

## Review Article

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# Procedures Guided by Ultrasonography in Injectable Treatments in Knee, Hip and Shoulder Pathologies

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## Abstract

The pathologies of the musculoskeletal system continue to be one of the main causes of the reduction of quality of life and are the main causes of disability with increasing incidence. The use of ultrasound equipment has gained importance, mainly with the improvement of image quality and technology. Currently, ultrasound has become the main diagnostic tool in traumatic, inflammatory and degenerative lesions in soft tissue conditions, and in the monitoring of joints, ligaments, cartilage and muscles. This work aims to present a review of the indicators of the use of intervention techniques with ultrasound equipment in musculoskeletal system disorders in knee, shoulder and hip joints.

**Keywords:** Shoulder; Knee; Hip; Ultrasonography

## 1. Introduction

The pathologies of the musculoskeletal system continue to be one of the main causes of the reduction of quality of life. Recently, the Arthritis Research, an English reputed institution demonstrated that between the years 2000 and 2015, the pathologies of the musculoskeletal system in the United Kingdom were the principal causes of disabilities, with an increase of 5% in this period and an increasing incidence curve [1]. In this scenario, the use of ultrasound equipment has gained importance, mainly with the improvement of image quality and technology. Currently,

ultrasound has become the main diagnostic tool in traumatic, inflammatory and degenerative lesions in soft tissue conditions, and in the monitoring of joints, ligaments, cartilage and muscles [2].

Besides being a tool for diagnosis and monitoring pathologies of the musculoskeletal system, the ultrasound has been proving to be an indispensable tool for interventional procedures. However, few medical professionals have appropriate training in interventional techniques guided by this equipment. Most professionals perform imaging biopsies of lesions in soft and bone tissues, not only joint aspirations and diagnostic fluids, but also for therapeutic procedures. The *American Medical Society for Sports Medicine* defends the use of diagnostic and interventional ultrasonography and notes the significant increase of this procedure by non-radiologists in the last decade, mainly in sports medicine. When comparing to palpation, the use of image during the procedures is more accurate and effective, showing a better result and better cost benefit as compared to other techniques [3]. This study aims to show an evidence review of the use of interventionist techniques with the use of ultrasound equipment on the pathologies of the musculoskeletal system on knee and hip joints.

## **2. Interventional Procedures on Knee Joints Guided by Ultrasonography**

The osteoarthritis, pathology with high prevalence in the population, is a major source of chronic pain and disability in the United States of America and other developed nations. The most affected joint by this pathology is the knee, being responsible for more than 80% of the total incidence and affecting at least 19% of the American adults with more than 45 years of age [4]. Both arthrosis and synovitis of the knee have been treated with corticosteroid joint injections. More recently, viscosupplementation with hyaluronic acid and platelet rich plasma have been used for treatment with excellent results. In 2011, a study published by Curtiss demonstrated the accuracy of 55% in knee injections of cadavers when the reference was the palpation of anatomical landmarks only, whereas in procedures with the aid of ultrasound the accuracy reached 100%. In this study, the author points out that on a non-guided injection differ significantly depending on the operator, whereas this does not happen in the guided procedure [5]. Besides been universally accepted, a literature review was published in 2012 only, where the accuracy of the ultrasound guided injection was compared to other techniques such as arteriography, fluoroscopy and magnetic resonance arthrography. The accuracy was 95.8% with ultrasound use, against 77.8% without the use of ultrasound [6].

In a randomized clinical study of 148 painful joints (41.9% knee joints), where guided ultrasonography and corticosteroid injections guided by palpation of anatomical landmarks were compared for rheumatoid arthritis (n=100) and arthrosis (n=48), Sibbitt et al. [7] reported that ultrasound guidance resulted in 43% of pain reduction, 59% reduction in absolute pain scores, at the end of two weeks, a 75% reduction in significant pain (VISA) was observed, as well as a 26% increase in response rate for pain (defined as reduction in visual analog score), and a 62% reduction in the rate of not scoring with pain (defined as reduction in visual analog score). The ultrasound also increased the effusion detection by 200% and the aspirate fluid volume by 337%. Sibbitt et al. [8] performed a randomized study comparing the clinical outcome of ultrasound guided (n=42) or arthrocentesis guided by palpation

of anatomical points (n=22) and intra-articular injections of corticosteroid. Patients that received ultrasound-guided injections reported 48% less pain in the procedure and 46% less joint pain in two weeks.

Moorjani et al. [9] in a randomized study, compared the pain in the arthrocentesis procedure by ultrasound guided or oriented only by palpation of anatomical landmarks and concluded that by palpation only, patients present more pain in the procedure, probably due to tissue damage caused by misplaced needle.

### **3. Interventional Procedures on Hip Joints Guided by Ultrasonography**

Byrd et al. [10], in a study with the objective of evaluating procedures guided by ultrasonography and fluoroscopy, evaluated patients submitted to intra-articular injection guided by hip ultrasonography (by a nurse) and who had previously undergone intra-articular injections guided by fluoroscopy by the musculoskeletal training center for radiologists. The success of the injection was documented in 206 patients who underwent ultrasound-guided injections during the study period. Ultrasound-guided injections resulted in an average rating of 9.8, while fluoroscopy injection ranged 3.1 on a scale of 1 to 10. As far as the pain, the ultrasound resulted in an average rating of 3 and the fluoroscopy ranged 5.6, difference that was statistically significant ( $P<0.01$ ). Regarding their preferences, 49 out of 50 patients in the control study (98%) declared to prefer ultrasound injection, while one was uncertain. This study concluded that hip ultrasound-guided injections were more convenient and less painful than fluoroscopy-guided injections and patients who underwent both, preferred the ultrasound-guided procedure. Ziv et al. [11], and Diracoglu et al. [12], evaluated the precision of hip joint injections with and without the use of images, showing an accuracy of 77.5% and 66.7%, respectively. However, other studies have reported 100% accuracy in ultrasound guided procedures [13, 14]. The only injection that did not evidence delivery of the drug in the intra-articular cavity was reported on a single episode of inadvertent withdrawal of the needle during syringe fixation for contrast administration. In this study the accuracy was 97% in a group of 28 patients [15].

