E-ISSN 2250-0944
ISSN 2250-1150
doi:10.31838/ijprt/16.1.690

Original Research Article

Impact of Fractionated Versus Bolus Intrathecal Hyperbaric Bupivacaine Administration on Postoperative Nausea and Vomiting in Patients Undergoing Elective Lower Abdominal and Lower Limb Surgeries: A Prospective Randomized Comparative Study

Dr. Sharat Savanth H.N.[1], Dr. Dheeraj R. Patel[2], Dr. Jayashree B. Patil[3], Dr. Priyanka D.B.[4]
[1]Third Year Postgraduate Resident, Department of Anaesthesiology, S. S. Institute of Medical Sciences and Research Centre, Davanagere, Karnataka, India.
[2]Professor, Department of Anaesthesiology, S. S. Institute of Medical Sciences and Research Centre, Davanagere, Karnataka, India.
[3]Assistant Professor, Department of Anaesthesiology, S. S. Institute of Medical Sciences and Research Centre, Davanagere, Karnataka, India.
[4]Second Year Postgraduate, Department of Anaesthesiology, S. S. Institute of Medical Sciences and Research Centre, Davanagere, Karnataka, India.
Corresponding Author: Dr. Priyanka D.B.
Second Year Postgraduate, Department of Anaesthesiology, S. S. Institute of Medical Sciences and Research Centre, Davanagere, Karnataka, India.

Received: 15.04.2026 Revised: 09.05.2026 Accepted: 17.06.2026 Published: 22.06.2026

ABSTRACT
Background: Postoperative nausea and vomiting (PONV) remains one of the most common and distressing complications following spinal anaesthesia. Fractionated intrathecal administration of hyperbaric bupivacaine has been suggested to improve haemodynamic stability, which may indirectly reduce the incidence of PONV. This study compared the effect of fractionated and conventional bolus administration of intrathecal hyperbaric bupivacaine on PONV in patients undergoing elective lower abdominal and lower limb surgeries.
Methods: A prospective, randomized comparative study was conducted in 100 ASA physical status I–II patients aged 18–60 years undergoing elective lower abdominal and lower limb surgeries under spinal anaesthesia. Patients were randomly allocated into two groups. Group B received 3 mL of 0.5% hyperbaric bupivacaine as a single bolus, while Group F received the same dose in two fractions administered 90 seconds apart. The primary outcome was the incidence of PONV during the first 24 postoperative hours. Secondary outcomes included intraoperative hypotension, haemodynamic parameters, and rescue antiemetic requirement.
Results: Baseline characteristics were comparable between the groups. The incidence of hypotension was significantly lower in Group F than in Group B. PONV occurred less frequently in Group F (18%) than in Group B (28%); however, the difference was not statistically significant (p=0.23). Patients receiving fractionated spinal anaesthesia also required fewer rescue antiemetics and demonstrated better haemodynamic stability throughout the intraoperative period.
Conclusion: Fractionated intrathecal administration of 0.5% hyperbaric bupivacaine provided superior haemodynamic stability compared with conventional bolus administration and demonstrated a clinically favourable trend toward reducing postoperative nausea and vomiting. Although the reduction in PONV did not reach statistical significance, the lower incidence of hypotension and reduced rescue antiemetic requirement suggest that fractionated spinal anaesthesia may be a useful alternative to the conventional bolus technique, particularly in patients where haemodynamic stability is desirable. Larger multicentre studies are warranted to confirm its effect on PONV.

Keywords: Postoperative Nausea and Vomiting, Fractionated Spinal Anaesthesia, Hyperbaric Bupivacaine, Haemodynamic Stability.

INTRODUCTION

Postoperative nausea and vomiting (PONV) is one of the most frequent and distressing complications encountered following anaesthesia and surgery. Although it is generally not life-threatening, PONV significantly affects patient comfort and satisfaction, delays oral intake and mobilisation, prolongs post-anaesthesia care unit (PACU) stay, and may increase the duration of hospitalisation.[1] Severe or persistent vomiting can also result in dehydration, electrolyte imbalance, wound dehiscence, aspiration of gastric contents, increased intracranial and intraocular pressure, and postoperative bleeding. Consequently, prevention of PONV remains an important component of quality perioperative care. Despite advances in anaesthetic techniques and antiemetic therapy, the overall incidence of PONV ranges from 20–30% in the general surgical population and may exceed 70–80% in high-risk patients.[1-3]

