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CASE REPORT

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Pentavalent Shoulder Block Under Ultrasound Guidance: A Novel Approach for Comprehensive Analgesia

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ABSTRACT

The quadrangular shoulder nerve block is presented as an innovative and integrative regional anesthesia technique aimed at optimizing peri-procedural analgesia and enhancing functional outcomes in patients with complex shoulder disorders, particularly adhesive capsulitis. Traditional isolated nerve blocks often provide incomplete analgesia due to the shoulder's complex innervation. This new approach addresses these limitations by targeting multiple key neural structures simultaneously.

Methods: This technique involves a multimodal ultrasound-guided blockade of the suprascapular, axillary, lateral pectoral, and upper subscapular nerves. The procedure is complemented by interventional maneuvers including capsular hydrodilatation, coracohumeral ligamentotomy, and post-injection joint manipulation. The article outlines detailed technical steps, including patient positioning, anatomical landmarks, ultrasound transducer orientation, needle trajectory, and specific anesthetic volumes administered to each nerve territory.

Preliminary Observations: Preliminary clinical applications have demonstrated a substantial improvement in patient comfort, with enhanced joint mobility and tolerance to passive manipulation immediately following the procedure. These outcomes suggest improved efficacy compared to traditional isolated nerve blocks, especially in outpatient settings, facilitating early rehabilitation initiation.

Conclusion: The quadrangular shoulder nerve block represents a promising advancement in the interventional management of adhesive capsulitis and other painful shoulder conditions. By achieving extensive sensory coverage of the glenohumeral joint, this technique offers superior analgesia, improved patient tolerance, and potential for earlier functional recovery. Further validation through randomized controlled trials is warranted to establish its safety, reproducibility, and long-term efficacy.

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Nerve Block, Ultrasonography, Shoulder, Adhesive Capsulitis, Analgesia, Hydrodilatation

Introduction

Shoulder pain is a prevalent musculoskeletal complaint, often debilitating, and commonly associated with conditions such as adhesive capsulitis (frozen shoulder), tendinopathies, and glenohumeral osteoarthritis. These conditions can result in significant functional impairment and a marked reduction in quality of life. Treatment options range from conservative approaches, such as physical therapy and pharmacologic management, to more invasive interventions, including image-guided injections and surgical procedures.

Adhesive capsulitis, in particular, is characterized by severe pain and progressive loss of range of motion due to thickening and contracture of the joint capsule. Its management poses a clinical challenge, with available treatment options including intra-articular corticosteroid injections, capsular hydrodilatation, and manipulation under anesthesia. Ultrasound-guided capsular hydrodilatation has demonstrated efficacy in reducing pain and improving shoulder mobility. However, the overall success of the procedure and patient comfort are intrinsically linked to the quality of analgesia during and after the intervention [1-7].

Traditionally, suprascapular nerve block (SSNB) has been widely employed, given its substantial contribution—approximately 70%—to the sensory innervation of the shoulder capsule8. Nevertheless, the innervation of the shoulder joint complex is multifactorial, involving additional neural structures such as the axillary, lateral pectoral, and upper subscapular nerves. Relying on a single nerve block may result in incomplete analgesia, patient discomfort during therapeutic maneuvers, and limitations in performing more invasive procedures, such as post-infiltration joint manipulation [8,9].

In this context, the present technical note introduces the "Quadrangular Shoulder Nerve Block," an ultrasound-guided multimodal approach that combines blockade of four key nerves with interventional procedures. The objective is to achieve comprehensive analgesia and enhance therapeutic efficacy. This article aims to detail the methodology for the safe

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and effective execution of this combined technique, enabling complex interventions to be performed in an outpatient setting with greater patient comfort.

Methods

The Quadrangular Shoulder Nerve Block is a sequential ultrasound-guided technique that integrates regional nerve blocks with interventional procedures to achieve comprehensive analgesia in patients with complex shoulder conditions. The precision offered by ultrasonography is essential to ensure procedural accuracy and patient safety throughout all stages.

The protocol follows a predefined sequence to optimize workflow and minimize patient repositioning: (1) suprascapular nerve block, (2) lateral pectoral nerve block, (3) upper subscapular nerve block, (4) coracohumeral ligamentotomy, (5) subacromial injection, (6) axillary nerve block, (7) capsular hydrodilatation, and (8) final joint manipulation.

