STUDY OF EFFECTIVENESS OF TWO SYRINGE SPINAL ANAESTHESIA TECHNIQUE FOR CAESAREAN SECTION

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ABSTRACT

Spinal anaesthesia using hyperbaric bupivacaine is the most popular method for caesarean section. Adjuvents like fentanyl which enhances the sensory block and provide stable haemodynamics are usually premixed with bupivacaine in a single syringe. Fentanyl when added to hyperbaric bupivacaine, decreases the density of solution to extent of 0.0006 which alters the spread of local anesthetics in CSF. If we inject both the drugs separately in different syringe, it may minimize the effect of the changes in densities and PH of both the drugs and produce their maximum effect with minimal haemodynamic alteration. Therefore this study was conducted to see the quality of sensory block and haemodynamic response by sequential intrathecal administration of fentanyl and hyperbaric bupivacaine in two different syringe for patients undergoing caesarian section. This interventional study was carried out in Seventy nine Patients undergoing caesarean section under spinal anesthesia with 0.5% hyperbaric bupivacaine 9mg (1.8 ml) and fentanyl 20 mcg in two different syringe administered sequentially. Out of 79 parturients only 22 (27.85%) had hypotension requiring vasopressor treatment during caesarean section and maximum amount of vasopressor used was 15 mg of mephentermine. The mean level of maximum sensory block after 20 mins of spinal anaesthesia was T2 in 20 (25.32%) patients, T3 in 19 (24.05%) patients, T4 in 32 (40.51%) patients, T5 in 1 (1.27%) patient and T6 in 7 (8.86%) Patients. Intraoperative quality of surgical anaesthesia was very satisfactory to the patients. Only 6 (7.59%) patients had mild discomfort whithout requirement of any medical treatment. The result of this study concluded that separate intrathecal injection of fentanyl and hyperbaric bupivacaine provides better haemodynamic stability, improves quality of surgical anaethesia allowing it to work at higher levels in the spinal cord with minimal other side effects in patient undergoing caesarean section.

KEYWORDS

Spinal anaesthesia, bupivacaine, seperate syringe, caesarean section, fentanyl

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INTRODUCTION

Spinal anesthesia using hyperbaric bupivacaine is most commonly used, however irrespective of medication used, it is now the safest and most popular methods for caesarean section.[1,2] It has several benefits such as good pain control both intra and post-operatively, decreased blood loss at operative field, early mother-baby contact, low cost, quick instillation of anesthesia and muscle relaxation for surgery.[2,3]

Most common problem with spinal anesthesia is hypotension which is due to sympathetic blockade leading to peripheral venous pooling of blood, dilated vascular bed, decreased venous return and cardiac output. Also, in parturients gravid uterus compresses inferior venacava and aorta which magnifies the hypotensive effect of spinal anesthesia by decreasing venous return and compromising uteroplacental circulation. While using hyperbaric bupivacaine alone, higher dose is required to obtain satisfactory level of sensory blockade resulting in adverse event such as profound hypotension and fetal distress.[1,2]

Most preferred method for management of hypotension during spinal anesthesia are fluid therapy and vasopressor bolus. Fluid therapy is done using preloading or co-loading technique by administration of crystalloid or colloid before or during spinal anesthesia respectively. Ephedrine, Mephenteramine, Phenylephrine are the vasopressor used as bolus which causes peripheral vasoconstriction to decrease vascular bed dilatation.[1,4]

Many adjuvents like opioids and non-opioids have been added to bupivacaine during spinal anaesthesia to prolong the duration of effect, provide stable haemodynamics and provide prolonged postoperative analgesia. Fentanyl used intrathecally acts on mu-receptor in spinal cord and cause decrease in visceral and somatic pain and improves quality of block and reduce analgesic requirement in postoperative period. In addition, fentanyl acts on afferent nociceptive pathway leading to less haemodynamic changes.[5-7]

