

## THE ROLE OF ULTRASOUND-GUIDED POPLITEAL NERVE BLOCK IN OPIOID-FREE ANESTHESIA FOR AN OSTEOSYNTHESIS MATERIAL EXTRACTION AFTER BILATERAL CALCANEAL FRACTURE

Chavkoska Marina<sup>1</sup>, Naumovski Filip<sup>2</sup>, Cvetkova Mladenovska Marija<sup>2</sup>

<sup>1</sup>Department of Anesthesiology and Intensive Care Medicine, Ohrid General Hospital, Republic of North Macedonia

<sup>2</sup>University Clinic for Traumatology, Orthopedics, Anesthesiology, Resuscitation, Intensive Care and Emergency Center – Skopje, Department of Anesthesiology, Resuscitation and Intensive Care Medicine, Faculty of Medicine, Ss. Cyril and Methodius University in Skopje, Republic of North Macedonia  
*e-mail: fnaumovskimd@gmail.com*

### Abstract

Peripheral nerve blocks (PNBs) for intraoperative and perioperative pain management are often part of the anesthetic plan for foot and ankle surgery. Usage of peripheral nerve blocks may limit occurrence of general anesthesia related complications by decreasing the amount of intraoperative anesthetic medications usage. Decreased postoperative opioids use and earlier time to discharge were encountered when peripheral nerve blocks were used. This case presentation is about a 38-year-old male patient with bilateral calcaneal OSM extraction and left calcaneal osteotomy, who refused spinal anesthesia, as well as refused to be awake during the procedure. Avoiding opioids was possible with usage of bilateral ultrasound-guided popliteal nerve block with 10 ml of 2% Lidocaine on each side. The purpose of this case report is to present the role of PNBs in intraoperative and postoperative decrease of opioids usage, as well as the absolute hemodynamic stability met during the procedure and pain-free extubated and awakened patient.

**Keywords:** popliteal nerve block, ultrasound-guided nerve block, opioid-free anesthesia

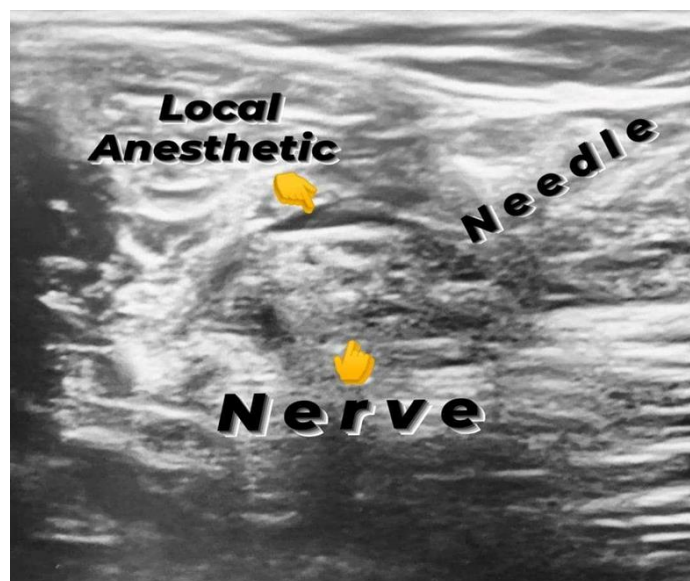
### Introduction

Peripheral nerve blocks for surgical anesthesia and postoperative pain management were frequently used in the past few years as a result of the significantly increased application of ultrasound<sup>[1]</sup>. Multimodal management of postoperative pain following orthopedic and trauma surgery may involve usage of regional anesthesia techniques. Foot and ankle surgery often are accompanied by applying ultrasound-guided peripheral nerve blocks (PNB) as popliteal nerve block or ankle block for intraoperative and postoperative pain management. Application of peripheral nerve blocks was related with less frequent occurrence of general anesthesia associated side effects by decreasing the amount of intraoperative anesthetic medication usage<sup>[2]</sup>. Decreased postoperative use of opioids and earlier time to discharge was encountered when peripheral nerve blocks were used<sup>[3]</sup>. Patients who underwent foot and ankle surgery where the anesthetic plan was augmented by ultrasound-guided popliteal nerve block have been reporting improved satisfaction scores, reduced postoperative pain and shorter recovery period as well. Application of the popliteal nerve block involves ultrasound-guided administration of a local anesthetic to the perineural region

along the sciatic nerve slightly above the level of the popliteal fossa<sup>[4]</sup>. The needle tip is positioned between the tibial and common peroneal components of the sciatic nerve near or above the division for successful distribution of the local anesthetic to both nerves with single injection. Unlike the nerve stimulation technique, ultrasound-guided technique of popliteal nerve block offers direct visualization of the nerve as well as the local anesthetic distribution after application<sup>[5]</sup>. Ultrasound guidance can help in confirming anatomic variation of the nerve structures, as well as can provide visualization of the local anesthetic distribution during injection and its diffusion around the nerve<sup>[5,6]</sup>. The purpose of this case report is to present the role of the ultrasound-guided PNB in intraoperative and postoperative decreased usage of opioids as well as reaching hemodynamic stability during surgery.

