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Research Article

Transtrapezoidal Accessory Nerve Block with a Novel Injectable Solution: An Innovative Approach to the Treatment of Chronic Shoulder Pain

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Abstract

This article presents an innovative technique for the management of chronic shoulder pain, a prevalent condition that can result from traumatic injuries, repetitive activities, and chronic conditions such as tendinitis and bursitis. The accessory nerve, which plays a crucial role in the motor innervation of the neck and shoulders, is often involved in compression syndromes that result in chronic pain.

The article describes a minimally invasive, ultrasound-guided technique for accessory nerve block. This technique allows real-time visualization of anatomical structures, increasing the accuracy and safety of the procedure. The combination of 5% glucose, 1% procaine, and N-acetylcysteine is used to provide pain relief, neuronal stabilization, and antioxidant support. Studies indicate that this multimodal approach can reduce the need for systemic pharmacological analgesia and promote functional recovery.

In addition to the description of the technique, the article reports three cases of treated patients, demonstrating the therapeutic efficacy of the proposed intervention. However, the article emphasizes the need for further studies to assess the durability of therapeutic effects and to establish optimized protocols for different patient profiles.

Keywords: Accessory nerve block; Chronic pain; Ultrasound guided intervention; Pain management; Anatomy; Compression syndromes; Diagnosis; Treatment.

INTRODUCTION

Shoulder pain is a condition that affects a substantial portion of the population, with prevalence ranging from 6.9% to 26% [1]. Causes include traumatic injuries, repetitive activities, and chronic conditions such as tendonitis and bursitis, often leading to a decrease in quality of life [2,3]. The diagnosis of shoulder pain can be complex due to the wide range of etiologies, including rotator cuff injuries, subacromial impingement, and glenohumeral arthritis [4,5]. Chronic shoulder pain often arises from injuries that are not properly treated or from repeated injuries over time, resulting in conditions such as Painful Shoulder Síndrome need to remove the acronym SOD and adhesive capsulitis [6]. The treatment of this condition involves a multimodal approach, including physical therapy, pharmacological therapies, and surgical interventions [4,5]. Multidisciplinary approaches have been shown to be more effective, integrating supervised exercise, relaxation techniques, and regular physical therapy [3, 7].

Ultrasound-guided interventional procedures have become increasingly common in the treatment of chronic pain, including shoulder pain [4,8]. This approach allows real-time visualization of joint, tendinea, muscle, and nerve structures, providing greater precision and safety in the administration of therapies [2,9-11]. Studies demonstrate that ultrasound-guided nerve blocks offer significant relief and improve functionality for patients with chronic pain [3,4]. In the context of this approach, the accessory nerve plays a key role in the mechanism of chronic pain in the shoulder and shoulder girdle [12,13]. Its motor and sensory innervation of key structures makes it a relevant target for innovative therapeutic interventions such as nerve blocks [14,15]. Exploring new techniques for refractory pain management can significantly contribute to improving patients' quality of life and reducing the overall impact of chronic pain [5,6].

This article aims to describe a minimally invasive, sonoguided, assertive technique for the management of chronic shoulder pain with accessory nerve block and to demonstrate its effectiveness with a series of clinical cases.

LITERATURE REVIEW

The accessory nerve is a mixed nerve whose main function is motor, innervating muscles crucial for neck and shoulder movement [12]. This review addresses the origin, anatomical correlations, sensory and motor

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functions, compression syndromes, and symptoms associated with complications of this nerve [4,13,14].

The accessory nerve plays a key role in innervating the muscles responsible for head and neck movement, as well as controlling shoulder elevation [8,16,17]. Understanding the anatomy and function of the accessory nerve, as well as its complications, is essential for clinical practice, especially in the areas of neurology, pain medicine, and physical therapy [2,13,15]. The accessory nerve has a unique origin that involves two roots: a cranial root, which emerges from the ambiguous nucleus of the brainstem, and a spinal root, originating from the anterior motor cells of the cervical medulla (C1-C5) [3]. Both roots join to form the accessory nerve, which follows a complex path through the neck, is closely related to crucial vascular and nerve structures [14,16], passes through the jugular foramen, and divides into branches that innervate specific muscles. [6,12], among which we need to highlight the sternocleidomastoid and trapezius, allowing the movement of the head and the elevation of the shoulders, being critical for posture and daily movements [2,4,16]. Its motor functions facilitate head rotation and shoulder elevation [7], and its cranial root may be involved in sensory functions through connections with other cranial nerves [12,16,17].

