DOI: 10.14260/jemds/2014/3135

ORIGINAL ARTICLE

INFLUENCE OF PROLONGED SITTING POSITION ON EFFECTS OF SPINAL ANAESTHESIA ON CAESAREAN DELIVERY: A RANDOMIZED CONTROLLED TRIAL

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HOW TO CITE THIS ARTICLE:
Priti Kolarkar, Gunjan Badwaik, Heena Pahuja, Ajay Watve, Jitendra Kalbande, Amol Bhalerao, Nupur Bhangale. "Influence of Prolonged Sitting Position on Effects of Spinal Anaesthesia on Caesarean Delivery: A Randomized Controlled Trial". Journal of Evolution of Medical and Dental Sciences 2014; Vol. 3, Issue 33, August 07; Page: 8860-8869, DOI: 10.14260/jemds/2014/3135

ABSTRACT: BACKGROUND: Hemodynamic disturbance and uteroplacental hypoperfusion can occur due to Aortocaval Compression (ACC) in parturient which are further aggravated by SAB. Incidence of maternal hypotension due to cephalad spread of local anesthetic (LA) in subarachnoid space and ACC by gravid uterus; both these factors influenced by parturient's posture during and immediately after SAB, we tested the hypothesis that keeping parturient in sitting position for five minutes after SAB, likely limit the spread of LA, thus reduce the incidence of hypotension and Intraoperative ephedrine requirements. **AIMS AND OBJECTIVES**: to determine the effects of making parturient sit up for five minutes after SAB, that would have on sensory block height, incidence of hypotension and ephedrine requirements. Secondarily, to study duration of postoperative analgesia. **MATERIALS AND METHODS**; Single blinded randomized comparative study having 30 parturients in each group CS and CL were allocated to receive 2ml of hyperbaric bupivacaine with 0.4ml NS, Or 20 µgm fentanyl added to 2 ml hyperbaric bupivacaine group FS or FL, either in sitting group (made to sit for 5 min. post SAB before supine) or in lying group, made supine immediately. The maximum level of sensory blockade achieved and monitoring of heart rate, noninvasive blood pressure, respiratory rate and oxygen saturation were done every 2 min for first 10 min then at 15 min interval for remainder of operation. Postoperatively, onset of pain was noted. **STATISTICAL ANALYSIS:** By using descriptive and inferential statistics using unpaired t-test, chi Square test, and Mann-Whitney U test. The Software used was SPSS 17.0 version and Graph Pad Prism 5.0. Analyzed data was expressed as mean ± SD for continuous variables and number (%) for categorical variables. P value < 0.05 was considered statistically significant **RESULTS:** Sitting Groups had lower sensory block height than lying Groups; also required less ephedrine. Duration of postoperative analgesia was prolonged in both the fentanyl Groups. **CONCLUSION:** prolonged sitting position after spinal anesthesia not only limit the spread of LA, producing lower sensory block height but also reduces the incidence of hypotension and Intraoperative ephedrine requirement in caesarean delivery.
KEYWORDS: Spinal anesthesia, caesarean section, aortocaval compression.

INTRODUCTION: Due to advantages like simplicity, rapid onset, reliability, dense motor block and avoidance of the potential airway complications associated with general anaesthesia, subarachnoid block is preferred anesthetic for caesarean section.[1, 2] As such supine hypotension that develops in pregnant women near term has been attributed to ACC by the enlarged gravid uterus, which decreases venous return to the heart. Use of subarachnoid block compounds the problem of hypotension in the supine parturient by causing vasodilation and venous pooling of blood in the

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lower limbs. The relative hypovolemia caused by the combination of aorotocaval compression and subarachnoid block may lead to placental insufficiency. The incidence of hypotension seems to be unexpectedly high despite preloading with crystalloids (47.4-83%) [3, 4] or colloids (17-38%) [5, 6] and the use of prophylactic vasoconstrictors (35-80%).[7]

The universal technique of employing a 15^0 left lateral tilt using an obstetric wedge under the right hip[8] or tilting the table leftwards[9] might help to decrease the degree of aortocaval compression but does not guarantee its absence[10] The hypotension is distressing to the mother who often develops nausea & vomiting which may also endanger the fetus as changes in maternal arterial pressure affect uteroplacental blood flow.[11]

The position of the patient at the time of subarachnoid block in caesarean section cases may be particularly important because a different spread of block may affect the incidence and degree of hypotension whereas differences in the degree of motor block may influence patient satisfaction and discharge times from the postanesthetic care unit.

