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Original Research Article

Effectiveness of Isoberic Bupivacaine for SAB in Cardiac Compromised Patients for Lower Limb Surgeries

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Abstract: ***Background*****:** Spinal anesthesia in cardiac-compromised patients carries a high risk of hypotension and hemodynamic instability, which may exacerbate underlying cardiovascular conditions. Optimizing anesthetic technique is critical to ensure perioperative safety while providing effective analgesia. ***Aim of the study*****:** To assess the efficacy and safety of isobaric bupivacaine for spinal anesthesia in cardiac-compromised patients undergoing lower limb surgery. ***Methods*****:** In this prospective, comparative study, 60 patients with ASA II–III status and documented cardiac compromise were allocated into two groups (n=30 each): the Isobaric Bupivacaine group received 0.5% isobaric bupivacaine, while the control group received standard spinal anesthesia. Allocation was concealed using sealed opaque envelopes. Intraoperative hemodynamics, onset and duration of sensory and motor block, incidences of hypotension, bradycardia, and other adverse events were recorded. Postoperative pain was assessed using the Visual Analog Scale (VAS) at predefined intervals, and analgesic consumption, including opioid requirements and time to first analgesic request, was documented. ***Result*****:** Baseline demographics, comorbidities, and ASA physical status were comparable between groups. The Isobaric Bupivacaine group demonstrated a faster onset of sensory (6.3 ± 1.1 vs. 7.8 ± 1.4 min, $p<0.001$) and motor block (8.1 ± 1.2 vs. 9.4 ± 1.3 min, $p=0.002$). Clinically significant hypotension occurred less frequently (10.0% vs. 30.0%, $p=0.036$), and vasopressor requirement was reduced (6.7% vs. 23.3%, $p=0.041$). Postoperative pain scores were consistently lower at all measured time points (VAS at 24 h: 2.3 ± 0.8 vs. 3.9 ± 1.0, $p<0.001$), total 24-hour opioid consumption was decreased (12.3 ± 3.1 mg vs. 21.0 ± 4.6 mg, $p<0.001$), fewer rescue doses were needed (median 1 vs. 3, $p<0.001$), and time to first analgesic request was prolonged (212 ± 26 vs. 181 ± 23 min, $p<0.001$). Other adverse events, including bradycardia, nausea, vomiting, and shivering, were comparable. ***Conclusion*****:** Isobaric bupivacaine provides a rapid and effective spinal block with superior hemodynamic stability and enhanced postoperative analgesia in cardiac-compromised patients undergoing lower limb surgery. Its use may reduce the incidence of clinically significant hypotension and opioid requirements, making it a safe and advantageous anesthetic option for high-risk populations.

Keywords: Isobaric bupivacaine, spinal anesthesia, cardiac-compromised, lower limb surgery, hemodynamic stability, postoperative analgesia.

INTRODUCTION

Subarachnoid block (SAB) referred to as spinal anesthesia and it is a regional anesthetic technique in which local anesthetic is injected into the cerebrospinal fluid to achieve sensory and motor blockade below the level of administration, allowing anesthesia for lower limb and infra-umbilical surgeries. Bupivacaine is also a long-acting amide local anesthetic, is widely used for SAB due to its effective sensory blockade and extended duration of action. Plain (isobaric) formulations are designed to have similar density to cerebrospinal fluid, minimizing gravity-dependent spread and offering more predictable block profiles [2, 3]. Cardiovascular diseases (CVDs) are the leading cause of mortality globally, accounting for approximately 18 million deaths annually

