Technical Note

Ultrasound-Guided Suprascapular Nerve Block at Spinoglenoid Notch and Glenohumeral Joint Hydrodilation

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Abstract: Hydrodilation of the glenohumeral joint is commonly employed as a nonsurgical intervention for the frozen shoulder. Accuracy and pain during the procedure can be regarded as difficulties in performing this procedure. Ultrasonography (USG) guided injection and suprascapular nerve block can improve the accuracy and can decrease pain during the hydrodilation procedure. We present the step-by-step method for performing USG-guided injections for suprascapular nerve block and hydrodilation.

Introduction

Frozen shoulder is an extremely painful and debilitating condition leading to stiffness and disability. The disability resulting from this condition has impacted the quality of life of affected individuals and society's economy. Frozen shoulder can either be primary (idiopathic) or secondary. Secondary frozen shoulder is associated with trauma, rotator cuff disease and impingement, cardiovascular disease, hemiparesis, or diabetes (although some classify this as primary frozen shoulder in diabetes).[1] In the general population, the incidence of frozen shoulder is estimated to be 3%-5%. Its peak incidence is between the ages of 40 and 60 and is rare outside these age groups, as well as in manual workers, and is slightly more common in women. According to general practice consultations, it is thought that the cumulative incidence of consultations is 2.4/1000/year (95% confidence interval: 1.9-2.9).[2]

Management of frozen shoulder is still controversial. Determining the pathophysiological processes of frozen shoulder is a pivotal milestone in the development of novel treatment for patients with frozen shoulder. To date, it is fairly well understood that frozen shoulder involves several stages, which reflect the process of inflammation of the capsule, fibrosis, and spontaneous resolution of the fibrosis.[3] Although disagreements occur, the most recognized pathophysiology is cytokine-mediated synovial inflammation with fibroblastic proliferation. This paradigm corresponds with arthroscopic observations. Additional findings include adhesions around the rotator interval caused by increased collagen and nodular band formation. The commonly affected structure is the coracohumeral ligament roof of the rotator cuff interval. Contraction of the coracohumeral ligament limits external rotation of the arm, which is usually the first to be affected in early frozen shoulder. In advanced stages, thickening and contraction of the glenohumeral joint capsule develop, further limiting the range of motion (ROM) in all directions.[4]

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Table 1. Pearls and Pitfalls

Surgical Step	Pearls	Pitfalls
1. Preparation	Pre-evaluation Only need one position for all procedures	Padding to protect prominent structures on the body Mixture (drug cocktail) pitfalls
2. Suprascapular nerve block at spinoglenoid notch	USG guidance promote accuracy in the procedure Needle insertion guided by dynamic evaluation Pure sensory nerve block Motor function is preserved	Need for accurate/correct identification of spinoglenoid notch (the suprascapular nerve passes through the spinoglenoid and supraglenoid notches)
3. Glenohumeral injection	USG guidance promote accuracy in the procedure Dynamic evaluation guided for needle insertion Painless joint capsular expansion (arthroscopic arthrolysis)	Need for accurate identification of the humeral head, glenoid, and joint space
4. Evaluation postinjection	Early motion Manual exercise	

USG, ultrasonography.

To date, treatment modalities for frozen shoulder has been proposed. The modalities include medication, local steroid injection, physiotherapy, exercise, hydrodilation, manipulation under anesthesia, arthroscopic capsular release, and open capsular release.[5,6] One such intervention is the hydrodilation of the glenohumeral joint with a high-volume injection, comprising a local anesthetic, corticosteroid, and normal saline, making a total volume of 40 mL. The procedure is commonly employed as a nonsurgical intervention after a failed round of conservative therapy, often being favored as it can be performed in an outpatient setting.[7]

It is increasingly becoming a common procedure and can be performed either under fluoroscopic or ultrasonographic guidance. The proposed mechanism of action is the mechanical distension of the joint space, ideally rupturing the tight, fibrotic joint capsule that develops during frozen shoulder.[8] We present a documented ultrasonography (USG)-guided suprascapular (SSP) nerve block and glenohumeral hydrodilation procedure.