However, there are few studies evaluating the influence of patient posture during the performance of neuraxial anesthetic techniques. Although all studies agree that right or left lateral decubitus positions can be used equally well,[12-14] the results with respect to the success rate & hemodynamic effects between the lateral & sitting position during spinal anesthetic techniques are more conflicting.[15,16]

A small dosage of fentanyl (10-40microgm) administered directly into CSF has been found to be very effective in minimizing discomfort during & after caesarean section without increasing serious side effects.[17-21] This study was primarily, designed to determine the effects of making parturient sit up for five minutes after SAB, that would have on sensory block height, incidence of hypotension and ephedrine requirements. Secondarily, to judge the advantage of added intrathecal fentanyl in prolonging the duration of complete and effective analgesia, intraoperative sedation and observe Side effects, if any.

MATERIALS AND METHODS: In this single-blind, randomized, controlled clinical trial, after approval from institutional ethical committee, and with written informed consent, one hundred and twenty, American Society of Anesthesiologists (ASA) class I or II parturients with full term singleton pregnancy scheduled for elective cesarean section to be performed under SAB were recruited. Parturients with essential hypertension or PIH, Diabetes, anemia, Pre-eclampsia, heart disease, IUGR, abruptio placentae, Prematurity (less than 37 wks. Gestation), fetal distress, fetal anomalies, contraindication to spinal anesthesia, Allergy to local anesthetic or fentanyl, patient refusal were excluded from the study.

Parturients were randomly divided into four treatment groups of 30 each depending upon the drug received intrathecally and the position after SAB ie.Gr1-CL (Control Lying), Gr2-CS (Control Sitting), Gr3-FL (Fentanyl Lying), Gr4-FS (Fentanyl Sitting) on the basis of computer generated randomization scheme. The test drug was prepared by anesthetist not involved in study. Both the patient and the anesthesiologist were unaware of the drugs.

In the control group 2ml of hyperbaric bupivacaine with 0.4ml NS and in fentanyl group 20µg fentanyl added to 2 ml hyperbaric bupivacaine was given. In both the groups the SAB was performed in sitting position. In lying group parturients were made supine immediately after SAB, in sitting group parturients were made to sit for 5 mins before giving supine position.

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To achieve left uterine displacement of 15^0, a 10 cms. Wedge was inserted under right hip to tilt the pelvis, while in supine position in both the groups. Since the groups had different positions for 5 min after SAB, the measurements were assessed by an unblinded observer until the patients in sitting group were placed in supine position. After this, all assessments and treatments were made by another observer who was blinded to the patient group.

After placement of standard noninvasive monitoring devices like automated NIBP, pulse oximetry and ECG, (baseline values were noted) preloading with 10ml/kg RL containing 50mg ranitidine was done. SAB was performed &the drug was given as per the group. Once in the supine position, the monitoring of heart rate and non-invasive blood pressure, respiratory rate, oxygen saturation were done every 2min for first 10min then at 15min interval for remainder of operation and thereafter at 30 min interval in PACU.

The maximum level of sensory blockade achieved was assessed by pinprick method separately on each side and noted. Surgery was performed after confirmation of successful block i.e. sensory block level T6 or higher. All patients received supplementation of O_2 (3 $lire^{-min}$) through a nasal catheter until after delivery. Fluid administration was continued with RL intraoperatively.

Hypotension, fall in systolic pressure by 20% of baseline was treated by fluid bolus & intravenous (iv) ephedrine 6mg and repeated every 2 min.to achieve SBP >100 mm Hg or SBP within 20% of baseline. If resting systolic blood pressure was 100 mmHg, then the intervention blood pressure was considered to be 90 mmHg.

Numbers of ephedrine doses were recorded. Bradycardia, fall in heart rate by 20% of baseline was treated with IV atropine0.6mg.Intraoperative Sedation (3 point rating score) was also noted. Oxytocin 5 i.u. was slowly infused intravenously after baby delivery followed by oxytocin infusion 0.03 U. mL^{-1}at a rate of 200 ml hr^{-1} Any unto ward side effects were noted (bradycardia, hypotension, resp. depression, pruritus, shivering, nausea and vomiting) Apgarscoreat1and 5min was noted.

