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ORIGINAL ARTICLE

Ultrasound guided superficial cervical plexus block versus greater auricular nerve block for postoperative tympanomastoid surgery pain: A prospective, randomized, single blind study

Ultrason eşliğinde uygulanan büyük aurikuler sinir bloğu ve yüzeyel servikal pleksus blokajının tympanomastoid cerrahisi sonrası analjezik etkinliklerinin karşılaştırılması: Prospektif, randomize, tek kör çalışma

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Summary

Objectives: The aim of the study was to investigate the effect of ultrasound guided superficial cervical plexus (SCP) block versus greater auricular nerve (GAN) block for on postoperative tympanomastoid surgery analgesia.

Methods: In this prospective, randomized, single-blind study, a total of 50 patients aged between 25 and 70 years, those who were in the American Society of Anesthesiologists I-II class and underwent tympanomastoid surgery were included in the study. Patients were randomized to either Group Y: intravenous patient-controlled analgesia tramadol (IV PCA) + SCP block; n=25 and Group G: IV PCA + GAN block; n=25. Postoperative pain was evaluated at the 2nd, 6th, 12nd, and 24th hours using the Visual Analogue Scale (VAS) and postoperative 6th, 12nd, and 24th hour follow-up results were evaluated to identify the quantity of tramadol use.

Results: The VAS scores at all measures time were found to be no statistically significant difference between groups (p>0.05). The amounts of PCA tramadol consumption at all measures time were significantly lower in Group Y than in Group G (p<0.05).

Conclusion: The results of this study have indicated that SCP and GAN blocks can be used for pain control after tympanomastoid surgery. We believe that the only disadvantage of SCP block application with lower amounts of tramadol use is that the complications that can occur are more serious than those that can occur in GAN application.

Keywords: Great auricular nerve; nerve block; superficial cervical plexus; tympanomastoid surgery; ultrasonography.

Özet

Amaç: Bu çalışmanın amacı, postoperatif timpanomastoid cerrahisi analjezisi için ultrasonografi (US) eşliğinde yüzeyel servikal pleksus (YSP) blok ile büyük auriküler sinir (BAS) bloğunun etkinliklerini karşılaştırmaktı.

Gereç ve Yöntem: Prospektif, randomize, tek kör çalışmada, Amerikan Anestezistler Derneği (ASA) I-II sınıfında olan ve timpanomastoid cerrahisi yapılan, 25-70 yaş arasındaki toplam 50 hasta çalışmaya dahil edildi. Hastalar Grup Y (n=25): intravenöz hasta kontrollü analjezik tramadol (IV PCA) + YSP bloğu ve Grup G (n=25): IV PCA + BAS bloğu olacak şekilde randomize edildi. Ameliyat sonrası ağrı 2., 6., 12. ve 24. saatlerde Vizüel Analog Skala (VAS) ile ve postoperatif 6., 12. ve 24. saat izlem sonuçları, tramadol kullanımının miktarını belirlemek için değerlendirildi.

Bulgular: Bütün ölçüm zamanlarındaki VAS skorlarında gruplar arasında istatistiksel olarak anlamlı bir fark olmadığı bulundu (p>0.05). Tüm ölçüm zamanlarındaki PCA tramadol tüketim miktarları, Grup Y'de Grup G'ye göre anlamlı olarak daha düşüktü (p<0.05).

Sonuç: Bu çalışmanın sonuçları, timpanomastoid cerrahiden sonra ağrı kontrolü için YSP ve BAS bloklarının kullanılabileceğini göstermiştir. Daha düşük tramadol kullanılan YSP blokajının tek dezavantajının, oluşabilecek komplikasyonların BAS uygulamasında oluşabileceklerden daha ciddi olacağına inanıyoruz.

Anahtar sözcükler: Büyük aurikular sinir; sinir bloğu; yüzeyel servikal pleksus; timpanomastoid cerrahi; ultrasonografi.

