Effect of Peripheral Nerve Blocks as anesthetic adjuvant with Spinal versus General anesthesia on pain control and early postoperative discharge

Gad Sayed Gad[a], , Almoutasem Gaafer Ahmed Esmail[a*], Mohammed Gaber Ahmed[a]

[a]Department of Anesthesia, ICU, and Pain Management, Faculty of Medicine, South Valley University, Qena 83523, Egypt

Abstract

Background: Spinal anesthesia may cause many side effects. Augmenting it with Peripheral nerve blocks reduce opioid use. Proficient neuroaxial blocks may cause hyperalgesia. Pain relief and recovery are improved with peripheral nerve blocks.

Objectives: To assess peripheral nerve blocks impact with spinal compared to with general anesthesia on sever post operative pain and early discharge.

Patients and methods: This randomized trial divided 60 foot and ankle surgery patients into two groups: A: spinal anesthesia with Popliteal PNBs, B: general. Ages 20-55, ASA 1 or 2, 1-3 hour surgeries. Age >55, allergies, ASA 3 or 4, pregnancy/breastfeeding excluded. History, examinations, lab tests, anesthetic, surgical records. The ethical clearance number is SVU-MED-AIP029-1-22-9-454. Main outcomes: VAS score, opioid usage; secondary outcomes: hospital stay, nausea/vomiting, PACU discharge time.

Results: Group A: mean age: 44.6±7.03 years, 53.3% male. In Group B, mean age: 46.27±8.18 years, 66.7% male. Non-significant gender or age differences (p>0.05). Surgical kinds similar (p>0.05). ASAII classification higher in Group A (86.7% vs. 53.3%, p=0.005). No significant VAS score differences at 4, 8, 12, and 24 hours (p>0.05). Group A (1.33±0.48 days, 20% opioids) and Group B (1.43±0.73 days, 6.7% opioids) had comparable hospital stays (p>0.05). On average, Group A discharged at 55.53±5.26 minutes with no nausea or vomiting occurrence, whereas Group B discharged at 32.60±3.34 minutes but, 93.3% of cases reported nausea or vomiting. The average PACU discharge time was 44.07±12.36 minutes (range 28-66 minutes).

Conclusion: general anesthesia led to faster PACU discharge but not overall discharge, lower postoperative pain levels, suggesting both approaches are viable for foot and ankle surgery.

Keywords: Peripheral Nerve Blocks; Spinal anesthesia; General anesthesia; Postoperative discharge.

DOI: 10.21608/SVUIJM.2023.232739.1671

***Correspondence**: asemgaafer34@gmail.com

Received: 14 August,2023.

Revised: 14 September, 2023.

Accepted: 19 September, 2023.

Published: 23 April, 2025

Cite this article as Gad Sayed Gad, , Almoutasem Gaafer Ahmed Esmail, Mohammed Gaber Ahmed. (2025). Effect of Peripheral Nerve Blocks as anesthetic adjuvant with Spinal versus General anesthesia on pain control and early postoperative discharge. *SVU-International Journal of Medical Sciences*. Vol.8, Issue 1, pp: 884-894.

Introduction

Spinal anesthesia, which is favored over general anaesthetic in lower limb surgeries, might result in delayed patients discharge from hospital. This method involves injecting a single dosage of anesthetic medicine into the subarachnoid space, causing caudal sensory blocking and transitory cauda equina syndrome while preserving proprioception. Spinal anesthesia is widely used in surgical procedures and obstetrics, making it a popular technique in lower extremity surgery. Individual patient features and the specific dose of the given anesthetic have the most influence on the incidence of these effects. Notably, combining spinal anesthesia with peripheral nerve blocks (PNBs) has resulted in less dependency on opioid analgesics and improved postoperative pain perception. But as compared to the use of general anesthesia with PNBs, this combination is more prone to problems like as emesis **(Mancel et al., 2021).**

Regional anesthesia, especially neuroaxial blocks, is often regarded as a very effective way of postoperative analgesia and opioid sparing. Nonetheless, the occurrence of hyperalgesia after neuroaxial blocks has the potential to impair or completely negate the overall advantages of this method. The inclusion of localized anesthetic into multimodal analgesic regimens has increased noticeably, with the goal of maximizing analgesia, reducing opioid use, and allowing early ambulation and rehabilitation **(Halaszynski, 2009).**

