Brazilian Journal of ANESTHESIOLOGY
Revista Brasileira de Anestesiologia

SCIENTIFIC ARTICLE

Efficacy of ultrasound guided suprascapular block in patients with chronic shoulder pain: observational, retrospective study

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Abstract

Introduction: Painful shoulder syndrome is a frequent condition among the elderly and an important cause of functional disability. As the conservative treatment is not always effective, ultrasound guided suprascapular nerve blockade presents as an important alternative treatment.

Objective: To evaluate the efficacy and safety of the use of 0.25% levobupivacaine and 40 mg of triamcinolone in the suprascapular nerve blockade in patients with chronic pain in the shoulder.

Methods: A retrospective, descriptive and analytical study of 71 patients submitted to suprascapular nerve infiltration between August 2014 and March 2017. Surveys were carried out to patients before the technique was performed, after 72 hours and at 1, 3 and 6 months. Pain intensity was assessed using a numeric pain scale (NPS).

Results: Out of the 71 patients who underwent a blockade of the suprascapular nerve, 81.2% reported a decrease in pain at 72 hours. In the first, third and sixth month, respectively, 89.8%, 76.1% and 61.8% of the patients presented pain relief. A statistically significant difference ($p < 0.001$) was verified between NPS and the 4 moments assessed after the technique. 43.7% had total pain remission (NPS = 0) at six months. Global effectiveness of suprascapular nerve blockade was 60.6% and for the subgroup of patients with rotators' cuff patology was 62.2%. No complications were reported regarding the suprascapular nerve block.

Conclusion: The results show that ultrasound-guided blockade of the suprascapular nerve using 0.25% levobupivacaine and 40 mg of triamcinolone is a safe and effective treatment in patients with chronic shoulder pain.

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Eficácia do bloqueio do nervo supraescapular guiado por ultrassom em pacientes com dor crônica no ombro: estudo observacional retrospectivo

Resumo

Introdução: A síndrome do ombro doloroso é uma condição frequente entre os idosos e uma causa importante de incapacidade funcional na população em geral. O tratamento conservador nem sempre é eficaz, pelo que o bloqueio do nervo supraescapular guiado por ecografia apresenta-se como uma opção de tratamento válida.

Objetivo: Avaliação da eficácia e segurança do uso de levobupivacaína a 0,25% e 40 mg de triancinolona no bloqueio do nervo supraescapular ecoguiado em doentes com dor crônica no ombro.

Métodos: Realizou-se um estudo retrospectivo observacional, descritivo e analítico com 71 doentes submetidos à infiltração do nervo supraescapular entre agosto de 2014 e março de 2017. Foram aplicados questionários antes da realização da técnica e após 72 horas, 1, 2 e 6 meses. A intensidade da dor foi avaliada usando a Escala de Avaliação Numérica (EAN).

Resultados: Dos 71 doentes submetidos ao bloqueio do nervo supraescapular; 81,2% referiram diminuição da dor às 72 horas. Aos primeiro, terceiro e sexto mês, respectivamente 89,8%; 76.1% e 61,8% apresentaram melhoria da dor. Verificou-se uma diferença estatisticamente significativa (*p* < 0,001), entre a EAN inicial e os 4 momentos após a realização da técnica. 43,7% dos doentes tiveram remissão total da dor (EAN = 0) aos seis meses. A eficácia global do bloqueio do nervo supraescapular foi de 60,6% e, para o subgrupo com patologia da coifa dos rotadores, de 62,2%. Nenhuma complicação do bloqueio do NSE foi registrada.

Conclusão: Este estudo mostra que o bloqueio ecoguiado do NSE usando levobupivacaína a 0,25% e 40 mg de triancinolona é um procedimento seguro e eficaz em doentes com dor crônica no ombro.

Introduction

Chronic shoulder pain is a relevant health and socioeconomic concern. It is defined as the presence of pain for a period longer than six months that has not responded to standard treatments, such as medications, physical therapy, rehabilitation, local infiltration or orthopedic procedures.

