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Kronik Omuz Ağrısında Ultrason Eşliğinde Derin Supraspinatus Kas Düzlemi Bloğu: Tek Merkezli Retrospektif Gözlemsel Çalışma

Ultrasound Guided Deep Supraspinatus Muscle Plane Block for Chronic Shoulder Pain: A Single-Center Retrospective Observational Study

Halil Cihan Köse[1], Ömer Taylan Akkaya[2]

[1]Kocaeli Şehir Hastanesi, Algoloji Kliniği, Kocaeli, Türkiye.
[2]Ankara Etlik Şehir Hastanesi, Ağrı Kliniği, Ankara, Türkiye.

ÖZ

Giriş: Kronik omuz ağrısı, günlük yaşam aktivitelerini ve psikolojik durumu etkileyebilen yaygın bir durumdur. Ultrason (US) kılavuzluğunda derin supraspinatus kas plan bloğu (DSKPB), akut ve kronik omuz ağrısı için kullanılan ve yeni tanımlanmış bir plan bloğudur. Bu çalışmanın amacı rotator manşet patolojisine bağlı kronik omuz ağrısında US eşliğinde DSKPB'nin etkinliğini araştırmaktı.

Yöntem: Bu çalışma retrospektif gözlemsel bir çalışma olarak tasarlanmıştır. Rotator manşet patolojisine bağlı kronik omuz ağrısı olan toplam 40 hasta çalışmaya dahil edildi. Hastalara US eşliğinde DSMPB verildi. Birincil sonuç olarak ağrı yoğunluğu, tedavi öncesinde, müdahaleden hemen sonra, 4. ve 12. haftalarda bir vizüel analog skala (VAS) skoru kullanılarak değerlendirildi. Kısa form-36, omuz ağrısı ve sakatlık indeksi, ağrı kesici ilaç tüketimi, hasta memnuniyeti ve komplikasyonlar da kaydedildi.

Bulgular: Ortalama VAS skorlarında tedaviden hemen sonra, 4. ve 12. haftalarda başlangıca kıyasla istatistiksel olarak anlamlı bir düşüş vardı ($p < 0.001$). Hastalar, tedaviden 12 hafta sonrasına kadar fonksiyonel yetersizlik, hasta memnuniyeti ve yaşam kalitesinde anlamlı iyileşme yaşadılar ($p < 0.001$). Takip süresi boyunca hastaların ağrı kesici tüketiminde istatistiksel olarak anlamlı bir azalma gözlendi ($p < 0.001$).

Sonuç: Rotator manşon patolojisine bağlı kronik omuz ağrısı olan hastalarda US eşliğinde DSKPB alternatif bir tedavi yöntemi olabilir. Ağrı skorlarında, fonksiyonel yetersizliklerde ve yaşam kalitesinde iyileşme sağlar ve ağrı kesici ilaç tüketimini azaltır.

Anahtar Kelimeler: kronik ağrı, derin supraspinatus kas plan bloğu, ultrason, vizüel analog skala, rotator manşet patolojisi, omuz ağrısı

ABSTRACT

Objective: Chronic shoulder pain is a common condition that may affect daily living activities and psychological status. Ultrasound (US)-guided deep supraspinatus muscle plane block (DSMPB) is a recently defined plane block and used for acute and chronic shoulder pain. The aim of this study was to investigate the effectiveness of US-guided DSMPB for chronic shoulder pain due to rotator cuff pathology.

Method: This study was designed as a retrospective observational study. A total of 40 patients with chronic shoulder pain due to rotator cuff pathology were included. The patients received US-guided DSMPB. The pain intensity as a primary outcome was assessed using a visual analogue scale (VAS) score at pretreatment, immediately after the intervention, at weeks 4 and 12. The short form-36, shoulder pain and disability index, pain medication consumption, patient satisfaction and complications were also recorded.

Results: There was a statistically significant decrease in average VAS scores immediately after treatment, at week 4 and 12 compared to the baseline ($p < 0.001$). Patients experienced significant improvement in functional disability, patient satisfaction and quality of life up to 12 weeks after the treatment ($p < 0.001$). Throughout the duration of the follow-up period, there was a statistically significant decrease observed in pain medication consumption among the patients ($p < 0.001$).