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Introduction

Tympanomastoid surgery is applied to remove the pathology that blocks the connection between the tympan (middle ear) and mastoid cells to heal the eradication of chronic otitis media infection and hearing function.[1,2] The surgical approach may include endoaural or transmeic, retroauricular (Wilde) and suprameatal (Lempert) methods.[2-4] NSAIDs, opioids and regional anesthesia techniques (Great auricular nerve (GAN) block, infiltration, Auriculo temporal nerve blockage) are often used for pain after postoperative tympanomastoid surgery. Regional anesthesia methods are commonly used in conjunction with general anesthesia for many surgical procedures. Regional anesthesia methods provide analgesia without sedation and longer postoperative analgesia.[5] In the postoperative pain, opioids can be used alone as analgesics. However, unwanted side effects such as nausea, vomiting, sedation and respiratory depression can be experienced.[6] They can increase the incidence of post-operative nausea and vomiting, commonly experienced by patients undergoing middle ear surgery, and this is further complicated by the use of intravenous (IV) opioids.[7,8] Peripheral nerve blocks can be combined with general anesthesia as an alternative to IV analgesics. Nerve blocks that can be applied pre-operatively and postoperatively can be used to reduce the need for opioids and for analgesia. GAN blockage from regional anesthesia methods has been used for auriculotemporal nerve (ATN) block and local anesthetic infiltration in tympanomastoid surgery.[9–12] The anatomical skin sensation of the ear area is provided by GAN, ATN and Lesser Occipital nerve. The superficial cervical plexus (SCP) arises from the anterior rami of the C1-C4 spinal nerves and the GAN composed of C2 and C3 nerve roots is its biggest branch. It provides sensory innervation of the anterior and posterior parts of the ear.[13,14] Lesser occipital nerve consisting of C2-C3 roots, such as GAN, also carries senses along the superior posterior neck, skin, and auricle.[13,14] GAN block, which can be applied ultrasound-assisted or blindly, was used for tympanoplasty and pain palliation after tympanomastoidectomy.[9–11,15] Lesser occipital nerve block, another branch of SCP, was used blindly by infiltration method in addition to GAN for ear surgery.[12] However, we have not been able to find a study carried out with SCP block in the literature for ear surgery. In this work, we aimed to determine the impact of GAN and SCP blockage we applied along with ultrasonography (USG) on the pain levels and analgesic consumption after tympanomastoid surgery applied posteriorly.

Material and Methods

After the local ethics committee's approval was obtained (Ethical number: 2011-KAEK-25 2016/21-02), 56 patients to be applied tympanomastoid surgery who accepted to participate in the study and whose written approvals were received were evaluated for eligibility in this prospective, randomized, single-blind study.

Patient selection

Patients aged between 25 and 70 years, those who were in the American Society of Anesthesiologists (ASA) I-II class and underwent tympanomastoid and tympanoplasty surgery were included in the study. Exclusion criteria were as follows: previous history of opioid use preoperatively, allergy to local anesthetics, uncontrolled arterial hypertension, uncontrolled Diabetes Mellitus, mental retardation, antidepressant use, metabolic disorders, the presence of any systemic infection.

Fifty patients who were eligible for the study were randomized using a random number table as Group Y (n=25) applied 10 ml of bupivacaine at 0.25% concentration with SCP Block in addition to IV tramadol infusion with patient controlled analgesia (PCA) and Group G (n=25) applied 5 ml of bupivacaine at 0.25% concentration with GAN Block in addition to IV tramadol infusion with PCA (Fig. 1).

Anesthetic management

Patients undergoing hemodynamic monitoring (non-invasive blood pressure, ECG, SpO_2) were applied NaCl infusion of 0.9% through IV before induction and preoxygenated with 100% Oxygen (O_2). Propofol (2-2.5 mg/kg) and rocuronium bromide (0.6 mg/kg) were used in through IV route in anesthesia management. Following the intubation with the appropriate size endotracheal tube, a mechanical ventilation was performed with 30–35 mmHg of end-tidal CO_2 ($ETCO_2$). During the anesthesia, 3 L/min flow was applied into the mixture of Sevoflurane (1-2, 5%), 50% O_2 and 50% air. Analgesic-requiring patient was treated with 1mcg / kg fentanyl.