The accessory nerve can undergo conditions that result in compression syndromes [12,18-20]. The most common causes include traumatic injuries, cervical region surgeries, and tumors or masses that compress the nerve [3,13,17]. Symptoms of accessory nerve involvement include difficulty moving the neck, trapezius weakness (difficulty elevating the shoulder), muscle atrophy, and neck pain or pain radiating to the shoulder. [4]. Myofascial pain of the shoulder is a common musculoskeletal condition that affects the quality of life of many individuals, being characterized by the presence of painful trigger points. The incidence of shoulder pain is quite significant, with studies showing that in the United States, the prevalence of shoulder pain is approximately 24% in the adult population [21]. In addition, shoulder myofascial syndrome is one of the most frequent causes of musculoskeletal pain, affecting people of all ages, especially those who are sedentary.

Figure 1 : Image showing main pain points reported by patients with myofascial pain syndrome in the shoulder.

For the treatment of shoulder joint and tendon pain, the nerves usually blocked are the suprascapular nerve and the axillary nerve. However, the muscular and myofascial origin of pain is often overlooked as a cause of shoulder pain, and it is critical to consider it in diagnoses and treatments. Myofascial pain can manifest as referred pain, i.e., pain perceived at a site far from the trigger point, complicating the diagnosis [22,23,24].

Recent studies highlight that the ultrasound-guided nerve block technique for the accessory nerve can improve the accuracy of the procedure and provide significant symptomatic relief [3,4,25].

Traditional Nerve Block Techniques and Their Limitations

Nerve block is widely used in the management of chronic pain, particularly in patient's refractory to conservative treatments [7,11]. Traditional block techniques involve the use of anatomical palpation and superficial landmarks to locate nerves, followed by the administration of local anesthetics [1,15]. However, these approaches have significant limitations, including poor accuracy, increased risk of injury to adjacent structures, and limited efficacy in cases of anatomical variations [10,12]. Studies show that the accuracy of the traditional lock can be compromised by the difficulty in identifying the exact location of the nerve, especially in areas with a high density of vascular and nerve structures [14,16]. In addition, the lack of real-time visualization increases the risk of complications, such as IV injection or nerve tissue damage [4,6].

With the introduction of ultrasound-guided techniques, these limitations have been progressively overcome [5,8]. Ultrasound allows for real-time visualization of the accessory nerve, facilitating a more accurate and safer approach [4,10]. Studies such as the one by Finlayson et al. (2019) have demonstrated that the use of ultrasound for accessory nerve block significantly improves clinical outcomes by reducing pain and increasing shoulder functionality [3,4]. In addition, the ultrasound-guided interventional technique proved to be effective in releasing adhesions and restoring tissue mobility around the accessory nerve.

Accessory nerve block is a widely used technique in the treatment of muscle and myofascial pain of the trapezius muscle. Studies such as the one by Herbst and Sorkin (2022) demonstrate its effectiveness in controlling intractable pain in this region. However, we propose an original approach to this technique, employing it in the treatment of pain associated with the shoulder joint, especially in cases refractory to other conventional therapies.

DESCRIPTION OF THE TECHNIQUE

To perform this procedure, an ultrasound device with a linear probe is required to visualize the sonoanatomy and accurately guide the needle during the block, as well as the professional who proposes to perform the procedure needs adequate training to use the equipment and to perform ultrasound-guided blocks. The patient should be comfortably seated, with his back to the examiner. The examiner should view both the posterior region of the shoulder to be treated and the ultrasound screen. For the characterization of the accessory nerve (Nervus accessorius), the transducer should be positioned over the descending (superior) portion of the trapezius muscle, in the middle third, on a longitudinal axis in relation to the patient.

Infiltration will be performed from posterior to anterior of the patient, with the needle kept under direct visualization on sonoimaging. The needle should follow a craniocaudal and posteroanterior path, heading to the interaponeurotic space between the trapezius and levator scapulae (Musculus levator scapulae) muscles, where the medication should be applied. The technique uses direct sonovisualization to infiltrate 10 ml of

Figure 2 : Positioning of the transducer on the descending (superior) portion of the trapezius muscle, in the middle third, on a longitudinal axis in relation to the patient for adequate visualization of the local anatomy for block.