Postoperatively in the PACU, time to achieve Bromage 2 score and onset of pain using VAS was noted. Duration of complete analgesia was defined as the time from the intrathecal injection to VAS score >0, and duration of effective analgesia was defined as time to VAS score ≥ 4, at which point the patient received iv diclofenac 75mg as rescue analgesic to achieve a VAS score of < 4.

RESULTS: The sitting Gps. had lower sensory block height than lying Gps. T 5 (T4-T6) v/s T3 (T2-4) resp. p= 0.001. (Table 2) lesser ephedrine (8 ± 4, 9 ± 3, 18 ± 2, 12 ± 5 P= 0.012) (Table 5) Duration of complete and effective analgesia was more in both the fentanyl Gps.

Than Control Gps. (226±8.2; 220± 6.5 & 116±7.3; 125±4.8 and 248 ±12.7; 256±3.7 & 130 ±5.7; s128± 2.9, p =0.014) (Table 3) Bromage 2 was prolonged in sitting than lying Gps. (120±14, 116±15 V/S 106±8, 98±16 P =0.001)Sedation was better in fentanyl Gps.25(83.3%) parturients in fentanyl lying and 22(73.3%) parturients in fentanyl sitting group were moderately sedated (grade 2) but easily arousable, none of the parturients were sedated in both the control groups.

Apgar's scores at 1 & 5 min were statistically similar in all the Gps. (p=0.767 and P=0.557) (Table 4) No significant side effects were noted. The incidence of hypotension was statistically more in both the lying than sitting groups, p=0.01.So also, the total doses of ephedrine requirements were more in both the lying than sitting groups, p=0.12. Time to first episode of hypotension was much delayed in both the sitting than lying groups, p=0.014.

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The time from SAB to delivery and uterine incision to delivery were statistically similar in all the groups, p=0.6 and p=0.5 respectively. (Table 5).

STATISTICS: The primary outcome was reduction in ephedrine requirements. Using data from previous study of Essam E et al[22]; we calculated that a sample size of 30 patients per group would have 95% power at the 5% significance level to detect a difference in ephedrine requirement of 10 mg among groups. The parameters were recorded and data was entered into statistical package (SPSS 17.0) and Graph Pad Prism 5.0.Comparison of demographic data, maximum block levels, time variables were done amongst all the 4 groups using unpaired t-test.

Incidences of adverse effects amongst the groups were compared using comparison chi Square test. Apgar scores were compared between the groups using Mann-Whitney U test. For intergroup of blood pressure, heart rate, paired T test was used. The data were expressed as mean ± SD for continuous variables and number (%) for categorical variables. P value<0.05 was considered statistically significant.

DISCUSSION: In the present study the relative efficacy of two different maneuvers were compared in a prospective randomized manner following spinal anaesthesia. Hypotension during caesarean delivery generally occurs around 6 min after intrathecal injection.[23-25]

However, delayed supine positioning from sitting as a new mode for intrathecal injection was the aim of many authors' researches of obstetric anesthesia. They reported that the characteristics of block spread differ somewhat and an insufficient sensory block by hyperbaric anesthetics which may be resulting from delayed supine positioning from sitting position.[25-27]

As there were inconsistencies in the intrauterine resuscitation (IUR) results we have also noted a more conflict between authors when comparing two different positions after intrathecal injection of a same hyperbaric bupivacaine dose and this clear from the research of Coppejans et al.[25] and Kohler et al.[23]

Who compared the incidence of hypotension with parturients in the lateral and sitting positions during combined spinal–epidural anesthesia when a delay of up to 3 min was allowed to insert the epidural catheter before supine positioning, the former found that there was no difference in the incidence of hypotension, although the degree of hypotension was less severe in the sitting group and the latter found that 3 min of sitting before supine positioning could reduce the incidence of hypotension.

However, we chose 5 mins duration and the dose of fentanyl from previous study[22].To counteract these prominent and immediate changes, vasopressor was given, though ephedrine and phenylephrine are standard drugs for maintaining maternal BP during caesarean delivery, we chose, ephedrine which, mainly acts as a β-agonist, would further increase cardiac output and this extra option than phenylephrine which is an α-agonist, can counteract the vasodilatory effect only.[28]

We observed that the incidence of hypotension was reduced in sitting than lying groups, as the parturients in sitting Groups. had lower sensory block height than those in lying Gps. and also required less ephedrine. This could be due to delayed and limited spread of sensory block and lower block height leading to less sympathetic blockade and less vasodilation.

