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ARTICLE

Peripheral Nerve Block in Below Knee Amputation: A Systematic Review

Andre Krislee[1], Andrio Suhadi[2], Charina Geofhany Debora[3]
[1]Department of Anesthesiology and Intensive Care, Risma Inpatient Primary Clinic, North Sumatra, Indonesia, [2]Faculty of Medicine Universitas Abulyatama, Aceh Indonesia, [3]Sultan Syarif Mohamasa Alkadrie Hospital Pontianak, Indonesia
*Corespondence author: Andre Krislee, Department of Anesthesiology and Intensive Care, Risma Inpatient Primary Clinic, North Sumatra, Indonesia (andre.krislee@gmail.com)

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ABSTRACT

Background: Patients who undergo below knee amputation (BKA) surgery are often accompanied with many comorbidities so that BKA surgery with general anesthesia (GA) or spinal or epidural may not be possible. Peripheral nerve block (PNB) is an alternative to this situation.
Objective: This study aims to investigate the used of PNB in BKA.
Subject and Methods: We performed a detailed search of PubMed, Scopus, and Web of Science database using the following search terms and their synonyms: "peripheral nerve block", and "below knee amputation". Only english articles are included in this study. Data extraction and systhesis were performed according to PRIMA guidelines
Result: A total 7 articles were included in this research, see table 1. For the case report and case series, five patients were undergo BKA using sciatic and femoral block combination, one patients using sciatic and lumbar plexus block combination, and five patients using sciatic and adductor canal block combination. One cohort showed that PNB had p=0.04 with adjusted OR 0.75 (0.57 – 0.98) againts GA.
Discussion: Beside being used as an additional analgesia in lower extremity surgery, PNB can also be used as primary anesthesia for patients who have contraindications to GA or neuraxial anesthesia. Two systematic review studies showed that nerve block in lower extremity surgery had better outcomes, fewer complications, and better pain management, but did not reduce mortality compared with GA.
Conclusion: PNB may be an alternative for BKA surgery. PNB was associated with a reduced risk of postoperative delirium but not of mortality or morbidity compared with GA.

Keywords: Below knee amputation, peripheral nerve block, systematic review

INTRODUCTION

Patients undergoing below knee amputation (BKA) often have complex comorbidities such as diabetes mellitus (DM), chronic kidney disease (CKD), peripheral arterial disease (PAD), coronary artery disease (CAD), and others.[1,2] These comorbidities are associated with increased perioperative morbidity and mortality. Spinal anesthesia, which is commonly used for lower extremity surgery, may cause hypotension and bradycardia. General anesthesia may be selected when spinal anesthesia is contraindicated; however, GA is associated with increased perioperative morbidity and a greater need for postoperative ventilatory support and intensive care. Therefore, in selected clinical situations, peripheral nerve block (PNB) may represent a viable anesthetic alternative.[3]

PNB techniques have gained increasing popularity in orthopedic surgery, particularly for procedures involving the lower extremities. This trend may be attributed to several advantages of PNB, including fewer cardiovascular effects, prolonged postoperative analgesia, reduced healthcare costs, and shorter hospital stays.[4,5] Nevertheless, technical difficulty, the risk of incomplete nerve blockade, and the need for additional equipment remain important limitations.[4]

Despite these limitations, PNB remains a valuable option when spinal or general anesthesia cannot be safely performed.[1] Furthermore, the use of PNB specifically for BKA surgery has not been extensively discussed in the literature. Therefore, this systematic review aims to evaluate the current evidence regarding the use of PNB in BKA surgery.

METHODS

This systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines.[6]

Eligibility Criteria

Eligibility criteria were defined based on the PICOS framework (participants, intervention, comparison, outcome, study design), including studies that utilized peripheral nerve block anesthesia in patients undergoing below knee amputation, as follows:

- Participants: All patients undergoing below knee amputation
- Intervention: Peripheral Nerve Block
- Comparison: Non-PNB techniques or PNB alone
- Outcome: Success of the anesthetic technique
- Study design: Case reports, case series, cohort studies, case-control studies, or randomized controlled trials

Literature Search Strategy

A literature search was conducted using electronic databases including PubMed, Scopus, and Web of Science, with the search period extending until May 16, 2024. Keywords used included "peripheral nerve block" and "below knee amputation," along with their synonyms. Detailed search strategies are provided in Supplementary File 1.