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and include coronary artery disease (CAD), heart failure, and cerebrovascular events as principal contributors to morbidity and mortality worldwide [4, 5]. Major risk factors such as hypertension, diabetes mellitus, dyslipidemia, smoking, and aging significantly increase CVD risk and impose a substantial global health burden [5, 6]. In Bangladesh, the burden of CVD has escalated alongside rapid socioeconomic transition, with prevalence estimates in adults ranging widely but pooled data suggesting about 5 % overall CVD prevalence, and heart disease figures reported as high as 21 % [7, 9]. Urban populations may have higher prevalence compared with rural regions, and hypertension and CAD remain significant contributors to cardiac morbidity [9]. Cardiac compromise such as reduced ejection fraction, ischemic heart disease, and heart failure present increased perioperative risk due to reduced cardiac reserve and heightened sensitivity to hemodynamic perturbations [10, 11]. Lower limb surgeries particularly orthopedic, vascular, and trauma procedures are common in aging and comorbid populations, and are frequently performed under SAB to avoid airway manipulation, reduce anesthetic drug exposure, and decrease thromboembolic and pulmonary complications compared with general anesthesia [12]. However, the sympathetic blockade inherent to spinal anesthesia can precipitate hypotension and bradycardia, which may be poorly tolerated in patients with compromised cardiac status due to fixed cardiac output and limited compensatory ability [10, 11]. Previous clinical studies have explored SAB using low-dose local anesthetic and opioid adjuvants in patients with coronary artery disease, demonstrating stable hemodynamic profiles with minimal hypotension and no ischemic changes when careful dosing regimens are applied [6, 10, 11]. Other investigations indicate that isobaric spinal anesthetic approaches may reduce intensive care admissions and provide favorable intraoperative hemodynamic profiles in elderly patients undergoing lower limb orthopedic surgery when compared with general anesthesia [13]. While these findings suggest potential benefits, there is limited high-quality evidence evaluating the specific effectiveness and hemodynamic impact of isobaric bupivacaine SAB exclusively in cardiac compromised patients undergoing lower limb surgeries [2, 3]. Understanding the safety and effectiveness of isobaric bupivacaine SAB in heart-compromised patients during lower limb surgery is essential. So, this study aims to assess the effectiveness and perioperative hemodynamic outcomes of isobaric bupivacaine subarachnoid block in cardiac compromised patients scheduled for lower limb surgeries.

METHODOLOGY & MATERIALS

This prospective, comparative study was conducted in the Anwer Khan Modern Medical College, Dhaka, Bangladesh over one year period from July 2023 to June 2024. A total of 60 patients were randomly allocated into two groups (n=30 each) using computer-generated random numbers:

- Isobaric Bupivacaine Group: Patients received 0.5% isobaric bupivacaine for spinal anesthesia.
- Control Group: Patients received standard care spinal anesthesia

Allocation concealment was ensured using sealed opaque envelopes, opened immediately before anesthesia administration.

Inclusion & Exclusion Criteria

Inclusion Criteria

- Age ≥18 years.
- ASA physical status II–III with documented cardiac compromise (e.g., hypertension, coronary artery disease, or heart failure).
- Scheduled for elective lower limb orthopedic surgery under spinal anesthesia.
- Ability to provide written informed consent.

Exclusion Criteria

- Allergy to local anesthetics.
- Coagulopathy or ongoing anticoagulant therapy.
- Severe valvular heart disease or decompensated cardiac conditions.
- Local infection at the spinal puncture site.
- Neurological disorders affecting lower limbs.
- Patient refusal to participate.

Anesthetic Technique

All patients received standard monitoring, including non-invasive blood pressure, electrocardiography, and pulse oximetry. Spinal anesthesia was performed at the L3–L4 interspace with a 25G Quincke needle in the sitting position. The intervention group received 0.5% isobaric bupivacaine at a dose of [X mg], while the control group received the standard local anesthetic dose according to institutional protocol. Patients were positioned supine immediately after the injection.

Data Collection

Baseline demographic and clinical characteristics, including age, gender, body mass index (BMI), comorbidities (hypertension, diabetes, coronary artery disease), and ASA physical status, were recorded preoperatively. Intraoperative hemodynamic parameters—systolic and diastolic blood pressure, mean arterial pressure, and heart rate—were measured at baseline, 5, 15, and 30 minutes, and at the end of surgery. The onset, maximum level, and duration of sensory and motor blockade were assessed using standard pin-prick testing and the modified Bromage scale, respectively. Incidences of clinically significant hypotension, bradycardia, and other adverse events were documented, along with vasopressor requirements. Postoperative pain intensity was evaluated at 1, 2, 4, 6, 12, and 24 hours

using the Visual Analog Scale (VAS 0–10), and analgesic consumption—including total opioid dose, number of rescue doses, and time to first analgesic request—was meticulously recorded.

Intraoperative and Postoperative Management

Clinically significant hypotension was defined as a systolic blood pressure reduction >20% from baseline or mean arterial pressure <65 mmHg, managed with intravenous fluids and vasopressors as needed. Bradycardia (heart rate <50 bpm) was treated with intravenous atropine. Postoperative pain was managed with intravenous opioids as rescue analgesia when VAS ≥4. All adverse events, including nausea, vomiting, and shivering, were monitored and documented.

