



Spinal anesthesia at L2-3 vs L3-4 levels: comparison of onset of block, maximum level of block and hemodynamic response in obstetric patients undergoing caesarian section

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Abstract

Background and Aims: Today intrathecal anaesthesia is used for almost any procedure below umbilicus. The present study evaluated Spinal anesthesia at L2-3 vs L3-4 levels with comparison of onset of block, maximum level of block and hemodynamic response in obstetric patients undergoing caesarian section.

Methodology: The study was conducted on seventy patients of American Society of Anesthesiologists Grade I and II of age group 18–37 years, allocated to one of the two groups of thirty five patients each. Group I received spinal anaesthesia at L2-L3 and Group II received spinal anaesthesia at L3-L4. Patients were monitored for onset of sensory and motor block, total duration of sensory block, level of sensory block, intraoperative haemodynamic characteristics and VAS score.

Results: Demographic variables were comparable. The onset times of sensory and motor block were significantly shorter in group I (7.10±1.40), (9.45±1.30) than group II (9.50±1.30), (13.00±1.20). There was a significant difference between the two groups in achieving the height of sensory block in the first 30 minutes after intrathecal injection ($p < 0.001$). The median height of the sensory block for patients in group I was T8 whereas in group II, it was T9. The incidence of hypotension showed no statistical difference ($p > 0.05$) between the two groups. The severity of intra operative pain, estimated using a 10 cm VAS, was significantly higher ($p = 0.038$) in group I than in the group II at the beginning of the caesarean section while in the later course of the surgery no statistical difference was found.

Conclusion: Intrathecal anaesthesia with hyperbaric bupivacaine administered in L2–3 interspace for caesarean section provides superior analgesia, significantly earlier onset of sensory and motor block and equal hemodynamic stability as compared to spinal anaesthesia administered in the L3–4 interspace.

Keywords: Intrathecal anaesthesia, spinal, analgesia, hypotension, bradycardia, caesarean section.

Introduction

Spinal anaesthesia, one of the most commonly preferred anaesthesia types in the practice, is used

widely, especially in lower extremity surgery, anorectal, urologic, obstetric, and gynecologic and lower abdominal surgery.¹ Compared to general

anaesthesia Spinal anaesthesia has decreased mortality, cardiovascular morbidity, deep venous thrombosis and pulmonary embolism, blood loss, duration of surgery, pain, opioid-related adverse effects, cognitive defects, and length of stay. It is also known that SA improved rehabilitation compared with general anaesthesia.^{2,3}

Spinal anaesthesia has become an increasingly popular technique for caesarean section in many countries over the last few decades. However, the rapid onset of sympathetic block and subsequent hypotension remains a major clinical concern when using the technique. In order to decrease the incidence and severity of hypotension, various attempts have been made to modify the technique and the dose of local anaesthetic used.^{6,7} However, spinal-induced hypotension is the most important side effect, with a reported incidence between 20% and 100%.^{4,5}

Recently, Cesur et al.⁶ demonstrated a marked decrease in the incidence of hypotension when 5 mg of isobaric bupivacaine was followed by 5 mg of heavy bupivacaine for spinal anaesthesia during caesarean section. They reported that the maternal hypotension frequency decreased from 67% to 14% when 5 mg of isobaric and 5 mg of hyperbaric bupivacaine were used sequentially instead of 10 mg of hyperbaric bupivacaine.^{7,8}

Material & Methods

The present study was conducted in the Tertiary care LD Hospital which is one of the associated Hospital of Govt, Medical Srinagar from 2016 to 2018 for 70 full term pregnant women for elective lower segment caesarean section belonging to ASA-I and II class categorized in to equally two groups based on effect and hemodynamic changes of spinal anaesthesia given at L2-L3 and L3-L4 interspace. After ethical approval and written, informed consent, 70 patients prepared in labour room. Exclusion criteria were strictly followed to control confounding variables. Using lottery method, patients were randomly allocated to receive hyperbaric bupivacaine solutions at two different interspaces. This created 2 distinct

groups I & II respectively. Detailed data of the patients was collected including age, height, weight, ASA status baseline blood pressure and heart rate senior anaesthesiologist was responsible for patient randomization and a resident doctor performed the spinal block and collected preoperative and intra operative data.