Spinal anaesthesia is widely used for lower abdominal and lower limb surgeries because of its simplicity, rapid onset, excellent analgesia, reduced blood loss, lower incidence of thromboembolic complications, and avoidance of airway manipulation.[1,4] Compared with general anaesthesia, spinal anaesthesia is associated with a lower incidence of PONV because inhalational anaesthetic agents and airway instrumentation are avoided. However, PONV still occurs during and after spinal anaesthesia due to several factors, including hypotension secondary to sympathetic blockade, visceral traction during surgery, administration of opioids, patient anxiety, and individual susceptibility.[5] Among these, hypotension is considered one of the most important modifiable contributors. Reduced cerebral perfusion and mesenteric hypoperfusion resulting from spinal-induced hypotension can stimulate the chemoreceptor trigger zone and vomiting centre, thereby increasing the likelihood of nausea and vomiting. Therefore, strategies aimed at improving haemodynamic stability during spinal anaesthesia may indirectly reduce the incidence of PONV.

Conventionally, hyperbaric bupivacaine is administered intrathecally as a single bolus. Although this technique is simple and effective, the rapid spread of local anaesthetic within the cerebrospinal fluid may produce an abrupt sympathetic blockade, leading to significant hypotension and bradycardia. Fractionated intrathecal administration has been proposed as an alternative technique in which the calculated dose of local anaesthetic is administered in two portions separated by a brief interval. This slower administration is believed to produce a more gradual onset of sympathetic blockade while maintaining adequate sensory and motor block. Improved haemodynamic stability with fractionated dosing has been demonstrated in several studies, but evidence regarding its influence on postoperative nausea and vomiting remains limited and inconsistent.[4-11]Since haemodynamic instability is closely associated with the development of PONV, it is clinically relevant to determine whether fractionated spinal anaesthesia offers additional benefits in reducing this troublesome postoperative complication.

The present prospective randomized comparative study was therefore undertaken to evaluate the impact of fractionated versus conventional bolus intrathecal administration of 0.5% hyperbaric bupivacaine on the incidence of postoperative nausea and vomiting in patients undergoing elective lower abdominal and lower limb surgeries under spinal anaesthesia. In addition, the study assessed intraoperative hypotension and the requirement for rescue antiemetic therapy to better understand the relationship between haemodynamic stability and PONV.

Aim and Objectives

Aim

To compare fractionated versus bolus intrathecal administration of 0.5% hyperbaric bupivacaine with respect to postoperative nausea and vomiting.

Objectives

- To compare incidence of PONV.
- To compare intraoperative hypotension.
- To compare haemodynamic parameters.

MATERIALS AND METHODS

Study Design

This prospective, randomized, comparative study was conducted after obtaining approval from the Institutional Ethics Committee of S. S. Institute of Medical Sciences and Research Centre, Davanagere. Written informed consent was obtained from all participants before enrolment.

Study Setting and Duration

The study was carried out in the Department of Anaesthesiology at S.S. Institute of Medical Sciences and Research Centre, Davanagere, over a period of 2 years among patients undergoing elective lower abdominal and lower limb surgeries under spinal anaesthesia.

Sample Size

Dr. N. Lakshmi Sowmya, Dr. M. V.Rama Rao, Dr. Anand Ram,[9] study was used to calculate sample size Sample Size:

$N = [(Z\alpha+Z\beta)^2 \times S^2 \times 2] / d^2$

Where Zα= Standard Normal deviate for α =0.05 =1.96

Zβ= Standard Normal deviate for β=0.1=1.282

Power of the study=90%

S1=Standard deviation of group B=13.24

S2=Standard deviation of group F=13.11

S=Common standard deviation between two groups

D=Clinically meaningful difference=m1-m2=11, then N=30 in each group.to increase the credibility of study sample increased to 50 in each group

Study Population

One hundred adult patients scheduled for elective lower abdominal and lower limb surgeries under spinal anaesthesia were enrolled in the study.

Inclusion Criteria

Patients fulfilling all of the following criteria were included:

* Age between 18 and 60 years.
* American Society of Anaesthesiologists (ASA) Physical Status I or II.
* Height between 140 cm and 180 cm.
* Patients willing to participate and provide written informed consent.

Exclusion Criteria

Patients with any of the following were excluded:

* Refusal to participate.
* Contraindications to spinal anaesthesia.
* History of severe postoperative nausea and vomiting or motion sickness.
* Use of antiemetic medication within the previous 24 hours.
* Chronic opioid therapy.
* Pregnancy.
* Severe cardiovascular disease.
* Coagulopathy or anticoagulant therapy.
* Known allergy to local anaesthetic drugs.

Randomization

Eligible patients were randomly allocated into two equal groups using the chit-and-box randomization method.

