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# Ankle Nerve Block Adjuvant to General Anesthesia Reduces Postsurgical Pain and Improves Functional Outcomes in Hallux Valgus Surgery

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**Significance of the Study**

- This study showed that ankle nerve block adjuvant to general anesthesia reduced postoperative pain and improved foot function after hallux valgus surgery during a 1-year period. If there is no allergy to the anesthetic or contraindication in patients who undergo hallux valgus surgery, ankle nerve block should be added to general anesthesia for providing better pain control and foot function.

**Keywords**

Ankle nerve block · General anesthesia · Hallux valgus · Postoperative pain · Foot function

**Abstract**

***Objective:*** Postoperative pain is a frequent problem after orthopedic procedures like hallux valgus surgery. The aim of this study was to evaluate whether ankle block improves early and mid-term functional outcomes and postoperative pain management after hallux valgus surgery in patients receiving general anesthesia. ***Subjects and Methods:*** This randomized controlled trial investigated 60 patients who underwent hallux valgus surgery under general anesthesia. Patients were prospectively randomized into 2 groups: general anesthesia only (group A) and ankle block added to general anesthesia (group B). Age, body-mass index, tourniquet time, duration of surgery, first analgesic need time, perioperative analgesic regimen, visual analog scale (VAS), American Orthopedic Foot and Ankle Score (AOFAS), and length of hospital stay were recorded. Independent variables were analyzed by *t* test. Nonparametric data were analyzed by the Mann-Whitney U test. ***Results:*** Patient age, demographics, and body mass indices were similar between the 2 groups. The average length of hospital stay was significantly longer in group A ($p < 0.01$). Group B had a longer time to first analgesic need than group A ($p < 0.01$). Patients in group B required less analgesic during the postoperative period. Preoperative VAS and AOFAS scores were not statistically different between the 2 groups. The postoperative day 1 VAS score was significantly lower in group B than in group A. Follow-up visits at 3, 6, and 12 months showed significantly lower VAS and higher AOFAS scores in group B than group A. ***Conclusion:*** Ankle block added to general anesthesia may improve early and mid-term postoperative functional outcomes and postoperative pain management in patients who undergo hallux valgus surgery.





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## Introduction

Postoperative pain is frequently encountered after orthopedic practice. Acute pain after surgery may be due to the existing disease or the surgical intervention itself, or a combination of them [1]. Inadequate treatment of acute pain is a critical risk factor for the development of chronic pain. Persistent pain is suggested to have the potential of influencing procedure-related functional outcomes [1].

Although ankle block usually provides sufficient anesthesia for forefoot surgery, it might be unsatisfactory in cases where tourniquet is applied or may lead to some problems related to limited patient adaptation [2]. General anesthesia is still in widespread use and is the preferred method for foot procedures in many countries [2]. Ankle block is often applied as an adjuvant to general anesthesia to establish postoperative analgesia in these cases [3]. The advantages of ankle block include the capability of controlling acute surgical pain, quicker patient ambulation, and absence of adverse effects related to opioids or nonsteroidal anti-inflammatory drugs [4]. In addition, it was reported to provide superior postoperative analgesia compared to opioids [5].

Hallux valgus is a relatively common forefoot disease in clinical practice [6]. Cases that are refractory to conservative therapy, painful, and of intermediate/advanced severity are treated by surgery [7]. The aim of our study was to prospectively investigate the early and mid-term effects of ankle block performed along with general anesthesia on postoperative pain and functional foot outcomes in hallux valgus surgery.