Ratio of specific density of anesthetics and cerebrospinal fluid (CSF) is termed as baricity. So, hyperbaric means heavier and hypobaric means lighter than CSF.[8] Density of fentanyl is 0.995, hyperbaric bupivacaine is 1.0262 and CSF mean density at term pregnancy is 1.00030.[4] Fentanyl when added to hyperbaric bupivacaine, decreases the density of solution to extent of 0.0006 which alters the spread of local anesthetics in CSF.[5]

Fentanyl and hyperbaric bupivacaine are usually premixed in a single syringe before intrathecal administration. Various factor influence the spread and action of anaesthetic solution like temperature, pH, density, volume of drug, patients position and height of the patient.[9] If we inject both the drugs separately in different syringe, it may minimize the effect of the changes in densities and pH of both the drugs and they produce their maximum effect.[10]

When patients are turned supine immediately after intrathecal injection in the lumbar region, hyperbaric solution will spread under the influence of gravity down the slope created by lumbar spinal curvature. However, plain solution being less viscous, mixes rather freely with CSF, and thus moves easily through compressed subarachnoid space and will not have gravity dependent spread. The mixture of hypobaric fentanyl and hyperbaric bupivacaine will sink down, then they creep up together when the patient lay down acting synchronously on the same level.

Hyperbaric bupivacaine injected separately without mixing is denser than bupivacaine fentanyl mixture and sink down and take a longer time to reach the final level which delays the onset of the sympathetic block and give time for a compensatory mechanism to prevent hypotension.[11,12]

Hence the rationale behind performing this study is to see the quality of sensory block and haemodynamic response by sequential intrathecal administration of fentanyl and hyperbaric bupivacaine in two different syringe for patients undergoing caesarian section.

MATERIALS AND METHODS

This interventional study was carried out at Nepal Medical College Teaching Hospital from August 2022 to January 2023 after approval from Institutional Review Committee. An informed consent was obtained from all the patients who participated in the study. Seventy nine patients belonging to American Society of Anesthesiologist (ASA) class I and II undergoing caesarean section under spinal anesthesia were enrolled for the study. Patients with pre-eclampsia or any other systemic illness, and patients contraindicated for spinal anaesthesia were excluded from the study. A thorough pre-anesthetic evaluation was done prior to surgery. Premedication of Ranitidine 50 mg, and Metoclopramide 10 mg was given. Demographic data of the patient was obtained before starting the procedure which include

age, height, weight and BMI. Weight of the patient include the weight during the first visit for antenatal check up during first trimester.

Patient was kept in sitting position and spinal anesthesia was given using two different syringe for fentanyl 20 mcg and 0.5% hyperbaric bupivacaine 9 mg (1.8 ml) sequentially without barbotage. Time gap between two different syringes was kept as less as possible to prevent loss. Fentanyl and hyperbaric bupivacaine in two different syringes of 5 ml each was prepared before insertion of needle. Fentanyl followed by hyperbaric bupivacaine was given through Quincke/Whitacre spinal needle, 25-27 gauge in L3-L4 or L4-L5 interspace. Immediately after spinal anesthesia was given patient was asked to lie down. For preloading and co-loading intravenous fluid ringers' lactate was given through 18-gauge IV cannula in a dose of 15 ml/kg starting at fast rate using pressure bag and was continued after spinal anesthesia was given.

Initially baseline blood pressure and heart rate was taken, then monitoring was done immediately after spinal anesthesia and every 3 minutes for next 15 minutes then every 5 minutes. Hypotension (more than 20% fall in blood pressure) was treated with mephentermine in dose of 5 mg bolus up to 30 mg. Electrocardiogram and oxygen saturation was monitored continuously. Sensory level was checked by using ice pack every minute until T6 level was reached to determine the onset of sensory block followed by measuring maximum height of sensory block after 20 minutes. Intraoperative quality of surgical anesthesia was assessed using Ochsner Health System[13] which measures patient satisfaction in four grades:

Excellent: No complain, patient felt comfortable, Good: A little discomfort but no need for additive medication, Fair: Discomfort but controlled by fentanyl, and Poor: Unable to be controlled even with additive medication and shift to general anesthesia was mandatory. Side effects like itching, nausea, vomiting, respiratory depression, or shivering was recorded and managed according to our hospital protocol. Statistical analysis was performed by using SPSS 16 software.

