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Araştırma

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Comparison of Two Methods in the Peripheral Nerve Block Application Used in Foot Surgery: USG-Guided and Anatomical Landmark-Guided

Ayak Cerrahisinde Kullanılan Periferal Sinir Blok Uygulamasında İki Metodun Karşılaştırılması: USG Yardımlı ve Anatomic Landmark Yardımlı

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ABSTRACT

Aim: Ankle peripheral nerve block is applied by two methods. These are peripheral block that is performed using USG-assisted and anatomical landmarks that do not require the use of Ultrasonography (USG). In our study, we aimed to compare these two methods applied in foot surgeries retrospectively.

Methods: Peripheral block patients performed with the USG-guided (group 1) were 20, anatomical landmarks- guided (group 2) were 20. In both groups, 40 cc of anesthetic mixture was used (bupivacaine + lidocaine). The recorded information of the patients were as follows: Block application time (BAT), surgery readiness time (SRT), duration of surgery (DoS), duration of block anesthesia (DBA) and intraoperative-postoperative Visual Analogue Scale (VAS). The results of the VAS applied to the patients postoperatively were obtained. Patients were contacted by phone and asked if they were satisfied with the anesthesia.

Results: The BAT and DBA values of the patients in Group 1 were high. SRT and VAS 6 values of the patients in group 2 were high. No significant difference was found between the groups in other parameters. No additional dose of anesthetic was needed in group 1 during the intraoperative period. In group 2, local additional dose was administered to 3 patients.

Conclusion: Peripheral block preparation USG-guided takes a long time. However, it is more comfortable during surgery. The USG-guided peripheral nerve block is more advantageous when considering the possibility of prolonging the duration of surgery for any reason and early postoperative pain control after surgery.

Key Words: Anesthesia, Ankle, Peripheral nerve block, Ultrasonography

ÖZET

Amaç: Ayak bileği periferik sinir bloğu iki yöntemle uygulanır. Bunlar; USG yardımlı periferik blok ve USG kullanımına ihityaç duymayan anatomik landmark'lar kullanılarak yapılan periferik bloktur. Biz de çalışmamızda ayak ameliyatlarında uygulanan bu iki yöntemi retrospektif olarak karşılaştırmayı amaçladık.

Yöntem: 2017 yılından itibaren ayak bileği periferik blok ile ameliyat edilen hastaların bilgilerine ulaşıldı. USG yardımıyla yapılan periferik blok hastaları (grup 1) 20 kişi, USG kullanılmadan, anatomik landmarklara göre yapılan periferik blok hastaları (grup 2) 20 kişiydi. Her iki grupta 40 cc'lik karışım kullanıldı (bupivakain+lidocain). Hastaların kayıt altına alınan bilgileri şunlardı: demografik bulgular, blok uygulanma süresi (BUS), operasyona hazır olma süresi (OHOS), operasyon süresi (OS), blok anestezi süresi (BAS) ve intraoperatif-postoperatif VAS skoru. Ameliyat sonrası hastalara uygulanan vizüel analog skalası (VAS) sonuçlarına ulaşıldı. Hastalara telefonla ulaşılıp anesteziden memnun olup olmadıkları soruldu.

Bulgular: Grup 1'deki hastaların BUS ve BAS değerleri yüksekti. Grup 2'deki hastaların OHOS ve VAS 6 değerleri yüksekti. Diğer parametrelerde gruplar arasında anlamlı bir farklılığa rastlanılmadı. İntraoperatif dönemde grup 1'de ek doz anestezik maddeye ihtiyaç olmamıştır. Grup 2'de ise 3 hastada intraoperatif hafif ağrı hissetmeleri üzerine lokal ek doz uygulanmıştır.

Sonuç: USG kullanılarak uygulanan periferik blok hazırlığı uzun sürmektedir. Anestezistlerin tecrübesi arttıkça bu sürenin kısalacağı kanaatindeyiz. Ancak cerrahi sırasında daha konforludur. Ameliyat süresinin herhangi bir sebepten uzama ihtimali ve postoperatif erken dönem ağrı kontrolü göz önüne alınınca USG eşliğinde yapılan periferik blok daha avantajlıdır.