Peripheral nerve blocks (PNBs) have become more important in the worldwide field of anesthetic management, notably in the field of orthopedic and vascular extremities surgery. These blocks are used for both perioperative and nonoperative analgesia. PNBs provide various advantages over spinal or general anesthetic, depending on specific patient variables and clinical conditions. They provide greater analgesic control and reduce the occurrence of anesthesia-related adverse effects by requiring fewer anesthetic volumes. Furthermore, they lead to shorter PACU stays and higher patient satisfaction by reducing the prevalent complaint of emesis associated with just general anesthesia **(Hartrick et al., 2006).**

Prior research revealed that patients getting adjuvant PNBs with general anesthesia may be discharged sooner and with a lower risk of side effects than those receiving PNBs simultaneously with spinal anesthesia **(YaDeau et al., 2018).**

Nonetheless, there is ongoing dispute over these conclusions. The use of popliteal and sciatic PNBs has been shown to be beneficial in pain control during lower extremity surgical operations. In some foot and ankle procedures, spinal or general anesthesia may be used to expedite tourniquet administration and speed the onset of surgical anesthetic with possibly increased dependability, while also maintaining patient immobility **(YaDeau et al., 2018).**

The aim of this study is to investigate the impact of peripheral nerve blocks as an anesthetic adjuvant in conjunction with spinal anesthesia compared to general anesthesia on pain control and the potential for early postoperative discharge.

Patients and methods

This randomized controlled experiment was carried out in the anesthesia and critical care unit (ICU) department at Qena University Hospitals, South Valley University, Egypt. This research included 60 patients who were hospitalized to the orthopedic and vascular departments for foot and ankle surgery. The subjects were split into two groups:

N=30 patients in Group (A) got spinal anesthesia with popliteal PNBs.

N=30 patients in Group (B) were given general anesthesia with popliteal PNBs.

In our study, 30 patients (16 males and 14 females) underwent spinal anesthesia with popliteal PNBs for a variety of procedures, including foot abscess (8 cases), big toe debridement (2 cases), dorsum of the feet debridement (2 cases), ankle open reduction internal fixation (ORIF) (4 cases), trans-metatarsal amputation (TMA) (8 cases), and infected gangrene of the toe (6 cases). There were four instances categorized as ASA I and 26 cases classed as ASA II. Only six individuals received opioids, and all 30 cases had problems such as nausea and vomiting. The average time to leave the post-anesthesia care unit was 55 minutes.

In our study, 30 patients (20 males and 10 females) underwent general anesthesia with popliteal PNBs for a variety of procedures, including foot abscess (6 cases), heel debridement (2 cases), dorsum of the feet debridement (2 cases), ankle ORIF (2 cases), trans-metatarsal amputation (TMA) (6 cases), and infected gangrene of the toe (12 cases). Fourteen instances were classed as ASA I, and sixteen cases as ASA II. Only two instances received opioids, and both had problems such as nausea and vomiting. The average time to leave the post-anesthesia care unit was 33 minutes.

Criteria for inclusion: Patients between the ages of 20 and 55 who are scheduled for elective ambulatory foot and ankle surgery are eligible for this research. Male and female patients are also welcome. Furthermore, patients must fall within the American Society of Anesthesiologists (ASA) categories 1 or 2, which correspond to normal healthy people and those with modest systemic disorders that do not impede their functioning . The foot and ankle operations under consideration for inclusion are likely to last 1 to 3 hours.

Criteria for exclusion: Patients who are above the age of 20 or over the age of 55 will not be considered for this research. Individuals who refuse to participate or who have a known allergy or intolerance to any of the drugs utilized in the research will also be excluded. Patients categorized as ASA 3, which indicates severe systemic disorders that are not life-threatening, or ASA 4, which indicates severe systemic diseases that pose a persistent danger to life, will be excluded (Doyle et al., 2017). Women who are pregnant or breastfeeding will also be barred from participating.

Method

All participants had a thorough history and physical examination, as well as basic laboratory testing such as a complete blood count (CBC), electroencephalography (ECG), and coagulation profile. The patients were then divided into two groups: those who underwent spinal anesthesia with peripheral nerve blocks (PNBs) using a 0.5% bupivacaine solution, and those who underwent general anesthesia with PNBs involving propofol induction (1.5 - 2 mg/kg), insertion of a laryngeal mask airway, a carefully adjusted propofol infusion(6-10 mg/kg/h), and administration of 1% sevoflurane. All nerve blocks were performed using ultrasound guidance.

The surgical time was documented, as well as any intraoperative occurrences, and the patient was subsequently moved to the PACU, where patients were observed (YaDeau et al., 2018).

Ethical clearance: The study was approved by the research ethics committee of South Valley University's Faculty of Medicine, with the code SVU-MED-AIP029-1-22-9-454.