Conclusion: The US-guided DSMPB could be an alternative treatment modality in patients with chronic shoulder pain due to rotator cuff pathology. It provides improvement in pain scores, functional disability and quality of life and decreases pain medication consumption.

Keywords: chronic pain, deep supraspinatus muscle plane block, ultrasound, visual analogue scale, rotator cuff pathology, shoulder pain

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Correspondence: Uzm. Dr. Halil Cihan Köse, Kocaeli Şehir Hastanesi, Algoloji Kliniği, Kocaeli, Türkiye **E-mail:** halilcihankose@hotmail.com

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INTRODUCTION

Chronic shoulder pain is a multifactorial condition characterized by changes in the joint, including degeneration of the joint capsule and muscle-tendon structures (1). Despite pain and loss of function being the dominant clinical symptoms, it poses a significant personal and socioeconomic burden. Due to the synergistic impact of aging and the escalating rates of obesity, the incidence of chronic shoulder pain is on the rise, exhibiting an overarching prevalence within the range of 18–26% (2).

The management of chronic shoulder pain focuses on symptom control, including pain relief and functional improvement. The treatment approach consists of a step-by-step, individualized, and multimodal strategy that needs to be tailored to the presenting patient. This approach includes interventions such as weight loss if overweight or obese, exercise, physical therapy, self-management and education, oral medications, and local treatments such as corticosteroid injections into the affected joint (3). While conservative treatment is generally effective, the potential side effects of oral drugs such as nonsteroidal anti-inflammatories, as well as the temporary efficacy of intra-articular injections, suggests the necessity for treatment options with extended-term effectiveness (4). Moreover, after repetitive intra articular treatment with steroids, an increased risk of adverse joint manifestations and accelerated OA progression was shown (5).

The sensory innervation of the shoulder joint is provided by the suprascapular nerve, axillary nerve, lateral pectoral nerve, long thoracic nerve and lower subscapular nerve . In the treatment of shoulder pain, interscalene block, brachial plexus blocks, suprascapular nerve block, and axillary nerve block are effective methods. However, unwanted complications of these mentioned blocks include motor weakness, recurrent laryngeal nerve block, and hemidiaphragmatic paralysis (6,7).

The growing utilization of ultrasound technology within the domain of pain medicine has led to heightened popularity in the adoption of recently defined fascial plane blocks. Deep supraspinatus muscle plane block (DSMPB) is an interfascial plane block which we recently defined and showed successful application of the intervention in shoulder tendonitis (8,9). Since then, several case reports have been reported describing the efficacy of DSMPB for a wide range of indications, such as post-laparoscopic shoulder pain and post-operative pain for shoulder surgery (10,11). Moreover, a cadaveric study has been performed to evaluate the spread of injectate (12). The US-guided DSMPB involves the injection of the drug solution into the space situated between the supraspinatus muscle and the posterior aspect of the scapula (8). DSMPB is a safe and volume-based block method which results in blockade of the suprascapular nerve branches by leveraging the foundational principles inherent to interfascial plane blocks.

The first objective of this retrospective trial was to evaluate the efficacy of DSMPB on pain intensity in patients with chronic shoulder pain unresponsive to conservative treatment modalities. Changes in quality of life, functional disability, pain medication consumption and patient satisfaction comprised secondary outcomes.

MATERIALS AND METHODS

This retrospective study received institutional review board approval (Ethics Committee of the Etlik City Hospital, number: 2023/418). The research included 40 patients experiencing shoulder pain persisting for a minimum of 3 months, or those with identified rotator cuff injuries based on shoulder ultrasonography. All patients had exhausted conservative therapies including oral analgesics and physical therapy. The study encompassed patients aged 18 to 65, who were treated at our pain clinic from January 2022 to January 2023. Exclusions encompassed patients with inflammatory arthritis, active synovitis in the joints, active systemic or local shoulder infections, prior shoulder surgery, intra articular injection in the past 3 months, history of trauma in the last 6 months, history of bupivacaine or dexamethasone allergy, shoulder-referred pain, pregnancy, neuro/psychiatric disorders, decline to participate, bleeding tendencies, or severe musculoskeletal impairment. The design and methodology of the study are illustrated in Figure 1.