Figure 3 : Aponeurotic fascia between the trapezius muscle and the levator scapulae muscle. Virtual space through which the accessory nerve passes.

Figure 4 : Positioning of the ultrasound probe and syringe for adequate needle sonovisualization.

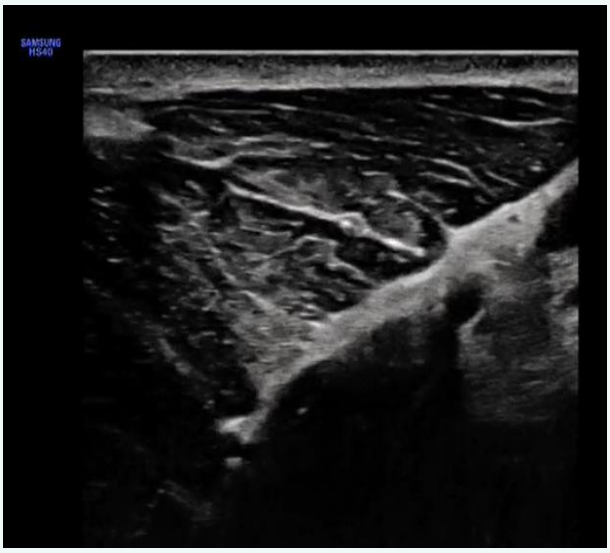

Figure 5 : Infiltration of the fascia between the trapezius and the levator scapulae should be performed, with the advancement of the needle being accompanied by direct sonovisualization and ensuring the effectiveness of the procedure.

solution into the aponeurotic fascia, making sure that the procedure was properly performed.

METHODOLOGY

This article aims to present, in association with the description of the technique, a series of three clinical cases submitted to the blockade described for the treatment of refractory chronic shoulder pain at the Regenera Dor Institute, in Juazeiro do Norte – Ceará, Brazil, between October 2024 and January 2025. All patients were duly informed about the proposed procedure before it was performed and signed an informed consent form. After evaluation, the patients were submitted to the treatment as the blockade, as described in the technique of this article.

Figure 6 : The block can be confirmed by direct visualization of the medication in the fascial plane.

Figure 7 : Performing the ultrasound guided block according to the technique described in this article with the patient's pain improvement.

CASE REPORTS

Case one

A 68-year-old female patient was admitted complaining of chronic pain in the right shoulder. The condition began after a rotator cuff injury and persisted for one year after arthroscopic repair. The pain was severe, limiting physical activity and reaching 9/10 on the Visual Analogue Scale (VAS). Several therapeutic approaches have been tried, including physical therapy rehabilitation in the immediate and late postoperative periods, use of Nonsteroidal Anti-Inflammatory Drugs (NSAIDs), opioid analgesics, and pregabalin, without significant improvement. A previous suprascapular nerve block was performed blindly, without symptomatic relief.

In the first evaluation, conducted on October 22, 2024, the patient presented pain and severe limitation of the range of motion of the right shoulder, with active abduction of 30º and assisted active abduction of 60º, above which she reported intense exacerbation of pain. Ultrasound evaluation revealed an intact supraspinatus tendon, anchored to the greater tuberosity of the humerus, with no signs of adhesive capsulitis. In view of this situation, accessory nerve block was proposed, as described in this study.

Immediately after the first session, the patient reported approximately 70% relief in pain and an increase in shoulder range of motion, as well as improved mobility of the scapulothoracic joint. Weekly follow-up revealed maintenance of relief for about two weeks, when pain returned with less intensity (VAS 5-6/10), at which time a second block was performed, providing complete relief. The patient maintained weekly follow-up and returned to physical and work activities. Two weeks after the second application, she reported mild pain (VAS 3/10) and was submitted to a third block in the fourth week. After this intervention, she

Figure 8 : ultrasound guided infiltration as described in this article. To relieve pain and reduce the patient's anxiety during the procedure, cryoanalgesia was used before application.

remained asymptomatic for 120 days, with no new complaints.

Case two

A 63-year-old male patient, admitted after a motorcycle accident that occurred on July 20, 2024, evolves with persistent pain in the right shoulder, without a fracture or tendon injury that justifies the symptomatology. He was admitted to the clinic 3 months after the accident, with pain that prevented shoulder mobilization (VAS 8/10). The pain condition did not improve, although he was using NSAIDs, analgesics and opioids.