Also, in part to the delayed aortocaval compression caused by keeping the patient upright for 5 mins after SAB. The time to first episode of hypotension was also delayed in both the sitting groups

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which are in accordance with previous study, [23]where maintaining sitting position for 3 mins after SAB, was associated with a delay of first occurrence of hypotension as well as lesser sensory block height.

The delay of first occurrence of hypotension was found to be after baby delivery which is beneficial to the uteroplacental perfusion.

Though it is assumed that cardiac output is more important for placental perfusion and there can be reduced placental perfusion without maternal hypotension, as maternal physiology preferentially preserves cerebral and cardiac circulation ahead of placental perfusion. In supine or with tilt < 15^0 Cardiac output did not significantly improved.[29]

So is the recommendation of tilt of at least 15^0 or more. Crawford[30] advocated the use of wedge shaped cushion (10 cms of height) arbitrarily angled at 15^0.We also used a 10 cms wedge. Previous investigators have also shown better hemodynamics and reduced ephedrine requirements with SAB in sitting rather than lateral position.[15, 25, 26]

Caesarean delivery requires traction of peritoneum and handling of intraperitoneal organs especially at times exteriorization of uterus resulting in Intraoperative visceral pain. Opioids have been a choice in regional anesthesia to improve antinociceptive effect of local anesthetics.

Morphine[31] and fentanyl[32] are being used intrathecally, with local anesthetics in cesarean section Fentanyl, a lypophylic opioid and is preferred having a rapid onset and short duration of action with lesser incidence of respiratory depression. Intrathecal (IT) administration of lipophilic opioid such as fentanyl, after administration diffuses into epidural space and subsequently into the plasma, suggesting that IT fentanyl not only act through spinal opioid receptors but also act systemically. Therefore fentanyl provides better intra operative analgesia.[33]

Since, characteristics of sensory block spread differ somewhat between these two positions used in our study; we could not assess block quality of intrathecally added fentanyl. But, we could evaluate the duration of complete and total analgesia which was found to be more in both the fentanyl Gps. than Control Gps.is in line with earlier studies using intrathecal lipophilic opoid[18, 20, 34-37]

During caesarean, with intrathecal fentanyl significant respiratory depression has not been observed.[19, 20] The risk of delayed respiratory depression is relatively small with spinal fentanyl, if it does occur, it usually manifests within 30 mins. In our study also, no patient in either group experienced respiratory depression defined as RR<10^{-1}or SpO_2<95% The incidence of bradycardia was nil in all the Groups, except only 1patient in fentanyl lying group recorded heart rate of < 50 bpm.

Despite increased incidence of hypotension and increased ephedrine usage in both the lying groups, Apgar scores at 1 and 5 min were similar in all the groups. Various authors have also found no difference in Apgar scores even if increased doses of vasopressors were used.[22, 26, 27] Sitting position is advantageous when performing SAB as it makes needle insertion easier, confers better patient comfort especially in obese indivisiuals and results in less ACC. with favorable hemodynamic effects.

Opponents, argue that vagal reflexes are more common in sitting position, uterine perfusion is better in lateral decubitus and due to lower hydrostatic pressure there is less likelihood of epidural vein puncture when neuraxial anesthesia is performed in lateral position.[38] None of the parturients in sitting group had inadequate block or received general anaesthesia or required supplementation of sedation during study, as was observed in previous study.[15]

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Supported by a systemic review[39] and metanalysis,[40] we administered ephedrine therapeutically rather than prophylactically to treat maternal hypotension. Prophylactic ephedrine administration has been used to reduce the incidence of maternal hypotension, but a dose of 12 mg is required, it does not completely eliminate occurrence of hypotension, additionally, maternal nausea, vomiting and neonatal acidemia are not different from placebo.[41]High dose ephedrine is associated with maternal hypertension and tachycardia.[40] and low umbilical cord pH with no fetal acidosis.[39]

The longer time to, motor recovery, Bromage 2 in both the sitting groups was likely due to downward concentration of the hyperbaric local anesthetic secondary to gravity, supported by an assumption proved in a spinal canal model showing hyperbaric solutions move downward due to gravity. The final recovery of motor functions in all the groups was within acceptable range of time though the difference in time to motor recovery, Bromage 2, was statistically significant in sitting and lying groups. No other side effects were observed.