Measurement of outcomes and follow-up

Postoperative monitoring (first 24 hours) of: time to discharge from PACU based on modified Aldrete post anesthesia score (9 or more discharged), pain free duration, postoperative pain assessed using the Visual Analogue Scale (VAS), and incidence of nausea and vomiting.

PNBs Functional Anatomy

The sciatic nerve (L4, L5, S1–S3) is the largest nerve in the body and exits the pelvis as a structure consisting of two nerve bundles: the more medially placed tibial nerve and the common peroneal (fibular) nerve lying laterally. These two bundles are enclosed within a common paraneural sheath. At its origin, it is broad and flat, but as it passes peripherally, it becomes more rounded. The branching of this sciatic nerve bundle into the two separate nerves occurs at a variable location during its course in the posterior aspect of the thigh, but it has usually occurred within 8–10 cm of the popliteal crease.

The popliteal fossa is a closely packed compartment through which all of the nerves and vessels pass from the thigh to the leg posteriorly. The biceps femoris muscle forms the upper lateral border. The upper medial border is formed by the muscle of semimembranosus and by the tendon of the semitendinosus. Appearing from between the biceps femoris and semimembranosus are the two heads of gastrocnemius, which form the lower medial and lateral muscular borders of the fossa. Within the popliteal fossa are the popliteal artery (which terminates as the anterior and posterior tibial arteries), popliteal vein, and the tibial and common peroneal nerves..

Technique

Prone Approach: Have patient lie prone (see image below); place ultrasound probe in the popliteal fossa in the crease. Look for the pulsation of the popliteal artery; adding color Doppler may help. Superficial and lateral to the artery is the tibial nerve. Angling the probe in different positions (toward and away from the clinician, as well as clockwise and counterclockwise) may help with getting the ideal view of the nerve. Once the tibial nerve is identified, move the probe slowly proximally, keeping the same rotation and angle of the probe looking for the common peroneal nerve

Research outcomes: The primary outcomes were the VAS score after 24 hours (2,4,8,12,24 hours) and opioid use after 24 hours.

Secondary outcomes include length of hospital stay, incidence of nausea and vomiting, and release from the intensive care unit.

Ethical Consideration: Data processing and dissemination are private activities. Participants were given a written statement outlining the process of the research. All patients gave their written consent after receiving necessary information. Only those with appropriate scientific training and experience did the research. The medical school's ethics board has looked into the plan.

Statistical Analysis

Analyses of statistics the results were analyzed using an ANOVA and a T test . For qualitative variables, numbers and percentages were used, while means and standard deviations (SDs) were calculated and displayed for quantitative data. The mean and SD were used to summarize the data . Student "t" test, Mann Whitney test, Chi-square (X2) test, Z-test for percentage, and odds ratio (OR) were used for the comparisons. If the P value is less than 0.05, the results are statistically significant.

Results

In Group A, the mean age was 44.6± 7.03 years, with a male predominance (53.3%). Conversely, Group B exhibited a mean age of 46.27± 8.18 years, with a higher proportion of males (66.7%). There was no statistically significant difference in gender distribution between the two groups (p>0.05). Similarly, there was no significant difference in age distribution between the two groups (p>0.05), as depicted in (**Table.1, Fig.1**).

Table 1. Comparison between the two studied groups regarding demographic data.

Variables		Group (A) Spinal anesthesia + popliteal PNBs (N= 30)		Group (B) General anesthesia + popliteal PNBs (N= 30)		Test value	P-value
		No.	%	No.	%		
Gender	Male	16	53.3%	20	66.7%	X^2= 1.111	0.292 (NS)
	Female	14	46.7%	10	33.3%		
Age (years)	Mean± SD	44.6± 7.03		46.27± 8.18		$^{Z}{}_{MWU}$= 1.187	0.235 (NS)
	Median (IQR)	45.0 (39.0- 51.0)		48.0 (43.0- 52.0)			
	Range	30.0 - 55.0		25.0 - 55.0			

p≤0.05 is statistically significant, p≤0.01 is high statistically significant, SD: standard deviation, X^2:Chi- Square test, $^{Z}{}_{MWU}$: Mann-Whitney U test

