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Case study
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Application of the Suprascapular Nerve Block in the Treatment of Shoulder Pain of Different Etiology – Our Experience

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ABSTRACT

Shoulder pain is a common cause of patients' visits to the pain management clinic. Pain in the musculoskeletal system limits the patients' ability to undergo physical rehabilitation which stabilizes the shoulder girdle, increases the range of motion, and contributes to the reduction of pain. The glenohumeral joint is one of the most mobile joints in the body. It is susceptible to instability. The suprascapular nerve innervates approximately 70% of the shoulder joint. It is a mixed, both sensory and motor, nerve which arises from the upper trunk of the brachial plexus which is formed by the ventral roots of the fifth and sixth cervical spinal nerves. The suprascapular nerve block is performed in treating acute and chronic shoulder pain of different etiology. An observational retrospective study of three patients was carried out. They were monitored for three months to evaluate the efficiency and safety of performing the ultrasound-guided suprascapular nerve block using levobupivacaine along with methylprednisolone acetate adjuvant on patients with shoulder pain. The study has shown that the ultrasound-guided suprascapular nerve block is effective and safe in treating shoulder pain and that it contributes to maintaining the functionality of the musculoskeletal system.

Key words: *suprascapular block, nerve block, shoulder pain, levobupivacaine, methylprednisolone*

Introduction

Shoulder pain is a common cause of patients' visits to the pain management clinic. If it lasts longer than six months it is defined as chronic pain. Pain in the musculoskeletal system limits patients' ability to undergo physical rehabilitation which is an essential part of the treatment of patients with chronic and acute pain.

The shoulder consists of two joints. The glenohumeral joint is the main ball-and-socket joint that connects the scapula and the humerus. It is one of the most mobile joints in the body. It is susceptible to instability because it enables a wide spectrum of extension, flexion, abduction, adduction, rotation and circumduction movements. The acromioclavicular joint, a plane joint, is located at the highest point of the shoulder. This joint has limited mobility due to a strong ligament apparatus. Additional stability to the shoulder is provided by tendons and muscles of the shoulder girdle, out of which the most significant are deltoid, trapezius, and pectoral muscles, as well as the rotator cuff muscles which include the subscapularis muscle (internal rotator and adductor), supraspinatus muscle (abductor and external rotator), infraspinatus muscle (external rotator) and teres minor muscle (external rotator).

The cause of the shoulder pain is diagnosed through anamnestic data, clinical examination, radiological and neurological assessments[1]. Selection of the diagnostic imaging procedure is based on the anamnestic data regarding the cause of the shoulder pain, clinical symptoms, their duration and the patient's age. A classical radiograph is usually the first and often the only imaging procedure in the orthopedic pathology of the shoulder. Adhesive capsulitis or the "frozen shoulder" occurs due to the contraction and thickening of the glenohumeral joint capsule and the synovium. Conventional shoulder arthrography is an imaging modality of choice for both the diagnosis and

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treatment[2]. To achieve better visualization of the orthopedic pathology, computerized tomography (CT) is frequently used. Magnetic resonance imaging (MRI) is chosen when diagnosing soft tissue pathology. Ultrasonography (USG) of the shoulder joint is useful for a dynamic evaluation of the shoulder. Neurological consultation and evaluation are necessary for patients experiencing neuropathic pain if there is a suspicion of damage or dysfunction of the peripheral or central nervous system.

Treatment of shoulder pain includes pharmacological therapy, local infiltration, physical therapy and orthopedic procedures. In clinical practice it is well known that relapses are common after undergoing shoulder pain treatment. Because pain is present, patients are often unable to perform exercises during physical therapy which additionally hinders treatment since rehabilitative exercises strengthen shoulder joint muscles and improve joint stability.

Nerves in the shoulder joint that transfer the sensation of pain are the suprascapular, axillary and the lateral pectoral nerves. The suprascapular nerve provides innervation to approximately 70% of the shoulder joint. It is a mixed, both sensory and motor, nerve that arises from the upper trunk of the brachial plexus which is formed by the ventral roots of the fifth and sixth cervical spinal nerves (C5 and C6)[3]. The suprascapular nerve and its branches provide motor innervation to supraspinatus and infraspinatus muscles. The superior joint nerve branches provide sensory innervation to the coracohumeral ligament, subacromial bursa and the posterior part of the acromioclavicular joint capsule, whereas the inferior parts of the joint nerve branches provide innervation to the posterior part of the glenohumeral joint capsule.