Anahtar Kelimeler: Anastezi, Ayak bileği, Periferal sinir bloğu, Ultrasonografi

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Introduction

Nowadays, regional anesthesia applications have become popular in lower extremity surgeries. Both economic reasons and complication rates of general anesthesia have been effective in this popularization [1,2]. Moreover, it is of great importance to shorten the length of hospital stay of patients. Chelly et al. revealed that the length of hospital stay depended on the type of anesthesia applied and postoperative pain control [3]. Accordingly, anesthesia is on the agenda as much as the surgeon needs. In other words, general anesthesia is replaced by spinal anesthesia and central/peripheral blocks in lower extremity surgeries. Peripheral nerve blocks influence only the distal of the block area. This reduces the risk of complications [4]. Since peripheral blocks are infiltration blocks, the mixing of the anesthetic agent into the blood occurs slowly. In this respect, the risk of complications is expected to be low [5]. In the literature, it is observed that cardiovascular complications of peripheral blocks are less compared to general and spinal anesthesia [6]. Hallux valgus, hallux rigidus, neuroma excision, Freiberg's disease, and middle-distal foot amputations constitute a significant part of foot surgery. These surgeries can be carried out comfortably with ankle block. This block type is mostly applied under Ultrasonography (USG) guidance. In our clinic, peripheral block at the ankle level is performed both under USG guidance and using anatomical landmarks without the need for USG. In the literature review, there are many studies comparing peripheral block methods among themselves and to spinal anesthesia [7,8]. However, studies comparing ankle block techniques with USG and without the need for USG have generally been conducted on a single nerve [9,10]. There are review studies evaluating all nerves, and these studies were carried out a long time ago [11]. Considering the development of USG devices and anesthesiologists to the present time, we needed to conduct this study. In this study, we aimed to compare the USG-guided ankle block and ankle block without USG guidance in foot surgeries performed in the operating room of our hospital. We think that this study can show that ankle nerve block can be easily applied by orthopedists.

Materials and Methods

The study was initiated after permission from the ethics committee of our hospital was obtained. (Date: 08/08/2022 No:2053) Patients operated on the middle and distal foot region were screened as of January 2017. Patients over the age of eighteen and those administered ankle block anesthesia were included in the study. Patients who underwent amputation due to diabetic foot wounds and trauma patients were excluded from the study. Patients who underwent ankle block with USG guide were called GROUP 1, and patients who underwent ankle block without using USG guide were called GROUP 2. Assuming that the medium effect size (effect size=0.30) is considered as a difference, the alpha significance level was calculated as 0.05 % 95% power, 12 in Group 1 and 14 in Group 2, a total of 26 patients. 20 patients in group 2 were reached. The number of patients in group 1 was higher. Therefore, 20 patients were selected by drawing lots. Fourty patients were reached and evaluated retrospectively.. The anesthesia methods administered to the patients were evaluated. 20 patients were administered USG-guided ankle peripheral block anesthesia (Group 1) and 20 patients were administered ankle anesthesia without USG guidance (Group 2). The patients' files were examined retrospectively. Demographic findings (age, sex, anesthesia risk group) of the patients were recorded. Block application time (BAT), surgery readiness time (SRT), and duration of surgery (DoS) were obtained from the records. The results of the visual analog scale (VAS) applied to the patients following the surgery were obtained. On the VAS, "no pain" was considered as "0," and "unbearable pain" was considered as "10." The first time the patients were administered analgesics was recorded from the ward observation records. The time between the start of the surgery and the time the first analgesic was administered was accepted as the duration of block anesthesia (DBA). The presence of complications due to anesthesia was evaluated. The patients were contacted by phone and asked whether they were satisfied with the anesthesia.

Prior to block anesthesia, 0.02 mg/kg midazolam Intravenous (IV) premedication was administered to all patients. To be used in both groups, a 40 ml mixture of Marcaine® 0.05% (bupivacaine) and Aritmal® 2% (lidocaine), each mixed in equal amounts, was prepared.