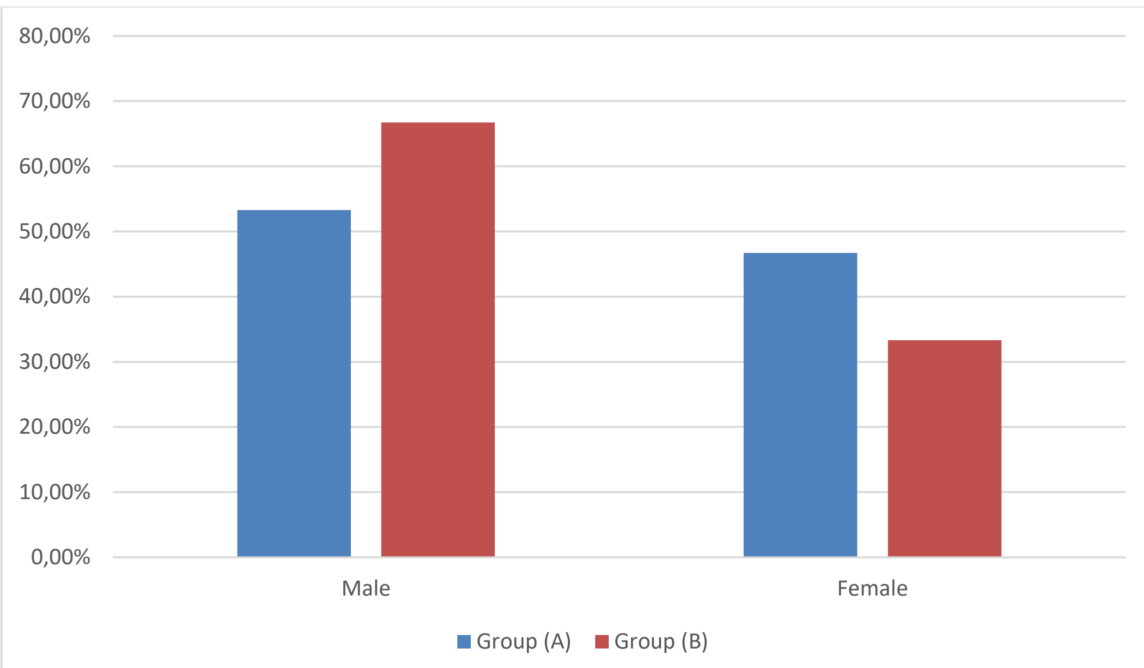

Fig.1.Gender distribution in the studied cases

The two groups did not significantly differ in terms of the type of surgery performed (p>0.05). The most frequently performed surgeries included foot abscess surgery (26.7%) and trans-metatarsal amputation (TMA) (26.7%), followed by surgery for infected gangrene (20.0%), as detailed in (**Table.2, Fig.2**).

Table 2. Comparison among the two studied groups regarding surgery.

Variables		Group (A) Spinal anesthesia + popliteal PNBs (N= 30)		Group (B) General anesthesia + popliteal PNBs (N= 30)		Test value	P-value
		No.	%	No.	%		
Surgery	Foot abscess surgery	8	26.7%	6	20.0%	X^2= 7.238	0.299 (NS)
	Infected amputated big toe for debridement	2	6.7%	0	0.0%		
	Leg and heel debridement	0	0.0%	2	6.7%		
	Leg and dorsum of feet debridement	2	6.7%	2	6.7%		
	Open reduction and internal fixation ankle	4	13.3%	2	6.7%		
	TMA	8	26.7%	6	20.0%		
	Toe infected gangrene	6	20.0%	12	40.0%		