There are two well-described techniques for blocking the suprascapular nerve[4]. The landmark-based posterior approach was described for the first time by Rovenstine and Wertheim[5] in 1941, and the second, ultrasound-guided anterior approach was described by Siegenthaler et al.[6] in 2012. The suprascapular nerve block can be performed on the posterior side of the shoulder at the suprascapular notch or via an anterior approach laterally to the supraclavicular brachial plexus. Ultrasound guidance can be used to facilitate both techniques. For performing the ultrasound-guided suprascapular nerve block a device with a high frequency (5 to 13 MHz) linear probe is used to visualize superficial structures. Pneumothorax is one of the potential complications. Using ultrasound with continuous visualization of the needle tip will reduce the risk of this complication which occurs in about 1% of procedures[7]. Intravascular application of local anesthetic is another possible complication which can result in systemic toxicity and a fatal outcome. Frequent aspiration and the visualization of local anesthetic spread are necessary to avoid this complication. There are other potential complications of the peripheral nerve blocks, including infection, nerve injury and bleeding, especially if the patient is anticoagulated. A randomised prospective study that compared the analgesic efficacy of the interscalene, suprascapular and supraclavicular nerve blocks in shoulder surgery has demonstrated an equianalgesic effect of the suprascapular and interscalene nerve blocks. Both blocks were slightly superior in comparison to the analgesic efficacy of the supraclavicular nerve block with the same opioid consumption[8]. The suprascapular nerve block is performed in treating acute and chronic shoulder pain of different etiology, such as adhesive capsulitis, rotator cuff rupture and degenerative or inflammatory glenohumeral arthritis[9-11].

The application of corticosteroids along with a local anesthetic ensures longer analgesic and anti-inflammatory effects[12]. It is also performed as a diagnostic block for suprascapular neuropathy[12]. This paper presents a series of patients with different etiology of shoulder pain treated by ultrasound-guided suprascapular nerve block. The goal was to evaluate the efficiency and safety of performing the suprascapular nerve block with 0.25% levobupivacaine and methylprednisolone acetate adjuvant, via ultrasound-guided technique, in patients with shoulder pain of different etiology.

Methods

An observational retrospective study was carried out. It included patients who consented to have the suprascapular nerve block applied at the pain management clinic after a pain syndrome relapse and after previously undergoing procedures which included medication treatment, physical therapy or acupuncture in the period between March 2023 and April 2024. After the suprascapular nerve block procedure was performed all patients were monitored for 3 months to observe the clinical effect of the block. Three patients with a different etiology of shoulder pain were observed. Two anesthesiologists alternated in performing the procedure following the same protocol and technique, and both were present while the procedure was performed along with a nurse. The patient was verbally informed during the previous examination about performing the procedure, possible complications and the intended impact of the suprascapular nerve block, thus by coming to the agreed appointment for the procedure the patient could have asked additional questions or decided to forgo the procedure. Before performing the block the patient signed the informed consent form.

After setting up the basic clinical monitoring which includes a pulse oximeter and a blood pressure monitor, the patient was moved into a upright sitting position. Before the procedure the skin was disinfected with a 2% chlorhexidine solution. Using the aseptic technique in a 10 ml syringe a solution of 0.25% levobupivacaine (a long acting amide-type local anesthetic) and 40 mg of methylprednisolone acetate (a synthetic glucocorticoid) was mixed. The second anesthesiologist and the nurse were present in order to assist during the procedure. For performing the suprascapular nerve block an ultrasound device with a high frequency (5 to 13 MHz) linear probe for visualizing superficial structures was utilized. A sterile ultrasound gel and probe cover were used. A 25-gauge Quincke-type spinal needle was used for a single-shot

nerve block. Needle was connected to an extended infusion line and flushed with a prepared solution to remove the air, which can cause artefacts if injected at the designated location. The posterior approach was used for the suprascapular nerve block at the back side of the shoulder, at the suprascapular notch. The ultrasound probe was put on the patient's shoulder blade. It provided the visualization of the trapezius and supraspinatus muscles, as well as the deeper structures, the suprascapular notch through which suprascapular artery passes and the nerve under the suprascapular ligament. The needle was inserted via an in-plane approach in relation to the probe directed medial to lateral to the suprascapular nerve. Extravascular needle position was confirmed by ultrasonic Color Doppler imaging and negative aspiration. A total volume of 7 to 10 ml of local anesthetic and glucocorticoid solution was applied.