- Group B (Bolus Group): 50 patients received 3 ml of 0.5% hyperbaric bupivacaine as a single intrathecal bolus injection.[3]
- Group F (Fractionated Group): 50 patients received 2 ml of 0.5% hyperbaric bupivacaine initially, followed by the remaining 1 ml after an interval of 90 seconds while maintaining the sitting position. The second aliquot was injected slowly at approximately 0.2 ml per second.[3]

Anaesthetic Technique-All patients underwent standard pre-anaesthetic evaluation before surgery. After arrival in the operating theatre, standard monitoring including electrocardiography (ECG), non-invasive blood pressure (NIBP), and pulse oximetry (SpO_2) was instituted. Baseline heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure, and oxygen saturation were recorded.

Peripheral intravenous access was secured using an 18G intravenous cannula, and patients received preloading according to institutional protocol. Under strict aseptic precautions, spinal anaesthesia was performed in the sitting position at the L3–L4 or L4–L5 intervertebral space using a 25G Quincke spinal needle. Hyperbaric bupivacaine (0.5%) was administered according to the allocated studygroup.

Following completion of spinal anaesthesia, patients were positioned appropriately for surgery. Haemodynamic parameters were monitored throughout the intraoperative period. Episodes of hypotension and bradycardia were managed according to standard institutional protocols, episode of PONV noted and managed with inj ondensetron 4mg iv stat.

Onset of Sensory Block: is defined as the time interval between intrathecal injection to loss of pin prick sensation at L1 dermatomal level.

Onset of Motor Block: is defined as the time interval between intrathecal injection to Modified bromage scale reaches 3.

Hemodynamic parameters such as HR [heart rate], SBP [systolic blood pressure], DBP[diastolic blood pressure], MAP [mean arterial pressure] recorded immediately after

administering spinal anaesthesia which is taken as zero minute reading followed by 5,10,15,30,45,60minutes vitals readings should be noted. And also hypotension treated only when mean arterial pressure [MAP] decreased 20% or more from baseline. Dose and frequency of vasopressor administered will be recorded. heart rate less than 50beats per minute will be treated with atropine 0.6mg iv and also recorded.

Duration of Sensory Block: is defined as time interval from intrathecal injection to L1 segment regression.

Duration of Motor Block: is defined as time interval from intrathecal injection to modified Bromage score reaches 0.

Outcome Measures

Primary Outcome

* Incidence of postoperative nausea and vomiting during the first 24 postoperative hours.

Secondary Outcomes

* Incidence of intraoperative hypotension.
* Requirement of rescue antiemetics medication

Statistical Analysis

Continuous variables were expressed as mean ± SD. Independent Student's t-test was used for continuous variables, while Chi-square/Fisher's exact test was used for categorical variables. A p-value <0.05 was considered statistically significant.

RESULTS

Parameter	Group B (n=50)	Group F (n=50)	P value
Age (years, mean ± SD)	39.8 ± 10.5	38.6 ± 9.8	0.58
Gender			0.68
Male	28 (56%)	30 (60%)	
Female	22 (44%)	20 (40%)	
ASA Physical Status			0.67
ASA I	32 (64%)	34 (68%)	
ASA II	18 (36%)	16 (32%)	
PONV (Yes/No)	14 (28%) / 36 (72%)	9 (18%) / 41 (82%)	0.23

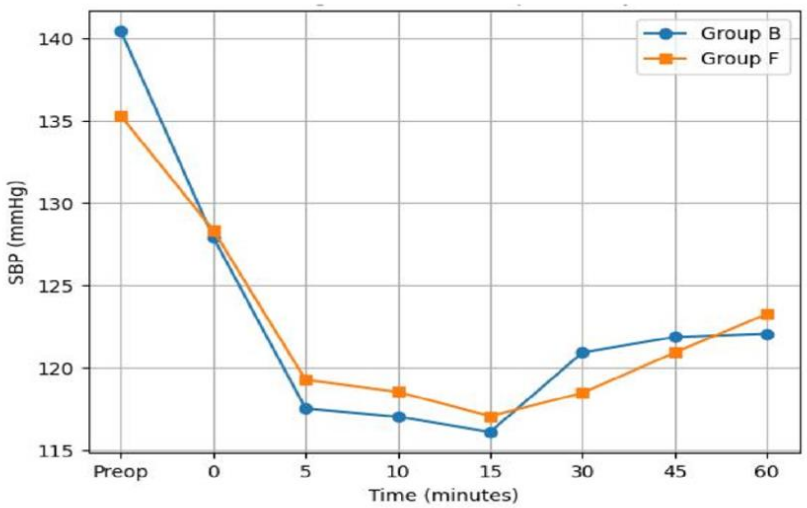
Table 1 - Demographic Data

GROUP-B/F	Baseline HR	HR at Zero	HR at 5 min	HR at 10 min	HR at 15 min	HR at 30 min	HR at 45 min	HR at 60 min
Group B	75.10 ± 11.78	73.03 ± 11.36	68.60 ± 11.12	65.63 ± 10.46	65.23 ± 9.46	65.00 ± 9.96	63.93 ± 9.23	63.73 ± 8.01
Group F	78.60 ± 15.40	76.90 ± 16.73	73.67 ± 18.99	69.53 ± 14.93	70.77 ± 11.42	69.17 ± 16.09	67.73 ± 13.33	68.50 ± 12.69