Painful shoulder syndrome is a common condition in adults and an important cause of functional loss. The prevalence is approximately 20% in the general population[1] and it affects mostly individuals over 40 years of age.[2] In general, the syndrome presents with diffuse shoulder pain and range of movement restriction.[3]

Many disorders can lead to painful shoulder, namely inflammatory process of tendons with or without calcifications, anatomic impingement processes, or bone, muscle and tendinous degenerative disorders.[4] Of these conditions, rotator cuff disorder, glenohumeral instability, osteoarthritis, acromioclavicular joint disorder and adhesive capsulitis stand out. Other common causes of shoulder pain are cervical radiculopathy and persistent shoulder pain post treatment for cervical neurologic disorders. Around 40% to 50% of patients present pain refractory to treatment or relapse after one year.[5]

The shoulder has two joints: acromioclavicular and glenohumeral. The rotator cuff is a muscle group comprised by four muscles (supraspinatus, infraspinatus, teres minor and subscapularis) that hold the humerus and scapula together at the glenohumeral joint.

Shoulder innervation is provided mainly by Suprascapular (SSN) and axillary nerves. The SSN originates at the brachial plexus superior trunk, and is largely comprised by fibers from the anterior part of the fifth and sixth cervical roots, and may have fibers from the fourth cervical root. SSN provides innervations to 70% of the shoulder area. SSN has motor rami (to the supraspinatus muscle and more distally to the infraspinatus muscle) and sensorial rami (to glenohumeral and acromioclavicular joints, subacromial bursa and coracoclavicular ligament). The axillary nerve (that innervates the teres minor muscle) and the upper and lower subscapular nerves (that innervate the subscapular muscle) originate at the brachial plexus posterior cord, and carry neural fibers that originate from C5 to C8.

As the SSN is responsible for 70% of sensorial shoulder innervations, SSN blockade is of great value for the management of chronic shoulder pain.

Suprascapular Nerve Blockade (SSNB) is a management approach that has been used for the relief of shoulder pain of several etiologies, and is used for blocking afferent and efferent autonomic and somatic neuronal transmission between the shoulder and spinal cord.[6] SSNB was first described by Wertheim and Rovenstine in 1941, although the technique was not frequently performed due to its complications, namely pneumothorax and injury to SSN and blood vessels.[7]

As technology evolved, it was possible to refine the SSNB technique. In past years, sonography has played an important role in regional anesthesia, for being an innocuous

approach (absence of ionizing radiation), low cost, without requiring contrast injection, and enabling accurate and real-time direct imaging of the anatomic site to be blocked. In 2007, Harmon and Hearty reported the ultrasound-guided SSNB technique, enhancing SSNB safety and efficacy.[8]

SSNB has been observed to be an excellent therapy tool, not only for its analgesic efficacy, but also for its enhanced safety.[9] Using corticoid in this technique enables longer relief of pain and inflammation.[10] SSNB has been performed for several disorders that prompt neuropathic and/or nociceptive shoulder pain, such as adhesive capsulitis, arthritis, arthroses, rheumatologic disorders, trauma, post-operative pain, neoplasm and pain after stroke with hemiplegic complications.[11]

Although the majority of studies report that blockades have satisfactory efficacy for pain management, the studies have the chief limitation of assessing small samples. The specific limitation regarding chronic shoulder pain is particularly heightened by the scarcity of studies, and it is not possible to find a systematic analysis of clinical results in the literature.

The main objective of the present study was to assess ultrasound guided SSNB efficacy using 0.25% levobupivacaine and 40 mg of triamcinolone for patients with chronic shoulder pain.

Methods

Study design and patient recruitment

An observational and retrospective study was performed, including all patients followed up at the Chronic Pain Unit of an Anesthesiology Department to be submitted to ultrasound guided SSNB between August 2014 and March 2017. No patients were excluded from the study, totaling the inclusion of 71 patients.

Two anesthesiologists of the department performed ultrasound guided SSNB in all patients, following the same technique and protocol. In the study all participants were followed up for six months after the blockade to assess their clinical progression.