The patients were kept under observation for 20 to 30 minutes after the procedure to monitor vital parameters and block efficacy. The block efficacy was confirmed if the pain had subsided by 50% from the initial assessment using the standard numeric rating scale (NRS). By the institution protocol, every patient had signed a consent form for the proposed procedure. The written consent for the processing of patient data was obtained after the procedure was performed with the stipulation that the identity of participants would be known only to the lead researchers and their colleagues and that the collected data would not be published outside of the research.

Results

The case study includes three patients with shoulder pain of different etiology who were treated at the pain management clinic. The intensity of pain, using standard NRS scores from 0 to 10, was recorded before the procedure, 20 minutes, 1 month and 3 months after the procedure (Table 1). All patients successfully completed physical rehabilitation. Data about the successfully completed physical rehabilitation was received from the physical medicine specialist who was responsible for carrying out the rehabilitation of each patient.

The first patient was a 60-year-old female housekeeper who came to the pain management clinic due to an acute shoulder pain that persisted for a week. The initial assessment NRS score was 9. Pain disturbed her sleep. Analgesic medication treatment with nonsteroidal anti-inflammatory drugs (NSAIDs) was started by the general medicine practitioner. On her own initiative, the patient took more medication than the prescribed maximum daily dose and complained of stomach pain. Since the prescribed therapy had inadequately managed the pain, she was referred to the pain management clinic. The patient claimed there was no previous trauma or shoulder injury. The physical examination determined limited shoulder mobility. A painful arc was present during passive arm abduction, and internal and external rotation. The patient complained about not being able to move the arm behind her back. Ultrasonography of her left shoulder and the subscapularis tendon junction, which was also the most painful location when pressure was applied, showed a cluster of calcifications (11x14 mm), and moderate degenerative changes on the tendon of the supraspinatus muscle with a smaller amount of linear calcifications, up to 4 mm in diameter, were present. At the tendon junction of the infraspinatus muscle, there was a visible calcification, 5 mm in diameter. This confirmed the diagnosis of calcific tendonitis of the shoulder. After performing the procedure, her NRS score was 3. This created the prerequisites for a successful physical therapy treatment. During the control check-up a month after the procedure, her NRS score was 2. Consultation by phone three months after the procedure revealed the same level of pain, NRS score 2. The patient was satisfied with the treatment.

The second patient was a 78-year-old retiree and a long-time patient at the pain management clinic. She was previously treated for chronic pain of the cervical and lumbosacral spine. The presence of the neuropathic pain component was evaluated by using the Pain Detect questionnaire. There are three results for evaluating the presence of neuropathic pain component on the questionnaire scale range: negative (0–12), unclear (13–18) and positive (19–38). The patient had the Pain Detect score of 16. For a month she felt intense pain in the right shoulder, NRS score was 8. She stated that the pain was not connected to a previous trauma. The patient indicated the strongest pain in the area of the supraspinous fossa. A painful arc was present during passive arm abduction, and internal and external rotation. The diagnosis was confirmed via MRI of the right shoulder. It showed tendinopathy and the

TABLE 1

INTENSITY OF PAIN BEFORE AND AFTER THE PROCEDURE

Diagnosis	NRS before	NRS 20 min	NRS 1 mo	NRS 3 mos
Calcific tendonitis	9	3	2	2
Partial rupture of the rotator cuff muscles	8	3	4	4
Radicular damage of C5-C6-C7-C8 segments	9	1	2	6

NRS - Numeric rating scale score

NRS before, NRS 20 min, NRS 1 mo, NRS 3 mos - NRS score before the procedure, NRS score 20 minutes, 1 month, and 3 months after the procedure, respectively

partial rupture of supraspinatus and infraspinatus muscles with a glenohumeral joint effusion. After performing the procedure, NRS score was 3. The patient successfully completed physical therapy. After one and three months she still reported the presence of pain, but much less intense than initially, NRS score 4. Analgesic medication treatment was continued with paracetamol 500 mg three times a day and tramdol 25 mg three times a day.