## Materials and Methods

A prospective comparative study including 65 patients with randomized allocation was conducted between September 2013 and August 2015 following ethics committee approval. Power analysis was conducted with a power analysis and sample size software package (NCSS, Kaysville, UT, USA), using simulation under Poisson distributions with the Mann-Whitney U test, and a target ≥0.05. The inclusion criteria consisted of ages 18–60 years, an American Society of Anesthesiologists (ASA) score of I–II, no peripheral neuropathy or allergy to local anesthetics, and no history of foot procedures. Five subjects with known allergy or intolerance to local anesthetics, who had diabetic or peripheral neuropathy or rheumatologic disorders, who had developed malunion, infection, or surgical technique-related complications, and who did not have regular follow-up data were excluded from the study. Informed consent was obtained for the procedure and follow-up.

The patients were divided into 2 groups: patients in group A ($n$ = 30) received general anesthesia alone, while patients in group B ($n$ = 30) received general anesthesia plus ankle block. All subjects underwent a standard general anesthesia procedure consisting of inhalation anesthesia ($N_2O$/sevoflurane) via a laryngeal mask following induction with propofol 2–3 mg/kg, fentanyl 2–5 μg/kg, midazolam 0.2 mg/kg, and rocuronium 0.6 mg/kg [9]. Long-acting opioid analgesics and nonsteroidal anti-inflammatory drugs were not used in either group. Ankle tourniquet was performed at the malleolar level by applying a pressure that was 100 mm Hg higher than the systolic blood pressure [2]. In group B, 5 mL bupivacaine 0.5% was administered to each anatomic landmark after general anesthesia and tourniquet. Figure 1 depicts the posterior tibial nerve, at the medial malleolar level and posterior to pulsation of the posterior tibial artery. Figure 2 shows the superficial peroneal nerve, lateral to the extensor digitorum longus at the junction of the 4th phalanx and ankle joint. The photograph in Figure 3 shows the dorsomedial part of the superficial peroneal nerve, dorsolateral to the 1st metatarsophalangeal joint eminence at the lateral of the extensor digitorum longus. The deep peroneal nerve is 2 cm lateral to the dorsalis pedis artery or extensor hallucis longus or intermalleolar line. Finally, the saphenous nerve is 1 cm anterior to the medial malleolus (Fig. 4) [9]. All subjects underwent distal metatarsal osteotomy and a modified McBride procedure conducted by the same orthopedic surgeon. Local anesthetic infiltration was not performed before or after incision in any of the patients.

The standard postoperative analgesia consisted of paracetamol 15 mg/kg i.v. 4 times a day. In case of severe pain (VAS >3), intravenous tramadol 2 mg/kg was added to the analgesic regimen. Age, body mass index, ASA score, tourniquet time (TT), first analgesic need time (FANT), duration of surgery (DOS; knife to skin to closed wound), and length of hospital stay were recorded.

Visual analog scale (VAS) and American Orthopedic Foot and Ankle Score (AOFAS) were used to assess the pain and foot func-




**Fig. 1.** Local anesthetic application to the posterior tibial nerve (PTN). MM, medial malleol; AT, achilles tendon.


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**Fig. 2.** Injection of local anesthetic to the superficial peroneal nerve.




**Fig. 3.** Injection of local anesthetic to the deep peroneal nerve (DPN). EHL, extensor hallucis longus; LM, lateral malleolus.



**Fig. 4.** Saphenous nerve anterior to the medial malleolus.

tional status of the patients. VAS is a 10-point scale which is used to evaluate pain in a quantitative manner, where 0 denotes no pain and 10 denotes severe pain. AOFAS is a 100-point scoring system that assesses 3 different parts of the foot – the hindfoot, the midfoot, and forefoot. It is used to assess pain, function, and alignment of patients undergoing forefoot surgery [8]. VAS and AOFAS were recorded at 3, 6, and 12 months during clinical visits.

*Statistics*

After the distribution of data was assessed by the Kolmogorov-Smirnov test, independent variables were analyzed by the *t* test. Nonparametric data were analyzed using the Mann-Whitney U test. Statistical significance was accepted at $p < 0.05$.