Procedure

This procedure can be use in an outpatient clinic. The patient is in a fully conscious state when the injection is performed. The procedure consists of four steps (Video l and Table 1).

Step 1: Preparation

This step comprises pre-evaluation, patient positioning, drug preparation, and assessment before injection.

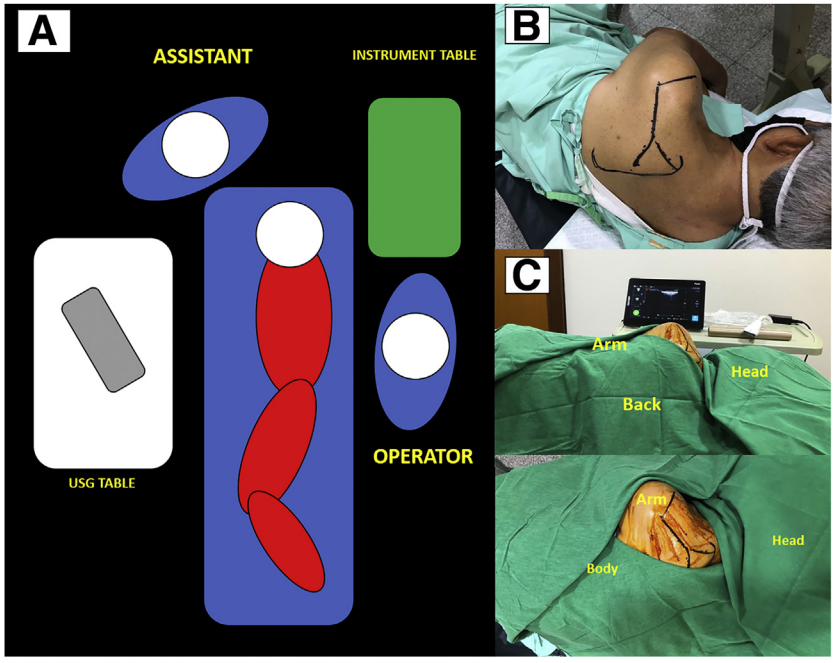

Fig 1. Patient's position during the procedure and the anatomical landmark. (A) The operator is standing behind the patient and in line with the ultrasound monitor to accomplish an ergonomic position. The ultrasound monitor is placed in front of the patient. (B) Patient is in the lateral decubitus with affected palm to nonaffected shoulder with padding to protect the prominent area of the body. The injection site is 2 cm below the spina scapula for the SSP nerve block at the spinoglenoid notch, and we use a posterior approach for glenohumeral joint injection, starting 2 cm below the posterolateral acromion and shifting to the medial side. (C) Then we prepare and clean the affected shoulder using a sterile technique.

Fig 2. Drug and instrument preparation. Two tubes of 5 cc triamcinolone acetonide, two vials of aquabidest, four ampules of 2% lidocaine, 23 G spinal needle (3.5 inch), 0.5% bupivacaine, and a precursor.

Pre-evaluation

During pre-evaluation, the patient's identity, the affected side, and active shoulder motion are checked before injection

Patient's position during the procedure and anatomical landmarks

Patient is positioned in lateral decubitus with affected palm to nonaffected shoulder (Fig 1) with padding to protect the prominent area of the body. The ultrasound monitor is placed in front of the patient. The operator stands behind the patient and in line with the ultrasound monitor to accomplish an ergonomic position. The injection site is 2 cm below the spina scapula for the SSP nerve block at the spinoglenoid notch, and we use a posterior approach for glenohumeral joint injection, starting 2 cm below the posterolateral acromion and shifting to the medial side (Fig 1). The affected shoulder is prepared and cleaned using a sterile technique.