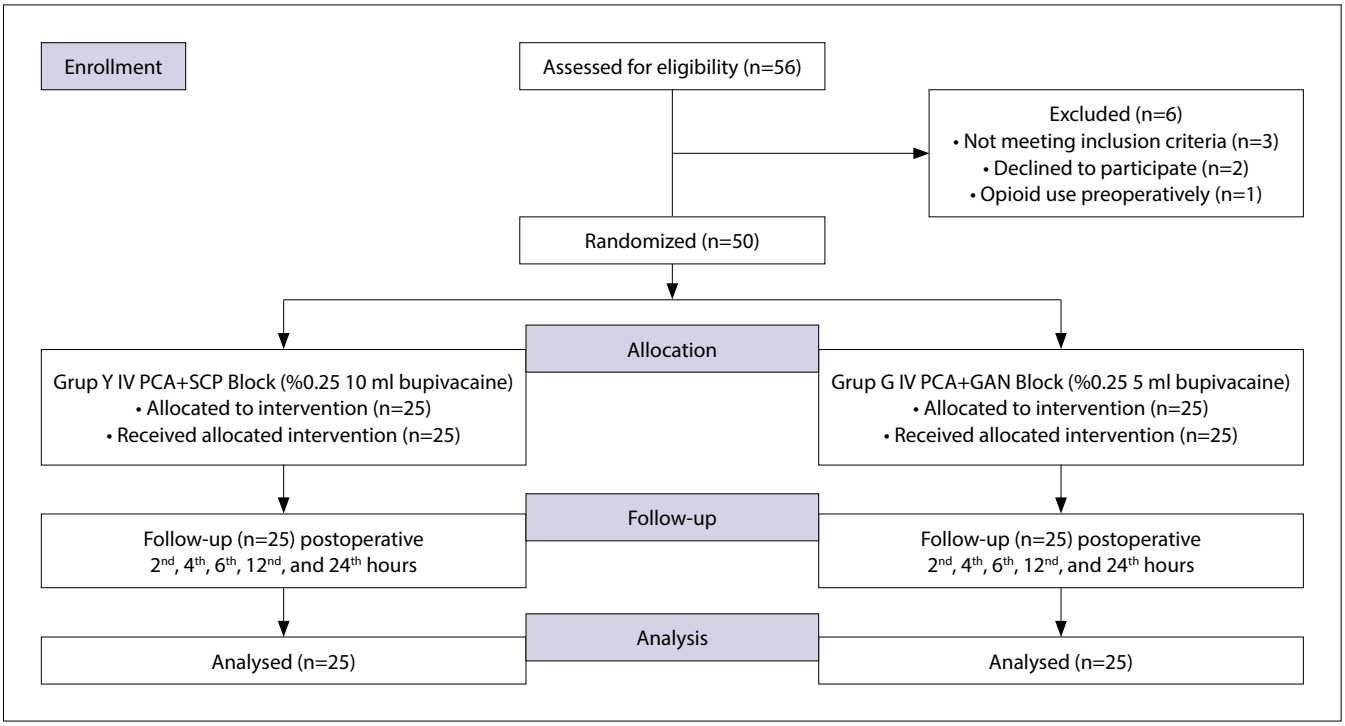

Figure 1. Consort diagram.

Before the operation is over and before the anesthesia has ended, tramadol infusion was initiated with IV PCA and SCP blocks and GAN blocks were applied with USG. After the operation was over, the recurarized patients were extirpated and then taken to the recovery room. Patients who were monitored for 30 minutes in the postoperative recovery unit were transferred to their services when their Ramsey sedation score (RSS) 2 and hemodynamic parameters were stable.