**Table 1.** Age, BMI, LOS, ASA, TOD, and TT of patients

| | Group A (GA) | | Group B (GA + block) | | *p* |
|---|---|---|---|---|---|
| | mean | SD | mean | SD | |
| Age, years | 44.7 | 9.48 | 47.6 | 6.48 | 0.172 |
| BMI | 26.36 | 3.46 | 24.96 | 3.87 | 0.146 |
| LOS, days | 2.43 | 0.67 | 1.3 | 0.46 | 0.01 |
| ASA score | 1.30 | 0.46 | 1.30 | 0.46 | 1.00 |
| DOS, min | 48.76 | 6.61 | 48.86 | 7.38 | 0.956 |
| TT, min | 52.26 | 6.48 | 60.76 | 7.87 | 0.001 |

GA, general anesthesia; LOS, length of hospital stay; ASA, American Society of Anesthesiologists; DOS, duration of surgery; TT, tourniquet time.

## Results

There were no significant differences between the 2 groups in terms of patient age, demographic data, and body mass index (Table 1). Thirty-five subjects were operated on the right foot, and 25 cases on the left foot. TT was found to be significantly longer in the general anesthesia + block group ($p < 0.01$). The time to first need for postoperative analgesic was significantly longer in the general anesthesia + block group than in the general anesthesia group (678.46 ± 92.32 vs. 64.33 ± 17.17 min, $p < 0.01$). DOS was not significantly different between the groups ($p = 0.956$). The average length of hospital stay in group B was significantly shorter than in group A ($p < 0.01$). We found transient nerve paralysis in 1 case in each group, one at the medial margin of the foot and the other at the dorsum of the foot, which resolved spontaneously in 3 weeks without medical treatment. Preoperative VAS and AOFAS scores were not statistically different between the groups. The postoperative day 1 VAS score was significantly lower in the general anesthesia + ankle block group than in the general anesthesia group (2.96 ± 0.71 vs. 1.3 ± 0.65, $p < 0.01$). Follow-up visits at 3, 6, and 12

**Table 2.** VAS of patients

| | Group A | | Group B | | $p$ |
|---|---|---|---|---|---|
| | mean | SD | mean | SD | |
| Preoperative | 6.6 | 0.81 | 6.1 | 1.28 | 0.097 |
| Early postoperative | 2.97 | 0.71 | 1.30 | 0.65 | 0.001 |
| 3rd month | 1.53 | 0.51 | 0.60 | 0.49 | 0.001 |
| 6th month | 0.63 | 0.61 | 0.30 | 0.47 | 0.021 |
| 12th month | 0.40 | 0.62 | 0.13 | 0.34 | 0.045 |

VAS, visual analog scale.

**Table 3.** AOFAS of patients

| | Group A | | Group B | | $p$ |
|---|---|---|---|---|---|
| | mean | SD | mean | SD | |
| Preoperative | 53.53 | 5.47 | 55.80 | 4.84 | 0.093 |
| 3rd month | 76.67 | 3.43 | 86.80 | 3.74 | 0.001 |
| 6th month | 87.60 | 2.40 | 89.73 | 2.80 | 0.002 |
| 12th month | 89.96 | 2.63 | 92.47 | 2.87 | 0.001 |

AOFAS, American Orthopedic Foot and Ankle Score.

months showed significantly diminished VAS and increased AOFAS scores in the general anesthesia + block group than in the general anesthesia group (VAS scores; $p = 0.001$, $p = 0.021$, $p = 0.045$, and AOFAS scores; $p = 0.001$, $p = 0.002$, $p = 0.001$, respectively; Table 2, 3).