In Group 1, the patients were placed in the supine position. A pillow was put under the heel, and the whole ankle was accessible. The area was stained sterile, and the procedure was initiated with a USG probe wrapped with a sterile glove. The anesthetic mixture was administered to the tibial nerve (8-10 ml), superficial peroneal nerve (5-7 ml), deep peroneal nerve (3-5 ml), saphenous nerve (2 ml), and sural nerve (2-3 ml), respectively.

In Group 2, a pillow was put under the heel of the patient in the supine position. Anatomical indicators were marked. Disinfection was done, and the procedure was initiated. The lateral malleolus-end was palpated for the superficial peroneal nerve block. Eight to ten cm proximal to this point, 5-7 ml of the anesthetic mixture was administered subcutaneously at the anterior of the fibula. The deep peroneal nerve runs laterally to the anterior tibial artery at the ankle level. If the artery could not be palpated, the anterior tibial tendon was found 4-5 cm proximal to the distal joint surface of the tibia. The insertion was made in a depth of 1-1.5 cm just lateral to this tendon. First, aspiration was made to ensure that the needle was not in the vein. 3-5 ml of the anesthetic mixture was injected. The medial malleolus-end was palpated for the saphenous nerve block. This point was found to be 3-5 cm proximal, and the needle tip was advanced toward the anterior. After aspiration, 2 ml of the anesthetic mixture was injected. For the sural nerve, 5 cm proximal to the lateral malleolus-end was marked. At this level, the peroneus longus tendon, running in the posterior of the fibula, was found. 2-3 ml of the anesthetic mixture was injected subcutaneously between the peroneus longus tendon and the Achilles tendon. Finally, the tibial nerve block was started. The posteromedial edge of the tibia was palpated 5 cm proximal to the medial malleolus-end. At this level, the flexor digitorum longus tendon and posterior tibial tendons were palpated. The needle inserted between these tendons and the Achilles tendon was guided to the inferior at a 60-degree angle. After aspiration, 8-10 ml of the anesthetic mixture was injected [12].

Pain control was carried out in the patients in both groups. When it was decided that anesthesia was adequate, an elastic bandage (15 cm) was tightly wrapped from around the tip of the toe to the ankle level. The bandage was untied starting from the tip of the toe. The tourniquet was provided by leaving the bandage at the ankle level. The surgical area was prepared with Batticon, and the surgery was initiated. If there were areas where the patient felt pain during the surgery, local infiltration anesthesia was administered using one ml of CITANEST® 2% (prilocaine) until anesthesia was achieved. Patients who required local anesthetic agents were recorded.

Statistical Analysis

The SPSS (Statistical Package for the Social Sciences) 25.0 package program was used in the statistical analysis of the data. Categorical measurements were summarized as number and percentage, while continuous measurements were summarized as mean and standard deviation values (when necessary, median and minimum-maximum values). Chi-square and Fisher's exact test were used in the analysis of categorical statements. The Shapiro-Wilk test was used to identify whether the parameters in the study were normally distributed. The Mann-Whitney U test was conducted to examine differences between the parameters that were not normally distributed. In all tests, the statistical significance level was accepted as 0.05.

Results

The demographic data were the same between the two groups. The BAT min. and DBA ($p<0.001$; $p<0.001$, respectively) findings of the patients in Group 1 were higher than those of the patients in Group 2, and their SRT min. and VAS 6 ($p<0.001$; $p=0.024$, respectively) findings were lower than those of the patients in Group 2, which were found to be significant ($p<0.05$). There was no significant difference between the groups in terms of DoS min., Anesthesia satisfaction, VAS intraoperative, and VAS 12-24 parameters ($p>0.05$) Table 1.

No additional dose of the anesthetic agent was needed in Group 1 in the intraoperative period. In Group 2, an additional local dose was administered to 3 patients since they felt mild intraoperative pain (2 patients VAS 2, 1 patient VAS 3). Two of these three patients felt pain in the tibial nerve, and one in the deep peroneal nerve sensory area. There was no neurological deficit in the examination of the patients on the first postoperative day.

Discussion

In recent years, there has been a considerable increase in studies on peripheral block anesthesia. In parallel, we see that its use in anesthesia routine has increased. The primary reason for this seems to be avoiding the complications of general anesthesia and spinal anesthesia, particularly in lower extremity surgeries. On the other hand, peripheral blocks also have important secondary and tertiary advantages.