Analgesic treatment

Group Y and Group G were applied tramadol with IV PCA. 4 mg/mL tramadol solution was added into the 100 mL of normal saline (a total of 400 mg tramadol). PCA settings: 5 ml mid-bolus dose and 20 min fixed period. The maximum daily dose was adjusted to be 400 mg.

Block applications

For both block applications, injection technique and 22 gauge sonovisible peripheral nerve block needle were used. At the end of the block applications operation, the skin incision was closed and in the supine position, the patient's head was turned to the opposite side of the block to be applied and it was applied in this position. The area was disinfected (povidone iodine). It was then placed in a transverse position with an 18-Hz Linear USG probe (Esaote MyLab 30 Gevova-Italia) at the level of thyroid cartilage in the neck lateral wall and at the midpoint of the sternocloidomastoid muscle (SCM).

For SCP block, the probe was shifted posteriorly and the prevertebral fascia and SCP (in the form of small hypoechoic nodules) were imaged under the SCM muscle.[16] Negative aspiration followed by injection of 1 mL bupivacaine to confirm the area was applied. Then in 10 mL of bupivacaine (0.25% concentration) was injected under the prevertebral fascia (Fig. 2).

For GAN block, the probe was moved in superior and inferior directions and a small round hypoechoic nerve was detected at the lateral border of the SCM muscle. 5 ml of bupivacaine at 0.25% concentration was injected to surround the great auricular nerve (Fig. 3).

When both groups were VAS> 5, 1 g paracetamol was planned to be given at intervals of up to 8 hours, 3 times at most, for the analgesic requirement of the patients in the group.

Outcome measures

Primary measures: Results related to the VAS score (postoperative, 2nd, 4th, 6th, 12nd, and 24th) and consumption of Tramadol (6th, 12nd, and 24th) were examined.

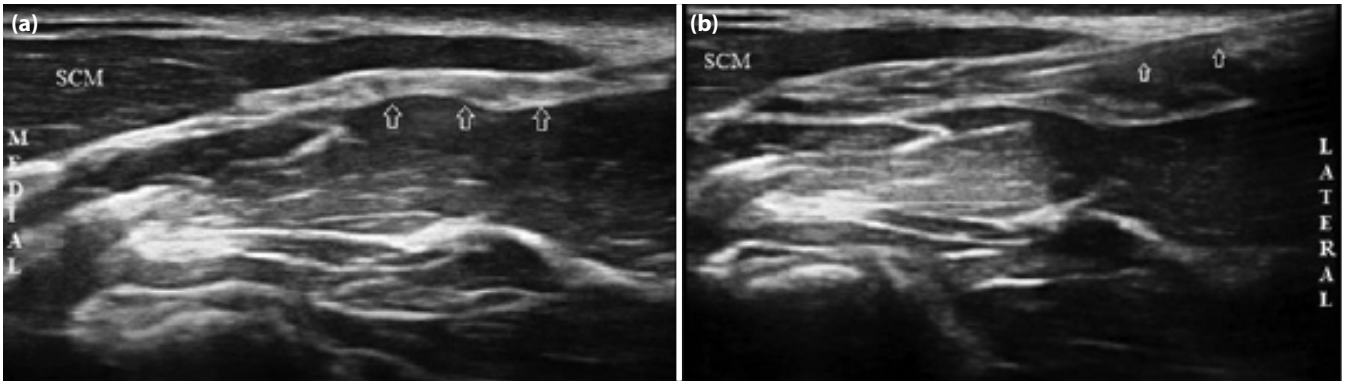

Figure 2. Superficial cervical plexus block. **(a)** Arrows are showing superficial cervical plexus. **(b)** After superficial cervical plexus block. Arrows are showing needle. SCM: sternocloidomastoid muscle.