Literature Selection

Literature selection was performed according to PRISMA 2020 guidelines Initially, all records identified from the electronic databases were collected, and duplicate studies were removed. Titles and abstracts were then screened, followed by full-text review of potentially eligible articles. Studies meeting the eligibility criteria were included in the final synthesis. Study selection was performed independently by the first and second authors (AK and AS). Discrepancies were resolved through discussion or consultation with the third author (CGD).

Data Extraction and Collection

Data extracted from the included studies comprised sample size, patient age and sex, American Society of Anesthesiologists (ASA) classification, comorbidities, surgical indication and site, anesthetic technique, and anesthetic outcomes. Data extraction was performed manually by all authors and summarized in tabular form using Microsoft Excel.

RESULT

Study Selection

A total of 81 records were identified from PubMed, Scopus, and Web of Science databases. After screening and eligibility assessment, seven studies met the inclusion criteria (Figure 1). These included five case reports, one case series, and one retrospective cohort study.

Study Characteristics

Seven studies involving a total of 758 patients were included, comprising 11 patients from case reports and case series and 747 patients from a retrospective cohort study (Table 1). All patients underwent BKA with PNB as the anesthetic technique. Detailed descriptions of the PNB techniques were available for only 11 patients. In the retrospective cohort study, specific PNB techniques were not reported.

Patient age ranged from 20 to over 80 years, with the majority aged older than 60 years. ASA classifications ranged from II to IV, with ASA III being the most common. The most frequent comorbidities were DM, PAD, and CKD. The most common indication for BKA was diabetic gangrene. Among the 11 patients with detailed reports, five received a combination of sciatic and femoral nerve blocks, one received a combination of sciatic and lumbar plexus blocks, and five received a combination of sciatic and adductor canal blocks. Ultrasound guidance was used in eight patients, while one patient underwent nerve stimulation–guided block. No study reported the combined use of ultrasound and nerve stimulation. Only two patients received sedation during the PNB procedure.

The onset time of anesthesia ranged from 20 to 30 minutes. Surgical duration ranged from 52 to 75 minutes. Time to first postoperative analgesic ranged from 6 to 10 hours. No intraoperative or postoperative complications were reported in the case-based studies. In the retrospective cohort study, PNB was not associated with significant differences in mortality (p = 0.60) or morbidity (p = 0.37) compared with GA; however, PNB was associated with a significantly lower incidence of postoperative delirium (p = 0.04).

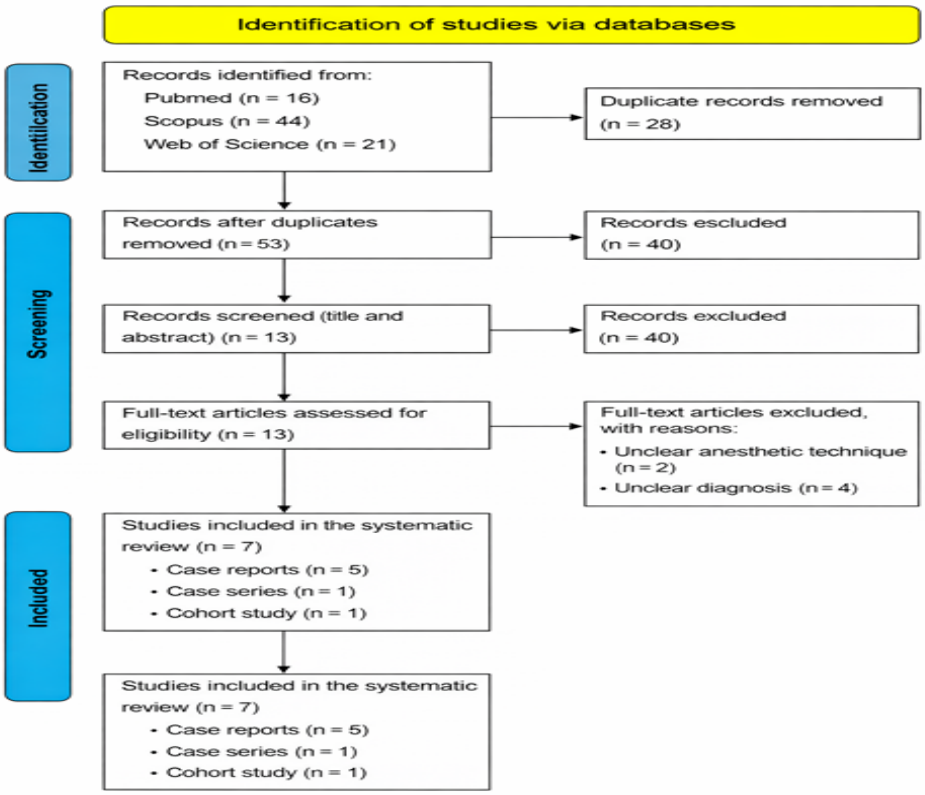

Figure 1. PRISMA Flow Diagram

Table 1a. Summary of Included Studies on Peripheral Nerve Block in Below Knee Amputation