Some limitations of this study are, first, although no major complications were observed and no parturient required conversion to general anesthesia, we did not assess the parturients' satisfaction. Second, when testing the anesthetic level, we only checked the pain sensation (pinprick test) and did not check the sympathetic level (i.e., cold test), which may have more of a relationship with hypotension. However, we assumed that both would have a close correlation. Unfortunately, we did not obtain umbilical cord pH and blood gas tensions at the time of delivery as it the practice of our institution to obtain it only when the Apgar score is < 7 at 1 or 5 min.

CONCLUSION: The milestone of achieving the best outcome of SAB in caesarean section is block height and hemodynamic stability. Keeping parturients in sitting position for five mins. rather than making them supine immediately after SAB, not only limits the spread of LA, producing lower sensory block height yet adequate and effective intraoperative analgesia, but also reduces the incidence of hypotension and Intraoperative ephedrine requirement. Thus, improving the outcome of intrauterine resuscitation during regional anaesthesia, which is an enigmatic challenge to the anesthesiologist.

Intrathecal Fentanyl, 20μg dose, additionally prolongs the duration of postoperative analgesia without any maternal side effects and no affection in the Apgar scores. Though the time to motor recovery (Bromage 2) gets delayed in sitting position after spinal anaesthesia, the final recovery of motor functions remains within acceptable range of time.

	Gr—CL	Gr—CS	Gr—FL	Gr—FS	P value
Age (yrs.)	24.50±3.21	23.22± 2.5	23.30±3.12	24.7± 4.03	0.145
Height (cms)	162 ± 6.48	161± 5.39	162 ± 6.03	161 ± 5.14	0.9220
Weight (Kg)	52.7 ± 15.5	51 ± 16.3	56.4 ± 13.5	55.1 ± 12.4	0.631
Surgery time	50.7 ± 20.9	55.3 ± 12.6	54.4± 14.5	53.7± 14..4	0.304
Baseline SBP (mmHg)	124 ± 6	125 ± 7	125 ± 6	125 ± 7	0.594

Table 1: Demographic Characteristics

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Gr n=30each	HB =T 2	HB =T 3	HB =T 4	HB = T5	HB=T 6
CL L	14	9	7	X	X
CL S	X	X	12	15	3
F L	12	9	8	1	X
F S	X	X	11	17	2

Table 2: Height of SAB block (HB)

	Gp-CL	Gr—CS	Gr—FL	Gr—FS	P value
Complete analgesia (min)	116 ±7.3	125 ±4.8	226 ±8.2	220± 6.5	0.014
Effective analgesia (min)	130±5.7	128 ± 2.9	248 ±12.7	256 ±3.7	0.018

Table 3: Duration of complete and effective analgesia

	Gr-CL	Gr—CS	Gr—FL	Gr—FS	p value
Duration of Bromage 2 motor block (min).	98 ±16	116 ±15	106 ±8	120 ±14	0.023
Time for complete regression of motor blockade (min)	180 ±25	177 ± 22	185 ± 37	183± 11	0.327
Apgar Score 1 min. 5 min	8-9 9-10	8-9 9-10	8-9 9-10	8-9 10	0.7679 0.557
Sedation (% of pts).	X	X	25(83.3%)	22(73.3%)	

Table 4: Maternal Side Effects and Apgar score

	Gr CL	Gr CS	Gr FL	Gr FS	p value
Ephedrine total dose, (mg,)	18 ± 2	8 ± 4	12 ± 5	9 ± 3	0.012
Hypotension (no & % of pts.)	5(16.66%)	1(3.33%)	8(26.66%)	2(6.66%)	0.01
Bradycardia	0/30(0%)	0/30(0%)	1 (3.33%)	0/30(0%)	1.000
Time to achieve T6 level(min)	3 ± 2	8 ± 3	4 ± 2	9 ± 3	0.4
Time from SAB to baby delivery (min)	7 ± 3	11 ± 2	8 ± 3	12 ± 3	0.6
Time of 1st episode of hypotension (min)	4.8 ± 1.2	12, 8 ± 2.8	5.1 ± 1	13.2± 3	0.014
Uterine incision to delivery time (secs)	35 ±13	33 ± 22	32 ± 18	34 ± 17	0.5

Table 5: Anesthetic data after intrathecal injection

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Date of Submission: 19/07/2014.
Date of Peer Review: 20/07/2014.
Date of Acceptance: 30/07/2014.
Date of Publishing: 05/08/2014.