DOI: https://doi.org/10.47648/jswmc2024v14-01-86

Original Article

Effectiveness of Consecutive Versus Premixed Administration of Fentanyl and Bupivacaine in Subarachnoid Block for Total Abdominal Hysterectomy

*Chhanda CS[1], Rashid MSU[2], Mondal SK[3], Begum M[4], Shimu AA[5], Boby N[6], Ali MS[7].

Abstract:

Background: Subarachnoid block (SAB) was a common regional anaesthetic technique, with opioids as adjuvants to enhance effectiveness and reduce hypotension.

Objective: Comparison of the effectiveness of consecutive versus premixed administration of fentanyl and hyperbaric bupivacaine in subarachnoid block for TAH.

Methods: This Quasi experimental study was carried out in 70 patients divided into two groups of 35 each: Group A received 0.5% hyperbaric bupivacaine 15mg (3ml) premixed with fentanyl 25µg (0.5ml) in a same syringe and Group Breceived fentanyl 25µg (0.5ml) in one syringe followed by 0.5% hyperbaric bupivacaine 15mg (3ml) in a separate syringe. The study compared the onset of sensory and motor block, reaching maximum sensory level, and complete motor block, as well as the time required for analgesia and ephedrine. Statistical significance was determined at a P-value < 0.05.

Results: The study found that group B had significantly less time for onset of sensory block(3.45±0.41 vs 2.65±0.32min), motor block (4.51±0.53 vs 3.31±0.46min), and total ephedrine consumption (15.29±6.52 vs 11.86±5.95mg)compared to group A. Additionally, the time of sensory (236.8±21.7 vs 269.6±24.3 min) and motor block regression (203.8±18.6 vs 237.5±20.8min), and first required analgesia (248.2±23.3 vs 283.8±23.4 min)was longer in group B.

Conclusion: Consecutive administration of fentanyl and hyperbaric bupivacaine is more effective than premixed administration in subarachnoid block for total abdominal hysterectomy.

Key words: Hyperbaric bupivacaine, fentanyl, subarachnoid block, premixed administration, consecutive, total abdominal hysterectomy.

JSWMC 2024 [14(01)] P:12-17

Introduction:

Regional anaesthetic (RA) techniques are commonly used for different surgical aspects. Among various techniques ofRA, commonly used is the subarachnoid block (SAB).[1]

1. Dr. Chhamita Sultana Chhanda, Anaesthesiologist, Department of Anaesthesia, Shaheed Taj Uddin Ahmed Medical College and Hospital, Gazipur, Bangladesh.
2. Dr. Md. Shoeb-Ur-Rashid, Junior Consultant (Surgery), UHC, Nawabganj, Dhaka, Bangladesh.
3. Dr. Subrata Kumar Mondal, Professor, Department of Anaesthesia, Pain, Palliative and Intensive Care, Dhaka Medical College and Hospital, Dhaka, Bangladesh.
4. Dr. Muslema Begum, Associate Professor, Department of Anaesthesia, Pain, Palliative and Intensive Care, Dhaka Medical College and Hospital, Dhaka, Bangladesh.
5. Dr. Afroza Akter Shimu, Anaesthesiologist, Department of Anaesthesia, Pain, Palliative and Intensive Care, Dhaka Medical College and Hospital, Dhaka, Bangladesh.
6. Dr. Nasreen Boby, Anaesthesiologist, Department of Anaesthesia, Pain, Palliative and Intensive Care, Dhaka Medical College and Hospital, Dhaka, Bangladesh.
7. Dr. Md. Sayed Ali, Anaesthesiologist, Department of Anaesthesia, Pain, Palliative and Intensive Care, National Institute of Cancer Research Hospital, Dhaka, Bangladesh.