The third patient was a 46-year-old truck driver who came to the pain management clinic on the recommendation of a spine surgeon due to pain in the cervical spine that spread to the right upper extremity which occurred after falling from a truck in 2022. The patient complained of feeling pain in the form of tingling and burning. His NRS score was 9 and Pain Detect score 24. The pain was continuous and significantly diminished the patient's quality of life. The patient was already operated on in October 2019, after being diagnosed with cervicobrachial syndrome and the pain radiating to the right arm and a protrusion of the cervical intervertebral discs (levels C5-C6–C7). Ablation of the intervertebral discs C6 and C7 was performed with a decompression of the spinal cord and an anterior spondylodesis in the C6–C7 segments. Electromyoneurography (EMNG) readings of the arm pointed to a severe acute radicular damage of C5–C6 without clear signs of reinnervation, the right C7 segment with signs of reinnervative polyphasic potential, and moderately serious damage of the right C8–Th1 segment. In the neurological status of the right arm, shoulder abduction was 0/5, flexion and extension in the elbow were not present 0/5, hand grip strength was 2/5. Dermatomal paresthesia in the C6 area was present. An emergency native MRI showed the bulging of the intervertebral disc in the C5–C6 segments with the narrowing of the right neural foramen. There was a protrusion of the intervertebral disc in the C4–C5 segments paramedially on the left side, reducing the premedullary cistern and exerting mild pressure on the spinal cord. In the C6–C7 segment, which had undergone surgery, there was slight residual bulging of the intervertebral disc in the form of a disc-osteophyte complex which together with the facet and uncovertebral joints degeneration contributed to the width reduction of both neural foramens. The voluminous appearance of the right C7–C8 spinal nerve root where it exited the right neural foramen was present. The issue remained whether it was an injury at the C5 spinal cord segment level or above it or if it was a C5–C6–C7–C8 root avulsion.

The exact diagnosis was supplemented by the USG and MRI of the brachial plexus. The USG of the brachial plexus showed a postganglionic traction lesion of the brachial plexus at the level of the C6–C7 anterior roots. MRI of the brachial plexus displayed voluminous right C6 and C7 anterior roots with the continuity of trunks, divisions and cords maintained. The patient was reevaluated by a spine surgeon who examined the MRI of the cervical spine performed after the injury, and did not indicate surgical treatment. In agreement with the physical medicine specialist, it was extremely important to start physical therapy as soon as possible. After the suprascapular nerve block was performed the patient claimed a significant decrease of neck and right shoulder pain, NRS score 1. Since the chronic pain was reduced, physical therapy was successfully completed which contributed to the significant recovery of the patient. The recovery was confirmed by a neurologist during a clinical examination. In clinical status the patient was able to abduct the right arm up to 20%, flexion of the right forearm was 3/5, right-hand muscle grip strength was 5/5. EMNG results suggested a moderately severe chronic neurogenic lesion of the right C5 segment and moderately severe chronic neurogenic lesion of the right C6 and C7 segments. There was an improvement in comparison to the previous results. During the control checkup at the pain management clinic after one month pain score remained low at NRS 2. At the next control checkup 3 months after the block was performed the patient stated that the pain increased after 6 weeks and reached NRS score 6 with the prescribed medication treatment of 1 to 3 tramadol/paracetamol tablets per day when necessary and pregabalin 75 mg tablets twice per day. A council of specialists consisting of a spine surgeon, neurologist, physical medicine specialist and two anesthesiologists together with the patient, are after examining the results of the repeated MRI of the cervical spine and EMNG were considering the necessity of another surgical treatment.

After the suprascapular nerve block treatment none of the three patients reported any adverse effects.