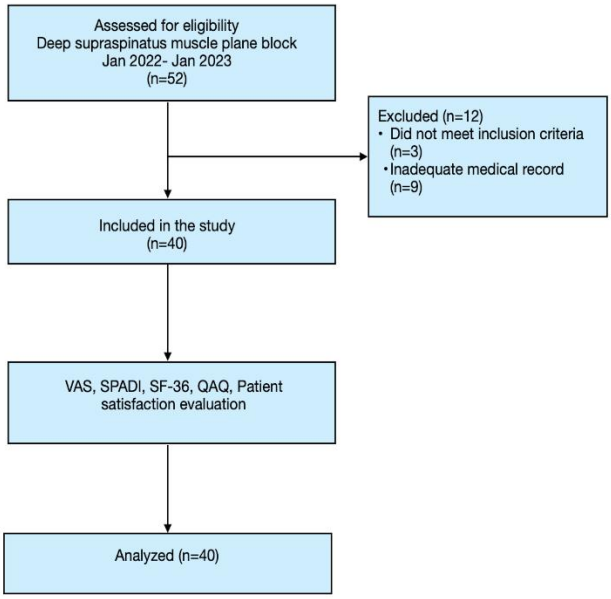

Figure 1: Flow diagram of study

Deep Supraspinatus Muscle Plane Block: The patient was positioned in a seated posture, with their left hand on the opposite shoulder. Following the cleansing of the skin, a linear ultrasound probe (Lociq, GE Healthcare, Chalfont St. Giles, Bucks, UK) was positioned on the scapula, oriented in the transverse plane. Subsequently, the transducer was moved caudally to locate the trapezius and supraspinatus muscles. By utilizing an out-of-plane technique, a 22-gauge, 80 mm needle was carefully inserted until the lateral side of the supraspinous fossa was contacted (Figure 2). After negative aspiration, a drug solution comprising 10 ml of local anesthetic (0.25% bupivacaine) and a corticosteroid (8 mg dexamethasone) was injected. It was observed that the local anesthetic diffused mediolaterally beneath the supraspinatus muscle.

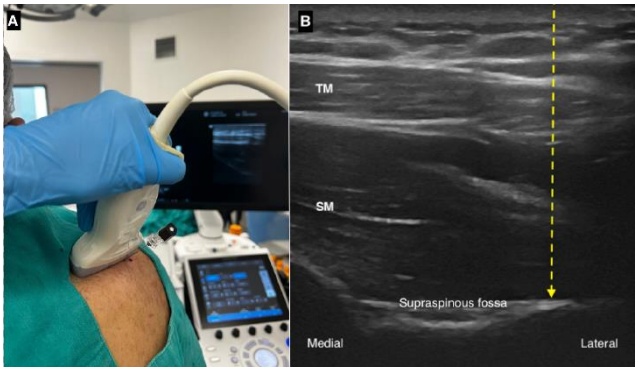

Figure 2: A) The positioning of the linear ultrasound transducer B) Sonoanatomy view of the deep supraspinatus muscle plane block. (TM: trapezius muscle, SM: suprascapular muscle. Yellow dashed arrow indicates needle.)

Follow up Measurements: Demographic data included age, gender, and body mass index. The assessment of the patients encompassed pain intensity, range of motion, functional impairment, patient satisfaction and the occurrence of complications. The patients' evaluations occured four times: at baseline, just after the procedure, and at 4 and 12 week intervals.

A blinded physician evaluated the maximum pain intensity experienced during motion and rest. This assessment was performed using the standard 100 mm visual analog scale (VAS), with scores ranging from 0 (indicating no pain) to 100 (representing the most severe conceivable pain) (13). The evaluations were conducted at the beginning, immediately after the intervention, and at the 4 and 12-weeks.