Table 2-Heart Rate (HR) Variables

GROUP-B/F	SBP Baseline	SBP Zero (mmHg)	SBP 5 min	SBP 10 min	SBP 15 min	SBP 30 min	SBP 45 min	SBP 60 min
Group B	140.47 ± 19.46	127.93 ± 19.96	117.53 ± 21.92	117.03 ± 22.28	116.10 ± 18.77	120.93 ± 17.44	121.87 ± 14.63	122.07 ± 14.48
Group F	135.30 ± 13.80	128.37 ± 16.55	119.27 ± 14.73	118.53 ± 14.40	117.07 ± 14.26	118.47 ± 13.64	120.93 ± 15.70	123.27 ± 15.07

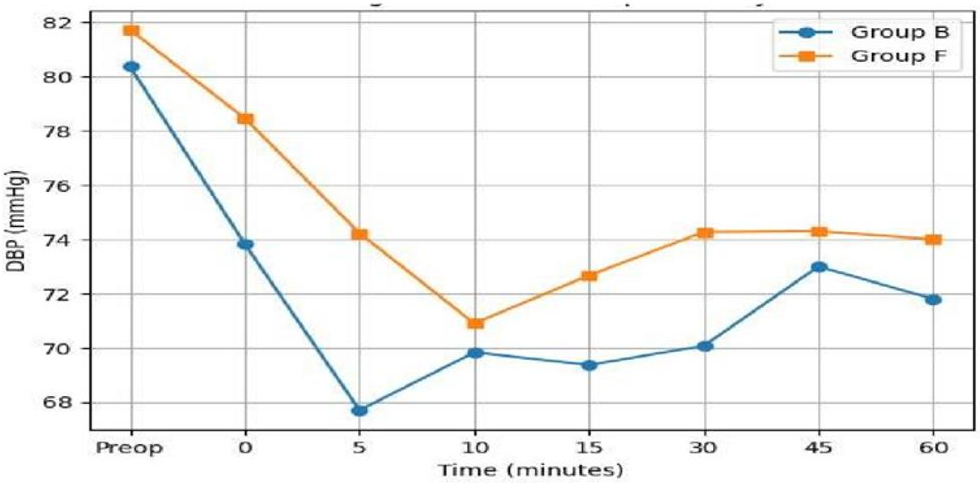
Table 3-Systolic Blood Pressure (SBP)



Graph 1-Changes in SBP Intraoperatively

GROUP-B/F	DBP Baseline	DBP Zero (mmHg)	DBP 5 min	DBP 10 min	DBP 15 min	DBP 30 min	DBP 45 min	DBP 60 min
Group B	80.37 ± 7.67	73.83 ± 9.12	67.70 ± 10.85	69.83 ± 9.84	69.37 ± 10.46	70.07 ± 10.74	73.00 ± 12.01	71.80 ± 10.95
Group F	81.73 ± 7.13	78.47 ± 9.64	74.23 ± 8.81	70.90 ± 9.41	72.67 ± 10.01	74.27 ± 10.43	74.30 ± 12.94	74.00 ± 10.46

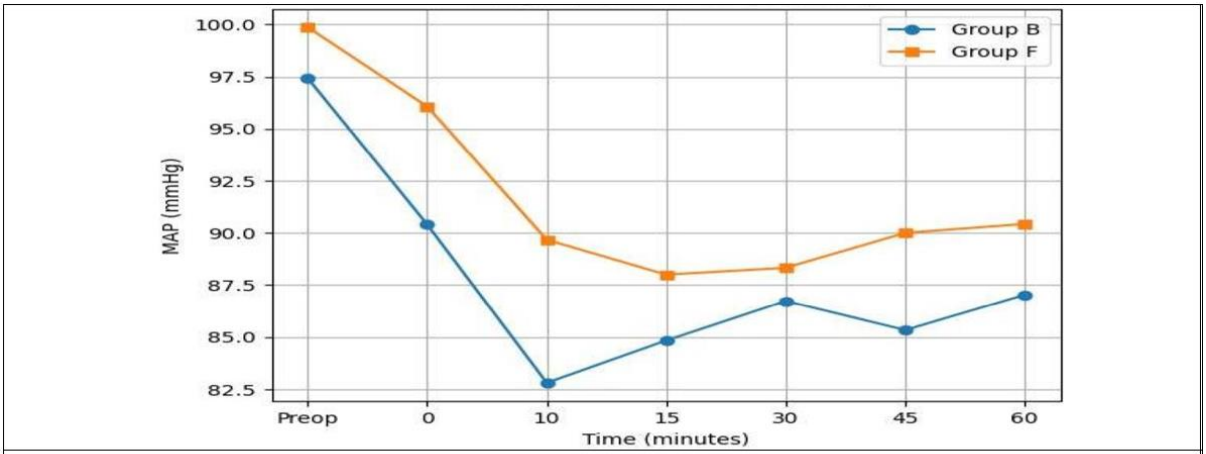
Table 4-Diastolic Blood Pressure (DBP)