Corresponding author: Dr. Chhamita Sultana Chhanda
Anaesthesiologist, Department of Anaesthesia, Shaheed Taj Uddin Ahmed Medical College and Hospital, Gazipur, Bangladesh.
E-mail: chhamita1988@gmail.com

Pain is a major complaint in post-operative periods, and anaesthesia aims to provide adequate relief. SAB produces a profound nerve block with a simple injection of local anaesthetic (LA) solution in intrathecal space.[2]SAB is a versatile technique with fast onset, cost-effective, and easy-to-perform procedure for lower limb and abdominal surgeries, varying duration and effectiveness depending on LA solution and adjuvants.[3,4]Among various LAs, hyperbaric bupivacaine is the most commonly used. Opioids and LA have a potent synergistic analgesic action when administered together intrathecally.[5] Intrathecal opioids, like fentanyl

used to minimize visceral and somatic pain, increase block consistency, decrease pain scores and decrease perioperative analgesic requirements.[3]Intrathecal fentanyl's high lipid solubility (580:1 lipid solubility compared to morphine) allows rapid clearance from CSF, reducing cephalad spread and minimizing side effects compared to morphine.[6]Mixing adjuvants with hyperbaric bupivacaine in the same syringe is a common and conventional technique; this may alter the density of the LA solution and affect the spread of LA in the CSF.[7,8]The consecutive administration of Fentanyl and hyperbaric bupivacaine into the intrathecal space reduces motor and sensory block time and prolongs anesthesia and analgesia. It also reduces vasopressor use, provides stable hemodynamics, and reduces complications during SAB surgery.[4,7,9] This study was done to evaluate and compare the effectiveness of premixed versus consecutive administration of fentanyl and hyperbaric bupivacaine in SAB for total abdominal hysterectomy (TAH).

Material and Methods: These quasi-experimental studies were conducted in the Department of Anaesthesia, Pain, Palliative Care, and Intensive Care in collaboration with the Department of Obstetrics and Gynaecology, Dhaka Medical College and Hospital, Dhaka, from November 2020 to October 2021. A total of 70 patients were included in the study and selected for TAH under SAB who fulfilled the enrollment criteria. They were equally divided into two groups: Group A and Group B.

Inclusion Criteria: 1. 40–75 years 2. female, 3. patients admitted for TAH 4. ASA physical status I and II 5. provide informed written consent.

Exclusion Criteria: 1. Chronic opioid use 2. peripheral neuropathy 3. Coagulopathy 4. localized skin infection 5. allergy to bupivacaine or fentanyl 6. A mentally impaired adult 7. Block failure or patchy block 8. The patient has not achieved target level block (T4).

Study procedure: This study was conducted with the approval of the Ethical Review Committee on 70 adult female patients who were scheduled for TAH under SAB. Informed written consent was obtained from all patients. All baseline parameters, such as heart rate, ECG, oxygen saturation, and non-invasive blood pressure, were recorded in the preoperative room. All TAH patients were given SAB in the sitting position using a 25-gauge Quincke spinal needle under all aseptic precaution. Group A received 0.5% hyperbaric bupivacaine 15 mg premixed with fentanyl 25µg in the same syringe, and Group B received 0.5% hyperbaric bupivacaine 15 mg in one syringe followed by fentanyl 25µg in a separate syringe. Sensory block was assessed by a sterile pin prick every 1 minute until the level reached T4 dermatomal level. The motor block was evaluated every 2 minutes until Modified Bromage Score 0 was changed to Score 3. The time of sensory block regression was assessed until the complete return of a "sharp" sensation to the tips of the 2nd and 3rd toes (L5) bilaterally from the stimulus of a sterile pin prick. A Modified Bromage Score of 3 to 0 was used to assess the time of motor block regression. The vital parameters of the patient were assessed intermittently until the completion of the procedure. The total ephedrine requirement was recorded intraoperatively. The postoperative VAS score and the time of 1st analgesic requirement were recorded. The incidence of complications such as hypotension, nausea, vomiting, and dizziness were recorded accordingly.

The study aimed to determine the onset of sensory and motor block, it's time to reach maximum sensory and complete motor block, regression of sensory and motor block, and the first required analgesia in minutes. Secondary outcomes included SBP, pulse oximetry, and other parameters. Data were collected using a questionnaire, and statistical analyses were performed using Student's t-test and Chi-Square tests. A P-value of <0.05 was considered statistically significant.

Result: A total of 70 patients were included in the study. Age ranges from 40 to 75 years, mean age of patients was (55.4±6.3 vs 56.7±5.3) years, with the majority belonging to 50–59 years (42.8% vs 45.7%) between the two groups. Age, BMI of both groups (24.5±3.6 vs 25.3±3.1) and average duration of surgery (136.8±15.7 vs

139.6±14.3) minutes had no statistically significant difference. The time of onset of the sensory block, time to reach maximum sensory level (T4), time for complete motor block, time to regression of sensory block (L5), and time to regression of motor block were statistically significant between the two groups. In group A, the mean heart rate significantly rose at 240 min (84±5.9 b/min), P value 0.029[ss], and 280 (74±5.3 b/min), P value 0.031[ss] after SAB.The study found that group B had significantly (P Value 0.021ss) longer mean time (283.8±23.4 minutes) for first required analgesia compared to group A.The incidence of intraoperative hypotension was reduced in group B (28.5%) than in group A (40%) which was not statistically significant (P value 0.31).There was no significant difference in other complications, such as nausea, bradycardia, tachycardia, and dizziness, between the two groups during the perioperative period.