Protocol used

After preparation of all material to be used in the technique, skin was prepared with povidone iodine solution and sterile drapes. With the patient sitting, the ultrasound (US) probe was placed parallel to the spine of the scapula and adjusted craniocaudally towards the internal portion of the coracoid apophysis, aiming to visualize the floor of the fossa, notch and suprascapular ligament. A 22 G needle was inserted using a US-guided in-plane approach in the mid-lateral direction, and approximately 3 mL of 0.25% levobupivacaine and 40 mg of triamcinolone were injected surrounding the suprascapular nerve. Additionally, trapezius and supraspinatus muscle fasciae were instilled with 4 mL of 0.25% levobupivacaine.

Data collection

Comprehensive data on clinical conditions (electronic or hard copy), namely age, sex, sociodemographic class, etiology of the painful syndrome, presence/absence of abnormalities on physical examination and imaging, previous shoulder surgeries, pain medications in use, pain description and intensity, complications and adverse effects due to the technique performed were collected. Assessment of patients was performed at several points in time: via questionnaires answered before the nerve blockade, telephone call 72 hours after blockade, and by assessment of records of the clinical conditions during pain consultation/telephone call during the first, third and sixth months.

Statistical analysis

Descriptive statistics are presented in absolute (n) and relative (%) frequencies for qualitative variables, while median, Interquartile Range (IQR) and minimum and maximum values [Mean (M) and Standard Deviation (σ)] for quantitative variables. Variable normality was tested by Kolmogorov-Smirnov, values for asymmetry and kurtosis (-1; 1) and histograms. We observed that data relating to pain intensity represented by numeric pain scale (NPS) did not show normal distribution during the several assessment times, thus non parametric statistics were used. We used Friedmanś test followed by Wilcoxonś test, with Bonferroni correction to establish differences in NPS along the several assessment times. To compare opioid consumption among the three assessment times, taking into account they were qualitative dichotomic variables, Q-Cochcran test was used followed by three Mc Nemarś tests with Bonferroni correction. We considered statistically significant values of $p < 0.05$. All statistical analyses were performed using IBM SPSS Statistics 23 (SPSS Inc., Chicago, IL, USA).

Ethics committee and informed consent

The study was approved by the Universidade do Minho Ethics Subcommittee and by the Hospital de Braga Health Ethics Committee. Informed consent was obtained from all study participants. The authors kept anonymity and confidentiality of all participants.

Results

The study included 71 patients with a mean age of 60 years, 58 of which were women (81.7%). Characteristics of participantsśocial and clinical conditions and pain syndrome etiology are shown in Table 1.

Table 2 depicts the progress of pain intensity over the several times of assessment. At the sixth month after SSNB, 31 participants (43.7%) presented NPS = 0 and 16 (22.5%), NPS ≥ 7.

Of the 31 patients achieving complete pain remission, 17 had rotator cuff disorder; four, glenohumeral instability; and ten, painful shoulder syndrome from undetermined cause, corresponding to 45.9%, 100% and 33.3% of cases, respectively, in complete pain remission.

Table 1 Social, clinical characteristics, pathology and etiology of painful syndrome patients.

Variables	n	%
Number of patients	71	
Age	60.4 ± 1.4	
Women	58	81.7
Profession		
Retired		32.4
Blue-collar, handicraft and similar workers		24.2
Non-skilled workers		13.6
Services and sales		10.6
Altered physical exam (Yes)	70	98.6
Altered imaging (Yes)	46	64.8
Previous shoulder surgery (Yes)	7	7.00
Cause of pain		
Rotator cuff	37	52.1
Non-specific cause	30	42.2
Glenohumeral instability	4	5.7
Characteristics of pain		
Nociceptive	48	67.6
Neuropathic	6	8.5
Mixed	17	23.9
Adverse effects of SSNB, vagal reaction	3	4.2

Table 2 Development of pain intensity at the different times of assessment.