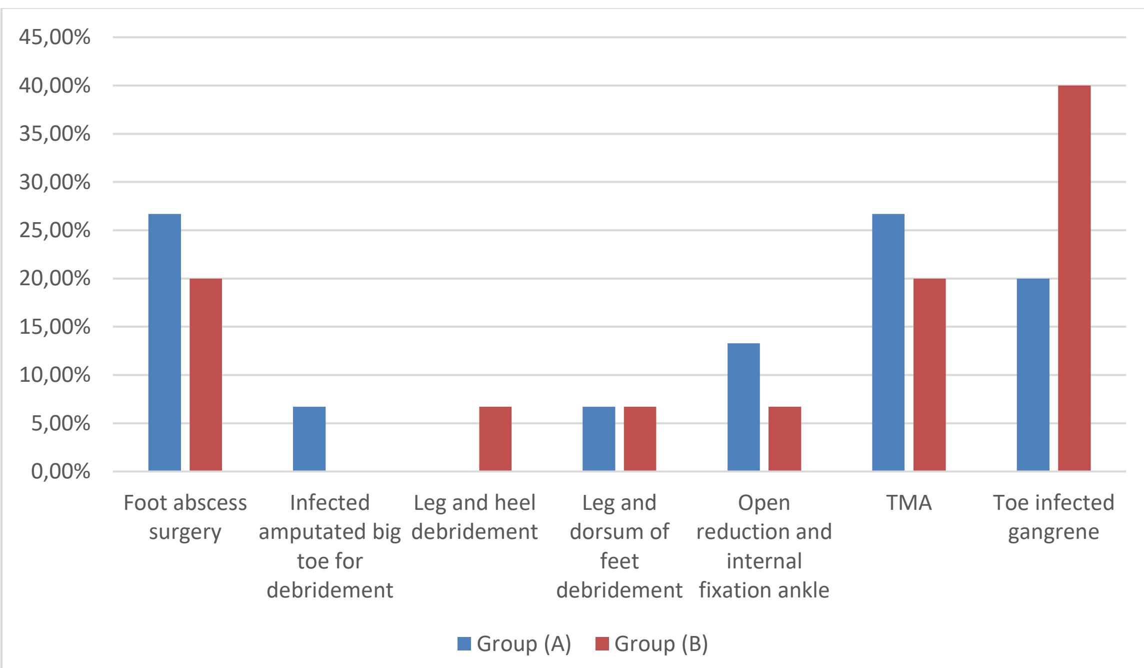

Fig.2. Distribution of the studied cases as regards surgery

In Group A, 86.7% of cases had an ASAII classification, compared to 53.3% in Group B. A significant difference in ASA classification was observed between the two groups, with ASAII being significantly higher in the spinal anesthesia group (p = 0.005), as outlined in (**Table.3**).

Table 3. Comparison among the two studied groups regarding ASA

Variables		Group (A) Spinal anesthesia + popliteal PNBs (N= 30)		Group (B) General anesthesia + popliteal PNBs (N= 30)		Test value	P-value
		No.	%	No.	%		
ASA	ASA I	4	13.3%	14	46.7%	X^2= 7.937	0.005 (HS)
	ASA II	26	86.7%	16	53.3%		

Both Groups A and B exhibited lower Visual Analog Scale (VAS) scores at 24 and 12 hours postoperatively compared to 2 and 4 hours postoperatively (p<0.001). However, no significant differences in VAS scores were noted at 4, 8, 12, and 24 hours after surgery between the two groups (p>0.05), as shown in (**Table.4, Fig.3**).

Table 4. VAS at different follow up periods among the studied groups

VAS	**Studied patients (N= 60)**															**Mann-Whitney U test**	
	Mean	**SD**	**Median**	**IQR**		**Range**		**Mean**	**SD**	**Median**	**IQR**		**Range**		**Test value**	**P-value**
2 hours	1.27	.94	1	1	2	0	4	1.87	1.11	2	1	2	0	4	2.473	0.013 (S)
4 hours	1.60	.72	1	1	2	1	3	1.33	.48	1	1	2	1	2	1.369	0.171 (NS)
8 hours	1.40	.81	1	1	2	0	3	1.07	.58	1	1	1	0	2	1.797	0.072 (NS)
12 hours	0.73	.58	1	0	1	0	2	0.53	.51	1	0	1	0	1	1.294	0.196 (NS)
24 hours	0.40	.50	0	0	1	0	1	0.27	.45	0	0	1	0	1	1.086	0.277 (NS)
Test value	55.796							72.87								
P-value*	<0.001							<0.001								

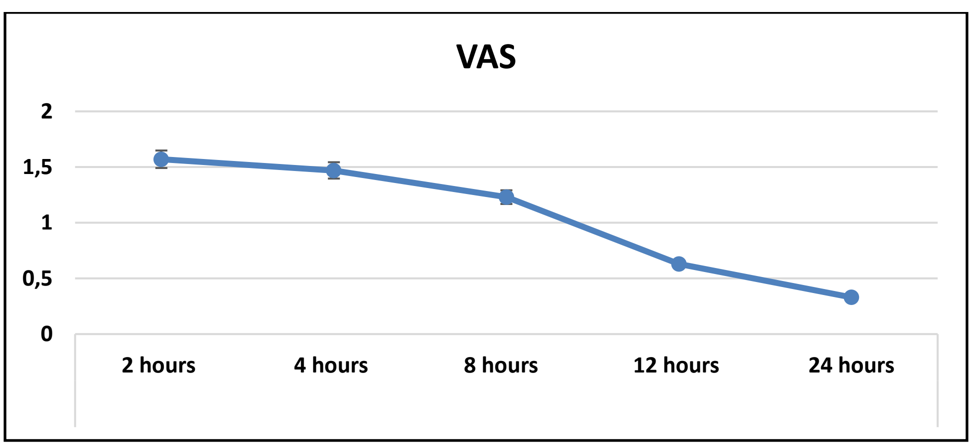

Fig.3. Mean VAS at different follow up periods.