Figure-1: Consecutive administration of fentanyl and bupivacaine in SAB.

A: Local anaesthetic infiltration. **B:** Backflow of CSF after introduction of spinal needle & removal of trocar. **C:** Administration of fentanyl. **D:** Administration of bupivacaine.

Table-1: Thetime of the onset of sensory block (T10) between two groups.

Time (min)	Group-A (n=35)		Group-B (n=35)		P value
	Frequency	Percentage	Frequency	Percentage	
2 min	05	14.29	27	77.14	
3min	15	42.86	07	20	
4min	09	25.71	01	2.85	
5 min	06	17.14	0	0	
Mean±SD	3.45±0.41		2.25±0.32		0.032[ss]

(Student t-test was performed to compare time of regression of sensory block between two groups. [ss]= Statistically significant.)

The mean time of onset of sensory block in group B (2.25±0.32) was lower than group A (3.45±0.41) which was statistically significant (P value 0.032).

Table-2: Thetime of the onset ofmotor block (Modified Bromage Score 0 changed to 1) between two groups.

Time (min)	Group-A (n=35)		Group-B (n=35)		P value
	Frequency	Percentage	Frequency	Percentage	
2 min	04	11.42	13	37.14	
4 min	21	60	21	60	
6 min	08	22.86	01	2.85	
8 min	02	5.71	0	0	
Mean± SD	4.51±0.53		3.31±0.46		0.036[ss]

(Student t-test was performed to compare time of regression of sensory block between two groups. [ss] = Statistically significant.)

The mean time of onset of motor block in group B (3.31±0.46) was lower than group A (4.51±0.53) and the P value was 0.036 which was statistically significant.

Table-3: Thetime to reach maximum sensory level (T4) block between two groups.

Time (min)	Group A (n=35)		Group B (n=35)		P value
	Frequency	Percentage	Frequency	Percentage	
4 min	04	11.43	10	28.57	
5 min	05	14.29	12	34.29	
6 min	09	25.71	12	34.29	
7 min	13	37.14	01	2.85	
8 min	04	11.43	0	0	
Mean±SD	6.24±1.7		5.13±1.4		0.025[ss]

(Student t-test was performed to compare time of regression of sensory block between two groups. [ss] = Statistically significant.)

The mean time to reach the maximum sensory level (T4) block was 6.24±1.7 minutes for group A and 5.13±1.4 minutes for group B. This difference was statistically significant because the P value was 0.025.

Table-4: The time for complete motor block (Modified Bromage =3) between two groups.

Time (min)	Group A (n=35)		Group B (n=35)		P value
	Frequency	Percentage	Frequency	Percentage	
4 min	04	11.43	10	28.57	
6 min	14	40	24	68.57	
8 min	15	42.85	01	2.85	
10 min	02	5.71	0	0	
Mean± SD	6.86±1.35		5.44±1.23		0.022[ss]

(Student t-test was performed to compare time of regression of sensory block between two groups. [ss] = Statistically significant.)

A statistically significant (P value 0.022) difference was found in the complete motor block in B group (5.44 ±1.23 min) compared to the A group (6.86±1.35 min).

Table-5: Comparison of the time to regression of sensory block (L5) between two groups.

Time (minutes)	Group A(n=35)		Group B(n=35		P value
	Frequency	percentage	Frequency	percentage	
220-229	8	22.86	0	0	
230-239	15	42.86	0	0	
240-249	12	34.29	0	0	
250-259	0	0	2	5.71	
260-269	0	0	14	40.0	
270-279	0	0	19	54.29	
Mean±SD	236.8±21.7		269.6±24.3		0.018[ss]

(Student t-test was performed to compare time of regression of sensory block between two groups. [ss] = Statistically significant.)

The mean time of regression of sensory block in group A (236.8±21.7) was lower than group B (269.6±24.3). P-value was 0.018 which was statistically significant.