Graph 2- Changes in DBP Intraoperatively

GROUP-B/F	MAP Baseline	MAP Zero (mmHg)	MAP 10 min	MAP 15 min	MAP 30 min	MAP 45 min	MAP 60 min
Group B	97.43 ± 13.40	90.40 ± 13.86	82.80 ± 16.65	84.83 ± 16.43	86.73 ± 13.82	85.33 ± 12.80	87.03 ± 11.72
Group F	99.87 ± 9.05	96.07 ± 11.92	89.67 ± 11.33	88.00 ± 11.14	88.33 ± 11.39	90.00 ± 10.95	90.43 ± 13.85

Table 5-Mean Arterial Pressure (MAP)



Graph 3- Changes in Map Intraoperatively

Parameter	Group B (Mean ± SD)	Group F (Mean ± SD)	Mean Difference	p-value
HR Max Drop	-14.27 ± 7.50	-13.37 ± 10.50	-0.90	0.704
SBP Max Drop	-32.73 ± 14.17	-24.23 ± 16.57	-8.50	0.037
DBP Max Drop	-19.60 ± 8.54	-14.93 ± 11.33	-4.67	0.077
MAP Max Drop	-24.27 ± 15.04	-17.27 ± 12.30	-7.00	0.053

Table 6-Comparison of Maximum Hemodynamic Changes Between Bolus (Group B) and Fractionated (Group F) Spinal Anaesthesia

Sensory onset was 1.63 ± 0.27 minutes in Group B and 2.43 ± 0.55 minutes in Group F, while motor onset was 1.96 ± 0.38 minutes and 2.77 ± 0.48 minutes. Sensory block duration, motor block duration, and analgesia duration were all higher in Group F, with statistically significant p values

Variable	Group B (Mean ±SD)	Group F (Mean ± SD)	Mean Difference	p-value
Sensory Onset (min)	1.63 ± 0.27	2.43 ± 0.55	-0.80	<0.001
Motor Onset (min)	1.96 ± 0.38	2.77 ± 0.48	-0.81	<0.001
Sensory Block Duration (min)	141.30 ± 20.15	154.17 ± 20.27	-12.87	0.017
Motor Block Duration (min)	183.43 ± 22.50	206.00 ± 22.03	-22.57	<0.001
Duration of Analgesia (min)	296.67 ± 33.56	337.83 ± 34.33	-41.17	<0.001

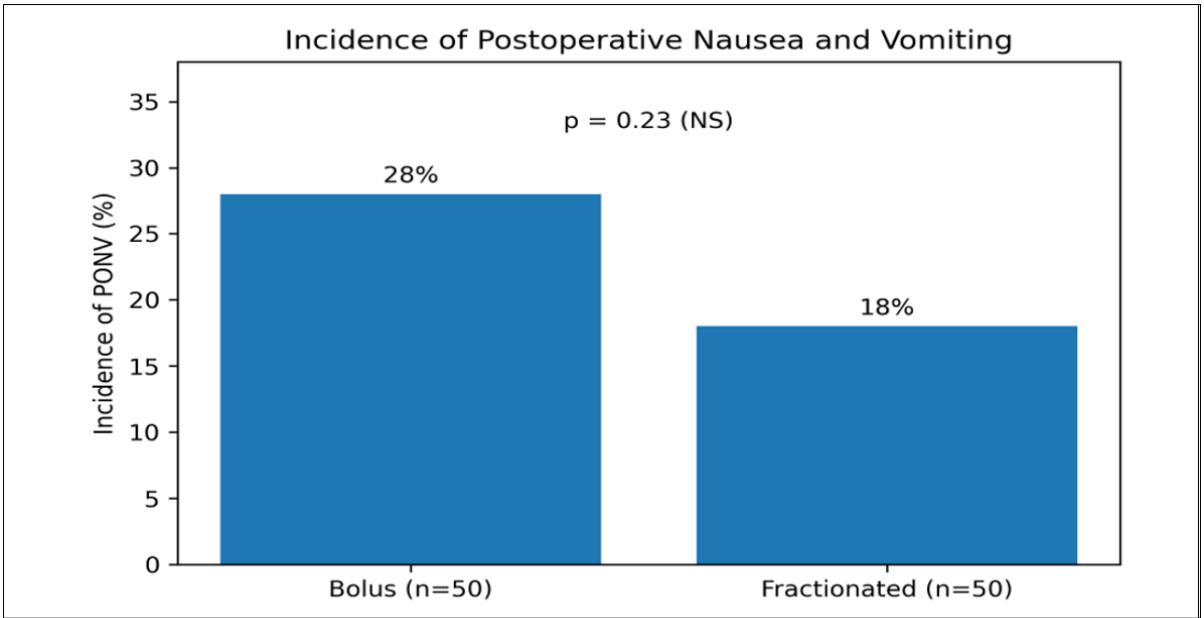
Table 7-Comparison of Sensory, Motor Block Characteristics and Duration of Analgesia