Patient positioning is adjusted according to each procedural phase. For the suprascapular nerve block (Phase 1), the patient is seated and facing away from the physician. For the lateral pectoral and upper subscapular nerve blocks, coracohumeral ligamentotomy, and subacromial injection (Phase 2), the patient is placed in the supine position. For the axillary nerve block, capsular hydrodilatation, and final joint manipulation (Phase 3), the patient is placed in lateral decubitus, with the affected shoulder facing upward.

Aseptic preparation involves rigorous disinfection of the entire shoulder region using alcoholic chlorhexidine. The ultrasound probe is covered with a sterile sheath or protective film to maintain sterility. Local anesthesia is first applied with a small-gauge needle (13 × 0.3 mm insulin needle) at the skin entry point prior to the insertion of larger-caliber needles used for nerve blockade and interventional procedures.

This methodology enables the safe and effective application of a multimodal technique, providing extensive regional analgesia and facilitating the execution of complex therapeutic maneuvers in an outpatient setting.

Materials and Equipment

The procedure requires an ultrasound system equipped with high-frequency linear transducers, which are preferred for their superior resolution. Curvilinear (convex) transducers may be used in patients with higher body mass index or when accessing deeper anatomical structures.

Needles include a 13 × 0.3 mm insulin needle for cutaneous anesthesia and a 90 × 0.7 mm spinal needle for the nerve blocks and interventional procedures. Syringes of various volumes (5 mL, 10 mL, and 20 mL) are prepared according to the requirements of each step.

A 0.9% normal saline solution is used for drug dilution and procedural steps: 10 mL for dilution of the anesthetic used in the upper subscapular nerve block and at least 20 mL for capsular hydrodilatation, with a total minimum volume of 30 mL.

Local Anesthetics and Adjuvants Include

- Lidocaine 2% with vasoconstrictor: 2 mL for the suprascapular nerve block, 2 mL for the axillary nerve, 2 mL for the lateral pectoral nerve, and 2 mL for the subacromial bursa (combined with 5 mg of betamethasone).
- Lidocaine 1% (diluted): 15 mL for the upper subscapular nerve block, prepared by mixing 10 mL of lidocaine 2% with 10 mL of 0.9% saline solution.

The total lidocaine dose used is 310 mg, remaining within the safety threshold for a 70 kg patient (maximum recommended dose: 7 mg/kg).

Execution of Blocks and Procedures

All syringes are pre-filled and clearly labeled with their respective solutions in advance, ensuring proper identification and procedural efficiency during each step of the technique.

The suprascapular nerve block is performed with the patient in a seated position (Figure1a). The ultrasound transducer is placed over the scapular spine and tilted inferiorly to visualize the suprascapular fossa. Key anatomical landmarks include the suprascapular notch, the transverse scapular ligament, and the suprascapular artery, with the nerve typically located medial and inferior to the artery. A spinal needle is introduced in-plane and advanced toward the notch, with the tip positioned adjacent to the nerve. A total of 2 mL of 2% lidocaine with vasoconstrictor is administered (Figure1b).

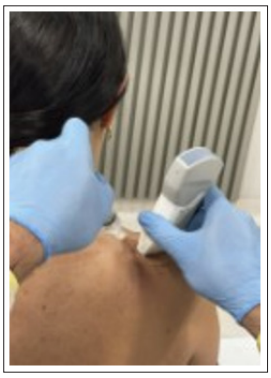

Figure 1a: The patient is seated, with the physician positioned behind. A linear ultrasound probe is placed in a transverse/oblique plane, and the needle is introduced from medial to lateral

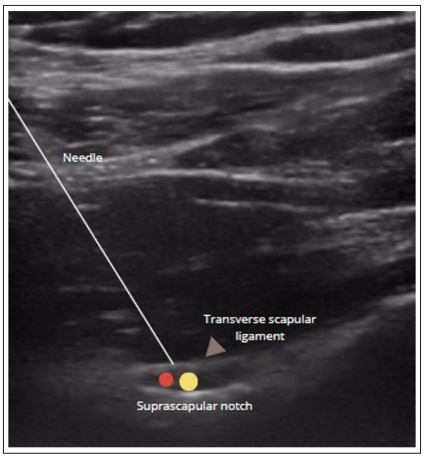

Figure 1b: Needle is visualized advancing toward the suprascapular notch, located beneath the transverse scapular ligament. The hyperechoic line represents the needle's path approaching the notch, where the suprascapular nerve (yellow circle) and artery (red circle) are identified;

The lateral pectoral nerve block is performed with the patient in the supine position. The ultrasound probe is initially placed at the tip of the coracoid process and then moved cranially to visualize the top of the coracoid. The lateral pectoral nerve is identified between the pectoralis major and minor muscles or on the deep surface of the pectoralis minor (Figure 2a). Using an in-plane approach, a spinal needle is directed toward the superior aspect of the coracoid, near the neurovascular bundle. Once in position, 2 mL of 2% lidocaine with vasoconstrictor is injected (Figure 2b).

