Open Access

Original Article

Comparison of Hemodynamic Stability in Patients with Intrathecal 0.75% Hyperbaric Bupivacaine Alone and with Pethidine

Muhammad Ammar Amjad, Muhammad Saeed, Abdullah, Muhammad Ali, Syed Majid Waseem, Abdul Khalique

Department of Anesthesia, Combined Military Hospital, Multan/National University of Medical Sciences (NUMS) Pakistan

ABSTRACT

Objective: To find out whether hemodynamic stability is noted in patients with intrathecal 0.75% hyperbaric bupivacaine alone and compared with pethidine.

Study Design: Quasi-experimental study.

Place and Duration of Study: Department of Anesthesiology, Combined Military Hospital, Multan. Pakistan, from Jan to Dec 2023.

Methodology: Pregnant women (n=78) with gravidity ≤2, undergoing elective lower segment cesarean section (LSCS) surgery were selected. They were divided into two equal groups: Group A and B, with n=40 in each. Group A received 10mg of 0.75% bupivacaine whereas Group B were injected with 7.5mg of 0.75% bupivacaine plus 25mg of pethidine. Comparative decrease in blood pressure in terms of Mean Arterial Pressure (MAP), incidence of hypotension, bradycardia, nausea and post-spinal shivering were noted.

Results: Mean Arterial Pressure (MAP) decreased in both groups at 2.5-minute post-intrathecal injection, but this decline was more prominent in Group A (64.56±6.10 mmhg versus 73.33±9.37 mmhg) than for Group B (*p* 0.001). At the 10th minute, decline in MAP was less but the difference between the two groups remained statistically significant. Similarly, frequency of bradycardia and post-op shivering remained on the lower side in Group B while a major difference was seen in the frequency of hypotension between both the groups.

Conclusion: Addition of pethidine to bupivacaine, for intrathecal, use keeps the hemodynamic profile of the patients relatively more stable and avoids adverse events.

Keywords: Bupivacaine, Hemodynamic, Hypotension, Pethidine, Spinal Anesthesia.

How to Cite This Article: *Amjad MA, Saeed M, Abdullah, Ali M, Waseem SM, Khalique A. Comparison of Hemodynamic Stability in Patients with Intrathecal 0.75% Hyperbaric Bupivacaine Alone and with Pethidine. Pak Armed Forces Med J 2025; 75(3): 487-490. DOI: https://doi.org/10.51253/pafmj.v75i3.10848*

INTRODUCTION

Hemodynamic stability remains a major concern following intrathecal regional anesthesia as heart rate, systolic and diastolic, along with mean arterial blood pressure changes are significant following the intrathecal regional anesthesia.[1] Incidence of post spinal anesthesia hypotension ranges from 20–40%, and its severity depends on factors like body mass index (BMI), multigravidity, volume of preloaded fluid, base line blood pressure, heart rate and choice of anesthetic agent used for block.[2] In obstetric surgeries, hemodynamic instability usually compromises feto-maternal outcomes, which may include maternal nausea, vomiting and fetal acidosis, and cardiovascular collapse, if left untreated, due to arterial dilation and decrease in systemic vascular resistance.[3] In order to avoid these unwanted effects, different additives, like clonidine, tramadol, and opioids, like pethidine, have been tried in conjunction with local anesthetics, to strengthen the block and increase postoperative analgesic duration, leading to avoidance of prelacteal feeding and resulting in better feto-maternal relation.[4] Bupivacaine, as a hyperbaric and an isobaric, has long been used for intrathecal block with a margin of tolerance in acceptance of the hemodynamic instability it causes.[5] Pethidine is a relatively newer agent in this regard and is being used with better quality and longer duration of analgesia along with faster reversal of motor block.[6] Hyperbaric bupivacaine, combined with pethidine, is used for intrathecal block in comparison to bupivacaine alone and can cause lesser hemodynamic instability with similarly lesser post spinal shivering, as pethidine may cause pruritus.[7] Thus, the aim of this study was to determine whether hemodynamic stability is present with intrathecal 0.75% hyperbaric bupivacaine alone and compared with pethidine