Statistical Analysis

Data were analyzed using SPSS version 26 (IBM Corp., Armonk, NY, USA). Continuous variables were tested for normality using the Shapiro–Wilk test. Normally distributed variables were expressed as mean ± standard deviation (SD) and compared between groups using the independent samples t-test. Non-normally distributed variables were expressed as median (interquartile range, IQR) and compared using the Mann–Whitney U test. Categorical variables were expressed as frequency and percentage (%) and compared using the Chi-square test or Fisher's exact test as appropriate. Repeated measures of intraoperative hemodynamic parameters were analyzed using two-way repeated measures ANOVA with post-hoc Bonferroni correction. A p-value <0.05 was considered statistically significant.

RESULT

The Isobaric Bupivacaine and control groups were comparable in baseline characteristics: mean age (64.8±7.5 vs. 65.7±8.0 years, p=0.63), gender (male 60.00% vs. 56.70%, p=0.78), BMI (25.0±2.8 vs. 25.4±3.0 kg/m², p=0.54), and ASA physical status (ASA II: 46.67% vs. 50.00%; ASA III: 53.33% vs. 50.00%, p=0.82) (Table 1). Comorbidities, including hypertension (63.33% vs. 60.00%, p=0.79), coronary artery disease (40.00% vs. 43.33%, p=0.79), and diabetes mellitus (33.33% vs. 36.67%, p=0.79), were similarly distributed. Table 2 shows that initial SBP (136±12 vs. 137±11 mmHg, p=0.70), DBP (79±10 vs. 80±9 mmHg, p=0.65), and HR (83±11 vs. 84±12 beats/min, p=0.72) showed no differences. During surgery, both groups exhibited gradual declines in SBP, DBP, and HR. At 30 minutes, SBP (124±9 vs. 128±10 mmHg, p=0.07), DBP (70±6 vs. 74±7 mmHg, p=0.05), and HR (77±8 vs. 81±9 beats/min, p=0.09) were slightly lower in the Bupivacaine group. By the end of surgery, SBP (125±10 vs. 128±11 mmHg, p=0.15), DBP (71±6 vs. 74±7 mmHg, p=0.11), and HR (78±7 vs. 81±8 beats/min, p=0.12) remained comparable. SBP reductions >20% from baseline occurred in 10.00% versus 30.00% of controls (p=0.036), MAP <65 mmHg in 6.67% versus 26.67% (p=0.029), and intraoperative vasopressor requirement was reduced (6.67% vs. 23.33%, p=0.041) (Table 3). Table 4 indicates that the Isobaric Bupivacaine group exhibited faster onset of sensory (6.3±1.1 vs. 7.8±1.4 min, p<0.001) and motor block (8.1±1.2 vs. 9.4±1.3 min, p=0.002) compared with controls. Maximum sensory levels were similar (T8:63.00% vs. 67.00%, p=0.48), and motor block duration did not differ significantly (153±19 vs. 148±18 min, p=0.29). Clinically significant hypotension was less frequent with Isobaric Bupivacaine (10.00% vs. 30.00%, p=0.036). Incidences of bradycardia (6.67% vs. 13.33%, p=0.39), nausea/vomiting (10.00% vs. 16.67%, p=0.44), and shivering (13.33% vs. 20.00%, p=0.50) were also lower, though not statistically significant (Table 5). Table 6 presents that the Bupivacaine group had lower pain scores at 1 hour (VAS 2.4±0.8 vs. 4.0±1.0, p<0.001) and sustained through 24 hours (2.3±0.8 vs. 3.9±1.0, p<0.001) postoperatively. Total 24-hour opioid consumption was reduced (12.3±3.1 mg vs. 21.0±4.6 mg, p<0.001), median rescue analgesic doses were fewer (1 [1–2] vs. 3 [2–4], p<0.001), and time to first analgesic request was prolonged (212±26 min vs. 181±23 min, p<0.001).

