

## ORIGINAL RESEARCH

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# Comparison of the effects of general anesthesia and combined femoral popliteal nerve block on postoperative pain in patients with diabetic underwent transtibial amputations

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### Abstract

To compare the postoperative pain effects of ultrasound-guided combined femoral-popliteal nerve block and general anesthesia in patients with diabetes mellitus (DM) underwent unilateral transtibial amputations. The study was planned as a retrospective study. Sixty-four patients who underwent unilateral transtibial amputations operations between July 2016 and July 2017, with either general anesthesia (GA, n=28) or ultrasound-guided combined femoral-popliteal nerve block (CFPNB, n=36) were included in the study. Postoperative visual analogue (VAS) pain scores at 2, 6, 12, 24, and 48th hours, total amount of consumed pethidine and the first analgesia requirement time were evaluated. The demographic characteristics of the patients were similar ( $p>0.05$ ). The VAS scores and total amount of consumed pethidine were lower, and longer the first opioid analgesia requirement time in the CFPNB group in the first 48 hours than in the GA group ( $p<0.05$ ). Ultrasound guided femoral popliteal nerve block could be a positive option for postoperative analgesia compared with GA in patients with DM undergoing transtibial amputations.

**Keywords:** Diabetes mellitus, transtibial amputation, general anesthesia, femoral nerve block, popliteal nerve block, ultrasonography, visual analogue score

### Introduction

Chronic diabetes mellitus (DM) may affect the peripheral vascular and nervous systems, resulting in the development of problematic ulcers in the foot with poor healing. Conservative methods in the treatment of diabetic foot ulcers, total contact casting and hyperbaric oxygen therapy are used effectively in treatment [1,2]. However, in these patients, progressive ulceration, exacerbation of tissue necrosis or infection may result in increased morbidity, reduced quality of life, prolonged hospital stay, high treatment costs [3,4]. Although the pain of transtibial amputation in diabetics is relatively less compared with the causal neuropathy, the aim should be to contribute to postoperative healing with good postoperative pain control and to reduce the likelihood of developing chronic pain [5]. In general, most patients who undergo amputations for diabetic foot are elderly, have long-standing

diabetes, at least one additional disease finding, and sometimes present with multiple organ dysfunction [6]. Accordingly, the use of central nerve blocks or general anesthesia has been defined for such patients. However, central nervous system block is avoided in patients undergoing major lower extremity amputations due to the necessity of administering anticoagulant and/or antiplatelet agents, or comorbidities causing possible hemodynamic instability due to general anesthesia [7]. In recent years, ultrasound-guided peripheral nerve block applications have become popular due to the effects of systemic anxiety that may be caused by general anesthesia (GA) and its negative effects on cardiopulmonary functions [8]. The use of peripheral nerve block rather than GA has been supported in various studies, and there is increased interest in its use [5,9]. Previous studies have reported on diabetic distal foot amputation procedures using popliteal nerve block; however, none have documented ultrasound-guided combined femoral-popliteal nerve block [9-11].

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In this study, we aimed to compare the postoperative pain effects of ultrasound-guided combined femoral-popliteal nerve block

applications vs. general anesthesia in patients with diabetes underwent unilateral transtibial amputations.

## Material and Methods

This study schemed a retrospective clinical study. Ethical approval was given by the observational ethics committee of the Selcuk University Medical School (Ref no: 2017/232). From all patients admitted from July 2016 to July 2017, anesthesia data of 78 patients aged 50-85 years who were American Society of Anesthesiologists (ASA) risk group III/IV and scheduled for diabetic with transtibial amputations were included. The information of the patients was collected from the hospital automation data base. All the surgeries were applied using transtibial amputations. The level was between 13-16 cm below the knee joint. The patients included in the study were evaluated, those who received general anesthesia (GA group, n=28), and those who underwent combined femoral-popliteal nerve block (CFPNB group, n=36).

### General Anesthesia Technique

All cases was applied to standard general anesthesia protocol. Anesthesia induction was performed with 2 mg kg<sup>-1</sup> propofol, 2 mg kg<sup>-1</sup> fentanyl, and 0.6 mg kg<sup>-1</sup> rocuronium at the onset of general anesthesia induction in the GA group. Anesthesia continued with 1-2% sevoflurane, 40% O<sub>2</sub>, 0.1 mcg kg min<sup>-1</sup> remifentanyl infusion at regular intervals and muscle relaxants.