Correspondence: Dr Muhammad Ali, Department of Anesthesia, Combined Military Hospital, Multan Pakistan

Received: 06 Sep 2023; revision received: 14 Mar 2024; accepted: 22 Apr 2024

METHODOLOGY

The quasi-experimental study was carried out at Combined Military Hospital (CMH), Multan, Pakistan, over six months, starting from January to July 2023. Permission from hospital Ethics Committee was granted via letter no 13/Trg/91/2023, dated 1st January 2023, and data collection was started after that. Sample size was calculated using Open Epi online calculator, with reference parameter of frequency of hypotension being 5 out of 25 in one Group and 17 out of 25 in the other Group 7. Non-randomized consecutive sampling technique was used to enroll a total of 80 patients. Informed, written consent was taken from all participants and their attendants.

Inclusion Criteria: Female patients who were pregnant with gravidity ≤2, aged between 20 to 30 years and American Society of Anesthesiologist (ASA) status ≤II were included.

Exclusion Criteria: Patients with diagnosed coagulopathy, low platelet count (≤100), any infection at the site of intrathecal injection, gravidity ≥3, body weight greater than 100kg, ASA≥III, advance stage renal or hepatic disease, preeclampsia, eclampsia or placental abnormalities were excluded.

Patients were divided into two equal groups, named Group A and Group B, with n=40 in each. Both groups were monitored intraoperatively using standard monitoring with non-invasive blood pressure measurements at 2.5-minute intervals, pulse oximetry for oxygen saturation and three lead electrocardiography along with temperature measurements. Patients in both groups were preloaded with Ringer's lactate 10ml/kg and pre-medicated with metoclopramide 0.15mg/kg and dexamethasone 0.1mg/kg. Patients in Group A received 10 mg of 0.75% hyperbaric bupivacaine as intrathecal injection whereas Group B received 7.5 mg of 0.75% hyperbaric bupivacaine with 25mg of pethidine. A 27G Quincke needle was used in both groups and intrathecal injection was given at the level L4-L5 intervertebral space. Immediately following the injection, patients were laid down in supine position with operating table leveled at zero position. Mean arterial pressure (MAP) was documented at the start as a base line and then at following intervals following the intrathecal injection: 2.5 and 10 minutes. Hypotension, defined as 20% decrease in MAP from base line, was noted. Incidence of bradycardia (heart rate ≤50), nausea and post spinal shivering were also noted. Post-op patients were kept in the recovery room and later shifted to in-patient wards. Statistical Package for Social Sciences (SPSS) version 25 was used for data analysis. Differences between the two groups for continuous and normally distributed variables were explained using independent t-test whereas numerical variables were explained in terms of Mean±SD. Frequency and percentage were used to present categorical data and *p*-values≤0.05 were taken as significant.

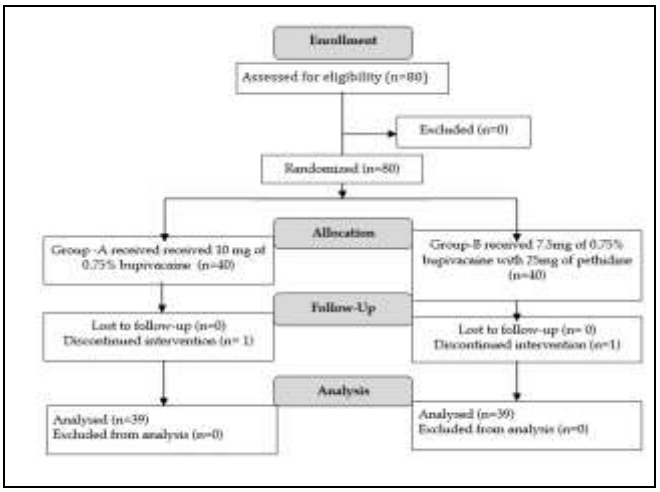

Figure: Patient Flow Diagram (n=80)

RESULTS

Out of 80 patients, 78 completed the study as two patients, one from each group, were dropped because intrathecal injection did not result in adequate motor blockage. Age range of participants was from 20 to 30 years. Patients' demographic characteristics listed in Table-I.