Time of assessment	NPS = 0 (%)	NPS ≥ 7 (%)
Pre-SSNB	0 (0%)	38 (53.5%)
72 hours after SSNB	13 (18.3%)	8 (11.3%)
30 days after SSNB	30 (42.3%)	6 (8.5%)
3 months after SSNB	34 (47.9%)	9 (12.7%)
6 months after SSNB	31 (43.7%)	16 (22.5%)

We observed a reduction in the percentage of patients presenting with severe initial pain (NPS ≥ 7) from 53.5% to 11.3%, 72 hours after SSNB. This percentage decreased to 8.5% at the end of the first month, when we registered the lowest number of patients with severe pain. Regarding complete pain relief (NPS = 0), we observed 18.3% at 72 hours, and 42.3% at the first month. The maximum peak of complete pain relief was registered at the third month, when 47.9% of participants referred no pain. At the sixth month, 43.7% of participants did not refer pain symptoms.

Table 3 shows a descriptive assessment with absolute numbers and percentages of patients referring change in the NPS in the five times of assessment. Table 3 allows considering the number of lost participants to follow-up: two at 72 hours post SSBN, two at the first month, five at the third, and four at the sixth month after SSNB.

In absolute terms, the results show that the initial pain referred by patients before SSNB was higher (statistically significant) than the pain referred at the four post SSNB assessment times (p < 0.001). When comparing the pain registered 72 hours after SSNB, with the first and third months after SSNB, we observed a statistically significant improvement in pain control (p < 0.001 and p = 0.013, respectively).

Table 3 Descriptive analysis of NPS at different times.

		n	%
Initial NPS – 72 h NPS	Decreased NPS	56	81.2
	Increased NPS	4	5.8
	Stable NPS	9	13.0
	n	69	
Initial NPS – 1st month NPS	Decreased NPS	62	89.8
	Increased NPS	2	2.9
	Stable NPS	5	7.3
	n	69	
Initial NPS – 3rd month NPS	Decreased NPS	51	76.1
	Increased NPS	1	1.5
	Stable NPS	15	22.4
	n	67	
Initial NPS – 6th month NPS	Decreased NPS	42	61.8
	Increased NPS	4	5.9
	Stable NPS	22	32.3
	n	68	
72 h NPS – 1st month NPS	Decreased NPS	37	54.4
	Increased NPS	14	20.6
	Stable NPS	17	25.0
	n	68	
72 h NPS – 3rd month NPS	Decreased NPS	34	50.7
	Increased NPS	13	19.4
	Stable NPS	20	29.9
	n	67	
72 h NPS – 6th month NPS	Decreased NPS	29	42.7
	Increased NPS	20	29.4
	Stable NPS	19	27.9
	n	68	
1st month NPS – 3rd month NPS	Decreased NPS	17	25.8
	Increased NPS	19	28.8
	Stable NPS	30	45.4
	n	66	
1st month NPS – 6th month NPS	Decreased NPS	16	23.9
	Increased NPS	27	40.3
	Stable NPS	24	35.8
	n	67	
3rd month NPS – 6th month NPS	Decreased NPS	4	6.0
	Increased NPS	15	23.4
	Stable NPS	48	71.6
	n	67	

However, at the end of the six months, pain recorded was not statistically different from the pain referred 72 hours post SSNB. There was a statistically significant increase in pain between the first and the sixth month (p = 0.010), as well as between the third and the sixth month (p = 0.012). After the first and the third months we did not find a statistically significant difference for the pain referred by participants.

To facilitate the understanding of pain fluctuations after SSNB, we present the values of NPS registered by time period on Table 4 and Fig. 1.

Considering SSNB as an efficacious blockade that decreases NPS ≥ 30% during a period of three months or more, we observed a SSNB efficacy of 60.6% (33.8% non-efficacious and 5.6% of participants without the follow-up required to assess efficacy).

Table 4 Behavior of Pain at the five study times. Analysis of median, mean, standard deviation and IQR.