The most important secondary advantage of peripheral nerve blocks appears to be postoperative analgesia. There are numerous studies indicating this effectiveness [13,14].

Even peripheral block methods with infusion catheters have been described to prolong the block effect time for postoperative pain control [15].

This situation suggests that the postoperative analgesic effect even takes precedence over the anesthetic effect. The absence of postoperative pain not only increases patient's comfort and satisfaction but also facilitates rehabilitation, increasing surgical success.

Chelly et al. demonstrated that the length of hospital stay was related to postoperative pain control and anesthesia type in orthopedic surgeries [3]. From this perspective, the tertiary advantage of peripheral nerve blocks emerges. They not only reduce the costs of drugs and personnel but also shorten the length of hospital stay.

Neurotransmitters and USG are the most commonly used procedures to determine nerve localization in peripheral nerve blocks. A study conducted by Gürkan et al. in 2014 reported that the most common procedure to determine the location of the nerve in peripheral nerve blocks was using a neurotransmitter, but USG was also becoming widespread [16]. Nowadays, USG is extensively used in ar-

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Table 1. Demographic data and efficacy comparison between groups

	Group 1	Group 2	p[a]
	n(%)	n(%)	
Sex			
Female	8 (40)	14 (70)	0.054
Male	12(60)	6 (30)	
Hospitalization	15 (75.0)	14 (70)	0.838
ASA			
1	16 (80)	15 (75)	0.793
2	4 (20)	5(25)	
Complication	-	3 (21.4)	0.088
	Group 1	**Group 2**	**p[b]**
	Mean±sd	**Mean±sd**	
Age	46±5.6	41.0±4.0	0.279
BAT min.	16.4±0.8	5.1±0.2	**<0.001****
SRT min.	15.4±0.9	21.6±0.9	**<0.001****
DoS min.	49.8±2.1	50.4±2.2	0.935
DBA min.	213.3±3.9	148.2±4.9	**<0.001****
Satisfaction with anesthesia	90.0±0.2	89±0.2	0.801
VAS intraoperative	0.0±0.0	0.5±0.3	0.095
VAS 6	2.1±0.2	2.9±0.2	**0.024***
VAS 12	4.7±0.3	4.5±0.3	0.690
VAS 24	1.58±0.2	1.64±0.7	0.887

* p<0.05, **p<0.001, a: Chi-square and Fisher's exact, b: Mann-Whitney U test

eas where the nerves such as the ankle block are close to the surface. One of the reasons for this is that the USG experience of anesthesiologists has increased considerably.