Sensory onset was 1.63 ± 0.27 minutes in Group B and 2.43 ± 0.55 minutes in Group F, while motor onset was 1.96 ± 0.38 minutes and 2.77 ± 0.48 minutes. Sensory block duration, motor block duration, and analgesia duration were all higher in Group F, with statistically significant p values

Hypotension	Group B	%	Group F	%
Present	37	74	17	34
Absent	13	26	33	66
Total	50	100	50	100

Table 8- Incidence Of Hypotension

Chisquare Test= 16.16 P < 0.001



Graph 4- Incidence of PONV

DISCUSSION

The present prospective randomized comparative study demonstrated a lower incidence of postoperative nausea and vomiting (PONV) in the fractionated spinal anaesthesia group (18%) compared with the conventional bolus group (28%). Although this reduction did not achieve statistical significance (p = 0.23), the findings suggest a clinically favourable trend towards reduced PONV with fractionated intrathecal administration of hyperbaric bupivacaine. The observed reduction in PONV is likely related to the significantly lower incidence of intraoperative hypotension in the fractionated group, as spinal anaesthesia-induced hypotension is a well-recognized precipitating factor for nausea and vomiting.

Our findings are comparable with those of Badheka et al. (2017)[4] who evaluated fractionated versus bolus spinal anaesthesia in patients undergoing elective caesarean section. Although the primary objective of their study was to assess haemodynamic stability, they also reported a lower incidence of nausea and vomiting in patients receiving fractionated spinal anaesthesia. Similar to our findings, the reduction in PONV was attributed to improved haemodynamic stability resulting from a more gradual sympathetic blockade rather than a direct antiemetic effect of the technique. However, PONV was not the primary outcome of their study.

A similar trend was observed by Venkatprabu et al.[3] who reported fewer episodes of postoperative nausea and vomiting in the fractionated group compared with the conventional bolus group. Their study mainly focused on haemodynamic variables and block characteristics, and although PONV occurred less frequently following fractionated spinal anaesthesia, detailed statistical analysis of this outcome was not performed. The findings nevertheless support the concept that improved cardiovascular stability may contribute to reducing postoperative nausea and vomiting.

In contrast, Derakhshan et al[2] demonstrated a statistically significant reduction in nausea and vomiting following fractionated intrathecal injection. They reported postoperative nausea and vomiting in approximately 25.7% of patients receiving a conventional bolus compared with only 2.8% of those receiving fractionated spinal anaesthesia. The greater reduction observed in their study may be related to differences in surgical population, sample size, perioperative management, and patient characteristics. Nevertheless, both studies consistently indicate that fractionated spinal anaesthesia is associated with a lower incidence of PONV.Graph 4- Incidence of PONV

Similarly, Patel and Patel (2023) [7] compared fractionated and bolus spinal anaesthesia in elective caesarean section. Their primary outcomes included haemodynamic stability, sensory block characteristics, and vasopressor requirement. Although postoperative nausea and vomiting was recorded as a perioperative complication, the study was not powered to

detect differences in PONV. Their observations nevertheless showed a lower frequency of nausea and vomiting with fractionated spinal anaesthesia, which is consistent with the trend observed in our study. Comparison with Derakhshan et al.