### Case report

We present the case of a 38-year-old male, 95 kg weight and 185 cm height, without history of chronic diseases and no therapy in use. A year ago, he had a traumatic injury that resulted in bilateral calcaneal fracture, after fall from a height, and underwent a surgical procedure where bilateral osteosynthesis was done. One year later, he was admitted to the Trauma Department of our hospital for an OSM extraction and left calcaneal osteotomy. He refused spinal anesthesia, as well as refused to be awake during the procedure. After he was introduced into opioid-free general anesthesia, by administering i.v. 1 mg Midazolam, 50 mg Ketamine, 200 mg of Propofol, muscle relaxation was provided with 50 mg of Rocuronium bromide. The maintenance of anesthesia was provided by the usage of inhalational anesthetic 1v% Isoflurane mixed with Nitric oxide. In terms of analgesia, we decided to perform bilateral popliteal nerve block. Under aseptic conditions and monitoring, we performed an ultrasound-guided popliteal sciatic nerve block using a peripheral nerve block needle (Stimuplex 20G 50 mm). The needle was inserted in plane under ultrasound guidance with a linear transducer and sterile technique (Figure 1). Then, 10 ml of 2% Lidocaine were administered on both sides, left and right, without incident. The surgical procedure was ongoing for the next 3 hours and 15 minutes, and the patient had a complete hemodynamic stability, with no need of opioids for pain management; no muscle relaxants were used except for the initial intubation dose. The patient was awakened with no complaints of pain. Postoperative pain two hours after surgery was interpreted as 0 out of 10, and 1 out of 10 the next day after surgery. No opioids were used in the postoperative period till patient's discharge.



**Fig. 1.** Ultrasound-guided anatomic visualization of popliteal nerve block

with needle placement, nerve structures and local anesthetic dispersion

### Discussion

In order to reduce the pain during the perioperative period, the ultrasound-guided popliteal nerve blocks are indicated in patients undergoing lower leg, foot and ankle surgery. When compared to placebo, performing peripheral nerve blocks with local anesthetics has resulted in improvement in postoperative analgesia<sup>[7]</sup>. There are studies that report reduction of postoperative pain that persists for more than 5.5 half-lives of the drug, which is approximately 8 hours for Lidocaine, and 12-16 hours for Bupivacaine<sup>[8]</sup>. The volume and concentration of the local anesthetic used does not appear to affect the efficacy of the block, but it seems that the greatest importance has the total used dose or the mass of the local anesthetic<sup>[8]</sup>. According to Araujo *et al.*, postoperative nerve impulse activity and changes in synaptic neuroplasticity in the CNS, as well as changes in the signaling properties of non-neuronal cells, such as microglia, are affected by local anesthetics used in peripheral nerve blocks<sup>[9]</sup>. It has been documented that peripheral nerve blocks have decreased the opioid consumption not only intraoperatively, but postoperatively as well<sup>[10]</sup>. This was seen in our case where no opioids were used either intraoperatively or postoperatively. When using ultrasound-guided regional anesthesia techniques, the most significant decrease in opioid consumption could be expected during the first 24-72 hours after surgery<sup>[3]</sup> as it can be seen in our case as well. Single injection peripheral nerve blocks could provide superior pain control and patient satisfaction as well as decreased side effects occurrence compared to opioid-based anesthetic techniques<sup>[5]</sup>. Studies have shown that pain scores were lower in patients who received peripheral nerve blocks as part of the anesthetic technique. The use of PNB leads to less frequent occurrence of side effects as nausea, vomiting, excessive sedation and pruritus in comparison to opioid-based analgesia<sup>[3]</sup>. None of the above-mentioned complications were seen in our patient making this procedure safe enough to be a part of the anesthetic plan in foot surgery. On the other side, we have to mention contraindications for PNB as well, which include infection at the site of injection, local anesthetic allergy, coagulopathies or pre-existing peripheral neuropathies<sup>[3]</sup>. None of them were met in our patient, which made him a suitable candidate for receiving bilateral ultrasound-guided peripheral nerve blockade.