After diagnostic clarification, the treatment of chronic pain with the block described in the article was suggested. The patient progresses with improvement of pain and range of motion. Although he reported a 100% improvement in symptoms, the pain returned with less intensity 2 weeks after the procedure. At this time, he had shoulder abduction in eight hundred and reported moderate pain (VAS 5/10). The second block was performed with improvement of the pain and a new return was scheduled for 2 weeks. At the time of the second return visit, the patient returned without pain and no longer presented recurrence of the pain condition after 4 months of the procedures.

Figure 9 : Patient reports improvement of pain and improvement in range of motion after infiltration.

Case 3

A 45-year-old patient was admitted complaining of pain in shoulder D associated with partial rupture of the supraspinatus tendon. This condition started about six months ago. The patient had already undergone an orthobiologic treatment, consisting of a bursal and intratendinous injection of BMA matrix, but experienced worsening pain and no symptom relief.

After etiological clarification, the patient chose not to undergo surgical treatment of the lesion, which led us to start a treatment with shock waves. Four sessions of focal shock waves (PiezoWave^2 - Richard WOLF)® were performed with 3,000 pulses at a depth of 15 mm (therapeutic target defined by ultrasound), at a frequency of 8 Hertz and energy density of 0.182 mJ/mm2.

During the sessions, an improvement in the range of motion of the right shoulder was observed, but the patient continued to complain of shoulder pain. Two weeks after the fourth shockwave session, with the patient presenting normal range of motion on physical examination and a healed supraspinatus tendon on USG, the pain remained at an intensity of 8/10 on the VAS. This pain condition prevented the patient from performing his work activities as a teacher, prevented him from driving and practicing physical activities. It was then suggested to perform accessory nerve block, which was performed according to the description of the present article.

The patient progressed with a reduction in pain (5/10 in the VAS), and 2 more blocks were performed with an interval of 2 weeks between each application. At the end of 6 weeks, the patient presents only mild pain during physical activity (1/10 in the VAS) and has returned to his work activities, evolving with total improvement of the pain complaint 8 weeks after the first block session. The patient's improvement was maintained until the publication of the present article, 4 months after the end of the therapeutic intervention with infiltrations.

DISCUSSION

Chronic shoulder pain represents a significant challenge in clinical practice, with multiple etiologies, including musculoskeletal, neuropathic, and myofascial impairments [21,28-31]. The accessory nerve (XI cranial nerve) plays a fundamental role in the motor innervation of the trapezius and sternocleidomastoid muscles, being essential for the stabilization and mobility of the scapula [32-34].

Anatomically, the accessory nerve has complex pathways and is vulnerable to compression and trauma, which can lead to chronic shoulder pain [12]. Poor innervation of the trapezius can result in muscle imbalance and compensatory overload of adjacent muscles such as the levator scapula and rhomboids, exacerbating pain [2]. This phenomenon can be observed in patients with post-surgical neuralgia after cervical procedures or lymph node dissections, where injury to the accessory nerve is frequent [14,35-38].

Changes in the accessory nerve can occur at several points along its path, being more common in the posterior trigone region of the neck, where it becomes superficial and more susceptible to extrinsic compressions or post-traumatic fibrosis. Patients with this type of impairment often have chronic pain and significant scapular dysfunction, making it difficult to elevate the shoulder and predisposing to compensatory muscle