The findings of the present study are in agreement with those reported by Derakhshan P, Faiz SHR, Rahimzadeh P, Salehi R, and Khaef G. In their randomized clinical trial involving patients undergoing lower limb fracture surgery, fractionated intrathecal injection of hyperbaric bupivacaine was associated with a significantly lower incidence of postoperative nausea and vomiting compared with conventional bolus administration. They reported postoperative nausea and vomiting in 25.7% of patients in the bolus group compared with only 2.8% in the fractionated group ($p = 0.05$). In the present study, the incidence of PONV was also lower in the fractionated group (18%) than in the bolus group (28%), although the difference was not statistically significant ($p = 0.23$). The similar direction of findings in both studies suggests that fractionated intrathecal administration may reduce PONV by minimizing spinal anaesthesia-induced hypotension. The lack of statistical significance in our study may be explained by differences in patient population, surgical procedures, perioperative management, and the multifactorial nature of PONV.

Unlike previous studies, the present study specifically evaluated PONV as the primary outcome, while simultaneously assessing intraoperative hypotension and haemodynamic parameters. Although the reduction in PONV did not reach statistical significance, the consistent numerical decrease, together with significantly improved haemodynamic stability, suggests that fractionated intrathecal administration may provide an important clinical advantage. Because PONV is a multifactorial complication influenced by patient-related, surgical, and anaesthetic factors, larger multicentre studies with standardized PONV risk stratification, such as the Apfel score, are required to determine whether the observed reduction can achieve statistical significance. The incidence of hypotension was one of the most important outcomes of the present study and showed a clear advantage for fractionated spinal anaesthesia. Hypotension was present in 37 patients in Group B, whereas it occurred in only 17 patients in Group F. This difference was statistically significant, indicating that bolus dosing was associated with a markedly greater incidence of hypotension than fractionated dosing. This is clinically important because hypotension is one of the most frequent and potentially serious complications of spinal anaesthesia, particularly in patients with limited cardiovascular reserve. The present finding is strongly supported by previous studies. Patel et al. reported hypotension in 16 patients in the bolus group compared with only 6 patients in the fractionated group ($p < 0.05$), and they also found that the duration of effective analgesia was significantly longer with fractionated dosing (338.25 ± 19.824 minutes vs. 266.875 ± 19.861 minutes). Venkatprabu et al. similarly documented a lower incidence of hypotension in the fractionated group (12%) compared with the bolus group (36%).[10] Tiwari et al. also demonstrated fewer hypotensive episodes and reduced**.**

A major finding of the present study was the significantly lower incidence of intraoperative hypotension in patients receiving fractionated spinal anaesthesia compared with those receiving a conventional bolus injection. Spinal anaesthesia produces sympathetic blockade, resulting in arterial and venous vasodilation, reduced systemic vascular resistance, and decreased venous return. When the entire dose of hyperbaric bupivacaine is administered rapidly as a bolus, sympathetic blockade develops abruptly, predisposing patients to marked hypotension. In contrast, fractionated administration allows a more gradual spread of the local anaesthetic within the cerebrospinal fluid, leading to a slower onset of sympathetic blockade and improved cardiovascular adaptation. This physiological mechanism likely explains the superior haemodynamic stability observed in the fractionated group.

The findings of the present study are consistent with several previous investigations that demonstrated improved haemodynamic stability with fractionated intrathecal administration of hyperbaric bupivacaine. Earlier studies have reported lower incidences of hypotension, reduced vasopressor requirements, and fewer episodes of severe haemodynamic instability when spinal anaesthesia was administered in divided doses. These observations support the concept that modifying the technique of intrathecal drug administration can influence the cardiovascular effects of spinal anaesthesia without compromising the quality of neural blockade.

The incidence of postoperative nausea and vomiting was lower in the fractionated group (18%) compared with the bolus group (28%). Although this reduction was not statistically significant, the observed trend is clinically relevant. PONV is a multifactorial complication influenced by patient-related factors, anaesthetic technique, surgical procedure, postoperative opioid consumption, and haemodynamic changes. Among these factors, intraoperative hypotension is recognised as an important contributor during spinal anaesthesia. Reduced cerebral perfusion and transient gastrointestinal hypoperfusion during episodes of hypotension may stimulate the chemoreceptor trigger zone and vomiting centre, thereby increasing the occurrence of nausea and vomiting.

The lower incidence of hypotension observed in the fractionated group may therefore explain the reduced frequency of PONV in these patients. However, because PONV results from the interaction of multiple independent risk factors, improvement in haemodynamic stability alone may not be sufficient to produce a statistically significant reduction in its incidence. Patient susceptibility, visceral manipulation during surgery, anxiety, perioperative medications, and postoperative analgesic requirements may also influence the occurrence of PONV and could have contributed to the lack of statistical significance despite the numerical reduction observed.

