ISSN 2664-8075 (Print) & ISSN 2706-5774 (Online)
South Asian Research Journal of Applied Medical Sciences
Abbreviated Key Title: South Asian Res J App Med Sci

| Volume-4 | Issue-5 | Sept-Oct- 2022 | **DOI: 10.36346/sarjams.2022.v04i05.004**

Review Article

Ultrasound Guided Injections in Shoulder as Compared to Direct Injections

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Article History
Received: 19.08.2022
Accepted: 26.09.2022
Published: 30.09.2022

Abstract: Ultrasound, also known as sonography, is an imaging method that uses high-frequency sound waves to produce real-time and dynamic images of the body. Ultrasound is increasingly being used to assist Sports Medicine Physicians, Rheumatologists, Orthopedists, and Primary Care. Procedural planning prior to any procedure increases efficiency in the operative field and reduces patient discomfort. Ultrasound is commonly utilized in regenerative medicine techniques due to the ability to visualize soft tissue targets with high resolution. Ultrasound is beneficial in both diagnostic purposes and image-guidance for procedures. Understanding how to quickly optimize the ultrasound image and ergonomics for the procedure will greatly improve your procedure workflow.

Keywords: Ultrasound, Procedural planning, Consent form, Ergonomics.

INTRODUCTION

Physicians in performing evaluations and injections of different muscles, tendons, ligaments, and joints. With the advancement of this technology, ultrasound machines have become smaller and more portable. This has allowed treating clinicians to be able to use real time, point of care ultrasound, to assist in the diagnosis and treatment of their patients. Although ultrasound is frequently used to identify injuries or abnormalities; it is also used when performing injections into the knee, shoulder, and hip. Injections can be beneficial for both the diagnostic and therapeutic treatment of a variety of problems involving the hip, shoulder, and knee. Typical problems include osteoarthritis, rheumatoid arthritis, labral tears, muscle tears, ligament tears and tendonopathies. Injections have been used in the management of inflammatory and degenerative conditions when rest, ice and anti-inflammatory medications fail to provide adequate relief. The use of ultrasound improves the accuracy of the injection of corticosteroids, hyaluronic acid, or other therapies such as Platelet Rich Plasma, Prolotherapy or Stem Cells. Ultrasound can also be used for joint aspirations to rule out joint infection or gout. Lastly, guided injections can be used diagnostically to help determine which structures are generating the patient's pain. Ultrasound-guided injections allow the practitioner to visualize the needle in real time as it enters the body and traverses to the desired location. This assures that the medication is accurately injected at the intended site. Despite good intentions, even in the most experienced hands, blind (injections performed without imaging) injections are not 100% accurate and, in some joints, accuracy is as low as 30%-40%. With ultrasound guidance the accuracy of nearly every joint injection exceeds 90% and approaches 100% in many. Additionally, ultrasound guided injections have been shown to be less painful than blind injections. Ultrasound injections also have the advantage of giving "real time" and "dynamic" feedback that the patient and the doctor can see and use immediately. The doctor can watch the desired treatment being delivered to the intended target and even visualize surrounding structures both before during and even after the procedure.

ADVANTAGES

Although there are many different types of imaging that can be used to assist with injections, ultrasound has a few distinct advantages.

1) Ultrasound has no radiation. Fluoroscopy (a type of real time X-ray) allows the provider to easily visualize the joint making injections easier; however, fluoroscopy is associated with repeated doses of radiation. Additionally with fluoroscopy the providers are unable to visualize surrounding soft tissue structures including tendon, blood vessels or nerves that may be in the path of the needle. This could lead to increased pain or other complications from the injection.
2) Ultrasound allows us to visualize the bony joint as well as all of the surrounding structures. Moving the ultrasound probe the practitioner can visualize what may be in the path of the needle and avoid any unwanted complications before they happen.
3) Ultrasound can identify fluid better than conventional radiographs and can see fluid that may have accumulated in and around joints, tendons, muscles, nerves and other soft-tissue structures. CT-guided (or CAT scan) injections are also frequently used to assist in delivering treatments. With the CT we can get a 3-D view of the joint to be injected and can accurately deliver the intended medication, however, these tests come with an increasingly large dose of radiation, they are expensive and time-consuming. Ultrasound injections have been shown to be as accurate as these other imaging-modalities with less cost, improved soft tissue visualization and without the associated radiation. Ultrasound-guided injections have been extensively studied and have been found to have very few complications.