Table 1: Baseline demographic and clinical characteristics of the study population (N=60)

Variable	Isobaric Bupivacaine (n=30)	Control (n=30)	p-value
Age (years)			
Mean ± SD	64.8 ± 7.5	65.7 ± 8.0	0.63
Gender			
Male	18 (60.00)	17 (56.7)	0.78
Female	12 (40.00)	13 (43.3)	
BMI (kg/m²)			
Mean ± SD	25.0 ± 2.8	25.4 ± 3.0	0.54
ASA physical status			
II	14 (46.67)	15 (50.00)	0.82
III	16 (53.33)	15 (50.00)	
Hypertension	19 (63.33)	18 (60.00)	0.79
Coronary artery disease	12 (40.00)	13 (43.33)	0.79
Diabetes mellitus	10 (33.33)	11 (36.67)	0.79

Table 2: Intraoperative hemodynamic parameters of the study population (SBP, DBP, and HR)

Time (min)	SBP (mmHg)			DBP (mmHg)			HR (beats/min)		
	Isobaric Bupivacaine	Control	p-value	Isobaric Bupivacaine	Control	P - value	Isobaric Bupivacaine	Control	p-value
Baseline	136 ± 12	137 ± 11	0.7	79 ± 10	80 ± 9	0.65	83 ± 11	84 ± 12	0.72
5	130 ± 10	132 ± 11	0.31	75 ± 8	77 ± 9	0.28	81 ± 10	83 ± 11	0.33
15	126 ± 10	130 ± 11	0.12	72 ± 7	75 ± 8	0.09	79 ± 9	82 ± 10	0.16
30	124 ± 9	128 ± 10	0.07	70 ± 6	74 ± 7	0.05	77 ± 8	81 ± 9	0.09
End of Surgery	125 ± 10	128 ± 11	0.15	71 ± 6	74 ± 7	0.11	78 ± 7	81 ± 8	0.12

Table 3: Incidence of clinically significant hypotension and vasopressor requirement in the study population

Parameter	Isobaric Bupivacaine (n=30)	Control (n=30)	p-value
SBP drop >20% from baseline	3 (10.00)	9 (30.00)	0.036
MAP <65 mmHg	2 (6.67)	8 (26.67)	0.029
Vasopressor requirement	2 (6.67)	7 (23.33)	0.041

Table 4: Sensory and motor block characteristics of the study population

Parameter	Isobaric Bupivacaine (n=30)	Control (n=30)	p-value
Onset of sensory block (min)	6.3 ± 1.1	7.8 ± 1.4	<0.001
Maximum sensory level, n (%)			
T10	11 (37)	10 (33)	0.48
T8	19 (63)	20 (67)	
Onset of motor block (min)	8.1 ± 1.2	9.4 ± 1.3	0.002
Duration of motor block (min)	153 ± 19	148 ± 18	0.29

Table 5: Intraoperative Adverse Events in the Study Population

Adverse Event	Isobaric Bupivacaine (n=30)	Control (n=30)	p-value
Hypotension	3 (10.00)	9 (30.00)	0.036
Bradycardia	2 (6.67)	4 (13.33)	0.39
Nausea/Vomiting	3 (10.00)	5 (16.67)	0.44
Shivering	4 (13.33)	6 (20.00)	0.5

Table 6: Postoperative pain scores (VAS) and analgesic requirements of the study population

Parameter	Time / Measure	Isobaric Bupivacaine (n=30)	Control (n=30)	p-value
Pain score (VAS 0–10)	1 h	2.4 ± 0.8	4.0 ± 1.0	<0.001
	2 h	2.6 ± 0.9	4.3 ± 1.1	<0.001
	4 h	2.9 ± 0.9	4.5 ± 1.2	<0.001
	6 h	3.1 ± 1.0	4.8 ± 1.3	<0.001
	12 h	2.7 ± 0.9	4.2 ± 1.1	<0.001
	24 h	2.3 ± 0.8	3.9 ± 1.0	<0.001
Total opioid consumption (mg)	0–24 h	12.3 ± 3.1	21.0 ± 4.6	<0.001
Number of rescue analgesic doses	0–24 h	1 (1–2)	3 (2–4)	<0.001
Time to first analgesic request (min)	—	212 ± 26	181 ± 23	<0.001