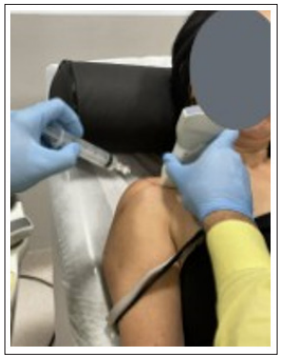

Figure 2a: The patient is in the supine position, with a linear ultrasound probe placed over the coracoid process;

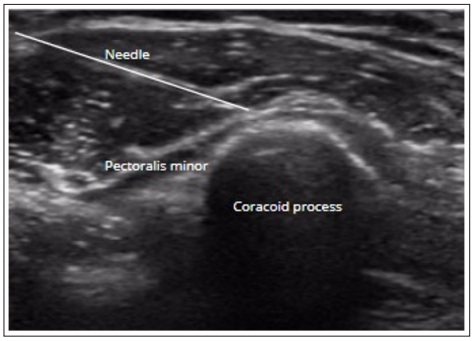

Figure 2b: Needle is visualized advancing toward the coracoid process, located deep to the pectoralis minor muscle;

The upper subscapular nerve block is performed with the patient in the supine position (Figure 3a). The ultrasound transducer is positioned caudally to the coracoid process to identify the conjoint tendon (comprising the coracobrachialis and the short head of the biceps) and the subscapularis muscle. The target site is the anatomical intersection between these two structures (Figure 3b). Using an in-plane approach, a spinal needle is advanced toward the intersection point, and approximately 15 mL of 1% lidocaine (prepared via dilution) is administered.

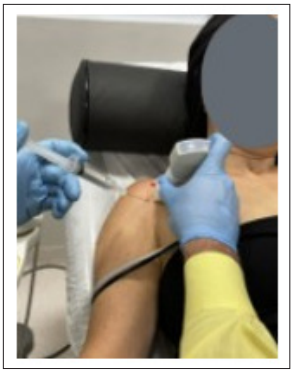

Figure 3a: The patient is positioned in the supine position with the shoulder slightly externally rotated. A high-frequency linear ultrasound probe is placed over the anterior aspect of the shoulder. The injection is performed using an in-plane approach, allowing continuous needle visualization throughout its trajectory;

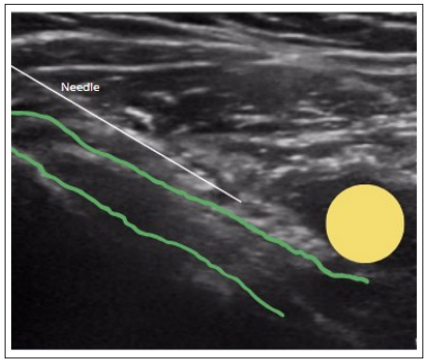

Figure 3b: The image shows a linear high-frequency ultrasound view of the target area, with the needle visualized in-plane and advancing toward the upper subscapular nerve (yellow circle). The needle path is clearly delineated, allowing real-time visualization. Green lines represent subscapular muscle boundaries used to guide the procedure and avoid neurovascular structures;

The coracohumeral ligamentotomy is also performed with the patient in the supine position (Figure 4a). The transducer is oriented cranially relative to the coracoid to identify the coracohumeral ligament laterally. Following local anesthesia, a spinal needle is inserted under ultrasound guidance to perform multiple percutaneous punctures at the ligament's insertion on the coracoid process, in a technique consistent with ultrasound-guided needle tenotomy (Figure 4b).

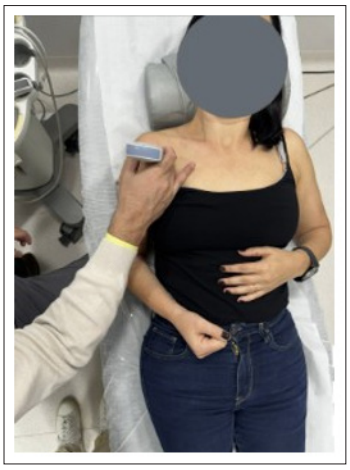

Figure 4a: The patient is positioned in the supine position. The high-frequency linear ultrasound transducer is placed in a transverse orientation relative to the coracoid process. The injection is performed using an in-plane approach, allowing real-time visualization of the needle throughout its course.