### Regional Block Technique

Standardization was achieved in patients of CFPNB who underwent transtibial amputation. Patients in the CFPNB group were placed in the lateral position for popliteal nerve block. The popliteal nerve was imaged by differentiating the sciatic nerve bifurcation 7-10 cm above the popliteal fossa. One percent 2 ml lidocaine was injected into the skin and subcutaneous tissues of the needle entrance. For the popliteal nerve block, under aseptic conditions, the nerve periphery was expanded using 15 ml of 0.25% bupivacaine with a 50-mm, 22-gauge block needle using the “in-plane” technique with a linear probe (8-10 MHz). For the femoral nerve block, patients were then placed in the supine position, and the nerve periphery was expanded using 15 ml of 0.25% bupivacaine with the “in-plane” technique using a linear probe (10-18 MHz) under ultrasonographic guidance.

A small dose of midazolam (0.02 mg.kg<sup>-1</sup>) was administered intravenously to the patient. Sensory function was assessed by checking for cold sensation on the plantar and dorsal surface of the foot. Motor function was assessed by ankle motion. The operation was initiated after confirmation of complete sensory and motor blocks.

The medical automation data included sociodemographic data, duration of anesthesia and operation, ASA status, first analgesia requirement time, total amount of consumed pethidine, postoperative VAS scores at 2, 6, 12, 24, and 48th hours (0= no pain, 10 =very severe pain), No patients received postoperative opioid analgesia until the first pain started. Patients who passed VAS 3 scores were treated with intravenous 50 mg pethidine.

### Statistical Methods

The statistical analyses of the study were performed using SPSS 20.0 software. Descriptive measures of continuous and categorical variables were extracted and are presented as tables and graphs. Continuous variables are presented in the form of mean  $\pm$  standard deviation or error and the frequencies and percentages of categorical variables are given. The Kolmogorov-Smirnov normality test was used for continuous variables. Group comparisons of the variables that showed normal distribution were performed using one-way analysis of variance. Mann-Whitney U variance analysis was used for discrete numeric variables that did not show normal distribution. Relationships between the categorical variables were determined by preparing crosstabs and using the Chi-square ( $\chi^2$ ) test. In all analyses, P<0.05 was accepted as statistically significant

### Results

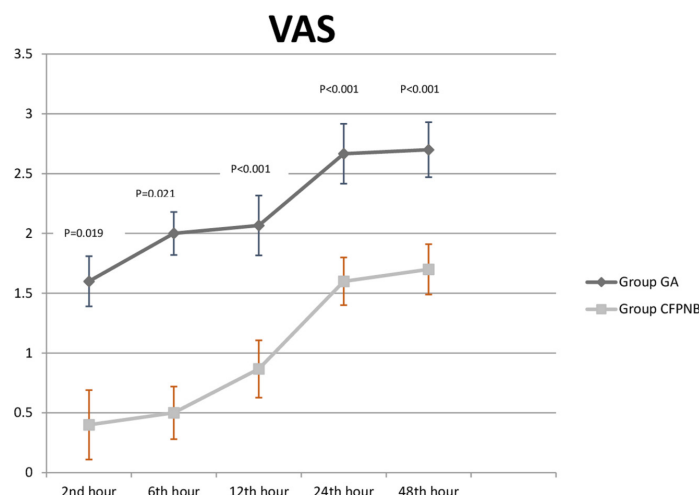
The results of this study were obtained from hospital anesthesia records for one year from July 2016 to July 2017. Total of 78 patients receiving with diabetic treated transtibial amputation were included. Ten patients were excluded from the analysis due to the inclusion criteria, and 4 patients due to data loss. Accordingly, 28 patients in the GA group and 36 patients in the CFPNB group were evaluated in the final analysis. The patients' demographic characteristics, duration of operation and anesthesia, ASA status, and hospital stay were similar (p>0.05) (Table 1).

Table 1. Patients' characteristics

|                        | Group GA N=28    | Group CFPNB N=36 | P  |
|------------------------|------------------|------------------|----|
| Gender M/F             | 18/10            | 23/13            | NS |
| Age, year              | 68.0 $\pm$ 7.1   | 67.5 $\pm$ 6.8   | NS |
| Weight, kg             | 85.5 $\pm$ 10.6  | 88.1 $\pm$ 8.0   | NS |
| Length, cm             | 161.7 $\pm$ 21.0 | 165.2 $\pm$ 17.0 | NS |
| ASA III/IV             | 20/8             | 25/11            | NS |
| Duration of Anesthesia | 69.9 $\pm$ 10.0  | 69.1 $\pm$ 10.7  | NS |
| Duration of Surgery    | 57.2 $\pm$ 10.3  | 56.4 $\pm$ 11.1  | NS |
| Type of DM I/II        | 6/22             | 11/25            | NS |
| Side of Operation R/L  | 15/13            | 17/19            | NS |

Values are presented as mean $\pm$ SD or number of patients. M/F; male/female, ASA; American Society of Anesthesiologists, R/L; right/left. NS= not significant

Within the first 48 hours postoperatively there was a significant difference between the VAS data (mean± standard error) for the GA and CFPNB groups ( $p<0.001$ ) (Figure 1).