Discussion

By presenting this series of patients with different etiology of shoulder pain we wanted to emphasize the importance of pain management as a prerequisite to successful physical therapy, which significantly contributes to faster patient recovery. Physical therapy stabilizes the shoulder girdle, increases the range of motion and contributes to the reduction of pain. Due to the presence of pain patients are often unable to begin the recommended individual physical therapy which causes a vicious circle leading to muscular atrophy, reduction of the range of motion and resulting in further increase of pain.

The first and second patient illustrate the importance of a timely and multimodal approach to pain treatment. In fact, in the first case the patient, despite the prescribed medication treatment, had still felt strong pain with gastric adverse effects of NSAIDs in the form of stomach pain. She was referred to the pain management clinic in the acute phase after she was successfully diagnosed with calcifications in the shoulder. It is important to emphasize that treatment in the early phase contributes to the better success rate of the treatment, by applying corticosteroids the anti-inflammatory effect was achieved, stopping the spread of the inflammatory process and thus making it possible for early physical therapy to be conducted.

The second case relates to a patient who was treated for several years at the pain management clinic. The long-term application of analgesics with a different mechanism of action contributed to her developing intolerance to the use of different analgesics. Moreover, every increase in the analgesic dosage would cause adverse effects due to which the patient refused to take the prescribed medicine. The regional block enabled early rehabilitation with the use of analgesics in the lowest dosage in agreement with the patient.

The regional analgesic block which was performed as a diagnostic nerve block on the third patient, who had neuropathic pain component present, proved successful due to his ability to undergo physical therapy and the improvement of the motor activity of the right arm which was objectively confirmed by EMNG results and neurologic examination. Diagnostic processing and examination confirmed radicular pain at the C5–C6 segment level. Anatomically, the suprascapular nerve arises from the upper trunk of the brachial plexus which is comprised by the ventral branches of the C5–C6 nerve roots. The block has prevented the pain pathway both distally and proximally from the block site, and the patient confirmed the reduction of tingling and pain at the C5 and C6 dermatome paravertebrally. This example emphasises the importance of pain treatment and rehabilitation in the waiting period until the final decision on the necessity of the patient's surgical treatment is made.

Conclusion

Performing regional analgesic block in pain management contributes to early rehabilitation. It can also be used in pain syndrome diagnostics. Testing its efficacy assists in a better understanding of mechanisms that cause the pain syndrome. A shorter time of inactivity stops the progression of muscular atrophy in patients and ends the vicious circle which leads to the progression of acute pain into chronic pain and the increase of chronic pain intensity. The study has shown that the ultrasound-guided suprascapular nerve block is effective and safe in treating shoulder pain and that it contributes to maintaining the functionality of the musculoskeletal system.

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PRIMJENA SUPRASKAPULARNOG BLOKA U LIJEČENJU BOLI RAMENA RAZLIČITE ETIOLOGIJE - NAŠE ISKUSTVO

S A Ž E T A K

Bol u ramenu je čest uzrok posjeta pacijenata ambulanti za liječenje boli. Bol lokomotornog sustava ograničava pacijente u provođenju fizikalne rehabilitacije, koja stabilizira rameni obruč, povećava opseg pokreta i pridonosi smanjenju boli. Glenohumeralni zglob je jedan od najpokretljivijih zglobova u tijelu. Podložan je nestabilnosti. Supraskapularni živac inervira oko 70% ramenog zgloba. Miješani je senzorni i motorni živac s ishodištem u gornjem trunkusu brahijalnog pleksusa kojeg čine cervikalni peti i šesti ventralni korijeni spinalnih živaca. Blokada supraskapularnog živca primjenjuje se za liječenje akutne i kronične boli u ramenu različite etiologije. Provedena je opservacijska, retrospektivna studija tri pacijenta koji su praćeni tijekom 3 mjeseca s ciljem evaluacije učinkovitost i sigurnosti izvođenja supraskapularnog bloka s levobupivakainom uz adjuvant metilprednizolon acetat pod kontrolom ultrazvuka kod pacijenata s boli u ramenu različite etiologije. Studija je pokazala da je supraskapularni blok vođen ultrazvukom učinkovit i siguran u liječenju boli ramena te pridonosi održavanju funkcije lokomotornog sustava.