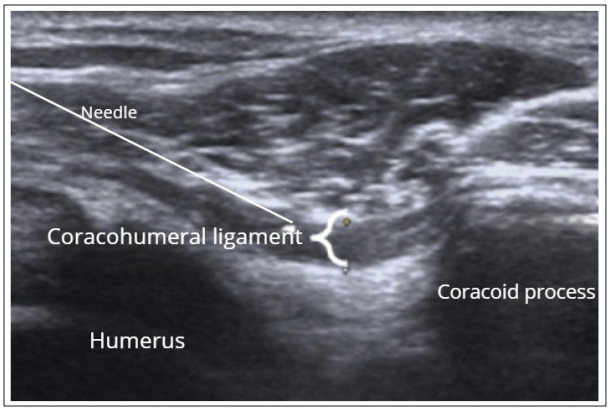

Figure 4.b: Ultrasound-guided in-plane ligamentotomy the coracohumeral ligament. The image shows a transverse view of the anterior shoulder with clear identification of the coracoid process, humerus, and the coracohumeral ligament;

The subacromial injection is performed with the patient in the seated upright position (Figure 5a). The ultrasound transducer is oriented laterally to identify the subacromial space, located between the acromion/deltoid complex and the rotator cuff tendons. Using an in-plane approach, a spinal needle is advanced into the bursal space (Figure 5b). A solution containing 5 mg of betamethasone and 2 mL of 2% lidocaine with vasoconstrictor is administered.

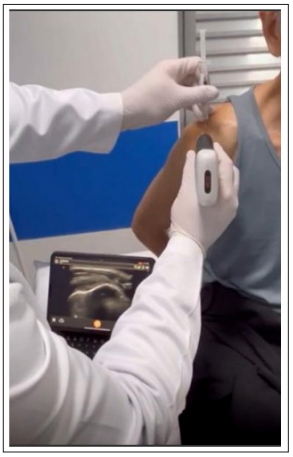

Figure 5a: The procedure is performed with the patient seated upright, allowing easy access to the subacromial space. Portable high-frequency linear ultrasound probe is positioned in a longitudinal orientation over the lateral aspect of the shoulder

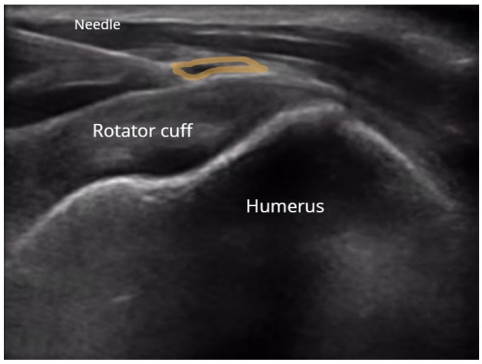

Figure 5b: Ultrasound image of the lateral shoulder showing the humeral head, rotator cuff, and subacromial-subdeltoid bursa. The needle is visualized in-plane approaching the bursa. The orange-shaded area highlights the distended bursa following the injection, indicating successful delivery of fluid into the subacromial space;

The axillary nerve block is performed with the patient in the lateral decubitus position, with the affected shoulder facing upward (Figure 6a). The ultrasound probe is placed over the posterior aspect of the shoulder to identify the infraspinatus in a transverse view. The transducer is then moved laterally to visualize the teres minor muscle underneath. The teres minor is followed distally toward the humeral shaft until the neurovascular bundle—comprising the posterior circumflex humeral artery and vein, along with the axillary nerve—is visualized. A spinal needle is inserted in-plane and positioned adjacent to the axillary nerve. A total of 2 mL of 2% lidocaine with vasoconstrictor is injected (Figure 6b).

