Original Article

Level of Block Achieved with 1.6 ml of 0.75% Bupivacaine along with the Hemodynamic Variations after Spinal Anesthesia: A Prospective Study among Pakistani Women undergoing Elective Caesarean Sections

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ABSTRACT

Objective: To evaluate the interval of time required for the maximal sensory block along with hemodynamic variations of pulse and blood pressure after spinal anesthesia among Pakistani women undergoing elective Caesarean Sections.

Place and Duration: From September 2012 to March 2013.

Study Design: Prospective Study

Materials and Methods: A total of 100 parturients categorized in the American Society of Anesthesia classification ASA – I and II, aged in between 20-40 years presenting with single pregnancy for the elective caesarean section were recruited in the study. Spinal anesthesia was given using 25 G, Quincke needle after ascertaining free clear flow of CSF(cerebrospinal Fluid),and 1.6ml of 0.75% hyperbaric bupivacaine was injected. Block level was assessed every 2 minutes with sensation to touch, pinprick, and cold ice saline for 30 minutes. Monitoring of blood pressure, pulse and pulse oximeter were continuous at every two minutes interval. Procedure was started as the maximal sensory T4 block confirmed. Maternal hypotension during procedure was treated with the bolus of 50% of the initial dose of vasopressor. Heart rate below 50 beats per minute accompanied by hypotension was treated with 0.5mg of Atropine.

Results: The maximal sensory block achieved was up to the level of 3rd thoracic site(T3) with a range of T2-T7.So our study clearly reflects that even a volume of 1.8ml ,0.75mg of bupivacaine is sufficient to achieve a reasonable sensory block level to conduct cesarean section. The mean±S.D time for the block to reach maximal sensory level was 9.2±4.6 minutes. The maximal decrease in pulse, systolic B.P and diastolic B.P were 15.4±8.7/min, 33.6±11.3 mmHg and 18.2±7.8 mmHg respectively from the baseline, keeping the study participants almost hemodynamically stable with in the normal physiological range without making the attending anesthetists to proceed emergency protocols for the management of adverse effects of spinal anesthesia. Nausea, vomiting and shivering were present among 52%, 34% and 16% respectively of our study participants.

Conclusion: .6ml of 0.75% injection bupivacaine injected via spinal needle in the subarachnoid space at the level of L3-L4 among Pakistani women undergoing elective cesarean section is sufficient to provide an adequate T4 sensory block.

Keywords: Spinal anesthesia, Level of block,Cesarean section.

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Introduction

Spinal anesthesia is one of the modality of regional anesthesia techniques in which the local anesthetic agent is injected in to the subarachnoid space so as to block the nerves supplying corresponding structures of the body. It has the advantage in terms of local blockade of sensations thus sparing rest of the body hemodynamics.[1]

But on the other hand, the major disadvantage of spinal anesthesia is that it's very difficult to predict height of block, extent and the level of spread after the injection. It varies from patient to patient primarily depending on local anesthetic agent properties, position of the patient along with the level of puncture.[2,3] Blocks that involve segments higher than desired put the patients on risk of complications associated with either higher spinal or total spinal anesthesia. Thus extreme care must be taken while performing such blocks. Its importance has further strengthened among obstetric population presenting for the cesarean sections, because of enhanced intra-abdominal pressure thus causing more cephaled spread of the local anesthetic drug, thus causing higher incidence of complications.[4]

Cesarean section is usually performed via lower segment of the uterus (LSCS).It seems that only the nerves supplying the lower abdomen should be blocked in order to carry out such operations. But the dermatomal innervations and manipulation of the structures attached with uterus during the procedure risks surgical complications and primarily the pain, during this procedure.[5,6] In keeping this anatomical distribution, a minimal sensory block up to T4-T5 has been recommended to carry out cesarean section without putting the patient in pain and further associated complications related with the procedure.[7] Theoretically and most of the times practically, blocks up to the T4 sensory levels provide adequate anesthesia to conduct the operation comfortably, but some peritoneal innervations still may get spared thus causing feeling of slight pain during the procedure.[8] Patients counseling, reassurance, coordination of the surgeons and finally supplemental analgesia may prevent such minor discomfort during the operation.[9]

The technique of anesthesia for cesarean section depends on indications of cesarean, its urgency, physical status of the patient and also the preference of patient and surgeon[8,9]. Regional anesthesia is more preferred because of less risk of gastric aspiration, failed intubation and depressant effects of anesthetic drugs on fetus. [10]

Not a single study in Pakistan has ruled out the exact volume and concentration of the local anesthetic required to achieve an adequate sensory level of block to conduct elective cesarean section surgery.