Table-I: Age, Weight and ASA Status Group Comparison (n=78)

Variable	Group A (n=39)	Group B (n=39)	p-value (≤0.05)
Age (years)	25.48±2.30	25.82±2.67	0.55
Weight (kg)	82.92±8.19	84.76±8.81	0.34
ASA Status I/II	0/39	0/39	--

** ASA: American Society of Anesthesiologists*

Mean Arterial Pressure (MAP) decreased in both groups at 2.5-minute post intrathecal injection (64.56±6.10 mmHg versus 73.33±9.37 mmHg) with *p*-value<0.001. Comparison of frequency of adverse events and their types are listed in Table-II.

The major difference was noted in the frequency of hypotension in both groups, as depicted in Figure-1 below.

Table-II: Bradycardia and Post-operative Shivering Frequency Comparison (n=78)

Variable	Group A (n=39)	Group B (n=39)	*p*-value (≤0.05)
MAP baseline (mmHg)	85.28±7.33	86.53±7.37	0.45
MAP at 2.5 min (mmHg)	64.56±6.10	73.33±9.37	<0.001
MAP at 10 min (mmHg)	72.28±5.95	80.56±5.97	<0.001
Hypotension	25(64%)	9(23%)	--
Bradycardia	8(20.5%)	10(25.1%)	--
Post-op shivering	(12.8%)	1(2.56%)	--

**MAP: Mean Arterial Pressure*

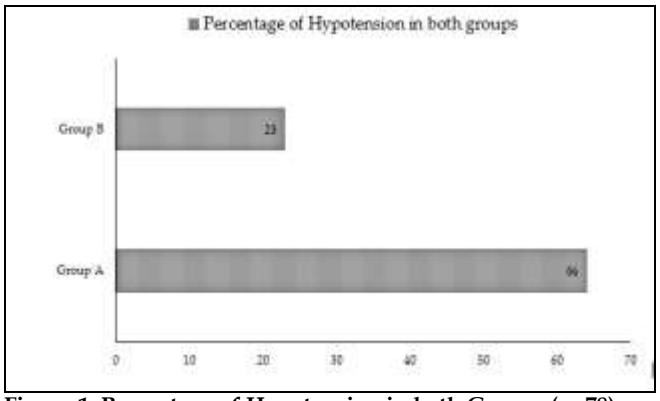

Figure-1: Percentage of Hypotension in both Groups (n=78)