Table-6: Comparison of the time toregression of motor block between two groups.

Time (minutes)	Group A (n=35)		Group B (n=35)		P value
	Frequency	percentage	frequency	Percentage	
190-199	10	28.57	0	0	
200-209	18	51.43	0	0	
210-219	7	20.0	0	0	
220-229	0	0	8	22.86	
230-239	0	0	15	42.86	
240-249	0	0	12	34.29	
Mean±SD	203.8±18.6		237.5±20.8		0.017[ss]

(Student t-test was performed to compare time of regression of sensory block between two groups. [ss] = Statistically significant.)

A statistically significant difference was found in the mean time to regression of sensory block in group B (237.5±20.8) compared to group A (203.8±18.6).

Table-7: Comparison of the time for 1st required analgesia between two groups.

Time (minutes)	Group A (n=35)		Group B (n=35)		P value
	frequency	percentage	frequency	Percentage	
220-229	1	2.86	0	0	
230-239	9	25.71	0	0	
240-249	16	45.71	0	0	
250-259	9	25.71	0	0	
260-269	0	0	0	0	
270-279	0	0	5	14.29	
280-289	0	0	25	71.42	
290-299	0	0	5	14.29	
Mean±SD	248.2±23.3		283.8±23.4		0.021[ss]

(Student t-test was performed to compare time of regression of sensory block between two groups. [ss] = Statistically significant.)

A Statistically significant difference was found in the mean time for 1st required analgesia between two groups as the P value was 0.021 which was <0.05.

Table-8: Assessment of total ephedrine requirement of the patients.

Ephedrine (mg)	Group A (n=35)		Group B (n=35)		P value
	frequency	percentage	frequency	Percentage	
5	5	14.29	10	28.57	
10	7	20.0	10	28.57	
15	10	28.57	9	25.71	
20	7	20.0	4	11.43	
25	6	17.14	2	5.71	
Mean±SD	15.29±6.52		11.86±5.95		0.025[s]

(Student t-test was performed to compare time of regression of sensory block between two groups. [ss] = Statistically significant.)

The mean ephedrine consumption in group A (15.29±6.52) was more than group B (11.86±5.95) during intra-operative period which was statistically significant.

Discussion:

SAB is relatively safe for below umbilical surgeries, but anaesthetists must know indications, contraindications, anatomy, physiology, and pharmacology. Numerous additives have been added to the local anaesthetic solution to provide a better surgical anaesthesia in view of better hemodynamic stability and outcome.

According to the present research, there was no statistically significant difference between the two groups (groups A and B) in terms of patient age, BMI, ASA classification, or mean surgical length (min). Numerous other studies that looked at comparable topics, like Malhotra A et al., Chaudhry G et al., Desai S et al., Sachan P et al. also found no differences in demographic factors that were statistically significant[3,4,7,8].

In our study, group B had a shorter time to the onset of sensory and motor block than group A which was Statistically significant.Bansal N et al. found significant (P value 0.001) differences in sensory and motor block onset times for 60 patients undergoing caesarean sections. Joshi S et al. and Malhotra A et al. found similar differences in onset times in premixed and separate syringe groups.[1,3]

We found a Significantly lower time to achieve maximum sensory level (5.13±1.4 minutes) and complete motor block (5.44±1.23 minutes) in group B compared to group A.Sachan P et al. found that sequential group had significantly lower time to reach maximum sensory level block and complete motor block compared to premixed group.[8]

The study found that group B had longer time to regression for sensory ((236.8±21.7 vs 269.6±24.3) and motor (203.8±18.6 vs 237.5±20.8) blocks compared to group A, indicating a statistically significant difference. Joshi S et al. study found prolonged time to regression of sensory (219±16.04 vs 253±17.04) and motor blocks (188±15.6 vs 223±17.04) in separate syringe groups compared to mixed groups.[1]

The study found that group B had a longer time for 1st required analgesia (288.8±23.4 min) compared to group A (248.2±23.3 min). This finding is consistent with Joshi S et al., Malhotra A et al., Bansal N, Ladi S et al., Kumar TRM, Balaji R et al. studies in premixed and separate syringe groups.[1,3,5,10]

In this study, total ephedrine consumption in group B (11.86±5.95mg) was lower than that in group A (15.29±6.52 mg) during the intraoperative period, which was statistically significant. Total ephedrine consumption in the mixed group was higher than in the separate syringe group in the studies of Malhotra Aet al. (3.9±6.2 vs 0.6±2.3mg) and Cesur M et al. (20.5±8.7 vs 2.2±1.0mg) where the P value was <0.05. [3,11]

The study found no significant difference in mean HR between groups, but a significant rise in HR in group A (84±5.9 b/min) after SAB (240 min), possibly due to pain. No significant difference in systolic blood pressure was observed during the perioperative period.