The Shoulder Pain and Disability Index (SPADI) is a self-report questionnaire utilized for evaluating pain and disability linked to shoulder conditions. Comprising 13 items, participants gauge the impact of shoulder functionality through two subscales: pain (consisting of 5 items) and disability (comprising 8 items). The pain scale yields scores ranging from 0 to 50, the disability scale from 0 to 80, and the total scale from 0 to 130. An upward trending score indicates escalating levels of pain or disability (14).

The assessment of quality of life (QoL) was conducted through the SF-36 questionnaire (15). Additionally, the questionnaire provides 2 summary scores, the Physical Component Summary (PSC) and the Mental Component Summary (MSC). Subscale scores on the SF-36 range from 0 to 100, where 100 signifies the highest level of QoL, and 0 represents the lowest. PC and the MCS scores of the SF-36 were assessed both prior to treatment and at the 12-weeks post-treatment.

The quantitative analgesic questionnaire (QAQ) was employed to assess chronic medication use as reported by the patients and to monitor alterations in medication usage over the duration of the follow-up period (16). Modifications in overall satisfaction levels were appraised through a 5-point Likert scale, ranging from 1 (very dissatisfied) to 5 (very satisfied) (17).

Statistical Analysis: IBM SPSS Statistics version 23 was utilized for the statistical analysis (IBM Corporation, Armonk, NY). Continuous quantitative data exhibiting a normal distribution were displayed as counts, mean ± standard deviation, while those with non-normal distribution were represented as median (interquartile range). The normal distribution of the gathered data was evaluated through the Kolmogorov-Smirnov test. To statistically analyze repeated measurements of parametric data, the paired sample test was employed. In cases of variables with non-parametric distribution, the intragroup distribution was assessed using Friedman's test. In the event of their presence, within-group comparisons of the difference were examined utilizing the Bonferroni-adjusted Wilcoxon signed ranks test for post hoc analysis. A significance level of $P < 0.05$ was regarded as statistically significant.

RESULTS

A total of 40 patients, including 23 (57.5%) females and 17 (42.5%) males with a mean age of 41.82 ± 10.64 years, were enrolled. The demographic data of the subjects were presented in Table 1. Regarding the assessment of the side of the procedure, blocks were performed at the right shoulder in 21 patients, while blocks were conducted at the left shoulder in 19 patients. The diagnosis of the patients were impingement syndrome, subacromial bursitis, partial tears of the supraspinatus tendon and supraspinatus tendinopathy. Notably, no adverse events were reported among any of the patients.

Table 1. Demographic Characteristics of the Patients

Age	41.82 ± 10.64
Gender (F/M)	23 (57.5%) /17 (42.5%)
Body mass index (kg/m^2)	25.56 ± 2.93
Affected body side (Left/Right; n)	19 (47.5%) /21 (52.5%)
Symptom duration (years)	12.8 ± 3.92
Diagnosis	
Impingement syndrome	4 (10%)
Subacromial bursitis	9 (22.5%)
Partial tears of the supraspinatus tendon	14 (35%)
Supraspinatus tendinopathy	13 (32.5%)
Values are presented as numbers (%) or mean ± standard deviation.	

Statistically significant differences in the VAS scores of the patients were identified ($p < 0.001$). When comparing binary time points to discern the origin of the variance in VAS scores, notable statistical significance was observed at the time points immediately after treatment, as well as at weeks 1, 4, and 12 in comparison to the baseline VAS ($p < 0.001$) (Table 2). Following DSMPB, the mean PCS of SF-36 progressed from 28.63 ± 12.65 to 52.18 ± 13.35 at 12-weeks. Similarly, for the MCS of SF-36, the average score rose from 46.53 ± 14.71 to 58.34 ± 11.27 after 12 weeks. An evident statistically significant decrease in mean SPADI scores was observed during the follow-up ($p < 0.001$). Notably, 42.5% of patients expressed being very satisfied with the procedure, 35% were satisfied. Changes in PCS and MCS scores of SF-36, QAQ, as well as SPADI scores are summarized in Table 3.