DISCUSSION

Different adjuvant drugs are in practice for intrathecal use in combination with local anesthetics with the primary aims being better hemodynamic stability, lesser period of motor blockage with longer period of post-operative pain relief.[8] Bupivacaine belongs to amide group of local anesthetics and is usually used intrathecal in isobaric or hyperbaric formulations to produce regional anesthesia as required for lower segment cesarean section.[9] Pethidine is an opioid and is being used intrathecally alone,[10] or in conjunction with other local anesthetic drugs for regional anesthesia.[11] Hemodynamic instability after intrathecal block can cause maternal and fetal compromise in gravid patients, with different drugs being used to prevent or correct it, which are themselves not devoid of adverse effects.[12] Our study found that when pethidine was added, decreasing the bupivacaine required dose, frequency of hypotension and bradycardia decreased and fall in MAP was reduced. A similar study found that addition of pethidine to bupivacaine lead to reduction in the incidence of hypotension thus reducing the dosage requirement of ephedrine required to counter hemodynamic instability with less duration of motor blockage but prolonged analgesia time. Contrary to our study, incidence of pruritus was also lesser in patients given pethidine.[6] Another author reported that low dosage of intrathecal bupivacaine was associated with decreased frequency of hypotension which suggested that the same might be the cause of low incidence of hypotension in Group B of our study.[13] In a double blind randomized clinical trial, the researchers found that addition of meperidine to bupivacaine resulted in lesser incidence of postoperative shivering and better intraoperative hemodynamic status that too without affecting the level of sensory blockage or infant's Apgar score, with meperidine providing better hemodynamic profile in comparison with fentanyl.[14] In another trial comparing the relative hemodynamic stability of meperidine alone, bupivacaine alone and bupivacaine plus meperidine, the meperidine group experienced more nausea, vomiting, and itching than the other two groups with meperidine plus bupivacaine being good substitutes for meperidine due to the nearly identical analgesic efficacy, the stabilization of other hemodynamic indicators and the decrease in frequency of nausea, vomiting, and itching.[15] A similar study on three groups, bupivacaine with saline and bupivacaine with 5 and 10 mg of pethidine, found out that maximal sensory blockage, hemodynamic indices, demographic and surgical profiles and core temperatures were similar in all three study groups but in comparison to the saline group, the bupivacaine plus pethidine groups showed considerably lower frequency and intensities of shivering, with pruritus occurring more frequently in the pethidine groups compared to the saline group with no other significant differences between groups for secondary outcomes, thus, a small intrathecal dose of pethidine reduced the frequency and intensity of adverse events during caesarean delivery.[16] Another study on comparative hemodynamic profile and motor/sensory blockade of bupivacaine plus fentanyl and bupivacaine plus pethidine in equipotent doses, reported that the onset of sensory/motor blockade in fentanyl group was more rapid and prolonged and incidence of hypotension, nausea and vomiting was more pronounced in pethidine group,[17] while a randomized controlled study with division of patients in four groups, bupivacaine alone 10mg, pethidine 1mg/kg, bupivacaine 10 mg plus magnesium sulfate 100 mg and pethidine 1mg/kg plus magnesium sulfate 100 mg, respectively, found no significant differences in the hemodynamic profiles of the patients, also

concluding that magnesium sulfate decreased the duration of motor blockage in bupivacaine group, increased this duration in the pethidine group,[18] in contrast to our study findings.

LIMITATIONS OF STUDY

The study was conducted at a single hospital, which limits the external validity and generalizability of results to broader populations and different healthcare settings due to small sample size. Additionally, the abstract does not mention blinding procedures, which could introduce observer bias in outcome assessment. The study population was restricted to pregnant women with gravidity ≤2 undergoing elective cesarean sections, limiting applicability to emergency cases, multiparous women, or other surgical populations.

CONCLUSION

Addition of pethidine to bupivacaine for intrathecal use keeps the hemodynamic profile of the patients relatively more stable and thus avoids adverse events.

Conflict of Interest: None.

Funding Source: None.

Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

MAA & MS: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

A & MA: Conception, data analysis, drafting the manuscript, approval of the final version to be published.

SMW & AK: Data acquisition, critical review, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