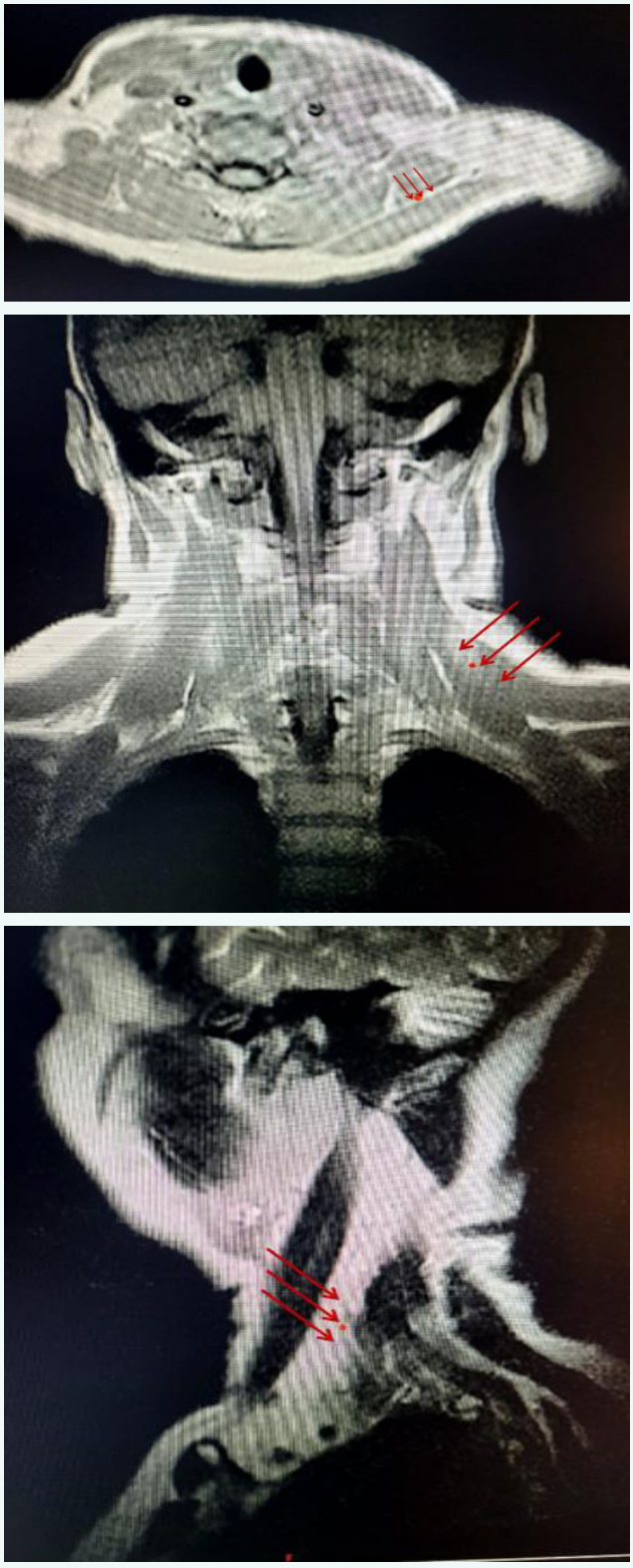

Figure 7,8 and 9 : Axial, coronal and sagittal sections of Magnetic Resonance Imaging with arrows showing the aponeurotic fascia between the trapezius muscle and the levator scapulae muscle, the therapeutic target of the block.

syndromes. Early diagnosis and targeted therapeutic interventions, such as myofascial release, ultrasound-guided infiltrations, and motor rehabilitation techniques, are key to restoring function and minimizing pain in these patients [39].

Ultrasound-guided infiltration has emerged as a promising technique for relieving pain associated with accessory nerve compression. Cass (2016) reviewed the use of this approach, highlighting its ability to reduce adhesion between the nerve and surrounding tissues, relieving compressive neuropathy. In addition, studies have shown that selective accessory nerve block significantly improves shoulder function and reduces pain in patients with patterns compatible with accessory neuropathy [40-42].

To perform the accessory nerve block by transdeltoidea, we use a solution prepared from the combination of 5% glucose, 1% procaine and N-acetylcysteine (NAC) for its analgesic, regenerative and antioxidant effects. This combination integrates the principles of neural therapy and neuroprolotherapy, promoting pain relief and functional improvements [43].

Neural therapy is a therapeutic methodology that is based on the regulation of the autonomic nervous system through the administration of local anesthetics in low concentrations. One percent procaine is widely employed due to its ability to stabilize cell membranes, reduce neuronal hyperexcitability, and modulate inflammatory responses [44]. Studies indicate that procaine has anti-inflammatory and antioxidant properties, inhibiting free radicals and attenuating degenerative processes in peripheral nerves [45]. In addition, its rapid and reversible blocking action on nerve impulse conduction provides a safe and effective analgesic effect.

Neuroprolotherapy, also known as perineural prolotherapy, is a therapeutic modality that uses glucose solutions in low concentrations to modulate neuropathic pain and promote neural regeneration. Research shows that 5% glucose acts in pain modulation by blocking TRPV1 (Transient Receptor Potential Vanilloid 1) channels, decreasing peripheral sensitization and promoting prolonged analgesia [46]. In addition, glucose favors a biochemical environment conducive to healing and the restoration of neural homeostasis.