Table 2. Summary of Pain Scores				
VAS Score	At rest	p	During movement	p
Pretreatment	5.60 ± 1.12		7.27 ± 1.15	
Immediately after treatment	0.92 ± 0.79	<0.001	2.22 ± 0.83	<0.001
4 weeks	1.50 ± 1.03	<0.001	2.62 ± 0.77	<0.001
12 weeks	1.77 ± 1.20	<0.001	3.07 ± 1.04	<0.001
Values are presented as numbers or mean ± standard deviation. P values comparing VAS between pretreatment vs. immediately after treatment, 4, 12 weeks. Statistically significant at the p < 0.05 level. VAS: visual analog scale.				

Table 3. SF-36, SPADI, QAQ Scores and Patient Satisfaction			
	Pretreatment	4 weeks	12 weeks
SF-36			
MCS	46.53 ± 14.71	55.83 ± 14.81*	58.34 ± 11.27*
PCS	28.63 ± 12.65	50.52 ± 12.42*	52.18 ± 13.35*
SPADI			
Disability	57.40 ± 18.93	35.46 ± 12.31*	30.62 ± 11.25*
Pain	55.85 ± 15.32	37.20 ± 18.49*	21.56 ± 11.05*
Total	56.80 ± 13.93	36.13 ± 11.68*	32.11 ± 10.64*
QAQ			
	2.35 ± 0.92	1.50 ± 0.55*	1.60 ± 0.59*
Patient Satisfaction			
			4 (3-5)
Data are expressed as means ± standard deviations, median (min-max) MCS, mental component summary score of the Short Form-36 health survey (SF-36); PCS, physical component summary score of the SF-36, SPADI: Shoulder Pain and Disability Index, QAQ: Quantitative analgesic questionnaire. (*) P <0.05 compared with baseline values in each group. P < 0.05 is considered statistically significant.			

DISCUSSION

Chronic shoulder pain is one of the most common causes of musculoskeletal pain and may affect a patient's daily life activities and work ability. In this study, we evaluated the clinical effect of US-guided DSMPB in patients with chronic shoulder pain unresponsive to conservative treatment modalities including oral analgesics and physical therapy. The results of the study showed that the severity of pain was significantly reduced for a 12-week follow-up period after US-guided DSMPB procedure. Also, the finding of the study demonstrated that DSMPB improves the quality of life, functional disability, pain medication consumption and patient satisfaction.

Interfascial plane blocks have gained traction within clinical practice, specifically within the realm of chronic pain management. Recently, we have described a novel interfascial plane block, US-guided DSMPB, which involves the injection of medications into the plane between the supraspinatus muscles and the posterior scapula (8). In another radiological study, we have investigated the spread of the injectate after DSMPB using a radiocontrast agent with computer tomography images. In this study, the images revealed significant dispersion of radiocontrast throughout the complete supraspinous fossa with partial dispersion into the infraspinatus fossa. Additionally, contrast agent was observed at the suprascapular notch with subsequent diffusion towards the anterior aspect of the scapula, coracoid process, and the surrounding vicinity of the acromioclavicular joint (9). Since then, several case reports have reported the successful application of DSMPB in acute and chronic shoulder pain (10,11). Recently, Altiparmak et al. performed a cadaveric study investigating the spread of injectate using 20 ml of 0.25% methylene blue in DSMPB. They found that the dye had spread densely in the supraspinous fossa region and around the suprascapular nerve. There was also dye visualized on both the anterior and posterior sides of the supraspinatus muscles and on the spinae scapula (12).

What clearly captures the attention of physicians is the exploration of the mechanism of action in plane blocks and their impact on the outcomes of treatments. Our results showed that the utilization of US-guided DSMPB led to a notable reduction in pain and notable improvements in functional outcomes in patients suffering from persistent shoulder pain that had previously not responded to conventional conservative therapeutic approaches. These positive outcomes persisted for a duration of 12 weeks following a single block. Analgesia is predominantly accomplished through the diffusion of the local anesthetic to the somatic nerve endings that are responsible for nociception. The administration of local anesthetics carries the potential to mitigate peripheral sensitization by impacting nociceptors in the interfascial space (18). Subsequently, these agents can either disseminate outwards from the plane into adjacent muscular and tissue compartments via processes like diffusion or bulk flow. Such interventions hold the capacity to modify pain sensitivity, thereby interrupting the pain cycle, fostering the normalization of muscular function, and ultimately reducing pain perception (19). Injections involving local anesthetics and/or corticosteroids have demonstrated efficacy in addressing chronic pain and are progressively gaining traction in the landscape of chronic pain management. An augmenting hypothesis posits a synergistic interplay between these two therapeutic agents. Corticosteroid injections have long held recognition within the sphere of chronic pain management, owing to their potential to provide pain relief by anti-inflammatory mechanisms, quelling of ectopic discharges, and modulation of conduction in nerve structures (20).