RESULTS

Total seventy nine parturients were involved in this study. The mean age of parturient involved in the study was 28.44 ± 4.55 yrs and body mass index was 24.11 ± 2.96 kg/m^2 (Table 1).

Table 1: Demographic variables

n	Characteristics	Mean	S.D
1	Age (yrs)	28.44	4.55
2	Body mass index (kg/m^2)	24.11	2.96

Table 2: Time to onset of sensory block (T6)

Level	Mean time (min)	S.D
T6	3.26	1.25

The mean time to reach T6 sensory block level after spinal anaesthesia was 3.26 ± 1.25 minutes (Table 2).

Table 3: Maximum sensory block height at 20 minutes

Block level	No	%
T6	7	8.86
T5	1	1.27
T4	32	40.51
T3	19	24.05
T2	20	25.32

The mean level of maximum sensory block after 20 mins of spinal anaesthesia was T2 in 20 (25.32%) patients. Similarly T3 level was seen in 19 (24.05%) patients, T4 level in 32 (40.51%) patients, T5 level in 1 (1.27%) patient and T6 level in 7 (8.86%) patients (Table 3).

In this study parturients mean baseline mean arterial pressure was 94.13 ± 9.63 mmHg and heart rate was 91.11 ± 14.54/min (Table 5 and Fig. 1). Out of 79 parturients only 22 (27.85%)

Table 4: Vasopressor requirement

Vasopressor	No	%
Yes	22	27.85
No	57	72.15

Table: 5 Haemodynamics

	Heart rate ± SD	Mean arterial pressure ± SD
Baseline	91.11 ± 14.54	94.13 ± 9.63
Immediate	89.77 ± 14.15	90.06± 11.19
3 min	87.28 ± 15.60	82.57 ±11.51
6 min	83.39 ± 13.69	80.20 ± 11.53
9 min	84.23 ± 14.28	80.61 ± 12.88
12 min	87.35 ± 14.11	81.43 ± 11.81
15 min	90.30 ± 14.78	80.92 ± 11.50
20 min	92.71 ± 13.15	81.19 ± 12.7
25 min	96.10 ± 12.04	78.28 ± 12.05
30 min	97.18 ± 11.40	77.78 ± 11.16