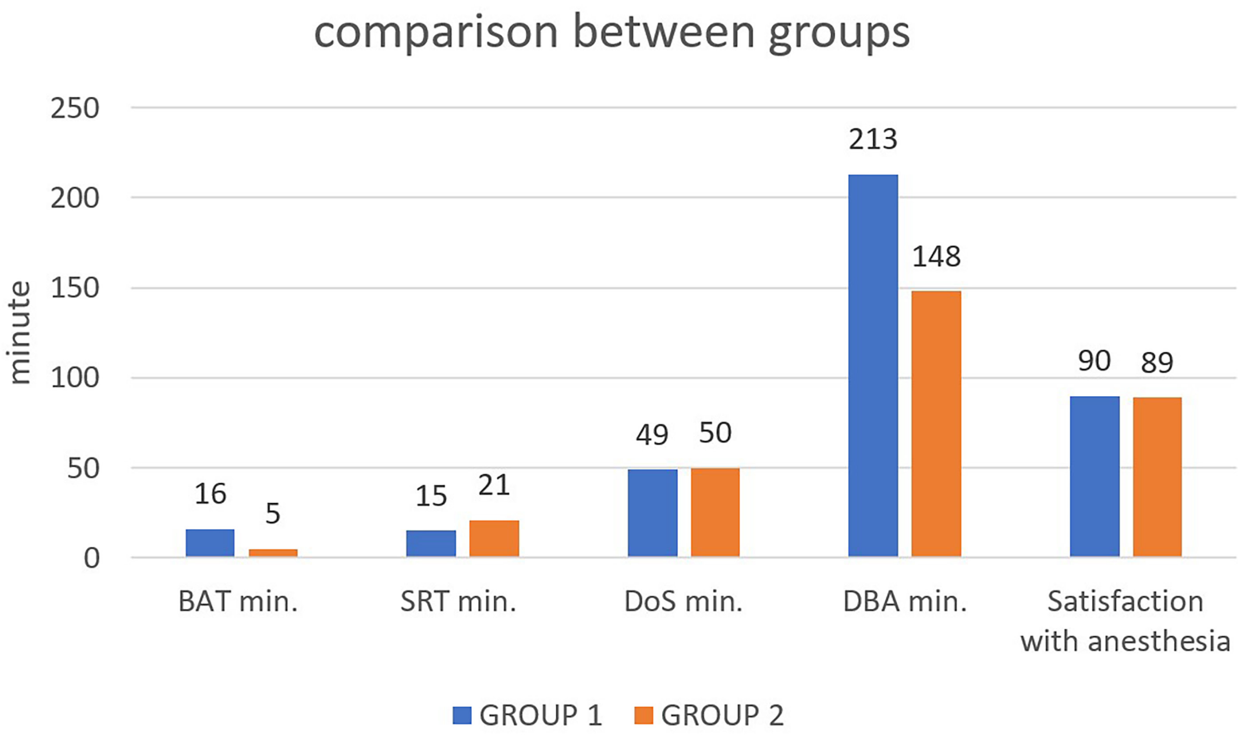
In our study, we tried to reveal whether the use of USG, which is common in ankle-level peripheral nerve block, contributed to the block. We reached striking results in our study, particularly focusing on surgical interventions applied to the metatarsi and phalanges. While the duration of the procedure was significantly longer in Group 1, it was observed that the surgery readiness time after the procedure was significantly longer in Group 2 (Graphic 1). We attribute this situation to finding the nerve via USG exactly in Group 1 and the administration of the anesthetic agent to its immediate surroundings. We see that the administration and readiness time in Group 1 is consistent with the literature [17].

The intergroup difference in the duration of anesthesia did not cause any intraoperative difference in the VAS score. This results from the fact that the surgery times were less than 60 minutes. However, we see that the anesthesia duration of 213 minutes in Group 1 and 148 minutes in Group 2 caused a significant difference in the early postoperative period. This difference resulted in the fact that the VAS score checked at the 6th hour was significantly lower in Group 1. This result suggested that some of the anesthetic agent used in Group 2 did not reach the target area. No significant difference was observed in the VAS scores checked at the 12th and 24th hours when the effect of the anesthesia was over in both groups (Graphic 2).

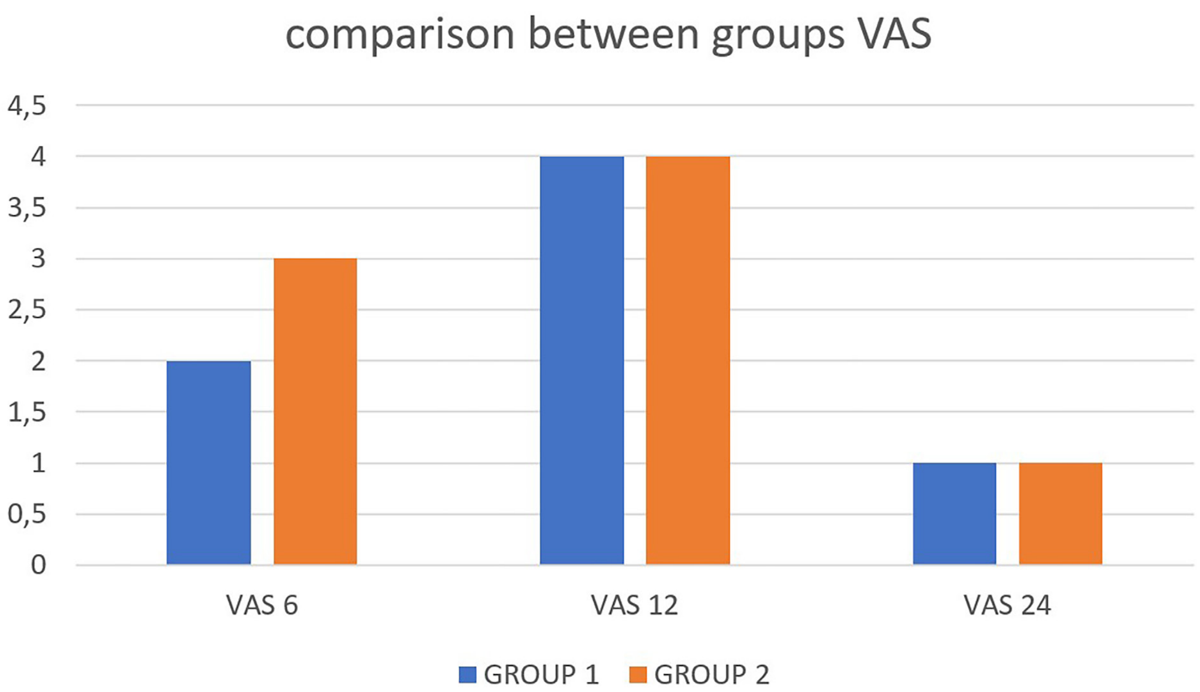
We observe that neither the additional intraoperative dose nor the difference in the 6th-hour VAS score affected the patient satisfaction score.