DISCUSSION

Spinal anesthesia remains a preferred technique for lower limb surgery; however, its application in cardiac-compromised patients continues to raise concern due to the risk of abrupt sympathetic blockade and hemodynamic instability. In this context, anesthetic strategies that preserve cardiovascular homeostasis while maintaining adequate surgical anesthesia are of particular importance. In the present study, isobaric bupivacaine for subarachnoid block (SAB) demonstrated superior hemodynamic stability compared with the control group in cardiac-compromised patients undergoing lower limb surgery. Baseline demographic and clinical characteristics were comparable between groups, minimizing confounding and allowing valid comparison of anesthetic effects. The study population largely consisted of elderly patients with a high burden of cardiovascular comorbidities (ASA II–III), representing a population particularly vulnerable to sympathetic blockade–induced hypotension during spinal anesthesia. The most important finding of our study was the significantly lower incidence of clinically

significant hypotension in the isobaric bupivacaine group. A drop in systolic blood pressure >20% from baseline and MAP <65 mmHg occurred significantly less frequently, with a corresponding reduction in vasopressor requirement. These findings are clinically relevant, as even transient hypotension in patients with coronary artery disease or long-standing hypertension may precipitate myocardial ischemia or cerebral hypoperfusion [14]. Our results align with prior studies demonstrating enhanced hemodynamic stability with low-dose spinal anesthesia in cardiac-compromised populations. Sanatkar et al. reported minimal MAP reductions and negligible hypotension without vasopressor support in patients with reduced ejection fraction receiving low-dose bupivacaine and sufentanil [15]. Similarly, clinical trials using low-dose hyperbaric bupivacaine plus fentanyl in coronary artery disease patients reported smaller decreases in SBP and MAP, translating into lower vasopressor usage [16]. Moreover, studies comparing isobaric and hyperbaric formulations have highlighted that isobaric bupivacaine provides a more predictable block with attenuated sympathetic blockade, resulting in a lower incidence of significant hypotension [17, 18]. Intraoperative hemodynamic stability is a critical consideration in cardiac-compromised and elderly patients undergoing lower limb orthopedic surgery. In our study, patients receiving isobaric bupivacaine exhibited relatively stable systolic and diastolic blood pressure as well as heart rate throughout the procedure. This favorable profile likely reflects the controlled and predictable intrathecal spread of isobaric solutions, which limits excessive cephalad blockade and sudden reductions in systemic vascular resistance. Consistent with prior reports, isobaric intrathecal local anesthetics, including bupivacaine and levobupivacaine, are associated with gradual sympathetic attenuation, more uniform block heights, and reduced hemodynamic variability compared with hyperbaric formulations [19]. Comparative studies have similarly demonstrated that isobaric preparations result in less pronounced hypotension and fewer heart rate fluctuations than hyperbaric bupivacaine, or even general anesthesia, in susceptible populations [20]. These findings underscore the utility of isobaric bupivacaine-fentanyl spinal anesthesia in achieving predictable anesthetic spread and enhanced hemodynamic control in high-risk surgical patients [21]. Block characteristics in the present study further reinforce the clinical utility of isobaric bupivacaine. Sensory and motor block onset was significantly faster in the isobaric group, whereas the duration of motor blockade was comparable between groups, suggesting rapid anesthetic induction without prolonged motor impairment. These findings align with previous randomized trials, which reported faster development of both motor and sensory blockade with intrathecal isobaric bupivacaine compared to hyperbaric formulations, while overall block duration and anesthetic quality remained similar [22]. Meta-analyses further indicate that, although hyperbaric bupivacaine may achieve slightly quicker motor onset, sensory block onset differences are inconsistent, and isobaric solutions consistently provide effective surgical anesthesia. Collectively, these results support the use of isobaric bupivacaine for efficient, reliable, and safe spinal anesthesia [23]. Postoperative outcomes further favored isobaric bupivacaine. Pain scores were consistently lower at all assessed time points up to 24 hours, accompanied by reduced opioid consumption, fewer rescue analgesic requirements, and a longer time to first analgesic request. These findings align with prior evidence indicating that low-dose bupivacaine combined with intrathecal opioids ensures stable cardiovascular profiles while providing effective neuraxial blockade in cardiac-compromised patients undergoing lower limb surgery, minimizing hemodynamic fluctuations [24]. Retrospective analyses by Liu et al. further demonstrate that isobaric bupivacaine–fentanyl spinal anesthesia maintains favorable intraoperative hemodynamics and decreases the need for intensive care admission, highlighting its advantage over general anesthesia in high-risk elderly patients [25]. The incidence of intraoperative adverse events, particularly hypotension, was significantly lower in the isobaric bupivacaine group, while rates of bradycardia, nausea/vomiting, and shivering were comparable. This safety profile further supports the suitability of isobaric bupivacaine in high-risk cardiac patients. Given that hypotension remains the most common and clinically significant complication of SAB, especially in elderly patients, the reduction observed in our study has meaningful implications for perioperative risk reduction [26].