The basic aim of our study was to evaluate the interval of time required for the maximal sensory block along with hemodynamic variations of pulse and blood pressure after spinal anesthesia among Pakistani women undergoing elective Caesarean Sections

Materials and Methods

A prospective study was conducted at the department of Anesthesia, Holy family Hospital, Rawalpindi Medical College Rawalpindi, Pakistan over a period of 6 months from October 2012 to March 2013.

Inclusion criteria: After approval from hospital ethical committee ,a total of 100 parturients categorized in the American Society of Anesthesia classification ASA – I (normal healthy patient) and II (mild systemic disease with no functional limitation),aged in between 20-40 years presenting with single pregnancy for the elective caesarean section were recruited in the study.

Exclusion Criteria: Patients with (Body Mass Index) BMI > 35, co-existing disease as diabetes mellitus, hypertension or contraindication to spinal block (coagulopathy, fixed cardiac output state) and refusal to conduct study were excluded from the study design.

All patients were assessed a day before surgery and written informed consent will be taken. After arrival in Operation theater, monitoring including Electrocardiography, pulse oximetery, noninvasive blood pressure cuff measurements were attached and the base line heart rate and blood pressure were noted.

Intravascular access with two 18G cannulae was established. Each patient was preloaded with 500ml Ringer lactate over 10 min. Patient were placed in sitting position, and after taking aseptic measures, local anaesthetic 2% plain Xylocaine 3ml was infiltrated at Lumber Intervertebral space L3-4 level.

Spinal anesthesia was given using 25 G, Quincke needle after ascertaining free clear flow of CSF(cerebrospinal Fluid), and 1.6ml of 0.75% hyperbaric bupivacaine was injected. Patients were positioned supine immediately and 10° head down tilt and wedge was placed under right hip to prevent aorto-caval compression. Oxygen via mask at rate of 4L/min was given to all the patients.

Block level was assessed every 2 minutes with sensation to touch, pinprick, and cold ice saline for 30 minutes. A standardized dermatome chart along with the study Performa was used to mark and label the dermatome level of sensory block achieved.

Monitoring of blood pressure, pulse and pulse oximeter were continuous at every two minutes interval. Procedure was started as the maximal sensory T4 block confirmed. Maternal hypotension during procedure was treated with the bolus of 50% of the initial dose of vasopressor. Heart rate below 50 beats per minute accompanied by hypotension was treated with 0.5mg of Atropine. All the statistical analyses were performed buy

using SPSS version 15. Standard descriptive statistics were used to characterize sample mean and standard deviation. Student's t-test was used to test for possible significant differences in ordinal and continuous variables. Range was calculated for continuous variables and frequencies and percent for categorical variables. The chi-square test was carried out to compare proportions. A p-value <0.05 was considered statistically significant.

Results

The common baseline parameters of the study participants have been summarized in table I. It is evident that all these parameters were almost with in the normal range according to the study inclusion criteria.

Table I: Baseline Parameters of Study Participants

No	Parameter	Mean±S.D
1	Age (Years)	29±3
2	Weight (Kg)	66.2±6.4
3	Height (cm)	153.7±5.7
4	Body Mass Index(BMI) (Kg/cm2)	26.9±4.8
5	Baseline Pulse (n/min)	90±18
6	Baseline Systolic Blood Pressure (mmHg)	131±23
7	Baseline Diastolic Blood Pressure (mmHg)	76±18

The maximal sensory block achieved was up to the level of 3rd thoracic site(T3) with a range of T2-T7.So our study clearly reflects that even a volume of 1.6ml ,0.75mg of bupivacaine is sufficient to achieve a reasonable sensory block level to conduct cesarean section.

The mean±S.D time for the block to reach maximal sensory level was 9.2±4.6 minutes.