At the end of our study, patients with chronic shoulder pain due to the rotator cuff pathology experienced improvement in terms of pain intensity and quality of life after DSMPB. Moreover, our results have shown that improvement was observed in functional status. Similarly to our results, two randomized control trials investigating the effectiveness of suprascapular nerve block for chronic shoulder pain showed that suprascapular nerve block provides pain relief and functional improvement for 12 weeks (21,22). Additionally, several studies have demonstrated the efficacy of suprascapular nerve blocks in individuals afflicted with profound rheumatoid arthritis and adhesive capsulitis (23). Within the context of the suprascapular nerve block, the target point is the

suprascapular notch. Although the suprascapular notch traditionally takes on a U-shaped configuration, deviations in the morphological attributes of the suprascapular notch have been discerned. On certain occasions, only a subtle bony depression or foramen may manifest at the expected site of the suprascapular notch, or the notch itself might be absent (24,25). The anatomical variations of the suprascapular notch has been shown to be important, because it may result in difficulties targeting the suprascapular nerve during the injection procedure. Compared to classical suprascapular nerve block procedure, there is no need to identify the suprascapular nerve or suprascapular notch in DSMPB. As the tip of the needle is projected towards the scapula, DSMPN provides a safe approach to block suprascapular nerve, while preventing the risk of pneumothorax. In addition, sonoanatomic landmarks including trapezius muscle, supraspinatus muscle and scapula are easy to identify.

In our perspective, the most important advantages of the US-guided DSMPB lies in its safety and sonoanatomic simplicity. Pneumothorax is a potential complication of suprascapular nerve block, occurring in about 1% of procedures (26,27). In DSMPB, the targeted point is distanced from the pleura, nerves, arteries and veins, resulting in reduced risk of complications. Moreover, the scapula can act as a barrier to prevent pneumothorax. Considering these advantages, we suggest that DSMPB could be an alternative method for the management of chronic shoulder pain.

Several limitations inherent in this study necessitate acknowledgment. Firstly, the scope of follow-up was confined to a relatively brief period, with assessments conducted over a span of merely 12 weeks. Secondly, the lack of a placebo group prevents us from definitively ruling out the potential influence of a placebo effect in the context of DSMPB. The potential impact of placebo and nocebo effects on interventional treatments can exhibit rates of 13–30% and 3–8%, respectively. Within the context of this study, all participants had exhibited non-responsiveness to conventional therapeutic modalities including oral analgesic and physical therapy. Consequently, the observed relief from pain subsequent to the intervention is more aptly attributed to the application of DSMPB, as opposed to the potential effects of spontaneous recovery from rotator cuff pathology or the placebo phenomenon.

Moreover, the outcomes of this study could potentially furnish valuable data for the calculation of sample sizes in future randomized controlled trials. Thirdly, pain intensity evaluation commonly relies on scales such as the Numerical Rating Scale, VAS, McGill Pain Questionnaire, and Pain Rating Scale. In this study, we exclusively employed the VAS score as the principal outcome metric.

In conclusion, this retrospective observational clinical trial has highlighted the potential of US-guided DSMPB as an alternative treatment option for managing patients with chronic shoulder pain. US-guided DSMPB can improve pain intensity, functional disability, quality of life, and patient satisfaction. Future studies are needed to investigate the potential of US-guided DSMPB and confirm or refute the findings of this study.

Ethics Committee Approval: Ethical approval was obtained. (26.07.2023 date and 2023/418 number)

Authors' contributions: All authors contributed equally.

Conflict of Interest: There is no conflict of interest.

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Informed Consent: Due to the retrospective design, which exclusively relied on formal electronic medical records, the requirement for patient consent was waived.

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