The RISKS associated with these procedures are the same as any type of injection: incomplete reduction of pain, bleeding, damage to surrounding structures and infection. The overall risks for injections are very low and the use of ultrasound guidance may further reduce some of these risks. Ultrasound is beneficial when performing injections in the knee, shoulder and hip; as well as many other structures throughout the body.

KNEE

Ultrasound can help evaluate a variety of structures within the knee including the quadriceps and patellar tendons, the extra-articular (outside the joint) ligaments, and some meniscus injuries. It can also be used to see if there is fluid within the knee joint. Although knee injections are typically performed without imaging, imaging can be particularly helpful in patients with difficult anatomy or in overweight patients.

HIP

Hip joint injections may be performed for osteoarthritis of the hip and the diagnosis and management of labral tears. Imaging is nearly always used when performing injections into the hip joint due to the deep location of the joint and the proximity of blood vessels and nerves. It is estimated that blind injections are accurate 50% to 80% of the time. Ultrasound allows us to visualize the hip joint, bursa, muscles and tendons surrounding the hip. The use of ultrasound when performing a hip injection increases the accuracy to up to 96%. Whereas in the past, hip injections were mainly performed using Fluoroscopy, ultrasound- guided injections have become more popular due to its ease of use; lower cost and ease of perform in the office setting.

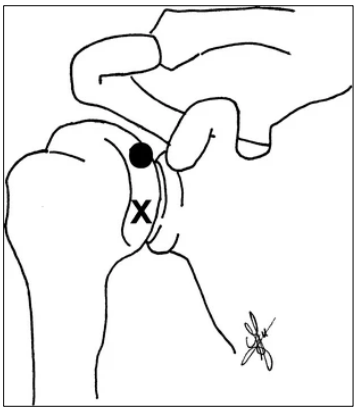
SHOULDER

Studies have shown that Ultrasound of the shoulder is just as sensitive and specific as MRI in the diagnosis of rotator cuff injury. Ultrasound can facilitate the more accurate injection of multiple different structures in the shoulder including the Acromioclavicular (AC) joint, the Glenohumeral joint (the true shoulder joint), the biceps tendon, and the subacromial bursa. All of these can be injected with or without guidance; however, as noted above the accuracy of these injections is significantly improved with the use of ultrasound guidance.

SHOULDER PAIN is most often caused by rotator cuff disease, or adhesive capsulitis (‘frozen shoulder’). The rotator cuff is a group of tendons that holds the shoulder joint in place allowing people to lift their arm. Shoulder pain can be related to wear and tear or inflammation of the shoulder tendons, and pressure on the tendons by the overlying bone when lifting the arm up (impingement). Both conditions cause pain with movement and often pain during the night and sleeping on the affected side; adhesive capsulitis also causes shoulder stiffness. Glucocorticoids injections can relieve shoulder pain but their effect usually wears off after six to eight weeks. Traditionally, injections are given using anatomic landmarks around the shoulder. Sometimes imaging techniques, such as ultrasound, are used to guide the injections more accurately into the shoulder. It is not known if image-guided injection relieves shoulder pain more effectively than injections delivered without imaging.

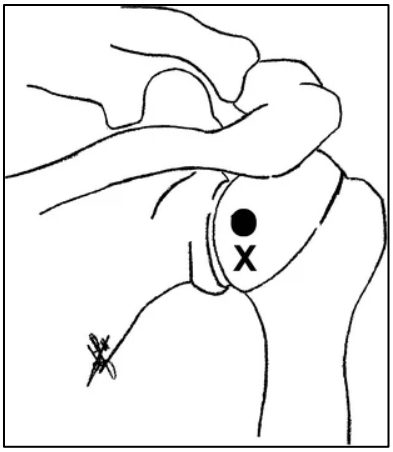
SCHEMATIC DRAWING OF THE ANTERIOR VIEW OF THE RIGHT SHOULDER SHOWING THE PUNCTURE SITES OF THE FLUOROSCOPIC- (X) AND US-GUIDED (●) ANTERIOR INJECTION TECHNIQUES

SCHEMATIC DRAWING OF THE POSTERIOR VIEW OF THE RIGHT SHOULDER SHOWING THE PUNCTURE SITES OF THE FLUOROSCOPIC- (X) AND US-GUIDED (●) POSTERIOR INJECTION TECHNIQUES



STUDY CHARACTERISTICS

Cochrane Reviews are systematic reviews of primary research in human health care and health policy, and are internationally recognized as the highest standard in evidence-based health care. They are published online in The Cochrane Library. Each systematic review addresses a clearly formulated question; for example: Can antibiotics help in alleviating the symptoms of a sore throat? All the existing primary research on a topic that meets certain criteria is searched for and collated, and then assessed using stringent guidelines, to establish whether there is conclusive evidence about a specific treatment. The reviews are updated regularly, ensuring that treatment decisions can be based on the most up-to-date and reliable evidence.