Pourbagher et al. [16] evaluated the efficacy of ultrasound-guided injection in patients with hip osteoarthritis, where 80% of patients reported improvement in function and pain six months post-injection. Micu et al. [14], reported a pain reduction in patients that received ultrasound-guided injections, when compared to patients who did not receive them. This study was conducted with 61 patients and the follow-up occurred after one and three months. Yoong et al. [17] evaluated the usefulness of using ultrasound to guide injections in the hip joint, before the patients underwent arthroplasty, thus anticipating the surgical results as a diagnostic tool. A total of 117 patients were suitable for inclusion in the study. Fifty-eight patients had hip arthroplasty following a good response to diagnostic injection. Of these 54 had a good outcome following surgery (93%). There was also a quantitative improvement in pain and function in these patients as measured by 1 year post-operative and pre-operative Harris hip scores ( $P<0.0001$ ). A total of 44/49 patients had no surgery following no response to injection. A clear alternative diagnosis to hip osteoarthritis was made in 40 of these patients (91%). The author concluded that diagnostic ultrasound-guided local anaesthetic injection of the hip joint is a useful test in confirming hip pathology.

In a retrospective study with 2,343 patients, Migliorini et al. [18] showed that the intra-articular hip injection with hyaluronic acid guided by ultrasound for arthrosis decreased the consumption of non-steroidal anti-inflammatory drugs. The consumption decreased 48.2% in the course of three months, followed by a 50% reduction in 12 months and a 61% decrease at the 24-month follow-up. This could lead to a significant decrease in costs, in long-term patient health care, resulting from a reduction in NSAID (Nonsteroidal Anti-inflammatory Drug) induced complications. In this review, we demonstrate the importance of the use of ultrasonography in treatments of pathologies of the hip joint. By using this technology, it is possible to reduce pain, viscosupplement and possibly slow degenerative processes, improving the quality and life expectancy of the patient.

#### **4. Interventional Procedures on Shoulder Joints Guided by Ultrasonography**

Shoulder pain is common in the general population, with a prevalence of 6.9% to 34%. It is the third most painful joint and one of the main reasons why patients seek medical help. Non-surgical modalities include activity modification, non-steroidal anti-inflammatory drugs (NSAIDs), physiotherapy, and various therapeutic injections. Surgery should be indicated for patients only when other therapeutic alternatives have already been exhausted. The application of corticoid in the subacromial space has been frequently used for the anti-inflammatory action, with the intrinsic risks of the drug, as an inhibitor of the proliferation of the tenocytes and the rupture of the tendon [19]. As the shoulder has a superficial anatomical position, it represents an excellent target for the performance of interventional procedures using ultrasonography. Thus, various pathological conditions can be treated using the ultrasound for needle orientation. The ultrasonography is an operator-dependent modality, so both scanning and clinical knowledge are essential to achieve good diagnostic accuracy.

In tendinosis, a percutaneous perforation of the affected tendon is performed, causing bleeding and local release of growth factors, facilitating healing and regeneration. On the other hand, it does not have the capacity to improve the partial damage of the supraspinatus tendon, as the treatment with platelet-rich plasma (PRP) has shown excellent results. Rha D et al. in a randomized clinical trial treated 39 patients for supraspinatus tendinopathy with injection of platelet-rich plasma, or dry needling only, and compared the improvement of the shoulder pain and function and concluded that autologous PRP injections could be safe and useful treatments for tendinosis and partial tears of the rotator cuff, with benefits still present 6 months after treatment [20].

Pandey V et al. in a randomized study, follow 102 patients (PRP group, 52 patients; control group, 50 patients) with medium-sized and large degenerative posterosuperior tears were included for arthroscopic repair with a minimum follow-up of 2 years, and concluded that the application of moderately concentrated PRP improves clinical and structural outcome in large cuff tears. PRP also enhances vascularity around the repair site in the early phase [21]. Intra-articular space injections can be performed in the treatment of various shoulder disorders. The choice of medication or supplement administered depends on the pathology. In the treatment of adhesive capsulitis, a degenerative disease with an incidence of 20% in diabetic patients [22], intra-articular injections containing anti-inflammatory and anesthetic guided by ultrasonography may be considered either in primary disease or in the

associated degenerative osteoarthritis, with reduced pain and increased mobility [23]. Another possibility of ultrasound-guided procedure in the treatment of adhesive capsulitis is to obtain capsular distension with lidocaine and hyaluronic acid [24]. This option is as effective as corticosteroid injection for pain relief and functional improvement.

## **5. Final Considerations**

Ultrasonography brings benefits as practicality and accuracy. Also, it provides useful information for the treatment of musculoskeletal and neurological disorders. For treatments of joint disease, sports injuries, osteoarticular infections or peripheral neuropathies, orthopedic interventions guided by ultrasonography can range from injections to aspirations. How can orthopedists incorporate ultrasonography into their practice? Following the training needed for the equipment's use, as it is operator dependent.

## **Interest Conflicts**

The authors declare no conflicts of interest.

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