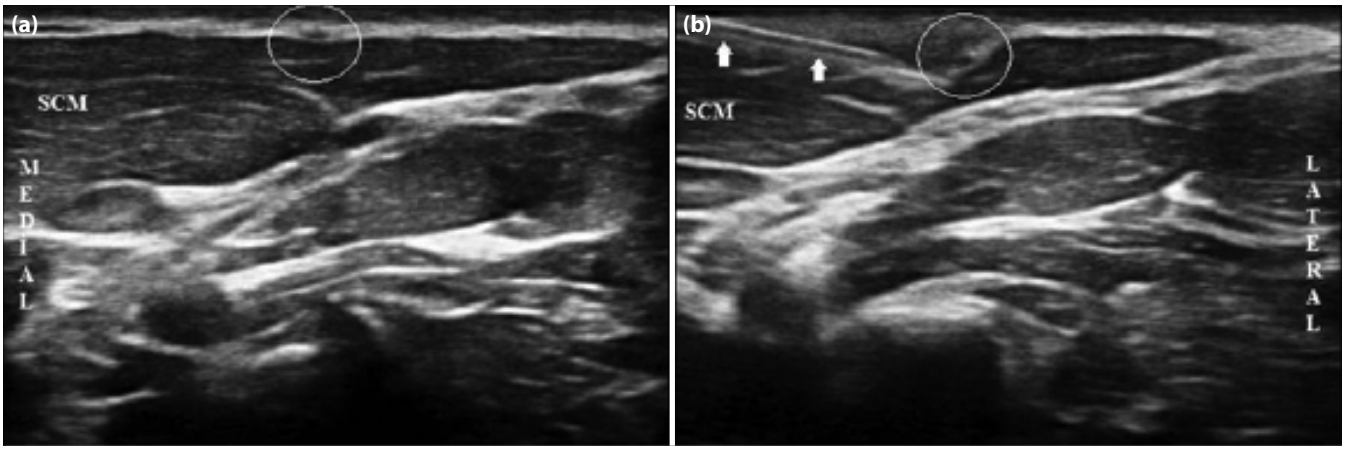

Figure 3. Great auricular nerve block. **(a)** White circle :Great auricular nerve. **(b)** After great auricular nerve block. Arrow are showing neddle. SCM: sternocloidomastoid muscle; White circle: Great auricular nerve+local anesthesic.

Secondary measures: Side effects (nausea and vomiting, hypotension), additional analgesic requirement, and Ramsey sedation scores (RSS) were recorded. Ramsey Sedation Score (RSS) ≥5 score was considered excessive sedation and the lock duration in PCA was increased to 40 minutes. Nausea and vomiting complaints were assessed by nausea-vomiting score (NVS) (1. no nausea, 2. mild nausea, 3. severe nausea, 4. vomiting) and antiemetic medication was applied on NVS 3. Mean arterial pressure (MAP) below 60 mgHg was considered hypotension and treated.

Statistical analysis

IBM SPSS 22.0 statistical package program was used to analyze the data. Chi-Square (χ^2) test was used in the comparison of descriptive statistical methods as well as in qualitative data. Shapiro-Wilk test used for normality (it was found out that the data did not show normal distribution). The Mann-Whitney U test was used in the comparison of VAS scores and tramadol consumption between the groups. Probability (P) values smaller than α=0.05 were considered significant and pointed to a difference between the groups.The main outcome measure of this study was a 30% reduction in opioid group's VAS scores at postoperative 4 hour.[12] For a study power of 90% (α=0.05), the required sample size per group was calculated to be 23, for a total of 46 patients. We included 25 patients in each group to secure patients dropouts for any reason.