Drug and instrument preparation

We prepare two tubes of 5 cc triamcinolone acetonide (50 mg), two vials of aquabidest, four ampules of 2% lidocaine, 23 G spinal needle (3.5 inch), 0.5% bupivacaine and a precursor (Fig 2).

Step 2: SSP Nerve Block at Spinoglenoid Notch

In the SSP nerve block procedure, identify the SSP nerve at the spinoglenoid notch using USG (Point of Care Ultrasound, Wisonic Piloter Series, Shenzhen Wisonic Medical Technology, Wisonic Medical, Shenzhen, China) at 2 cm below the spine scapula, with Doppler identification of the suprascapular artery at the lateral SSP nerve, and insertion of an echogenic 23 G spinal needle (3.5 inches) from medial to lateral. Perform the injection (20 mg triamcinolone acetonide, 4 cc 2% lidocaine, and 4 cc 0.5% bupivacaine as a cocktail), and wait for 1-2 min (Fig 3).

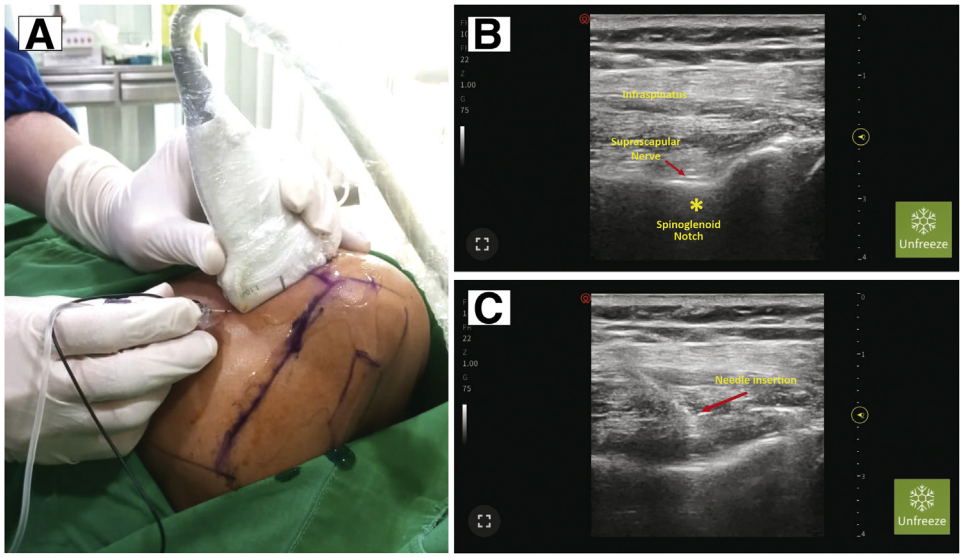

Fig 3. (A) Identify the SSP nerve at the supraglenoid notch using USG at 2 cm below the spine scapula. (B) Identification of the suprascapular nerve (*) below the transvers scapular ligament (red arrow) at spinoglenoid notch. (C) Inserting an echogenic 23 G (3.5 inches) spinal needle (blue arrow) from medial to lateral. Injection (20 mg triamcinolone acetonide, 4 cc 2% lidocaine, and 4 cc 0.5% bupivacaine as a cocktail) was performed, and we waited for 1-2 min.