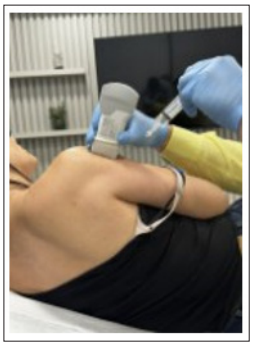

Figure 6a: The patient is placed in lateral decubitus with slight forward flexion of the shoulder to optimize access to the posterior region. A high-frequency linear ultrasound transducer is positioned in a transverse oblique plane over the posterior shoulder, aligned with the teres minor;

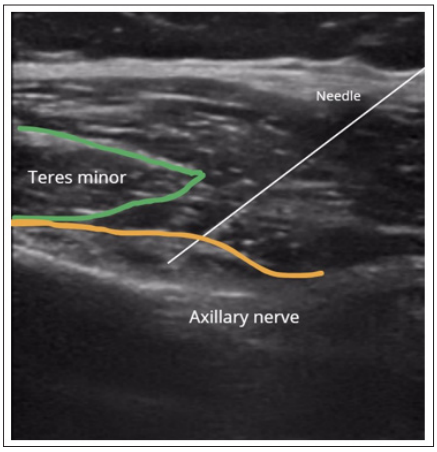

Figure 6b: The teres minor muscle is outlined in green, and the axillary nerve is visualized within the neurovascular bundle (highlighted in orange) adjacent to the posterior aspect of the humerus. The needle trajectory is directed toward the interfascial plane between the teres minor and the underlying structures, allowing for precise targeting and potential hydrodissection of the axillary nerve;

The capsular hydrodilatation is performed with the patient remaining in the seated upright position, affected shoulder upward (Figure 7a). The ultrasound transducer is positioned to visualize the glenohumeral joint, including the superior glenoid rim, labrum, capsule, and humeral head. The access point is the joint space between the humeral head and the glenoid (Figure

7b). A spinal needle is inserted in-plane, with its tip confirmed within the intra-articular space. A total of 20 mL of 0.9% saline solution is injected gradually under controlled pressure.

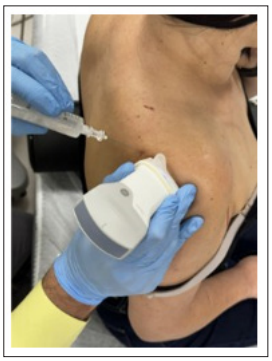

Figure 7.a: A high-frequency linear ultrasound probe is placed over the posterior aspect of the shoulder, aligned with the infraspinatus muscle and scapular spine;

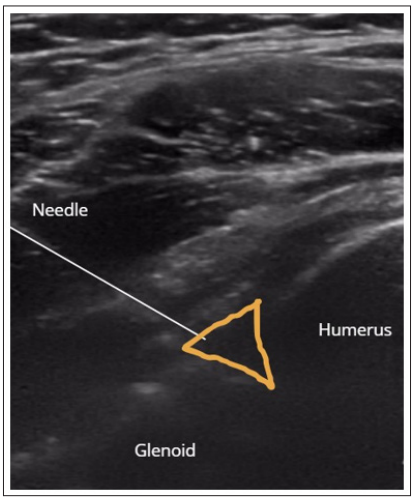

Figure 7.b: The image shows a transverse view of the posterior shoulder with clear visualization of the humeral head and glenoid. The needle is introduced in-plane, directed toward the intra-articular space (outlined in orange) between the humeral head and the glenoid cavity.

Finally, the post-procedural joint manipulation is performed approximately 10 minutes after the last injection, allowing full onset of anesthetic effect. The manipulation is conducted in a controlled and gentle manner, aiming to release residual adhesions and consolidate the gains in joint mobility achieved during the procedure.

Discussion

This technical note provides a detailed description of the Quadrangular Shoulder Nerve Block, an innovative and comprehensive approach to regional analgesia for the shoulder. This technique aims to optimize interventional procedures such as subacromial injection, capsular hydrodilatation, and coracohumeral ligament tenotomy—key elements in the management of challenging shoulder conditions including adhesive capsulitis, calcific tendinopathy, and glenohumeral osteoarthritis, which are frequently associated with severe pain and substantial functional disability.

Traditionally, regional nerve blocks—particularly the suprascapular nerve block—have demonstrated efficacy in relieving pain associated with adhesive capsulitis. The suprascapular nerve contributes to approximately 70% of the sensory innervation of the shoulder capsule, making it a well-established target for analgesia8. However, the primary value of the Quadrangular Block lies in its ability to provide near-complete desensitization of the shoulder's complex innervation, overcoming the inherent limitations of isolated nerve blocks. As shown in recent anatomical studies9,10, the sensory innervation of the glenohumeral joint and surrounding periarticular structures is multifaceted, involving significant contributions from the axillary, lateral pectoral, and upper subscapular nerves. Persistent pain and the inability to perform effective joint manipulation under partial blocks—commonly encountered in the treatment of frozen shoulder—highlight the need for a more holistic strategy.