Patients were preloaded with 1000 ml of lactated ringer solution prior to spinal anaesthesia. After all aseptic measures and skin infiltration with 2% xylocaine solution. LP was performed in midline at 90 degree to skin between L2-L3 or L3-L4 space in sitting position. 2.5 ml of 0.5% hyperbaric bupivacaine was injected intrathecally to both groups. Patient were given supine position with table kept head down. Motor Block was assessed by using a modified bromage scale. Complete loss of pain prick sensation to T6 on both sides was regarded as sufficient for surgery. Detailed data of patients was collected including time of onset of block, highest sensory analgesia level, degree of motor block, cardio-respiratory status and duration of surgery (skin incision to closure), B.P., heart rate, respiratory rate, oxygen saturation was recorded every 3 minutes for 30 minutes, and then every 5 minutes till the end of surgery. Special note was made of any hypotension, use of mephaternin and extra fluids. The procedure began by identifying anatomic landmarks. The patient was placed in the sitting position and the line joining the superior aspect of the iliac crests posteriorly (Tuffier's line) was palpated. When the Tuffier's line crossed an interspinous space, the spinal level was identified as L3-L4 interspace. According to this land-mark, the L2-L3 interspace was identified as one interspace above. Identification of lumbar interspaces was performed separately by a junior and senior anesthesiologist and if there was any discrepancy in the identification of lumbar interspace, the patient was excluded from the study. Spinal puncture was performed at the L2-L3 interspace in group L2-L3 (N=35) and in L3-L4 interspace in group L3-L4 (N=35). All patients in each group received 12.5 mg of 0.5% hyperbaric

bupivacaine via 25 G Quincke's needle and the same junior anaesthesiologist gave the spinal injection to every patient to avoid inter operator variability. This dose was injected at a rate of approximately 0.2 mL/s. All patients were then placed supine and administered air/oxygen mixture (60%: 40%) via facemask. During the procedure an electrocardiogram, the heart rate and pulse oximetry were monitored continuously. Non-invasive blood pressure was taken before the conduct of spinal anaesthesia and every 5 minutes after the intrathecal injection until the end of surgery. Hypotension was defined as a decrease in the mean arterial blood pressure, more than 20% from baseline within a 5 min interval.

Hypotension was treated with either fluid boluses or aliquots of intravenous mepathermin 6 mg since the efficacy of mepathermin) was recognized in earlier studies. Bradycardia was defined as heart rate less than 50 beats min^{-1} and was treated with i.v. injection of atropine 0.5–1 mg. The quality of anaesthesia was assessed by testing severity of intra operative pain using a 10 cm VAS, where VAS 0 meant no pain and VAS 10 worst pain imaginable. VAS was evaluated every 5 min from the time of skin incision until the end of surgery. The use of VAS had previously been explained to each patient before surgery. VAS 1–3 was considered as mild pain, VAS 4–6 as moderate, VAS 7, 8 as severe and VAS 9, 10 as unbearable pain. Five minutes thereafter, the VAS was assessed. The height of sensory block was also noted. The level of sensory block was determined by the loss of pinprick sensation and was performed using a 22 G hypodermic needle. Sensory block level was tested every 5 minutes during the first 30 minutes after the intrathecal injection. The surgeon started all operations 30 minutes after intrathecal injection in every patient. No sensory testing was performed during surgery.

Data analysis plan

Data was analyzed using spss (version 10)

= Mean and standard deviation was calculated for quantitative variables i.e time of onset of blocks, age, weight and height.

= frequency and percentage were presented for qualitative variables i.e hypotension, sensory block, motor block, use of mepathermin.

= Independent sample t-test was used to compare time of onset of block in both groups.

= chi square test was applied to compare hypotension, sensory block, motor block and use of mepathermin.

Results

All the patients in treatment groups were similar with respect to age, weight, height, Duration of surgery and ASA class of status.

Table 1 Demographic characteristics of the patients (Mean±SD)

Parameters	Group I (N=35)	Group II (N=35)	P value
Age(years)	28.55±11.56	30.80±12.37	0.73*
Weight(kg)	61.50±8.87	62.50±10.99	0.885*
Height(cm)	165.3±3.610	167.4±4.547	0.748*
ASA status I/II	23/12	26/9	0.587*
Duration of surgery	42.5±9.12	45.7±8.20	0.610

ASA American society of Anaesthesiology, SD standard deviation, * Level of significance.

There was no significant difference between baseline systolic, diastolic, mean arterial pressure and heart rate between the groups (Table 2) prior to as well as after intrathecal injection of local anaesthetic. The incidence of hypotension showed no statistical difference ($p>0.05$) between the two groups (21% in group I vs. 18% in group II), neither the incidence of bradycardia (18% in group I vs. 13% in group II).

Table:2 Base line hemodynamic characteristics.

Variables	Group I N=35	Group II N=35	P value
Baseline SBP(mmHg)	128±12.50	130±13.65	0.468*
Base line DBP (mmHg)	85±12.75	88±13.44	0.387*
HR(beats min^{-1})	85±10.5	78±8.6	0.231*

SD standard deviation, * Level of significance.

The mean time of onset of sensory block in groups I and group II was 7.10±1.40 min, and 9.50±1.30 min respectively. The time of onset of sensory block in group II was delayed significantly as compared to groups I ($P < 0.05$). [Table 3].