There are ankle block studies conducted on patients with diabetic foot wounds [17]. However, the results may have been affected since this group might have diabetic neuropathy. Therefore, patients who underwent amputation due to diabetes were excluded from our study.

Compared to spinal anesthesia, the biggest disadvantage of peripheral blocks is shown as the length of administration time and surgery readiness time in the literature [17]. Spinal anesthesia must be applied on the operating table due to the risk of complications at the time of its administration. In block anesthesia, on the other hand, the patient to whom anesthesia is administered in another area can



Graphic 1. Degrees of associations between Nottingham Clavicle Scores and other assessment tools



Graphic 2. Comparison between groups VAS

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be brought to the operation room at the appropriate time. Hence, the disadvantage of time loss can be eliminated.

It is a fact that the complications of peripheral blocks are extremely low [6]. Although there is a risk of the drug entering systemic circulation, this risk can be avoided through aspiration before the drug is injected. This is particularly important at the tibial nerve block stage due to its proximity to the artery. In terms of the location of the tibial nerve, it is recommended to find the tibialis posterior artery. However, most of the time, it cannot be palpated clearly [18]. In our study, additional intraoperative doses were required to be injected into the tibial nerve in two patients in Group 2. By clearly localizing the nerve via USG, it was ensured that no additional dose was required for any patient in Group 1.

Peripheral blocks are usually thought to be safe. [13,19]. However, although rare, there are large-scale studies in which complications were encountered in peripheral block anesthesia administered in foot-ankle surgery. In these studies, smoking and the level of the procedure came to the forefront as risk factors. It has been stated that the complication rate decreases as the procedure level approaches the distal [20]. In our study, we did not face any short-term or long-term anesthesia complications.

In both groups, the ankle tourniquet was well tolerated by the patients, which is consistent with the literature [21]. There are studies reporting that peripheral nerve block can be used safely even in pediatric patients [22].

In both groups, there were patients who were discharged on the day of surgery. There was also no significant proportional difference in the day of hospitalization. However, this situation is a significant advantage of peripheral block compared to other anesthesia techniques.

The authors are aware of the study's limitations. The low number of patients and the non-prospective design of the study are its limitations. Collaborating with other centers focusing on feet, such as our clinic, and turning it into a multicenter study will increase the study's reliability.

The only disadvantage in Group 1 seems to be the duration of administration. We are of the opinion that this period will be shortened with an increase in the experience of anesthesiologists.

We believe that the importance of peripheral nerve block will increase over time. It is known that nerve block application gives successful results in chronic pain [23]. These studies show that the usage areas will also increase.

Conclusion: The common opinion of this team of authors, including surgeons and anesthesiologists, is that more importance should be attached to peripheral blocks in the training of anesthesiologist assistants. In clinics where USG devices cannot be accessed, block application can be performed using anatomical landmarks. However, USG-guided peripheral block is more advantageous when the possibility of prolonging the duration of surgery for any reason and early postoperative pain control are considered.

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