The Quadrangular Block addresses this challenge by combining the blockade of these four key nerves, thereby providing more robust analgesia and enabling subsequent procedures, including capsular hydrodilatation and joint manipulation, to be performed with greater patient comfort and operator precision. The synergy of the proposed nerve blocks is crucial: the suprascapular nerve block addresses posterior and superior shoulder pain; the axillary nerve block complements analgesia of the inferior and lateral capsule while also anesthetizing the deltoid, which is critical for tolerating manipulation; and the lateral pectoral and upper subscapular nerve blocks—though less frequently included in standard regional protocols—are strategically important for anterior and deep innervation, respectively, contributing to more complete muscle relaxation and broader periarticular analgesia.

This multimodal approach enhances the effectiveness of capsular hydrodilatation, which, when performed under ultrasound guidance, is already known to improve pain and mobility7. With comprehensive analgesia, hydrodilatation can be carried out with less resistance and greater volume, facilitating more effective lysis of intra-articular adhesions. Coracohumeral ligament tenotomy, in turn, can be executed with greater accuracy and minimal discomfort.

The clinical implications of this technique are significant. By providing superior and global analgesia, the Quadrangular Block reduces the need for deep systemic sedation, thereby minimizing associated risks and promoting faster post-procedural recovery. The ability to perform complex interventions in an outpatient setting, with a conscious and cooperative patient, represents a notable advancement in workflow efficiency and cost reduction. Furthermore, increased comfort during and after the procedure—culminating in a smoother and more controlled joint manipulation—encourages adherence to early rehabilitation, a critical factor in long-term treatment success. The integration of nerve blocks, hydrodilatation, and joint manipulation into a single multimodal protocol aligns with current best practices aimed at maximizing pain relief and functional recovery 11. It is essential that all interventions are performed by experienced clinicians, and that the treatment plan is tailored to the individual patient's anatomical and clinical characteristics.

It is important to recognize that this technical note presents a procedural description rather than comparative outcome data. Thus, while the technique is clinically promising, its long-

term efficacy and safety must be validated through randomized controlled clinical trials. Operator proficiency in ultrasound-guided regional anesthesia is a key requirement, as the success of the technique depends on accurate anatomical identification and real-time needle manipulation. Additionally, its applicability may be limited in patients with altered anatomy or pre-existing conditions that compromise ultrasound visualization.

Conclusion

The Quadrangular Shoulder Nerve Block is a novel and comprehensive ultrasound-guided technique that enables effective regional analgesia for complex shoulder procedures. By targeting multiple key nerves, it enhances patient comfort, reduces the need for systemic sedation, and facilitates outpatient interventions such as capsular hydrodilatation and ligamentotomy. This technique offers a promising addition to the orthopedic pain management toolkit and warrants further clinical validation.

Level of Evidence: IV

References

[1] Michener LA, Walsworth MK, Burnet EN (2004) Effectiveness of a progressive exercise program for patients with subacromial impingement syndrome: a randomized controlled trial. Arch Phys Med Rehabil 85: 1203-1209.

[2] Lundberg BJ (1969) The frozen shoulder. Clinical and arthrographical findings and the effect of steriod treatment. Local intraarticular injection versus systemic administration. J Orthop Surg 49: 695-703.

[3] Neviaser RJ, Neviaser TJ (1987) Adhesive capsulitis of the shoulder. J Bone Joint Surg Am 69: 1609-1617.

[4] Zuckerman JD, Rokito A (2011) Frozen shoulder: a systematic review of therapeutic options. J Am Acad Orthop Surg 19: 582-590.

[5] Wang K (2017) Effectiveness of intra-articular corticosteroid injection for adhesive capsulitis of the shoulder: a meta-analysis. J Shoulder Elbow Surg 26: 465-474.

[6] Watson L, Shi M, Zhou C, Shi Z, Cai X, et al. (2009) Hydrodilatation for adhesive capsulitis of the shoulder: a systematic review. Arch Phys Med Rehabil 90: 1772-1779.

[7] Puertas FF, Oliveira MP, Moreira MLC (202) Efficacy of hydrodilation in the treatment of adhesive capsulitis of the shoulder: pain, mobility and function. Rev Bras Ortop 57: 114-118.

[8] Anand P, Mehta A (2016) Suprascapular Nerve Block: A Review. Anesth Essays Res 10: 205-211.

[9] Adey-Wakeling Z, Crotty M, Shanahan EM (2013) Suprascapular nerve block for shoulder pain in the first year after stroke: a randomized controlled trial. Stroke 44: 3136-3141.