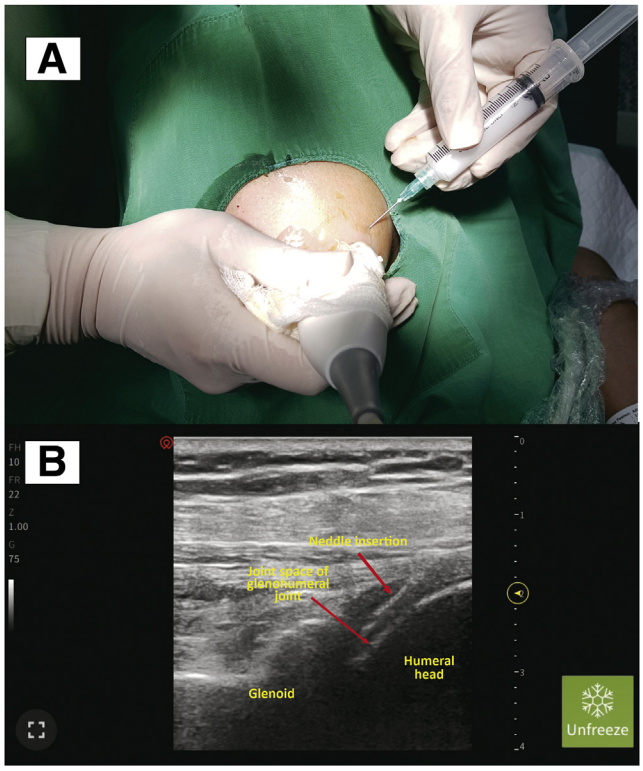

Fig 4. (A) Create an anatomical landmark approximately 1-2 cm below the posterolateral acromion and shift to the medial, short axis probe position. (B) Echogenic needle insertion in plane position from the lateral to the medial, penetrating the infraspinatus muscle and posterior capsule, and injecting the steroid (40 mg triamcinolone acetonide), as well as 15-20 cc aquabidest.

Step 3: Glenohumeral Joint Injection

The next step is glenohumeral joint hydrodilation by USG (Point of Care Ultrasound, Wisonic Piloter Series, Shenzhen Wisonic Medical Technology) identification. We create an anatomical landmark ~1-2 cm below the posterolateral acromion and shift to the medial, short axis probe position, echogenic needle insertion in plane position from the lateral to the medial, penetrating the infraspinatus muscle and posterior capsule, and injecting the steroid (40 mg triamcinolone acetonide), as well as 15-20 cc aquabidest (Fig 4).

Step 4: Evaluation After Injection

We direct the patients to perform the manual exercise after the procedure (Fig 5).

Discussion

Frozen shoulder is a self-limiting but debilitating condition. As mentioned above, the symptom can manifested itself over several years. Hence, pain management and optimization of exercise can renormalize the ROM faster. As an implication, the patient can reach the normal ROM in a shorter period. However, this is also affected by other factors. The stiff shoulder passes through various developments and stages. There is adequate evidence to presume that symptoms and physical findings alone provide a reliable basis for a prediction regarding clinical status. Development of symptoms is directly correlated to anatomical deterioration, spontaneous recovery to normal levels of function is possible, and standardized nonoperative treatment programs are effective alternatives to surgery in most cases. However, patients with chronic symptoms and those who have risk factors, such as diabetes mellitus, or are affected bilaterally might benefit from earlier surgical intervention.[9]

USG guidance can enhance the accuracy of the procedure, and it can prevent injury of the nearby structures. Injections into the glenohumeral joint have been studied for both accuracy and efficacy. Patel's study compared the accuracy of landmark- versus USG-guided glenohumeral injections by injecting 80 cadaveric shoulders. The results of the study reported that USG-guided injections have an accuracy of 92.5% compared with 72.5% for landmark-guided injections.[10] Although more time-consuming, USG-guided injections are more accurate, alleviate pain, and improve ROM compared with blind injection. The accuracy of injections was also higher in the USG-guided group compared with blind injection (90% vs 76.19%).[11] Hence, the USG-guided