Based on the available data, popliteal nerve blocks have a relatively low complication rates ranging from 0-10%, while long-term complications were met in less than 1% of patients. Despite the fact that there are studies with quite different overall incidence of neurological complications related to popliteal nerve block, most of the authors reported a low incidence of complications associated with the block technique, highlighting this analgesic modality as a safe and even protective in terms of developing chronic neuropathic pain<sup>[11]</sup>. Previous surgery on both feet in our patient and the need of a second bilateral surgery was the reason why we decided to use a regional anesthesia as a modality to prevent developing a chronic neuropathic pain. There are specific risk factors for development of complications related to popliteal nerve blocks, including patients between 40-65 years of age, patients with normal or underweight body mass index, current smokers, as well as an outpatient surgery<sup>[11,12]</sup>. Regarding the above-mentioned risk factors, our patient was with normal body weight, and with no other risk factors or comorbidities. According to the in-hospital and out of hospital follow-up, there were no signs or symptoms that could suggest any complications related to the used regional anesthesia technique.

### Conclusion

The follow-up of our patient showed a strongly positive effect of the bilateral popliteal nerve block as part of the anesthetic technique, for suppressing intra- and postoperative pain

as well as withdrawing opioid consumption. This case report shows that PNB is a safe regional anesthetic technique for foot surgery without development of complications perioperatively and a non-opioid source of analgesia when performing opioid-free anesthesia techniques. We strongly believe that reduced postoperative pain leads to an improved and shortened period of functional recovery, shorter hospitalization, decreased acute morbidity as well as possibility to reduce the development of chronic postoperative neuropathic pain.

*Conflict of interest statement.* None declared.

### References

1. Kirksey MA, Haskins SC, Cheng J, Liu SS. Local Anesthetic Peripheral Nerve Block Adjuvants for Prolongation of Analgesia: A Systematic Qualitative Review. *PLoS One* 2015; 10(9): e0137312. doi: 10.1371/journal.pone.0137312.
2. Gabriel RA, Ilfeld BM. Peripheral nerve blocks for postoperative analgesia: From traditional unencapsulated local anesthetic to liposomes, cryoneurolysis and peripheral nerve stimulation. *Best Pract Res Clin Anaesthesiol* 2019; 33(3): 293-302. doi: 10.1016/j.bpa.2019.06.002.
3. Sara J. Judickas, DPM, Ryan Stone, DPM, AACFAS, Ian Barron, DPM, FACFAS, Popliteal Nerve Blocks: Risks and Benefits in Foot and Ankle Surgery, *Podiatry Today*, June 2023, Vol. 36, Issue 6
4. Sagherian BH, Kile TA, Seamans DP, Misra L, Claridge RJ. Lateral popliteal block in foot and ankle surgery: Comparing ultrasound guidance to nerve stimulation. A prospective randomized trial. *Foot Ankle Surg* 2021; 27(2): 175-180. doi: 10.1016/j.fas.2020.03.011.
5. Boysen PG 2nd, Pappas MM, Evans B. An Evidence-Based Opioid-Free Anesthetic Technique to Manage Perioperative and Periprocedural Pain. *Ochsner J* 2018; 18(2): 121-125. doi: 10.31486/toj.17.0072
6. Cardwell TW, Zabala V, Mineo J, Ochner CN. The Effects of Perioperative Peripheral Nerve Blocks on Peri- and Postoperative Opioid Use and Pain Management. *Am Surg* 2022; 88(12): 2842-2850. doi: 10.1177/00031348211023395.
7. Blair TT, Weatherley TS, Panchbhavi VK. Techniques and complications of popliteal nerve blocks. *Foot Ankle Surg* 2022; 28(7): 852-857. doi: 10.1016/j.fas.2021.11.008.
8. Barreveld A, Witte J, Chahal H, Durieux ME, Strichartz G. Preventive analgesia by local anesthetics: the reduction of postoperative pain by peripheral nerve blocks and intravenous drugs. *Anesth Analg* 2013; 116(5): 1141-1161. doi: 10.1213/ANE.0b013e318277a270.
9. Araujo MC, Sinnott CJ, Strichartz GR. Multiple phases of relief from experimental mechanical allodynia by systemic lidocaine: responses to early and late infusions. *Pain* 2003; 103: 21-29. [https://doi.org/10.1016/s0304-3959\(02\)00350-0](https://doi.org/10.1016/s0304-3959(02)00350-0).
10. Mendicino RW, Statler TK, Catanzariti AR. Popliteal sciatic nerve blocks after foot and ankle surgery: an adjunct to postoperative analgesia. *J Foot Ankle Surg* 2002; 41(5): 338-341. doi: 10.1016/s1067-2516(02)80055-2.
11. Kahn RL, Ellis SJ, Cheng J, Curren J, Fields KG, Roberts MM, YaDeau JT. The Incidence of Complications Is Low Following Foot and Ankle Surgery for Which Peripheral Nerve Blocks Are Used for Postoperative Pain Management. *HSS J* 2018; 14(2): 134-142. doi: 10.1007/s11420-017-9588-y.
12. Rodziewicz TL, Stevens JB, Ajib FA, Tunnell DJ. Sciatic Nerve Block. 2023 Jun 5. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023 Jan.