No	Author (years)	Study Design	Sample, age, sex	ASA	Comorbidities	Indication and surgical site	Anesthetic technique or intervention	Anesthetic outcomes
1	Baddoo (2009)7	Case Report	63 y.o, male	IV	DM	Left lower limb due to diabetic gangrene	Femoral block: 5 mL of 2% lidocaine with adrenaline (1:200,000) + 5 mL of 0.5% bupivacaine Sciatic block (posterior approach): 15 mL of 2% lidocaine with adrenaline (1:200,000) + 10 mL of 0.5% bupivacaine Nerve stimulator–guided Sedation: No sedation	Onset time: 30 min Surgery duration: 75 min Time to first analgesic: 10.5 hours postoperatively Complications: –
	Choi et al (2015)8	Case Report	63 y.o, female	IV	HT, RA, MI	Right lower limb due to thrombotic occlusion	Popliteal sciatic block: 20 mL of 0.75% ropivacaine with epinephrine 1:100,000 Femoral block: 10 mL of 0.75% ropivacaine with epinephrine 1:100,000 Ultrasound-guided Sedation: Preoperative (fentanyl 25 mcg and midazolam 1 mg) and intraoperative (midazolam 2 mg and fentanyl 50 mcg)	Onset time: 25 min Surgery duration: 52 min Time to first analgesic: – Complications: No cardiovascular complications, femoral and popliteal artery hematoma up to 14 days postoperatively
3	Byun et al (2016)5	Case Report	70 y.o, male	-	DM,HT,CAD	Bilateral lower limbs due to atherosclerotic gangrene	Left Lower Limb Sciatic block: 24 mL of 1.0% mepivacaine + 0.75% ropivacaine (1:1 ratio) Femoral block: 21 mL of 1.0% mepivacaine + 0.75% ropivacaine (1:1 ratio) Ultrasound-guided Sedation: No sedation	Onset time: 23 min Surgery duration: 76 min Time to first analgesic: – Complications: No hemodynamic instability, LAST, or neurological complaints up to 25 days postoperatively
				-			Right Lower Limb Sciatic block: 30 mL of 1.0% mepivacaine + 0.75% ropivacaine (1:1 ratio) Femoral block: 17 mL of 1.0% mepivacaine + 0.75% ropivacaine (1:1 ratio) Ultrasound-guided Sedation: No sedation	Onset time: – Surgery duration: – Time to first analgesic: – Complications: No hemodynamic instability, LAST, or neurological complaints up to 25 days postoperatively

*p>0.05; Singkatan: Abbreviations: aOR, adjusted odds ratio; CAD, coronary artery disease; CKD, chronic kidney disease; DM, diabetes mellitus; HT, hypertension; MI, myocardial infarction; LAST, local anesthetic systemic toxicity; PAD, peripheral arterial disease; RA, rheumatoid arthritis; POD, postoperative delirium; IS, ischemic stroke; US, ultrasonography; y.o, years old.

Table 1b. Summary of Included Studies on Peripheral Nerve Block in Below Knee Amputation