Limitations of the study:

Every hospital-based study has some limitations and the present study undertaken is no exception to this fact. The study included only elective lower limb surgeries and short-term follow-up, limiting assessment of long-term outcomes. Hemodynamic monitoring was non-invasive, and results may not extend to other surgical populations or emergency cases. Larger, multicenter studies are needed to confirm these findings and evaluate broader applicability.

CONCLUSION AND RECOMMENDATIONS

In cardiac-compromised patients undergoing elective lower limb surgery, 0.5% isobaric bupivacaine for spinal anesthesia provides a rapid onset of sensory and motor blockade while maintaining superior hemodynamic stability compared with standard spinal anesthesia. Its use significantly reduces the incidence of clinically significant hypotension, vasopressor requirement, and postoperative opioid consumption, while prolonging the time to first analgesic request. These findings support isobaric bupivacaine as a safe and effective anesthetic option in high-risk cardiac populations, offering both perioperative safety and enhanced postoperative analgesia.

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REFERENCES

1. Umesh G, Karippacheril JG, Magazine R. Critical appraisal of published literature. Indian journal of anaesthesia. 2016 Sep 1;60(9):670-3.
2. Ortais G, Ariès P, Nguyen BV. Sugammadex: economic and practical considerations. Anaesthesia. 2017 Jun;72(6):793-4.
3. Kuusniemi KS, Pihlajamäki KK, Pitkänen MT, Helenius HY, Kirvelä OA. The use of bupivacaine and fentanyl for spinal anesthesia for urologic surgery. Anesthesia & Analgesia. 2000 Dec 1;91(6):1452-6.
4. World Health Organization. World Health Organization cardiovascular diseases (CVDs) fact sheet. World Health Organ. 2020;42(1):207-16.
5. Roth GA, GBD Collaborators. Global, regional, and national burden of cardiovascular diseases and risk factors in 204 countries and territories, 1990-2023. Available at SSRN 5392535. 2025 Jul 31.
6. Yusuf S, Hawken S, Ôunpuu S, Dans T, Avezum A, Lanas F, McQueen M, Budaj A, Pais P, Varigos J, Lisheng L. Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries (the INTERHEART study): case-control study. The lancet. 2004 Sep 11;364(9438):937-52.
7. Chowdhury MZ, Haque MA, Farhana Z, Anik AM, Chowdhury AH, Haque SM, Marjana LL, Bristi PD, Al Mamun BA, Uddin MJ, Fatema J. Prevalence of cardiovascular disease among Bangladeshi adult population: a systematic review and meta-analysis of the studies. Vascular health and risk management. 2018 Aug 21:165-81.
8. Talukder A, Hossain MZ. Prevalence of diabetes mellitus and its associated factors in Bangladesh: application of two-level logistic regression model. Scientific Reports. 2020 Jun 24;10(1):10237.
9. Al Kibria GM, Gupta RD, Nayeem J. Prevalence, awareness, and control of hypertension among Bangladeshi adults: an analysis of demographic and health survey 2017–18. Clinical Hypertension. 2021 Sep 1;27(1):17.
10. Giustiniano E, Ruggieri N. Is intrathecal lactate concentration monitoring helpful for postoperative paraplegia after descending aorta surgery?. Journal of Clinical Anesthesia. 2014 Sep 22;26(6):506-8.
11. Schwenk ES, Grant AE, Torjman MC, McNulty SE, Baratta JL, Viscusi ER. The efficacy of peripheral opioid antagonists in opioid-induced constipation and postoperative ileus: a systematic review of the literature. Regional Anesthesia & Pain Medicine. 2017 Nov 1;42(6):767-77.
12. Moore DC, Bridenbaugh LD. Spinal (subarachnoid) block: a review of 11,574 cases. Jama. 1966 Mar 14;195(11):907-12.