The mean length of hospital stay in Group A was 1.33± 0.48 days, with 20% of patients receiving opioids, while in Group B, it was 1.43± 0.73 days, with 6.7% receiving opioids. There was no significant difference between the two groups in terms of opioid use and hospital stay (p>0.05), as indicated in (**Table.5, Fig.4**).

Table 5. Comparison between the two studied groups regarding operative data.

Variables		Group (A) Spinal anesthesia + popliteal PNBs (N= 30)		Group (B) General anesthesia + popliteal PNBs (N= 30)		Test value	P-value
		No.	%	No.	%		
Opioid consumption	No	24	80.0%	28	93.3%	X^2= 2.308	0.129 (NS)
	Yes	6	20.0%	2	6.7%		
Hospital stay (days)	Mean± SD	1.33± 0.48		1.43± 0.73		$^{Z}_{MWU}$= 0.091	0.928 (NS)
	Median (IQR)	1.0 (1.0- 2.0)		1.0 (1.0- 2.0)			
	Range	1.0 - 2.0		1.0 - 3.0			

$p \leq 0.05$ is statistically significant, $p \leq 0.01$ is high statistically significant, SD: standard deviation, X^2:Chi- Square test, $^{Z}_{MWU}$: Mann-Whitney U test

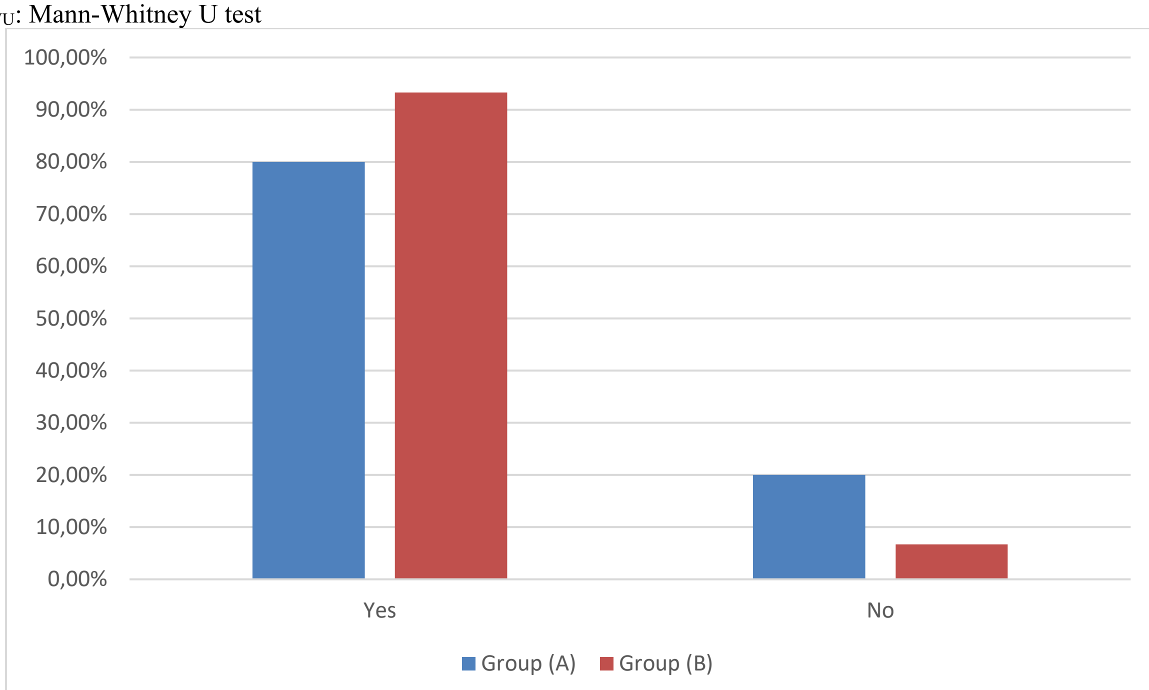

Fig.4. Distribution of the studied cases as regards opioid consumption

In Group A, the mean time until discharge was 55.53±5.26 minutes, and no patients experienced nausea and vomiting. In contrast, in Group B, the mean time until discharge was 32.60±3.34 minutes, but 93.3% of patients experienced nausea and vomiting. A significant difference was observed between the two groups (P < 0.001), as presented in (**Table. 6**).

Table 6. Comparison between the two studied groups regarding operative data.