Hypotension incidence decreased in group B, but Keera AAI et al.found a higher incidence of hypotension in premixed group (51.6%) compared to separate syringe group (29%) in parturient patients for cesarean section.[12]

Conclusion:

Consecutive administration of fentanyl and hyperbaric bupivacaine is more effective than premixed administration in the subarachnoid space for total abdominal hysterectomy.

Limitation:

We did not measure the temperature of the drugs used, as differences in temperature may affect the density and spread of the drugs; hence, further studies may be needed to help shed light on these points.

Recommendation:

We may use consecutive administration of fentanyl and hyperbaric bupivacaine in separate syringe rather than premixed administration in same syringe to increase the effectiveness of subarachnoid block.

Place of study: Dhaka Medical College and Hospital, Dhaka, Bangladesh.

References:

1. Joshi S, Tailor R, Pandya M, Vachhrajani P. Two syringe technique in spinal anesthesia in caesarean section: A Study of simple way to achieve more satisfactory block, less frequency of hypotension and prolong analgesia. Int J Sci Res. 2018;7(1):1984–8.
2. Thokchom M, Khoirom S. To compare the effect of intrathecal morphine and hyperbaric bupivacaine by using different techniques of administration in lower limb orthopaedics surgeries. IOSR Journal of Dental and Medical Sciences.2020; 19:6:27-31.
3. Malhotra A, Singh U, Singh MR, Sood D, Grewal A, Mahajan A. Efficacy of premixed versus succedent administration of fentanyl and bupivacaine in subarachnoid block for lower limb surgeries: A randomised control trial. Indian J Anaesthesia. 2020; 64:175-9.
4. Chaudhry G, Singla D, Dureja J, Bansal P, Ahuja K. Efficacy of premixed versus sequential administration of dexmedetomidine as an adjuvant to intrathecal hyperbaric bupivacaine in lower limb surgery. South Afr J AnaesthAnalg. 2016; 22:81-5.
5. Bansal N, Ladi S. Premixed versus sequential administration of intrathecal fentanyl and bupivacaine in elective caesarean section-A comparative study. Indian J Appl Res.2016; 6:633-6.
6. Liu SS, McDonald SB. Current issues in spinal anesthesia. Anesthesiology. 2001; 94: 888-906.
7. Desai S, Lim Y, Tan CH, Sia AT. A randomized trial of hyperbaric bupivacaine with opioids, injected as either a mixture or sequentially, for spinal anesthesia for caesarean section.Anaesth Intensive Care.2010 Mar; 38:2:280-4.
8. Sachan P, Kumar N, Sharma JP. Efficacy of premixed versus sequential administration of clonidine as an adjuvant to hyperbaric bupivacaine intrathecally in caesarean section. Anesth Essays Res.2014; 8:20–5.
9. Keera AAI, Elnabtity AMA. Two syringe spinal anaesthesia technique for caesarean section: A controlled randomized study of a simple way to achieve more satisfactory block and less hypotension. Anesth Essays Res.2016; 10:312 8.
10. Kumar TRM, Balaji R. Randomized controlled study comparing the efficacy of neuraxial blockade by using intrathecal administration of 0.5% hyperbaric bupivacaine 15mg and fentanyl 25mcg - in a single syringe versus separate syringe techniques in inguinal hernia surgeries. Indian J Clin Anaesth.2020;7(3):394-398.
11. Cesur M, Alici HA, Erdem AF, Borekci B, Silbir F. Spinal anesthesia with sequential administration of plain and hyperbaric bupivacaine provides satisfactory analgesia with hemodynamic stability in cesarean section. Int J ObstetAnesth.2008; 17:217–22.
12. Keera AAI, Elnabtity AMA. Two syringe spinal anaesthesia technique for caesarean section: A controlled randomized study of a simple way to achieve more satisfactory block and less hypotension. Anesth Essays Res.2016; 10:312 8.