A lower requirement for rescue antiemetic medication was also observed among patients receiving fractionated spinal anaesthesia. Although the difference between groups was not statistically significant, it is consistent with the reduced incidence of nausea and vomiting in the fractionated group and further supports the potential clinical benefit of improved haemodynamic stability. Reduced antiemetic use may improve patient comfort, decrease drug-related adverse effects, and contribute to enhanced postoperative recovery.

From a clinical perspective, fractionated intrathecal administration of hyperbaric bupivacaine is a simple modification of the conventional spinal anaesthesia technique that requires no additional equipment or significant increase in procedure time. By reducing the incidence of hypotension, this technique may decrease the need for vasopressor therapy and contribute to more stable intraoperative haemodynamics. Although the reduction in PONV did not reach statistical significance in the present study, even a modest reduction may improve patient satisfaction and postoperative recovery, particularly in individuals at increased risk for PONV.

The absence of statistical significance in PONV incidence should not necessarily be interpreted as a lack of clinical benefit. The study may have been underpowered to detect relatively small differences in PONV rates, especially considering the multifactorial nature of this complication. Larger multicentre studies with greater sample sizes and stratification according to validated PONV risk scores, such as the Apfel score, may provide more definitive evidence regarding the effect of fractionated spinal anaesthesia on postoperative nausea and vomiting.

CONCLUSION

Fractionated intrathecal administration of 0.5% hyperbaric bupivacaine provided better haemodynamic stability than conventional bolus administration in patients undergoing elective lower abdominal and lower limb surgeries under spinal anaesthesia, with a significantly lower incidence of intraoperative hypotension.Although the incidence of postoperative nausea and vomiting (PONV) was lower in the fractionated group, the difference was not statistically significant. However, the reduced need for rescue antiemetics suggests a potential clinical benefit.

Strengths

Prospective randomized design; comparable baseline characteristics; standardized technique; clinically relevant outcomes; simple intervention.

Limitations

Single-centre study; relatively small sample size; multifactorial nature of PONV; patient satisfaction not assessed.

REFERENCES

1. Miller RD, Cohen NH, Eriksson LI, Fleisher LA, Wiener-Kronish JP, Young WL. *Miller's Anesthesia*. 8th ed. Philadelphia: Elsevier; 2015.
2. Derakhshan P, Faiz SHR, Rahimzadeh P, Salehi R, Khaef G. Anesth Pain Med. 2020;10(5):e102228.
3. Venkatprabu P, Anand S, Bernnon H. J Chem Health Risks. 2025;15(3):1244-1250.

4. Badheka JP, Oza VP, Vyas A, Baria D, Nehra P, Babu T. Comparison of fractionated dose versus bolus dose injection in spinal anaesthesia for patients undergoing elective caesarean section: A randomised, double-blind study. Indian J Anaesth. 2017 Jan;61(1):55-60.
5. Srivastava N, Ahluwalia P, Jheetay GS, Singh G. Bolus dose versus fractionated dose injection of hyperbaric bupivacaine in spinal anaesthesia among adult patients undergoing lower limb surgery: A prospective study. Indian J Clin Anaesth. 2020
6. Vanagondi siva kumar, Manjula V Ramsali, Vankayapati Sarada devi et al. fractionated dose versus conventional method of drug administration in spinal anaesthesia for pregnant women undergoing cesarean section: A Comparative study. Indian J Anaesth Analg. 2019;6(6Part-II):2206-11.
7. Patel DD, Patel C. Comparison of fractionated versus bolus dose of bupivacaine heavy (0.5%) spinal anesthesia for elective cesarean section-A prospective, randomized, single blind, and clinical trial. J Obstet Anaesth Crit C 2023;13:187-92.
8. Nugroho AM, Sugiarto A, Chandra S, Lembabmanah L, Septica RI, Yunera A. A comparative study of fractionated versus single dose injection for spinal anaesthesia during cesarean section in patients with pregnancy induced hypertension. Anesth Pain Med. 2019;9(1):85115.
9. Dr. N. Lakshmi Sowmya, Dr. M. V. Rama Rao, Dr. Anand Ram, "Comparison of Fractionated versus Bolus Dose Injection of Drug in Spinal Anaesthesia for Lower Limb Surgeries", International Journal of Science and Research (IJSR), 2020;9(1):1729-33.
10. Khare D, Nema N. Comparison of bolus versus fractionated dose of injection bupivacaine heavy(0.5%) in spinal anaesthesia for patients undergoing emergency caesarean section: A randomized study. Anesthesiol. 2019;8(6):82-7.
11. Gandhi M, Kabir KK, Arora KK, Tiwari K. Comparative study between fractionated and single bolus dose of local anaesthetic in elective lower segment caesarean section. Indian J Clin Anaesth. 2019 Jul;6(3):386-90.