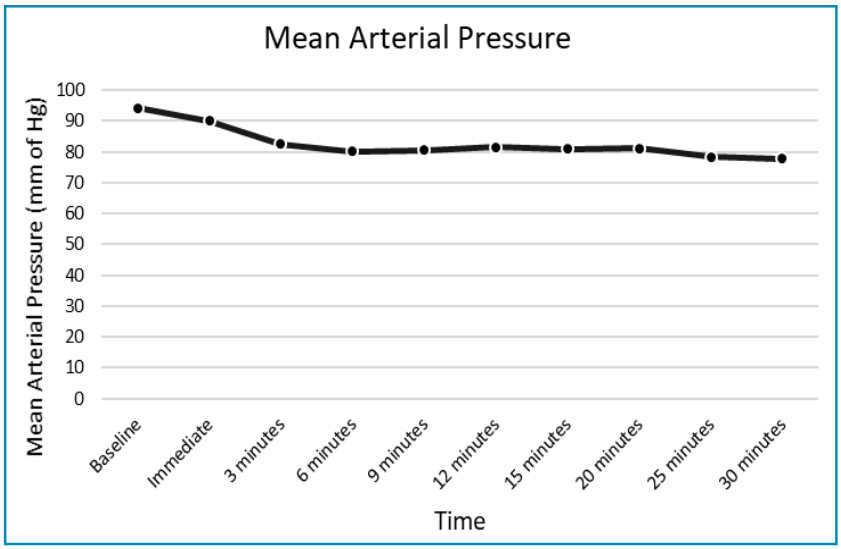

Fig. 1: Mean arterial pressure

Table 6: Quality of surgical anaesthesia

Grade	Mean
Excellent	73 (92.41%)
Good	6 (7.59%)
Fair	0
Poor	0

Table 7: Side effects

Side effects	Mean
Nausea	0
Vomiting	0
Itching	9 (11.39%)
Sedation	7 (8.86%)
Shivering	7 (8.86%)
None	56 (70.89%)

had hypotension requiring vasopressor treatment during caesarean section and maximum amount of vasopressor used was 15 mg of mephentermine (Table 4).

The intraoperative quality of surgical anaesthesia was very satisfactory to the patients. only 6 (7.59%) patients had mild discomfort which did not require any medical treatment. No patient required conversion to general anaesthesia due to intraoperative pain (Table 6).

Nine patients (11.39%) in this study developed itching, seven patients (8.86%) were sedated and seven patients (8.86%) developed mild shivering requiring no medical treatment. No nausea and vomiting and any other complications, other than mentioned above was seen during the study (Table 7).

DISCUSSION

Premixed administration of intrathecal fentanyl with hyperbaric bupivacaine for patients undergoing caesarean section is a common practice world wide. In this study, we used sequential method with two different syringe to administer intrathecal fentanyl and hyperbaric bupivacaine for caesarean section which is getting popular for having better haemodynamic control and better quality of sensory block.

In our study, out of 79 participants, only 22 (27.85%) had hypotension requiring vasopressor treatment during caesarean section and maximum amount of vasopressor used was 15 mg of mephentermine. The mean time for onset of sensory block (T6) after spinal anaesthesia was 3.26 ± 1.25 minutes. The mean level of maximum sensory block after 20 mins of spinal anaesthesia was T2 in 20 (25.32%) patients, T3 in 19 (24.05%) patients, T4 in 32 (40.51%) patients, T5 in 1 (1.27%) patient and T6 in 7 (8.86%) patients. Intraoperative quality of surgical anaesthesia was very satisfactory to the patients. Only 6 (7.59%) patients had mild discomfort. This is similar to study conducted by Keera *et al*[1] and Joshi *et al*[4] who concluded that separate intrathecal injection of fentanyl and hyperbaric bupivacaine provided significant improvement in the quality of sensory block and significant reduction in the frequency of hyotension compared to injection of mixed drugs.

Chekole *et al*[8] also did a comparative study between sequential versus pre mixed administration of intrathecal fentanyl with hyperbaric bupivacaine for patients undergoing elective caesarean section and concluded that sequential intrathecal injection provided significant improvement in blood pressure stability and of sensory and motor block compared to premixed group.

Besides fentanyl, other drugs like clonidine and dexmedetomidine have also been studied in many trials to see the quality of spinal anaesthesia with hyperbaric bupivacaine in premixed and separate syringe sequential administration technique and found that separate administration of adjuvants with bupivacaine have beter haemodynamic and analgesic outcome[6,14] which is similar to our study.

Malhotra *et al*[5] conducted a study of premixed versus succedent administration of fentanyl and bupivacaine in spinal anaesthesia for lower limb surgeries and concluded that administration of hyperbaric bupivacaine first followed by fentanyl leads to an early onset and prolonged duration of sensory and motor block with significant lesser incidence of hypotension.

Most of the study support the use of sequential administration over premixed solution ,hence we concluded that separate intrathecal injection of fentanyl and hyperbaric bupivacaine provides better haemodynamic stability, improves quality of surgical anaethesia allowing it to work at higher levels in the spinal cord with minimal other side effects in patient undergoing caesarean section.

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