No	Author (years)	Study Design	Sample, age, sex	ASA	Comorbidities	Indication and surgical site	Anesthetic technique or intervention	Anesthetic outcomes
4	Mehta (2021)2	Case Report	50 y.o, female	IIIE	DM, HT	Right lower limb due to persistent pain, swelling, and fever after embolectomy	Sciatic block: 20 mL of lidocaine with adrenaline + bupivacaine + normal saline (2:2:1 ratio) Lumbar plexus block: 30 mL of lidocaine with adrenaline + bupivacaine + normal saline (2:2:1 ratio) No nerve stimulation or ultrasound guidance Sedation: No sedation	Onset time: 22 min Surgery duration: – Time to full recovery: 8 hours postoperatively Complications: No complications up to 7 days postoperatively
5	Devkota and Thapa (2023)	Case Report	67 y.o, male	-	DM,HT,CKD,IS	Left lower limb due to diabetic gangrene	Subgluteal sciatic block: 20 mL of 0.2% plain bupivacaine Femoral block: 20 mL of 0.2% plain bupivacaine Ultrasound-guided Sedation: Midazolam 0.5 mg	Onset time: – Surgery duration: 1 hour Time to first analgesic: 6 hours postoperatively Complications: No intraoperative complications
6	Sandhya et al (2023)3	Case Series	57 y.o, female	III	DM,HT,CAD	Right lower limb due to diabetic gangrene	Popliteal sciatic block: 20 mL of 0.5% bupivacaine + 2% lignocaine with adrenaline (1:200,000) + distilled water (2:1:1 ratio) Adductor canal block: 16 mL of 0.5% bupivacaine + 2% lignocaine with adrenaline (1:200,000) + distilled water (2:1:1 ratio) Ultrasound-guided Sedation: No sedation	Onset time: 20–25 min Surgery duration: – Time to total recovery: 6–10 hours Complications: No hypotension, bradycardia, or anesthetic complications up to 24 hours postoperatively
			60 y.o, male	III	DM,CKD	Left lower limb due to diabetic gangrene with sepsis		
			58 y.o, male	III	DM,CKD	Left lower limb due to diabetic gangrene		
			76 y.o, female	II	DM,HT	Right lower limb due to diabetic gangrene with PAD		
			66 y.o, male	III	DM,CKD	Right lower limb due to diabetic gangrene		
7	Abe et al (2020)1	Cohort Retrospective Study	N=747 20-49 y.o (n=33) 50-59 y.o (n=81) 60-69 y.o (n=220) 70-79 y.o (n=266) ≥80 y.o (n=147)	-	DM (n=504) PAD (n=488) CKD (n=368) CAD (n=152) HT (n=149)	Not specified	PNB with or without sedation compared with general anesthesia	Mortality: p = 0.60, aOR 1.11 (0.75–1.64) Morbidity: p = 0.37, aOR 1.15 (0.85–1.56) POD: p = 0.04*, aOR 0.75 (0.57–0.98

DISCUSSION

PNB techniques are most commonly used for postoperative analgesia or as adjuncts to anesthesia.[10] However, PNB can also serve as a primary anesthetic technique when GA or neuraxial anesthesia is contraindicated.[3] Among the 758 patients included in this review, only 11 had detailed descriptions of the PNB techniques used. In all reported cases, a combination of nerve blocks was employed, with the sciatic nerve block serving as the primary component and additional blocks involving the femoral nerve, lumbar plexus, or adductor canal.

The sciatic nerve block is typically used for surgical procedures involving the foot, ankle, and posterior aspect of the knee. Femoral nerve block provides coverage of the anterior thigh and medial lower leg but may result in quadriceps muscle weakness. The adductor canal block targets the saphenous nerve and branches to the vastus medialis, providing sensory anesthesia of the medial knee, leg, and ankle while preserving motor function and facilitating early mobilization.[10] Lumbar plexus block is generally indicated for hip or thigh surgery; however, rare complications such as epidural spread of local anesthetic may occur, resulting in bilateral motor weakness, hypotension, and urinary retention.[10,11] Combining the sciatic nerve block with other peripheral nerve blocks allows complete anesthesia for procedures below the knee. Nevertheless, incomplete blockade may occur and necessitate conversion to an alternative anesthetic technique.[4,12]

Six case-based studies demonstrated satisfactory outcomes with or without sedation, ultrasound guidance, or nerve stimulation, with no reported complications. The retrospective cohort study showed no significant differences in mortality or morbidity between PNB and GA but demonstrated a lower incidence of postoperative delirium in the PNB group. These findings are consistent with other systematic reviews reporting better outcomes, fewer complications, and improved pain control with PNB, although without reduced mortality compared to GA.[10,13]

A systematic review conducted by Lee at al demonstrated that surgery performed under spinal anesthesia was associated with a higher postoperative analgesic requirement and a reduction in systolic blood pressure during the first 30 minutes compared with peripheral nerve block (PNB). However, spinal anesthesia provided a faster onset of anesthesia and a shorter procedural time.[4] This review has several limitations. Only English-language studies were included, which may have resulted in the exclusion of relevant articles published in other languages. Additionally, the limited number of cohort studies and randomized controlled trials restricts the strength of the conclusions. Further high-quality randomized controlled trials are required to better evaluate the effectiveness of PNB in BKA surgery.