Results

The present study was completed with a total of 50 patients (Group Y; n=25 and Group G; n=25) (Figure 1).There was no statistically significant difference between the groups in terms of gender, age, body mass index (BMI), operation indications and operation durations (p>0.05) (Table 1).There was no statistically significant difference between both two groups in terms of VAS scores in all postoperative times (p>0.05). Tramadol consumption levels were found to be statistically significantly higher in Group G at all measurement times (p<0.05) (Table 2). There was no statistically significant difference between

Table 1. Demographic characteristics of the patients (Mean±SD)

		Group G (n=25)	Group Y (n=25)	p
Gender	Female/Male (%)	18/7 (72%/28%)	20/5 (80%/20%)	0.399
Age (year)		34.40±9.20	33.80±8.25	0.907
Height (cm)		165.92±6.40	162.50±7.90	0.870
Weight (kg)		71.20±6.10	70.50±8.50	0.830
Indications for surgery	Tympanomastoidectomy	20 (80%)	19 (76%)	0.595
	Tympanoplasty	5 (20%)	6 (24%)	

SD: Standard deviation; Group Y: Intravenous patient-controlled analgesia contramal (IV PCA)+ superficial cervical plexus block (SCPB) (0.25% 10 ml bupivacaine); Group G: IV PCA+ GAN (0.25% 5 ml bupivacaine).

Table 2. Comparison of VAS scores between groups (Mean±SD)

	Post-operative	2nd hour	6th hour	12nd hour	24th hour
	VAS				
Group G (n=25)	3.36±0.70	3.28±0.79	2.80±0.57	2.32±0.90	2.00±0.70
Group Y (n=25)	3.50±1.02	3.12±0.92	2.68±0.74	2.08±1.03	1.80±0.70
P	0.636	0.403	0.677	0.371	0.315
	Tramadol consumption (mg)				
Group G (n=25)			34.80±8.50	47.70±11.40	62.40±16.70
Group Y (n=25)			26.20±5.35	36.22±9.01	45.50±15.30
P			**0.002**	**0.001**	**0.003**

SD: Standard deviation; VAS: Visual Analogue Scale; Group Y: Intravenous patient-controlled analgesia contramal (IV PCA)+ superficial cervical plexus block (SCPB) (0.25% 10 ml bupivacaine); Group G: IV PCA+ GAN (0.25% 5 ml bupivacaine).

Table 3. Comparison of the side effects, additional analgesic requirement, Ramsay Sedation Scale (RSS) scores, and duration of surgery between the groups (Mean±SD)

	Group Y (n=25)	Group G (n=25)	P
Side effects			
Nausea and vomiting	1	1	NA
Hypotension	1	0	0.317
Additional analgesic requirement	1	1	NA
Ramsay Sedation Scale (RSS) scores	2.56±0.50	2.76±0.66	0.312
Duration of surgery (min)	123.40±16.80	129.60±17.86	0.709

SD: Standard deviation; Group Y: Intravenous patient-controlled analgesia contramal (IV PCA)+ superficial cervical plexus block (SCPB) (0.25% 10 ml bupivacaine); Group G: IV PCA+ GAN (0.25% 5 ml bupivacaine).

the groups in terms of RSS, side effect profile and additional analgesic use (p>0.05) (Table 3).

Discussion

We tried to determine the efficacy of SCP and GAN blocks we applied for pain palliation after tympanomastoid surgery by VAS scores and tramadol consumption quantities. According to the results of our study, although there was no statistically significant difference in pain scores between the two groups at all measurement times, we found higher tramadol consumption in the group which was applied GAN block.

In the literature, there are a limited number of regional anesthesia methods for ear surgery.[9,17] GAN