## Discussion

The principal finding in this study was that ankle block added to general anesthesia seems to reduce chronic postsurgical pain (CPSP) and enhance foot function both in early and 1-year postoperative periods. Studies in the literature report that ankle block is effective in early postoperative pain control, allows early mobilization, and prevents adverse effects secondary to oral analgesic use [10–14]. In their prospective study of 71 cases, Russell et al. [2] reported that ankle block markedly decreased the postoperative 24-h VAS score and that it is a safe method. On the contrary, Turan et al. [15] performed preincisional local lidocaine with general anesthesia in 90 cases and found no effect of adjuvant ankle block on acute surgical pain. In their study, etoricoxib and paracetamol were administered as the standard analgesic treatment, and no difference was detected between the groups. In the current study, preemptive local anesthesia was not performed after general anesthesia. The aim was only to assess the efficacy of ankle block as an adjuvant to general anesthesia. Turan et al. [15] found that the ankle block group had markedly lower 24-h VAS scores. Paracetamol and tramadol were used for the postoperative analgesic regimen. Different results between the 2 studies might be attributed to preemptive lidocaine administration before the incision or the use of different postprocedural analgesic regimens.

Ankle block application after the inflation of tourniquet is suggested to provide better pain control than application before inflation [4]. On the other hand, a prolonged TT may increase the risk of tourniquet paresis, which ranges from mild transient loss of function to permanent nerve injury [16]. While permanent nerve paralysis is estimated to be a rare complication, transient injury is more frequent. The transient nerve injury rate is reported to be between 3 and 4.9% in the literature [4, 16]. In the current study, TT was found to be significantly longer in group B than in group A ($p < 0.05$). Additionally, we found transient nerve paralysis in 1 case in each group ($n = 2$, 3.3%), 1 at the medial margin of the foot and the other at the dorsum of the foot in accordance with other studies. These signs were completely resolved in the third week with no need for medical treatment. The equal number of transient paralysis in each group might be due to the tourniquet itself rather than the block. Therefore, ankle block after tourniquet application seems to be a safe technique, although this needs to be confirmed in large clinical studies.

FANT was also evaluated in our study; this was found to be dramatically prolonged in patients who received additional ankle block compared to those undergoing general anesthesia alone. Urfalioglu et al. [17] compared spinal anesthesia and ankle block in patients undergoing foot surgery, and reported that ankle nerve block significantly increased the time to first analgesic need and showed a more prolonged effect which is consistent with the current study.

The mean length of hospital stay has been reported as 1–4 days in hallux valgus procedures [18, 19]. The length of stay in our study was in accordance with the literature. When the groups were compared in terms of hospital stay, ankle block was detected to statistically decrease the length of hospital stay ($p < 0.01$).

Acute postoperative pain was reported to occur in nearly three quarters of surgical patients, 80% of whom had an intermediate or severe level of pain [21, 22]. The possibility of postoperative acute pain to become chronic is 10–50%, depending also on the type of the procedure [23]. Inadequate treatment of acute postoperative pain, iatrogenic peripheral nerve injury, central neuronal sensitization, and genetic susceptibility may lead to chronic postoperative pain [22]. CPSP is defined as postoperative pain occurring in the absence of local complications and persisting for more than 2 months. Acute postoperative pain management and avoiding perioperative nerve damage is suggested to reduce CPSP as the intensity of acute postoperative pain correlates with the risk of chronic pain development [1]. Ankle nerve block inhibits the acute pain signaling intensity from the surgical site to the spinal cord and decreases the sensitization of the central nervous system [24]. Remérand et al. [25] assessed 1-year CPSP after foot surgery and reported an intermediate-advanced level of pain in 21% of patients during rest and 43% of patients while walking, which were also stated to be similar to those in serious orthopedic procedures such as knee or hip arthroplasty.

The limitations of this study include the fact that this was a single-center study, had a small sample size, and the lack of a group of patients receiving ankle block alone. Other limitations include the lack of a group consisting of local analgesia added to general anesthesia control groups, and the lack of measurement of perioperative hemodynamic parameters.

## Conclusion

Ankle nerve block added to general anesthesia seems to reduce chronic and acute postsurgical pain. Postoperative pain control with ankle block also provides better foot function after hallux valgus surgery.

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