REFERENCES

1. Panda A, Muni MK, Nanda A. A Comparative Study of Hemodynamic Parameters Following Subarachnoid Block in Patients with and Without Hypertension. Cureus 2022; 14(1). https://doi.org/10.7759/cureus.20948
2. Fakherpour A, Ghaem H, Fattahi Z. Maternal and anaesthesia-related risk factors and incidence of spinal anaesthesia-induced hypotension in elective caesarean section: A multinomial logistic regression. Indian J Anaesth 2018; 62(1): 36. https://doi.org/10.4103/ija.IJA_416_17
3. Lee JE, George RB, Habib AS. Spinal-induced hypotension: Incidence, mechanisms, prophylaxis, and management: Summarizing 20 years of research. Best Pract Res Clin Anaesthesiol 2017; 31(1): 57-68. https://doi.org/10.1016/j.bpa.2017.01.001
4. Goma HM, Flores-Carrillo JC, Whizar-Lugo V. Spinal additives in subarachnoid anaesthesia for cesarean section. Topics in Spinal Anaesthesia 2014; 99(4): 67-95. https://doi.org/10.5772/58851
5. Etemadi S, Mahmoodiyeh B, Rajabi S. Evaluation effectiveness and safety of Hyperbaric and Isobaric Bupivacaine for spinal anesthesia for noncesarean delivery surgery: A Systematic Review and Meta-Analysis. Ann Romanian Soc Cell Biol 2021: 2417-2426.
6. Fyrfiris N, Micha G, Magklari C. B424 Low dose pethidine vs ropivacaine and fentanyl for subarachnoid anaesthesia in urological operations. Reg Anesth Pain Med 2022; 47(1): eA284-A285. https://doi.org/10.1136/rapm-2022-ESRA.500
7. Priyanga K, Sree MS, Sowbhagyalakshmi B. Comparison of Intrathecal Hyperbaric Bupivacaine with Pethidine Versus Intrathecal Hyperbaric Bupivacaine Alone During Caesarian Section To Prevent Spinal Induced Hypotension. J Dent Med Sci 2020; 19(12): 26-32.
8. Mehta N. Adjuvant drugs to local anesthetics. In: Topics in Local Anesthetics. Intech Open; 2020. https://doi.org/10.5772/intechopen.91980
9. Noviasky J, Pierce DP, Whalen K. Bupivacaine liposomal versus bupivacaine: comparative review. Hosp Pharm 2014; 49(6): 539-543. https://doi.org/10.1310/hpj4906-539
10. Aminisaman J, Hasani H. Bupivacaine vs. Pethidine in Spinal Anesthesia of Old Patients: Haemodynamic Changes and Complications. Asian J Anesthesiol 2019; 2019(2019): 1-9. https://doi.org/10.6859/aja.201907/pp.0001
11. Girma T, Alemu W, Assen S. Effect of Prophylactic Intrathecal Pethidine on the Incidence of Shivering on Mothers Undergoing Cesarean Section Under Spinal Anesthesia: A Randomized Controlled Trial. Front Med 2022; 9: 887724. https://doi.org/10.3389/fmed.2022.887724
12. Fitzgerald JP, Fedoruk KA, Jadin SM. Prevention of hypotension after spinal anaesthesia for caesarean section: a systematic review and network meta-analysis of randomised controlled trials. Anaesthesia 2020; 75(1): 109-121. https://doi.org/10.1111/anae.14841
13. Channa S, Faridi MA, Sameeuddin S. Comparison of two different spinal doses of 0.75% bupivacaine causing maternal hypotension in elective caesarean section. PAFMJ 2019; 69(5): 1120-1124. https://doi.org/10.51253/pafmj.v69i5.3213
14. Hirmanpour A, Talakoub R, Shafa A. Evaluating the Effect of Intrathecal Sufentanil and Meperidine on Shivering after Caesarean Section Under Spinal Anesthesia. Arch Anesth Crit Care 2017; 3(4): 365-372
15. Zangoue M, Sabertanha A, Younesi Z. Comparing the Effect of Intrathecal Injection of Meperidine, Meperidine-bupivacaine, and Bupivacaine Alone on Pain Severity and Hemodynamic Parameters after Elective Cesarean Section. Anesthesiol Pain Med 2022; 12(5). https://doi.org/10.5812/aapm-117090
16. Shami S, Nasseri K, Shirmohammadi M. Effect of low dose of intrathecal pethidine on the incidence and intensity of shivering during cesarean section under spinal anesthesia: a randomized, placebo-controlled, double-blind clinical trial. Drug Des Devel Ther 2016; 10: 3005-3012. https://doi.org/10.2147/DDDT.S115201
17. Mohamed GS, Ahmed NS, Abdel Hameed GE. Comparative study between the addition of pethidine Vs fentanyl to hyperbaric bupivacaine for spinal anesthesia in caesarean section. Egypt J Hosp Med 2018; 73(1): 5813-5817. https://doi.org/10.21608/EJHM.2018.12044
18. MojaverAghili S, Halakou S, Talebi F. bupivacaine, pethidine and sole pethidine on the hemodynamic status and duration of sensory and motor block: A randomized clinical trial in iran. Res Square 2022: 1-14. https://doi.org/10.21203/rs.3.rs-1913797/v1