Variables		Group (A) Spinal anesthesia + popliteal PNBs (N= 30)		Group (B) General anesthesia + popliteal PNBs (N= 30)		Test value	P-value
		No.	%	No.	%		
Nausea and vomiting	No	30	100.0%	2	6.7%	X^2= 52.5	<0.001 (HS)
	Yes	0	0.0%	28	93.3%		
Time to discharge from PACU (min)	Mean± SD	55.53± 5.26		32.60± 3.34		Z_{MWU}= 6.665	<0.001 (HS)
	Median (IQR)	56.0 (50.0- 58.0)		32.0 (30.0- 36.0)			
	Range	49.0 - 66.0		28.0 - 39.0			

During postoperative monitoring of all patients, 46.7% (28 patients) experienced postoperative nausea and vomiting. The mean time to discharge from the Post-Anesthesia Care Unit (PACU) was 44.07± 12.36 minutes, with a range of 28 to 66 minutes, as documented in (**Table.7, Fig.5**).

Table 7. Distribution of studied patients regarding postoperative monitoring.

Parameters		Studied patients (N= 60)	
		n	%
Nausea and vomiting	No	32	53.3%
	Yes	28	46.7%
Time to discharge from PACU (min)	Mean± SD	44.07± 12.36	
	Median	44.0	
	Range	28.0 – 66.0	

SD: standard deviation, n: number, %: percentage.

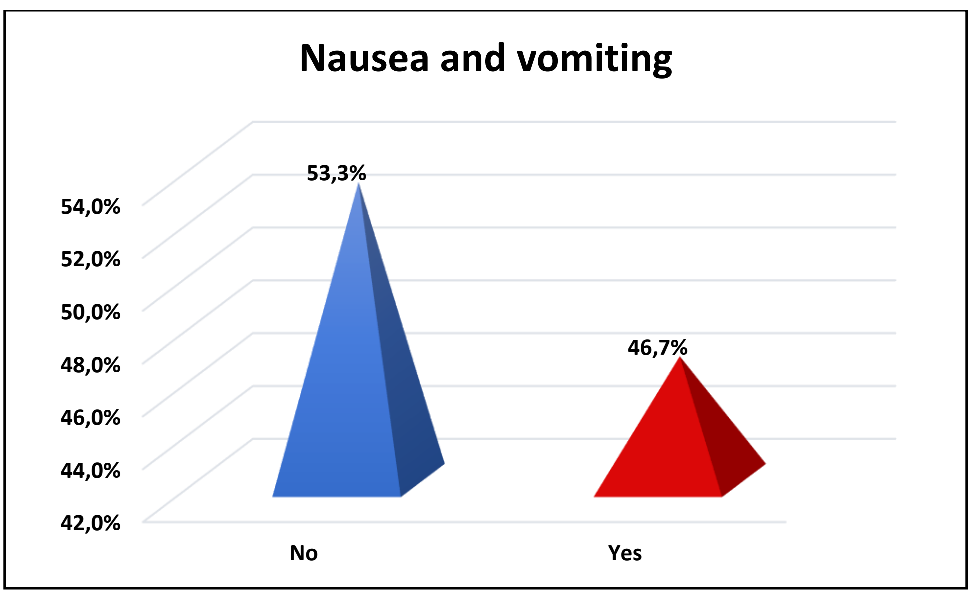

Fig.5. Distribution of the studied cases as regards postoperative nausea and vomiting

Discussion

When compared to individuals receiving spinal anesthesia alongside PNBs, patients undergoing combined administration of general anesthesia and PNBs had shorter hospital stays, lower postoperative pain levels, and a lower incidence of symptoms such as nausea and vomiting, either alone or in conjunction with general anesthesia, for decreasing postoperative pain and accelerating recovery. The particular benefits of this combination treatment on delayed postoperative pain, however, remain undetermined **(Joshi and Kehlet, 2019).**

Individuals who got a peripheral nerve block with general anesthetic had lower Visual Analog Scale (VAS) ratings in our research, especially within the first two days after surgery. This prolonged analgesic effect cannot be ascribed only to the durability of the local anesthetic, since ropivacaine's analgesic qualities normally fade after 10 hours (Liu et al., 2005). Instead, we suggest that this benefit is related to the interception of nociceptive signals prior to surgical trauma, thereby limiting central sensitization during surgery and hence lowering postoperative hyperalgesia. In contrast to opioids, which mainly relieve pain but do not inhibit central nociceptive input or prevent sensitization **(Kopp and Horlocker, 2010).**