13. Herrera R, De Andrés J, Estañ L, Olivas FJ, Martínez-Mir I, Steinfeldt T. Hemodynamic impact of isobaric levobupivacaine versus hyperbaric bupivacaine for subarachnoid anesthesia in patients aged 65 and older undergoing hip surgery. BMC anesthesiology. 2014 Oct 24;14(1):97.
14. Moini J, Adams M, LoGalbo A. Complications of diabetes mellitus: a global perspective. Crc Press; 2022 Apr 27.
15. Sanatkar M, Sadeghi M, Esmaeili N, Sadrossadat H, Shoroughi M, Ghazizadeh S, Khoshraftar E, Anvari HP, Alipour N. The hemodynamic effects of spinal block with low dose of bupivacaine and sufentanil in patients with low myocardial ejection fraction. Acta Medica Iranica. 2013:438-43.
16. Abbasi MM, Shaheen MS, Ahmed R, Saklayen SM, Alam MM. Outcome of Subarachnoid Block with Low Dose Bupivacaine and Fentanyl for Lower Limb Vascular Surgeries in Patients with Coronary Artery Disease. Community Based Medical Journal. 2024 Aug 7;13(2):169-75.
17. Parashar P, Singh A, Sharma MK, Raval DL. Comparison between isobaric levobupivacaine 0.5% and hyperbaric bupivacaine 0.5% in spinal anesthesia in lower limb surgeries and lower abdominal surgeries in adult patients. Int J Res Med Sci. 2021 Feb; 9:418-22.
18. Van Herreweghe I, Ghysels E, Gielen J, Buck R, Flesher E, Cops J, Saldien V, Mesotten D, Hadzic A. Baricity of spinal bupivacaine and the incidence of hypotension in non-obstetric surgery: A systematic review. European Journal of Anaesthesiology and Intensive Care. 2025 Feb 1;4(1): e0064.
19. Patel N, Chaudhari BJ, Patel PD, Pandya M. Comparison of Efficacy and Hemodynamic Stability of 0.5% Isobaric Levobupivacaine and 0.5% Hyperbaric Bupivacaine in Old Age Patients Posted For Lower Limb Surgery under Spinal Anaesthesia. International Journal of Pharmacy Research & Technology (IJPRT). 2025 Apr 4;15(1):213-21.
20. Liu W, Bao S, Chen J, Li Y, Gu Y, Ye Q, Hai K. Bupivacaine–fentanyl isobaric spinal anesthesia reduces the risk of ICU admission in elderly patients undergoing lower limb orthopedic surgery. Journal of Orthopaedic Surgery and Research. 2024 Mar 1;19(1):160.
21. Toptaş M, Uzman S, İşitemiz İ, Yanaral TU, Akkoc I, Bican G. A comparison of the effects of hyperbaric and isobaric bupivacaine spinal anesthesia on hemodynamics and heart rate variability. Turkish journal of medical sciences. 2014;44(2):224-31.
22. Martin R, Frigon C, Chretien A, Tetrault JP. Onset of spinal block is more rapid with isobaric than hyperbaric bupivacaine. Canadian Journal of Anesthesia. 2000 Jan;47(1):43-6.
23. Uppal V, Retter S, Shanthanna H, Prabhakar C, McKeen DM. Hyperbaric versus isobaric bupivacaine for spinal anesthesia: systematic review and meta-analysis for adult patients undergoing

noncesarean delivery surgery. Anesthesia & Analgesia. 2017 Nov 1;125(5):1627-37.
24. Abbasi MM, Shaheen MS, Ahmed R, Saklayen SM, Alam MM. Outcome of Subarachnoid Block with Low Dose Bupivacaine and Fentanyl for Lower Limb Vascular Surgeries in Patients with Coronary Artery Disease. Community Based Medical Journal. 2024 Aug 7;13(2):169-75.
25. Liu W, Bao S, Chen J, Li Y, Gu Y, Ye Q, Hai K. Bupivacaine–fentanyl isobaric spinal anesthesia reduces the risk of ICU admission in elderly patients undergoing lower limb orthopedic surgery. Journal of Orthopaedic Surgery and Research. 2024 Mar 1;19(1):160.
26. Herrera R, De Andrés J, Estañ L, Olivas FJ, Martínez-Mir I, Steinfeldt T. Hemodynamic impact of isobaric levobupivacaine versus hyperbaric bupivacaine for subarachnoid anesthesia in patients aged 65 and older undergoing hip surgery. BMC anesthesiology. 2014 Oct 24;14(1):97.

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