TYPES OF COCHRANE REVIEW

Intervention reviews assess the benefits and harms of interventions used in health care and health policy. Diagnostic test accuracy reviews assess how well a diagnostic test performs in diagnosing and detecting a particular disease. Methodology reviews address issues relevant to how systematic reviews and clinical trials are conducted and reported.

Qualitative reviews synthesize qualitative evidence to address questions on aspects of interventions other than effectiveness. Prognosis reviews address the probable course or future outcome(s) of people with a health problem. This Cochrane review is current to 15 February 2021. Nineteen trials (1035 participants) compared ultrasound-guided injection to 'blind' injection. Fourteen trials included participants with rotator cuff disease, four with adhesive capsulitis, and one with mixed shoulder pain. Trials were performed in Korea, Taiwan, Iran, Turkey, Australia, Norway, Spain, Ireland, India, and Switzerland. Most participants were female, with a mean age from 31 to 60 years, and mean symptom duration from 2 to 23 months. Six studies reported funding sources.

KEY RESULTS

Compared to injection into the shoulder without image guidance, ultrasound-guided injection resulted in little to no benefit at three to six weeks:

PAIN (**Lower Scores Mean Less Pain**)

1) Improved by 0.5 points more (0.2 more to 0.8 more) on a 0 to 10-point scale. Differences of 0.5.
2) To 1.0 points are considered slight or small and are unlikely to be clinically important.
3) People who had ultrasound-guided injection rated their pain as 2.6 points.

4) People who had injection without image guidance rated their pain as 3.1 points.
5) Function (higher scores mean better function).
6) Improved by 2.4 points more (0.2 points worse to 5.1 points more) on a 0 to 100-point scale. Differences below 10 points are considered slight or small and are unlikely to be clinically important. - People who had ultrasound-guided injection rated their function as 70.4 points.
7) People who had injection without image guidance rated their function as 68 points.
8) Quality of life (higher scores mean better quality of life) Improved by 2.8 points (0.7 worse to 6.4.
9) Better on a 0 to 100-point scale.
10) People who had ultrasound-guided injection rated their quality of life as 67.8 points.
11) People who had injection without image guidance rated their quality of life as 65 points.

Treatment Success (Defined as Pain Moderately or a Great Deal Better)

22% more people rated their treatment a success (4% fewer to 62% more), or 22 more people out of 100.

1. 61 out of 100 people reported treatment success with ultrasound-guided injection.
2. 39 out of 100 people reported treatment success with injection without image guidance.
3. Adverse events.
4. 7% fewer people (15% fewer to 7% more) had adverse events (post-injection pain, facial redness, and warmth) with ultrasound-guided injection.
5. 18 out of 100 people reported adverse events with ultrasound-guided injection.
6. 25 out of 100 people reported adverse events with injection without image guidance.

SERIOUS ADVERSE EVENTS

Five trials reported that there were no serious adverse events (like infection or nerve injury) with or without use of ultrasound guidance of the injection.

Withdrawals due to Adverse Events

One trial reported that 1/53 (or 19 out of 1000) people who received the injection without image guidance withdrew from the study due to adverse events, while no one (0/53) in the ultrasound-guided injection group withdrew due to adverse events.

QUALITY OF EVIDENCE

Low to moderate-certainty evidence shows that in people with shoulder pain, ultrasound-guided injection does not provide clinically important benefits in pain, function or quality of life compared with non-image-guided injection, nor does it reduce the risk of adverse events. These findings were consistent across different shoulder conditions. Further high-quality research is unlikely to change the conclusions of this review.

CONCLUSIONS

Our updated review does not support use of image guidance for injections in the shoulder. Moderate-certainty evidence indicates that ultrasound-guided injection in the treatment of shoulder pain probably provides little or no benefit over injection without imaging in terms of pain or function and low-certainty evidence indicates there may be no difference in quality of life. We are uncertain if ultrasound-guided injection improves participant-rated treatment success, due to very low-certainty evidence. Low-certainty evidence also suggests ultrasound-guided injection may not reduce the risk of adverse events compared with non-image-guided injection. No serious adverse events were reported in any trial. The lack of significant benefit of image guidance over injection without image guidance to improve patient-relevant outcomes or reduce harms, suggests that any added cost of image guidance appears unjustified.

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