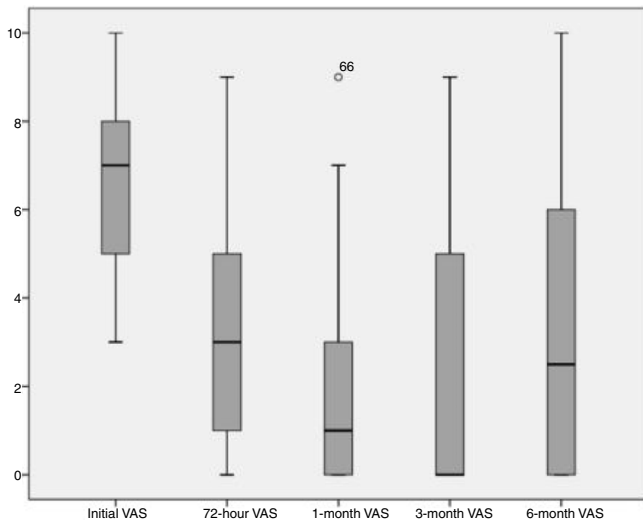| Moment assessed	Median (Med)	Mean (x)	Standard deviation (O')	IQR: minimum–maximum
Initial NPS	7.0	6.58	± 0.200	3:3–10
72 hour NPS	4.0	3.33	± 0.287	4:0–9
1st month NPS	1.0	2.07	± 0.296	3:0–7
3rd month NPS	0.0	2.51	± 0.351	5:0–9
6th month NPS	2.5	3.18	± 0.399	6:0–10

Figure 1 Behavior of Pain at the five assessment times. Assessment of Med, IQR, maximum and minimum.

Table 5 Efficacy of SSNB, considering as efficacious ≥ 30% reduction in NPS during a period ≥ 3 months.

Efficacy of blockade	n	%
Efficacious SSNB	43	60.6
Non-efficacious SSNB	24	33.8
Patients without required follow-up	4	5.6

The group of patients with rotator cuff disorder diagnosis showed similar results for NPS after SSNB: statistically significant pain relief at 72 hours, one month, three and six months. SSNB efficacy (reduction in NPS ≥ 30%) during a period longer than three months or more was 62.2% (29.7% non-efficacious, and 8.1% of patients without the follow-up required to assess efficacy).

After SSNB, patients' medication was adjusted according to their needs. Table 5 summarizes the changes in opioid

Table 7 Efficacy of SSNB in patients with rotator-cuff, considering as efficacious ≥ 30% reduction in NPS during a period of ≥ 3 months.

Efficacy of blockade	n	%
Efficacious SSNB	23	62.2
Non-efficacious SSNB	11	29.7
Patients without required follow-up	3	8.1

medication of patients. We observed statistically significant differences in the proportion of patients using opioid medications at the different times of assessment (p < 0.001).

Discussion

Chronic shoulder pain is a common reason for medical consultation and causes significant functional impairment to the upper limb.[3] Conventional treatment with physical therapy and oral medication often does not provide pain relief and functional recovery.[12] Besides, oral medication, even in low doses, is frequently not well tolerated by many patients and, when over used, among other effects, can often lead to gastrointestinal complaints.[13] Thus, SSNB can be a noteworthy alternative to conventional management of shoulder pain.[14]

In the past, nerve blockades were performed without imaging support, limiting the accuracy and efficacy of the technique, with greater incidence of adverse effects. Currently, advances in imaging, particularly Ultrasonography, allow real-time identification of anatomic structures with 95% to 100% accuracy, enabling efficacious and safe invasive approaches.[15,16] In the present study we observed that ultrasound-guided SSNB proved to be extremely safe, as no adverse effect was registered, except for three patients that presented transitory vasovagal response followed by immediate resolution.

Several studies have aimed to assess SSNB efficacy in comparison to other treatment techniques (Tables 6–8).

Table 6 Behavior of pain in patients with rotator-cuff etiology shoulder pain. Analysis of median, mean, standard deviation and IQR.

Moment assessed	Median (Med)	Mean (x)	Standard Deviation (O')	IQR: minimum–maximum
Initial NPS	6.0	6.30	± 0.276	3:3–9
72 hour NPS	3.0	3.19	± 0.390	4:0–7
1st month NPS	1.0	1.78	± 0.401	3:0–7
3rd month NPS	0.0	2.20	± 0.452	5:0–7
6th month NPS	1.0	2.85	± 0.492	5:0–8

Table 8 Development of opioid use at the different times of assessment.