The mean time of onset of motor block in group I and group II was 9.45 ± 1.30 min, and 13.00 ± 1.20 min respectively. The time of onset of motor block was significantly delayed in group II as compared to groups I ($P = 0.0001$). (Table :3)

The duration of both sensory and motor block was significantly prolonged in groups I as compared to groups II ($P = 0.0001$).

Table: 3 Characteristics of spinal block

Parameters	Group I N=35	Group II N=35	P value
Time of onset of sensory block (min)	7.10 ± 1.40	9.50 ± 1.30	0.036*
Time of onset of motor block (min)	9.45 ± 1.30	13.00 ± 1.20	0.003*
Duration of sensory block (min)	120.10 ± 10.80	112.30 ± 9.50	0.002*
Duration of motor block (min)	110.50 ± 7.50	128.20 ± 7.48	0.005*
Highest dermatome level of sensory block	T8	T9	0.001*

Values in the table are mean \pm SD or absolute numbers (percentage). All times are in calculated from time of intrathecal injection. SD = Standard deviation.

There was a significant difference between the two groups in achieving the height of sensory block in the first 30 minutes after intrathecal injection ($p < 0.001$). The median height of the sensory block for patients in group I was T8 whereas in group II it was T9 (Table 3).

Discussion

Spinal anaesthesia for caesarean section is an old and well established method. It was first used in obstetrics in 1901 for pain relief during vaginal delivery and also became popular for caesarean delivery because of its rapid onset and a high frequency of successful blockade. The development of thinner spinal needles and better local anaesthetic agents like bupivacaine for subarachnoid use, and more knowledge of the path physiology of hypotension may have contributed to a rising popularity of spinal anaesthesia.⁹

The advantages of regional anaesthesia include an awake mother, minimal depression of the newborn, and avoidance of the risks of general anaesthesia (especially failed intubation and aspiration pneumonitis); and spinal anaesthesia specifically has the advantages of its simplicity,

small drug dose, low Failure rate and rapid onset.¹⁰

In our study there was no significant difference between baseline systolic, diastolic, mean arterial pressure and heart rate between the groups prior to as well as after intrathecal injection of local anaesthetic. It is well known fact that there are many factors that may alter a spinal anesthetic block height and that the puncture site is just one of them. In this study, loss of pinprick sensation was tested only in the first 30 minutes after spinal injection, to reassure that sensory blockade was progressing. However, Tuominen M. et al. found that the subarachnoid spread of local anesthetic using plain bupivacaine continued beyond 30 min³.

We observed in our study that maximum sensory block level in group I2-13 was higher and development of motor block was faster and lasted longer. The results of our study are similar to the results reported by Gautier et al.¹¹ during spinal anaesthesia for caesarean delivery. They compared the same interspaces and reported that duration of motor block and analgesia was shorter in the I2-13 group. In our study also, sensory and motor block durations were found to be shorter in I2-13 group.

Our study has found that neuroaxial anaesthesia achieved by administering 0.5% hyperbolic bupivacaine at L2–3 interspace has the median height of sensory block in first 30 minutes after spinal injection for patients in group I was T8 and in group II it was T9 conducted during surgical procedures in the caesarean section. Hartmann B. et al. found in their study that the risk of circulatory instability was increased if the sensory block height was T6 dermatome level 10 min after application of the local anesthetic intrathecally.² Hypotension occurred frequently during spinal anaesthesia (21% in L2–3 group and 18% in L3–4 group) and with incidences similar to those in previous reports.¹² The heart rate was found to be lower; less than 50 beats min⁻¹, in (18%) patients in group L2–3 and in (13%) patients in group L3–4. Although we did observe difference, there was certainly a trend toward more bradycardia and

hypotension in the L2–3 group but within manageable condition. Bradycardia noticed during spinal anesthesia, was believed to be a result of at least two causes: blockade of sympathetic cardio accelerator fibers and decrease in the venous return to the heart. Sympathetic cardiac accelerator fibers arise from the first four thoracic spinal segments, so a sympathetic block at T1 level should completely eliminate sympathetic outflow to the heart. Severity of pain that was estimated using a 10 cm VAS was significantly different among the observed groups. The absence of pain (VAS 0) was significantly higher in the L2–3 group than in the L3–4 group but only in the first minute after beginning of surgery. An explanation for this finding may be in the spreading of sensory blockade with bupivacaine beyond 30 min consistent with previous reports of Tuominen M. et al.³

Our study has proven that Intrathecal anaesthesia with hyperbaric bupivacaine administered in L2–3 interspace for caesarean section provides superior analgesia, significantly earlier onset of sensory and motor block and equal hemodynamic stability as compared to spinal anaesthesia administered in the L3–4 interspace.

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