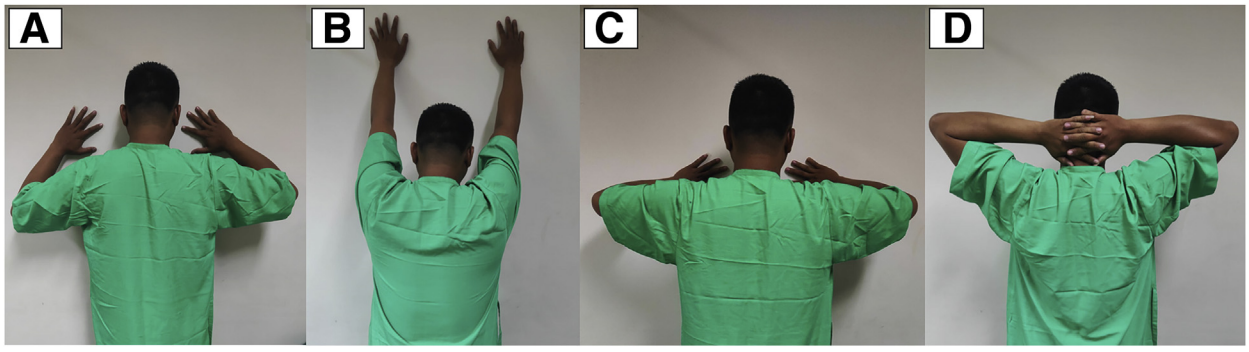

Fig 5. Post-procedure assessment: manual exercise. Evaluate and compare the active motion of the shoulder joint, such as forward flexion (A and B) and external rotation (C and D), with the motion prior to injection.

Table 2. Advantages and Disadvantages

Advantages	Disadvantages
USG-guided injection	Technically demanding
Minimally invasive	Communication is required
Dynamic evaluation needle insertion without surrounding structure injured	
Increased accuracy in injection	
Outpatient clinical setting surrounding structure injured	
Increased accuracy in injection	
Outpatient clinical setting	
Manual exercise	
Painless procedure	

procedure can minimize the circumstance structure injury.

Other advantages include that the procedure can be performed in an outpatient setting, avoids free-radicals, and is more cost-effective (Table 2). Hydrodilation is an effective therapeutic intervention that promises rapid symptomatic relief from frozen shoulder; this technique consists of an injection of a saline or saline combined with corticosteroids that distend the capsule by hydrostatic pressure. Hydrodilation (also called hydrodistension) of the glenohumeral joint with normal saline and corticosteroid was found to increase the shoulder volume capacity. Because of the physiological benefits of distending the contracted shoulder joints, capsular distension has been used for the treatment of frozen shoulder.[12] Hydrodilation can be performed with fluoroscopic guidance or ultrasonographic guidance, and both methods have similar outcomes. However, USG-guided hydrodilation has the advantage of avoiding the use of ionizing radiation. It is also more time-efficient, is cost-effective, and allows the assessment of the rotator cuff muscles.[13]

During hydrodilation, an SSP nerve block injection reduced pain by manipulating nerve ending excitation of the capsule, which is more convenient and painless for patients. SSP nerve blockade (SSNB) is a simple and safe technique for providing relief from various types of shoulder pain, including rheumatologic disorders, cancer, trauma pain, and postoperative pain due to shoulder arthroscopy. Posterior, superior, and anterior approaches may be used, the most common being the posterior. Recently, a USG-guided approach has been described.[14] Arcila Lotero's study reported the evaluation of the SSP nerve block injection. Forty-six blocks were performed, and overall, 78.3% of the patients experienced at least 50% reduction of pain 2 days later, and 47.8% had pain relief after 1 month, with a statistically significant difference ($P < .0001$) between the starting VAS median score and the median scores on the second postoperative day and at 1 month. There were no complications.[15] A meta-analysis also reported on SSNB, regarding pain relief. SSNB provided better pain relief for 12 weeks compared with physical therapy and placebo injections, but it was not superior to intra-articular injections.[16] The use of bupivacaine suprascapular nerve blocks was effective in reducing the pain of frozen shoulder at 1 month. Clinical studies with a larger number of subjects and a longer study period will help determine the duration and nature of the effect of bupivacaine SSP nerve blocks in treating the pain, disability, and glenohumeral joint contracture associated with frozen shoulder.[17]

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