The maximal decrease in pulse, systolic B.P and diastolic B.P were 15.4±8.7/min, 33.6±11.3 mmHg and 18.2±7.8 mmHg respectively from the baseline, keeping the study participants almost hemodynamically stable with in the normal physiological range without making the attending anesthetists to proceed emergency protocols for the management of adverse effects of spinal anesthesia. (Table II)

Table II: Study Parameters After Spinal Block

No	Parameter Measured	Value
1	Maximal Sensory Block Reached (Pin Prick)-Level	T3(T2-T7)
2	Time to Maximal Sensory Block (Min)	9.2±4.6
3	Maximal Decrease in Pulse from Baseline (n/min)	15.4±8.7
4	Maximal Decrease in Systolic B.P from Baseline (mmHg)	33.6±11.3
5	Maximal Decrease in Diastolic B.P from Baseline (mmHg)	18.2±7.8

Discussion

Spinal anaesthesia or sub-arachnoid block (SAB), is a form of regional anaesthesia involving injection of a local anaesthetic into the subarachnoid space, generally through a fine needle. Regardless of the anaesthetic agent used, the desired effect is to block the transmission of afferent nerve signals from peripheral nociceptors. Sensory signals from the site are blocked, thereby eliminating pain[11,12]. The degree of neuronal blockade depends on the amount and concentration of local anaesthetic used and the properties of the axon. Thin unmyelinated C-fibres associated with pain are blocked last, while thick, heavily myelinated A-alpha motor neurons are blocked moderately. Heavily myelinated, small preganglionic sympathetic fibers are blocked first. The desired result is total numbness of the area. A pressure sensation is permissible and often occurs due to incomplete blockade of the thicker A-beta mechanoreceptors. This allows surgical procedures to be performed with no painful sensation to the person undergoing the procedure[13,14].

Among all the anesthesia techniques, spinal anesthesia is considered most superior to all because of its quick onset and decreased risks of airway complications[6,7,8]. But, despite all these benefits, its major complication involve higher than desired spread of the drug causing related airway and circulatory collapse. With the conventional spinal block especially amomg high risk patients like obstetric cases, higher sympathetic block leading to profound arterial hypotension remains the most common problem.Factors that can primarily resolve this problem include reducing the volume of injected drug and using highly concentrated solution of hyperbaric anaesthetic agent. But despite all these manipulations, one cant exactly predsict the height of block of extent of spread after the spinal anesthesia.The mainstay of avoiding these problems remain adequate volume loading with intravenous fluids before performing the block.

Many factors[9,10,15] can play a role in the cephalad spread of local anesthetic in the subarachnoid space, including lumbosacral cerebrospinal fluid volume, increased intra-abdominal pressures during labor, maternal position while performing the block , and the baricity of the agent. The cardiovascular effects of spinal blockade occur because of the combined loss of tone of the resistance as well as the capacitance vessels, thus leading to hemodynamic stress and even collapse if the block acheieves very higher levels or compensatroy mechanisms are exhausted among certain patient group.

Variability in lumbosacral CSF volume can explain the wide range of spread of spinal anesthesia observed in

clinical practice[16]. We determined the extent and duration of sensory blockade during spinal anesthesia using standard spinal anesthesia technique for cesarean section. Similarly, serial intra-thecal injections of local anesthetic into the same patient produces spinal anesthesia that is less variable in extent and duration than when the same dose of local anesthetic is injected into different patients[17].

In contrast to the correlations between CSF volume and measures of sensory anesthesia, CSF volumes usually do not correlate with the duration of motor blockade[18]. The hyperbaric solution would be expected to preferentially distribute to the dorsal nerve roots, and the anterior roots should be exposed to less local anesthetic[19,20]. While performing the block among parturients, extreme care should be directed at the level of puncture, posture, immediate position of the patient after the intrathecal injection, placing the wedge under hip so as to avoid aorto-caval compression, assessing regularly the height of block and continuous hemodynamic monitoring so as to early detect and treat the complications associated with higher spinal.

Our findings help explain the predictability of spinal anesthesia in clinical practice and provide valuable insight into mechanisms of spinal anesthesia spread for the sensory level block among patients presenting for the elective cesarean sections.

Conclusion

1.6ml of 0.75% injection bupivacaine injected via spinal needle in the subarachnoid space at the level of L3-L4 among Pakistani women undergoing elective cesarean section is sufficient to provide an adequate T4 sensory block in the desired time.

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