blockade and local anesthetic infiltration were used in case presentations and controlled trials.[9,17,18] SCP blockade studies were used for anesthesia and analgesia in the neck area surgeries such as carotis and thyroid.[19–21] Fewer studies reported that it can be used for ear analgesia and anesthesia.[22] There are two studies measuring the effect of GAN blockage in the ear surgery in the paediatric age group in the literature. The first of these is Suresh et al's study conducted in 2002. In this study, 40 patients underwent GAN blockade for pain palliation after tympanomastoid surgery. They determined less postoperative morphine use and side effects in the patient group who were applied 2 ml of bupivacaine at 0.25% concentration than the placebo group. [9] In another study they carried out in 2004, they tried to evaluate the analgesic efficacy of pre- and postoperative block application of GAN blockade. In the study results, they did not find any difference in the results of both block applications.[17] In another study using regional anesthesia techniques for pain after mastoid surgery, GAN and auriculotemporal nerve blockage were used together. The results of this study by Swain et al.[12] showed that this method is safe, tolerable and effective. Additionally, they determined that nerve blocks reduced the incidence of postoperative nausea and vomiting. On the other hand, the efficacy of local anaesthetic infiltration and GAN blockade were compared in the study that involved the children undergoing otoplasty.[11] There was no difference between the postoperative results of both applications and the researchers recommended the use of the local anaesthetic application. As the reason for this, they reported that peripheral nerve block administration may result in vascular and phrenic nerve spread, especially in children.[11]

In the literature, besides the studies applying GAN blockade using anatomical signal points, the case presentation about GAN block applied along with USG is also draws attention. In this study, the researchers applied GAN block with 4 mL of 0.5% bupivacaine in 2 different cases with outer ear helix and ear lobe and with ear lobe abscess. In both cases, the surgical procedure was completed without the need for additional analgesia during the surgical procedure.[18] In a study to determine the anesthetic spread of GAN block administration along with USG, Thallaj et al. applied 0.1 ml of mepivacain to 20 volunteers. The results of this study revealed that the tail of the helix, antitragus, lobule, and mandibular angle were blocked in all patients while post-auricular region could be blocked in 18 of 20 patients. No complications were observed in any patient.[23] In our study, post-auricular block was performed in 25 patients after GAN block, and no complication was observed. We believe that higher block achievement in our study may depend on the use of more local anaesthetic (5 ml).

SCP block is now used mainly for neck surgeries such as carotid and thyroid. Bilateral blocks are, on the other hand, used for pain after thyroid and parathyroid surgery.[20–24] In their study in which Gürkan et al. applied block along with USG for pain after thyroidectomy, they found lower opioid consumption in the group who were applied blockade after the use of 10 ml of bupivacaine at 0.25% concentration and shared this in the literature.[19] Hering et al. found a decrease in post SCP block VAS scores applied to patients with clavicular injury. After the block application in which they used 0.25% 8 ml of bupivacaine, they obtained analgesia in the clavicle, ear and neck region. They reported that SCP block could be used safely in emergency services for pain in injuries such as soft tissue, ear, neck region bone injuries (clavicular fractures and acromioclavicular).[22] Although postoperative complications such as systemic toxicity and hematoma are predicted in the intensive vascular structure of the neck region after SCP block application, it is recommended as a safe method in the literature.[20,25–27]

In our study, we did not encounter complications similar to those in the literature. This may be due to the relatively low number of patients and the use of blocks along with the USG. In addition, it was reported that complications such as hoarseness and numbness in ear may also be seen in studies conducted.[19,20,25–27] However, numbness in ear which was determined and regarded as a complication in other studies was a result that we wanted to achieve in our study. According to our study results, there are two reasons for the lower amount of tramadol found in the SCP block-administered group. The first of these reasons is: Lesser occipital nerve blockage, a branch of SCP and contributing to the sensation of ear posterior, may have provided better analgesia in

the ear region. The second reason may be that the 10 ml (or more) volume used in SCP block application may have provided a longer blockade than 5 ml volume used in GAN.[19,28]

Limitation: Small sample size and there is no control group.

Conclusion

The results of this study show that SCP and GAN blocks are similar in pain control after tympanomastoid surgery.

Informed consent: Informed consent: Informed consent was obtained from all individual participants included in the study.

Financial disclosure: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Ethical approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Conflict-of-interest: The authors declare that they have no conflict of interest.

Peer-reiew: Externally peer-reviewed.

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