Time of assessment	n	%
Pre-SSNB	66	93.0
1–3 months after SSNB	56	78.9
6 months after SSNB	45	63.4

Taskaynatan et al. (2005) compared the efficacy of corticoid injection (in bursa subacromial and bicipital groove) with lidocaine SSNB in 60 patients presenting chronic shoulder pain of undetermined etiology. Both approaches presented equal efficacy for pain decrease; however, there were no SSNB-related complications, while corticoid injection was associated with increase in anterior shoulder pain in three to four patients in the initial days. Due to the adverse effects of corticotherapy, the authors concluded that although both approaches were efficacious, SSNB was preferable for the management of shoulder pain of undetermined etiology.[17]

In a randomized controlled trial, Kiliç et al. (2015) studied the benefit of associating SSNB with physical therapy in 41 patients presenting adhesive capsulitis. The authors concluded that SSNB is a safe well-tolerated technique and provides a clear benefit for patients as it reduces pain level and improves functional capacity when the technique is associated with a rehabilitation program with physical therapy.[18]

Picelli et al. (2017) also obtained encouraging results when studying the SSNB effect in ten patients presenting chronic shoulder pain of hemiplegic etiology. No adverse effects associated with SSNB were found and there was clear improvement in the pain referred by patients along the month-long assessments.[9]

The results of the present study have confirmed results in the literature, as we found statistically significant improvement in the pain perceived by patients in the different assessment times when compared to the pain described by them before SSNB. The absence of complications or adverse effects reported in our study agrees with previous published studies.

Previously to SSNB almost all patients (93%) were medicated with opioids. After SSNB, a statistically significant reduction in opioid consumption could be observed, showing the intensity of pain relief experienced by patients and also the improvement in their quality of life, as they were less exposed to opioid side effects.[19]

Our study is retrospective and this is the major study limitation, resulting in sampling errors and in non-representation of the population. The reduced sample size, derived from the short duration of the study, also contributed.

The functional impairment of patients previous to SSNB could not be considered in this study due to the scarcity of clinical documentation regarding the matter.

The presence of co-morbidities, such as fibromyalgia or psychiatric disorder, or the fact that participants had been already submitted to shoulder surgical procedures may also have affected the results, and more detailed studies are required to assess the effect of SSNB in these patients. It is noteworthy that in the present study all patients who required surgical procedures were submitted to surgery previously to SSNB.

The great heterogeneity of etiology of shoulder pain without observing the same efficacy of response to SSNB in our study should be highlighted. Although the group of patients with glenohumeral instability showed 100% pain remission rate, possibly indicating a potential group particularly responsive to SSNB, the reduced number of patients in this group does not permit inference of conclusions. However, a prospective randomized study using SSNB in patients presenting chronic shoulder pain with glenohumeral instability can test the efficacy of this treatment approach in this particular population.

The population of patients diagnosed with rotator cuff disorder that showed complete pain remission six months after SSNB was 45.9%. As rotator cuff tendinopathy is the most common etiology of shoulder pain with a prevalence in the general population that can reach 30%,[20] SSNB in this group of individuals can represent a symptomatic relief for millions of individuals with this syndrome. Future prospective randomized studies on the use of SSNB in this population may attest the pain improvement for these patients. As further studies for this group of patients, it would be interesting to assess what implications symptomatic improvement triggered by SSNB would have on the rehabilitation of patients presenting rotator cuff tendinopathy, as a consequence of improved patient collaboration in their physical rehabilitation.

Conclusions

Our results show an evident benefit of using 0.25% levobupivacaine and 40 mg of triamcinolone in SSNB for patients with chronic pain, refractory to physical therapy and oral medication therapy. SSNB, for its efficacy in providing pain relief for painful shoulder syndrome and for the excellent safety profile demonstrated, can be a satisfactory treatment option when conservative treatment is not efficacious.

Given there are scarce published studies on the subject, further prospective studies, with large samples and standardized protocols are essential for validating the results described in the present study.

Conflicts of interest

The study was performed without commercial, monetary or other interests that could prevent it.

Acknowledgements

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