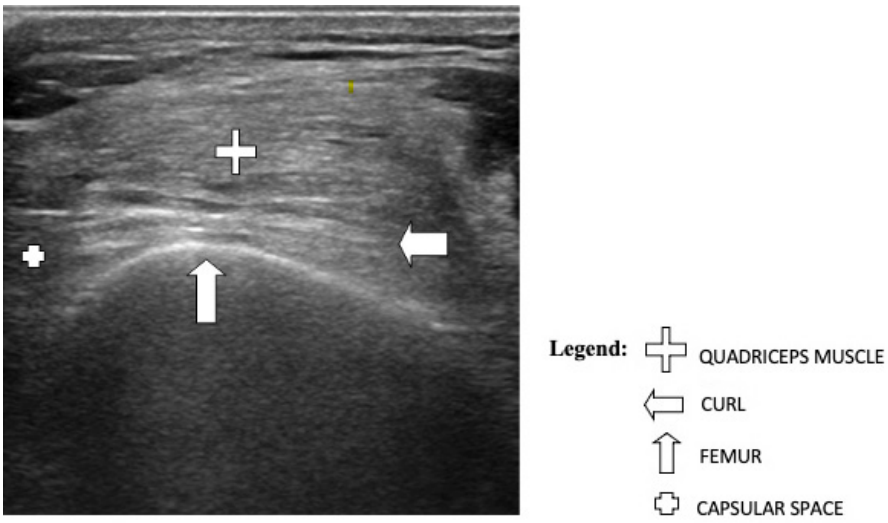

Figure 2. Knee, capsular ultrasound reference line.

CONCLUSIONS

In contrast to palpation-guided injection, ultrasound increases the precision and effectiveness of injection. It allows real-time and dynamic visualization of the anatomy and prevents inaccurate needle placement in extra-articular tissue or adjacent structures. Ultrasound makes possible performing intra-articular infiltrative therapy with greater precision and executing more targeted and advanced hip and knee procedures without any radiation exposure for the patient and physician.

The advantages of ultrasound guidance are the reduction of complications caused by needle malpositioning, precise needle positioning, real-time visualization from the skin puncture to the final target space and an increase in the success rate of the infiltrative procedure. The patient's response to the ultrasound-guided infiltrative treatment give indications for surgical intervention, allows monitoring of the pathology, and enables better pain control.

The positive outcome is enhanced by the use of ultrasound landmarks, such as the CURL, a reference line that provides demarcation of the target joint space and guides the needle into the intra-articular space. The CURL is an ultrasound landmark that improves intra-articular therapy.

This article shows that the use of ultrasound guidance and specific retrievals, such as the CURL, improves the accuracy of intra-articular injection in large joints, including the knee. The use of ultrasound guidance results in correct needle placement and safe inoculation of the substance into the joint. In the absence of standardization of the infiltrative technique and concordant clinical studies, positive results could be obtained in a randomized manner.

The aim of this study is to contribute to the standardization of the infiltrative technique, to define the techniques and indications in order to arrive at a unanimous consensus on the timing of administration, the doses and the minimum concentration of drugs to be injected.

Acknowledgments:
The author acknowledges Sabrina Di Giacomo, for her help with manuscript writing and Assunta Spataro for the editorial support.

Conflict of interest:
The author has no competing to declare.

Ethics approval:
The research was conducted in accordance with the Declaration of Helsinki.

Informed consent:
Formal consents are not required for the use of entirely anonymized images from which the individual cannot be identified.

Availability of data and material:
All data generated or analyzed during this study are included in this published article [and/or its supplementary material].

Funding:
The writing and preparation of this paper was funded by author.

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