Despite the fact that regional anesthetic has been demonstrated to successfully decrease postoperative pain, it is seldom utilized in outpatient settings owing to concerns about muscular weakness lengthening the recovery process. To address this worry, we used a little amount of low-concentration local anesthetic to generate selective nerve blocks, which provided pain relief while having no influence on muscular strength. We employed 0.2% ropivacaine effectively for this purpose, and our research participants recovered quickly from motor blockage. Previous research has shown that low-volume 0.2% ropivacaine may achieve nerve blockage in up to 90% of patients. Combining this method with general anesthesia reduces the chance of ineffective pain control **(Narayan et al., 2021).**

The combination of general anesthesia with a low-volume, low-concentration, single-shot peripheral nerve block resulted in persistent pain alleviation for at least two days after surgery. It was also linked to quicker hospital release and higher patient satisfaction **(Schug et al., 2009).**

There were significant disparities between the two groups in terms of time to release and overall hospital stay. Prolonged motor block was linked to delayed discharge in a research by **Fosnot et al. (2015).** These results are consistent with those published by **YaDeau et al. (2018).**

Conclusion

Patients subjected to general anesthesia in conjunction with PNBs exhibited a shorter hospitalization duration compared to those who underwent spinal anesthesia along with PNBs. However, the adjusted discrepancy of 39 minutes may not bear substantial clinical significance. Except for pain levels recorded one-hour post-arrival in the PACU, the secondary outcome measures demonstrated comparability across both study groups. Considering these observations, it is judicious to consider spinal anesthesia and general anesthesia as equally viable supplementary options to complement the efficacy of peripheral nerve blockade, with due regard for patient preferences, clinician discretion, and institutional protocols.

List of Abbreviations

ASA	American Society of Anesthesiologist
PNBs	Peripheral nerve blocks
PACU	post anesthetic care unit
CBC	Complete blood picture

GA	general anesthesia
ORIFs	Open reduction and internal fixation
PONV	postoperative nausea and vomiting
SD	standard deviations
VAS	visual analogue score

References

- **Doyle DJ, Hendrix JM, Garmon EH. (2017).** American society of anesthesiologists classification. 1: 20-32.
- **Fosnot CD, Fleisher LA, Keogh J .(2015).** Providing value in ambulatory anesthesia. Current opinion in anaesthesiology, 28(6): 617–622.
- **Halaszynski TM .(2009).** Pain management in the elderly and cognitively impaired patient: the role of regional anesthesia and analgesia. Current opinion in anaesthesiology, 22(5): 594–599.
- **Hartrick CT, Bourne MH, Gargiulo K, Damaraju CV, Vallow S, Hewitt DJ .(2006).** Fentanyl iontophoretic transdermal system for acute-pain management after orthopedic surgery: a comparative study with morphine intravenous patient-controlled analgesia. Regional anesthesia and pain medicine, 31(6): 546–554.
- **Hopkins PM, Rüffert H, Snoeck MM, Girard T, Glahn KP, Ellis FR, et al. (2015).** European Malignant Hyperthermia Group guidelines for investigation of malignant hyperthermia susceptibility. British journal of anaesthesia, 115(4): 531–539.
- **Joshi GP, Kehlet H .(2019).** Postoperative pain management in the era of ERAS: an overview. Best Practice & Research Clinical Anaesthesiology, 33(3): 259-267.
- **Kopp SL , Horlocker TT .(2010).** Regional anaesthesia in day-stay and short-stay surgery. Anaesthesia, 65 (1): 84–96.
- **Liu SS, Strodtbeck WM, Richman JM, Wu CL .(2005).** A comparison of regional versus general anesthesia for ambulatory anesthesia: a meta-analysis of randomized controlled trials. Anesthesia and analgesia, 101(6): 1634–1642.
- **Mancel L, Van Loon K, Lopez M. (2021).** Role of regional anesthesia in Enhanced Recovery After Surgery (ERAS) protocols. Current Opinion in Anesthesiology, 34(5), 616-625.
- **Narayan PK, Phan DHB, Liu G .(2021).** COVID-19 lockdowns, stimulus packages, travel bans, and stock returns. Finance research letters, 38(1): e101732.
- **Schug SA, Joshi GP, Camu F, Pan S, Cheung R .(2009).** Cardiovascular safety of the cyclooxygenase-2 selective inhibitors parecoxib and valdecoxib in the postoperative setting: an analysis of integrated data. Anesthesia and analgesia, 108(1): 299–307**.**
- **YaDeau JT, Fields KG, Kahn RL, LaSala VR, Ellis SJ, Levine DS, et al .(2018).** Readiness for Discharge After Foot and Ankle Surgery Using Peripheral Nerve Blocks: A Randomized Controlled Trial Comparing Spinal and General Anesthesia as Supplements to Nerve Blocks. Anesthesia and analgesia, 127(3): 759–766.