N-acetylcysteine (NAC) is a direct precursor to glutathione, one of the most important antioxidants in the body. In the context of neural block, NAC has been explored for its neuroprotective and anti-inflammatory potential. NAC administration has shown positive effects in reducing oxidative stress and inhibiting neuro-inflammation, factors often associated with chronic neuropathic pain [43,47]. In addition, its ability to modulate inflammatory pathways and reduce neural hypersensitivity reinforces its usefulness in blocking sensory nerves. Ultrasound-guided interventional procedures have become increasingly common in the treatment of chronic pain, including shoulder pain [3-5,7,8]. These procedures are minimally invasive and allow real-time visualization of joint, tendon, muscle, nerve, and ligament structures. This method has been shown to be effective for both acute and chronic injuries, especially in small joints such as the shoulder. Ultrasound-guided nerve blocks and infiltrations offer greater precision in the introduction of needles and medical devices into target tissues, minimizing the risk of injury to adjacent structures and improving therapeutic outcomes [8,10,12]. Studies have proven the effectiveness of ultrasound-guided peripheral nerve blocks in pain management, bringing greater safety and efficiency in clinical practice [35,40,42,48].

Other interventional approaches include ultrasound-guided interfascial blocks, which allow for more effective and minimally invasive analgesia for myofascial pain of the trapezius and adjacent structures [4,5]. The use of ultrasonography improves the accuracy and assertiveness of the procedure, minimizing the possibility of errors such as intramuscular injection instead of interaponeurotic, which will not

have the same therapeutic effect. Additionally, the use of mesotherapy has been studied as a complementary therapeutic option in cervicobrachial pain, which may benefit patients with accessory nerve involvement [6]. Pires et al. (2024) described a mesotherapy protocol for cervico-scapulobrachial pain, highlighting its effectiveness in reducing pain and improving functionality in patients with superior cruciate syndrome and excessive tension in the upper scapular muscles [49,50].

Therefore, understanding the contribution of the accessory nerve to chronic shoulder pain allows advances in differential diagnosis and the development of more effective therapeutic strategies, especially with the increasing use of ultrasound-guided minimally invasive techniques.

CONCLUSION

The accessory nerve plays a vital role in the motor function of the neck and shoulders. A detailed understanding of its anatomy, correlations, and complications is imperative for the effective diagnosis and treatment of dysfunctions related to this nerve. The combination of 5% glucose, 1% procaine, and N-acetylcysteine represents an innovative approach in the management of chronic pain and neurogenic dysfunctions. Glucose acts in the modulation of neuropathic pain, procaine stabilizes neuronal membranes and reduces inflammation, while NAC provides antioxidant and neuroprotective support. This multimodal approach, based on neural therapy and neuroprolotherapy, may represent an effective alternative for patients with persistent pain, reducing the need for systemic pharmacological analgesia and promoting functional recovery. The combination of these agents provides synergistic effects, contributing to neuronal stabilization, reduction of oxidative stress, and tissue regeneration, in line with the principles of neural therapy and neuroprolotherapy. In addition, the precision provided by ultrasound improves the effectiveness of the procedure and minimizes risks, making this strategy a viable and safe option for patients with refractory pain.

Accessory nerve block, when combined with other techniques such as suprascapular and axillary nerve block, can provide significant postoperative pain relief in shoulder surgeries. In addition, the multidisciplinary approach, which includes physical therapy and shockwave therapy, has shown promising results in the management of myofascial pain. This case series suggests that accessory nerve block may be an effective alternative for patients who do not respond to conventional treatments, offering rapid and prolonged relief. Therefore, the application of this technique in the treatment of pain associated with the shoulder joint represents a significant innovation, expanding the therapeutic possibilities and improving the quality of life of patients. Given the challenges posed by chronic shoulder pain, the incorporation of minimally invasive techniques, such as ultrasound-guided nerve blocks, should be considered as part of a multidisciplinary protocol. However, further studies are needed to evaluate the durability of the therapeutic effects, compare this technique with conventional approaches, and establish optimized protocols for different patient profiles. Controlled clinical trials are also essential to validate the efficacy and safety of this intervention, enabling its wide adoption in clinical practice and optimizing this therapeutic approach, consolidating it as an essential resource in modern clinical practice.

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