CONCLUSIONS

In addition to its role as an adjunct for postoperative analgesia in lower extremity surgery, peripheral nerve block may serve as an alternative primary anesthetic technique for patients undergoing below knee amputation who have contraindications to general or neuraxial anesthesia. PNB was associated with a reduced incidence of postoperative delirium but showed no significant differences in mortality or morbidity compared with GA. Further randomized controlled trials are needed to clarify the role of PNB in BKA surgery.

REFERENCES

1. Abe H, Sumitani M, Matsui H, Aso S, Inoue R, Fushimi K, et al. Comparing outcomes after peripheral nerve block versus general anesthesia for lower extremity amputation: a nationwide exploratory retrospective cohort study in Japan. Reg Anesth Pain Med. 2020;45(6):399–404. Doi: 10.1136/rapm-2019-101208
2. Mehta JB, Naik GR, Chauhan D. Sciatic nerve and lumbar plexus block for below knee amputation- newer approach for better haemodynamic stability and patient safety. J Clin Diagnostic Res. 2021;15(3):10–2. Doi: 10.7860/JCDR/2021/47451.14634
3. Sandhya M, Shenoy S, Shetty SR, Chanakya A. A Combination of Ultrasound-guided

Popliteal Sciatic Nerve Block and Adductor Canal Block as a Sole Anaesthetic Technique for below Knee Amputation in High-risk Patients: A Case Series. J Clin Diagnostic Res. 2023;17(9):25–8. Doi: https://doi.org/10.7860/jcdr/2023/66221.18436
4. Lee M, Lee C, Lim J, Kim H, Choi YS, Kang H. Comparison of a peripheral nerve block versus spinal anesthesia in foot or ankle surgery: a systematic review and meta-analysis with a trial sequential analysis. J Pers Med. 2023;13(7): 1–18. Doi: doi: 10.3390/jpm13071096
5. Byun SH, Lee J, Kim JH. Ultrasound-guided bilateral combined inguinal femoral and subgluteal sciatic nerve blocks for simultaneous bilateral below-knee amputations due to bilateral diabetic foot gangrene unresponsive to peripheral arterial angioplasty and bypass surgery in a coagulopathic patient on antiplatelet therapy with a history of percutaneous coronary intervention for ischemic heart disease: A case report. Medicine (Baltimore). 2016;95(29):1–5. Doi: 10.1097/MD.0000000000004324
6. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ. 2021;10(21): 1–11. Doi: 10.1186/s13643-021-01626-4
7. Baddoo H. A preliminary report on the use of peripheral nerve blocks for lower limb amputations. Ghana Med J. 2009;43(1):24–8.
8. Choi YS, Shin HJ, Park JY, Kim HJ, Yun SH. Ultrasound-guided femoral and popliteal sciatic nerve blocks for below knee surgery in patients with severe cardiac disease. Korean J Anesthesiol. 2015;68(5):513–5. Doi: 10.4097/kjae.2015.68.5.513
9. Devkota S, Thapa Y. Ultrasound-guided femoral and sciatic nerve block as an option for below-knee amputation in an elderly patient: A case report. Clin Case Rep. 2023; 11(3):1–4. Doi:10.1002/ccr3.7111
10. 10. Rodziewicz TL, Patel S, Hendrix JM, Garmon EH. Lower extremity blocks. StatPearls [Internet]. 2025. Available from: https://www.ncbi.nlm.nih.gov/books/NBK470184/
11. Gutierrez JJP, Ben-David B. Lumbar plexus block. StatPearls. [Internet]. 2023. Available from: https://www.ncbi.nlm.nih.gov/books/NBK556116/
12. Li H, Cho DH, Tokhner V. Unique considerations for complete surgical analgesia for below-the-knee amputations. Cureus. 2021;13(3):1–3. Doi: 10.7759/cureus.14224
13. Mufarrih SH, Qureshi NQ, Yunus RA, Katsiampoura A, Quraishi I, Sharkey A, et al. A systematic review and meta-analysis of general versus regional anesthesia for lower extremity amputation. J Vasc Surg. 2023;77(5):1542–552. Doi: 10.1016/j.jvs.2022.10.005