**Figure 1.** Postoperative VAS scores during the first 48 hours after surgery. Values are presented as P value. GA= General anesthesia, VAS= Visual analogue scale, CFPNB= Combined femoral-popliteal nerve block, SE= Standard errors

The total pethidine consumption was  $46.6 \pm 29.8$  and  $15.0 \pm 12.4$  mg for the GA and CFPNB groups, respectively. The difference between the two groups was a significant ( $p<0.001$ ) (Table 2).

The first analgesia requirement time was  $11.0 \pm 8.4$  and  $19.1 \pm 2.3$  hour for Group GA and Group CFPNB, respectively. The difference between the two groups was a significant ( $p=0.013$ ) (Table 2).

**Table 2.** The first analgesia requirement time and the total amount of consumed pethidine during the first 48 hours after surgery

|                                             | Group GA<br>N=28 | Group CFPNB<br>N=36 | P      |
|---------------------------------------------|------------------|---------------------|--------|
| The first analgesia requirement time (hour) | 11.0±8.4         | 19.1±2.3            | 0.013  |
| The total amount of consumed pethidine (mg) | 46.6±29.8        | 15.0±12.4           | <0.001 |

Values are presented as means ± SE. GA=general anesthesia, CFPNB=combined femoral-popliteal nerve block, SD=standard deviation

## Discussion

This retrospective study was the first to compare the ultrasound-guided combined femoral-popliteal nerve block vs. general anesthesia in transtibial amputations. In transtibial amputations performed with CFPNB, the amount of pain and total amount of opioid consumed during the first 48 hours postoperatively were less, and the first analgesia requirement time were longer than those of general anesthesia.

The most important reasons of morbidity and mortality including significant underlying ulceration in patients with DM can be associated with foot complications [12]. Diabetic foot ulcers lead to increased morbidity, decreased quality of life, prolonged hospital

stay, high treatment costs, and lower extremity amputations, needed avoiding and fearing due to high rates mortalities [3,4]. The annual prevalence of major foot amputations in patients with DM is between 5% and 25% [13-15]. Although this rate has changed over the years, Turkey has a high rate of 9.4-50% [16-18].

Although pain control in diabetic foot amputations is considered an important component of postoperative care, pain control is an important factor in controlling postoperative complications in high-risk patient populations, such as those with severe comorbidities [19]. Patients with high ASA level (ASA III-IV) DM are a particular concern for anesthesiologists because of the risk of multiple organ failure associated with many neuropathic, nephropathic, and microangiopathic diseases [12]. In this study, 8 patients in the GA group and 11 patients in the CFPNB group met ASA IV criteria. For all these reasons, anesthesia is essential for patient safety, especially for high-risk patients with diabetes undergoing distal foot surgery [20].

Central nervous block or general anesthesia techniques have been considered in patients undergoing amputations with additional disease and/or multiple organ failure. However, patients with anticoagulant and bleeding disorders should be avoided in central nerve blocks [21]. Captevilla et al [22] and Naja et al [23] indicated that they preferred peripheral nerve blocks, which are well known to be associated with better postoperative analgesia, increased functional recovery rate, and decreased hemodynamic instability. In this study, ultrasound-guided CFPNB was provided for both adequate anesthesia and postoperative analgesia. No perioperative pain was observed, and better VAS values were obtained with CFPNB in the 2, 6, 12, 24, and 48th postoperative follow-up hours.

This study has some limitations. First, because this study is a retrospective, single-center study, patients' reamputation and mortality data have not been identified. Second, there were different surgical and anesthesia teams that participated in operations according to the medical records. We therefore believe that additional investigations are needed to evaluate the effects of anesthetic techniques on long-term morbidity and mortality in patients with high-risk diabetic foot, including larger, controlled, double-blinded, and prospective studies.

## Conclusion

In showed a significant conclusion, in this study, a significant difference was found between CFPNB and GA as anesthetic management techniques for patients with diabetes undergoing transtibial amputations, and CFPNB may be a positive option for postoperative analgesia.

## Competing interests

The authors declare that they have no competing interest.

## Financial Disclosure

All authors declare no financial support.

## Ethical approval

Ethic approval was received from Selcuk University Faculty of Medicine Observational Ethics Committee (Prot. No= 2017/232)

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