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Original Research Article

Effect of patient's position on the success rate of subarachnoid block in parturient undergoing caesarean section: A prospective cohort study

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Abstract

Background: Technical aspect including proper position is important in subarachnoid block (SAB). The success rate in different positions has not been compared in parturient. The present study was conducted to evaluate the effect of lateral decubitus knee-chest position with a 45degree head-up tilt on the first attempt success of the spinal tap.

Materials and Methods: Parturients undergoing lower segment cesarean section (LSCS) were included in the study, with two groups of 100 each, based on the position in which spinal tap was performed, Lateral decubitus knee-chest position (Group-L) and Lateral decubitus knee-chest position with 45-degree head-up tilt (Group-LH).

Results: A successful cerebrospinal fluid (CSF) tap on the first attempt was achieved in 69% of patients in group LH and 55% in group L (odds ratio 1.82, 95% CI 1.02–3.25, p = 0.041). The mean time to perform the spinal tap was significantly shorter in group LH. Group L exhibited a faster onset (p = 0.002) but slower recovery (p = 0.002) of the sensory blockade. The incidence of motor blockade, bloody spinal taps, analgesic supplementation, nausea, and headache were similar between the two groups. However, hypotension and vomiting occurred more frequently in group L.

Conclusion: 45-degree head-up tilt in lateral decubitus knee-chest position improves the first-attempt success rate of spinal tap with slower onset of the sensory blockade, faster recovery, fewer chances of the inadvertent high block, and fewer complications compared to lateral decubitus knee-chest position. A 45-degree tilt with lateral decubitus position may be helpful in improving success of subarachnoid block in parturients considered difficult spinal taps.

Keywords: Parturient; Position; Subarachnoid; Head; Up; CSF.

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1. Introduction

Rapid onset, excellent operative conditions, and minimal depressant effect on mother and fetus make the subarachnoid block, the technique of choice for parturient undergoing LSCS. Various studies on success rate in obstetrics report technical aspect as the main cause of failure.[1,2] Overall failure rate of subarachnoid block is reported to be upto 17% in nonpregnant patients.[3] First attempt success is as low as 40% in parturients.[4]

Lack of free flow of CSF was associated with increased failure of subarachnoid block. If SAB is not successful, GA needs to be administered with added risk.

A proper position goes a long way in ensuring that the first attempt is successful for the CSF tap and reduces the time taken to perform the SAB. It is advocated that maternal position can affect the spread of SAB.[5] Attempts have been made to use sitting[6-9] as well as head-up[10-12] position for LSCS to prevent higher block spread and improve hemodynamics. A 45-degreehead-up tilt has been reported to have better success rate in general population,[13] the success in different positions has not been compared in parturients.

The present study was planned to evaluate the effect of lateral decubitus knee-chest position with a 45-degreehead-up tilt on the success rate of spinal CSF tapping and subsequent neuraxial block. We went ahead with null hypothesis assuming there was no difference in first attempt success rate of spinal CSF tapping in lateral decubitus knee-

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chest position with a 45-degreehead-up tilt as compared to lateral decubitus knee-chest position. The primary objective was to study the effect of the patient's position on the first-attempt success rate of subarachnoid block in parturients undergoing cesarean section. The primary outcome was the free flow of cerebrospinal fluid (CSF) in the first attempt. Secondary outcomes studied were the time taken for CSF tap, the incidence of blood in CSF, onset, and recovery of the sensorimotor block, need for analgesic supplementation, the occurrence of other effects like nausea, vomiting, bradycardia, hypotension and APGAR score of the baby.

2. Materials and Methods

This was a prospective cohort study conducted in the institute. Ethical approval (LHMC/ECHR/2016/46) was taken from institutional ethical committee and study was also registered with CTRI (CTRI/2018/04/013546). A pre-anaesthetic check-up was performed and informed consent was taken. Two hundred parturients of ASA grade I & II belonging to 18-40 years of age, undergoing cesarean section were included in the study. Parturients who refused to participate in the study, had deranged coagulation or those with a history of allergy to the study drugs were excluded from the study.

After being taken inside the operation theatre, standard monitors were applied I.V. access with an 18 G cannula was secured and 500 ml of Ringer Lactate solution was infused over 20 minutes. The position for SAB was given as per the preference of the consultant anesthesiologist. Overall plan was to include both groups alternately to reduce bias. Each group consisted of hundred parturients based on the position of the parturient in which subarachnoid block was administered: lateral decubitus knee-chest position (Group L) or lateral decubitus knee-chest position with 45-degree head-up tilt (Group LH).

In all the cases, the skin overlying the space was infiltrated with 1 ml of 2% lignocaine, and a subarachnoid block was performed taking aseptic precautions with 25 G Quincke's needle and standard midline approach at L4-L5 or L3-L4 interspinous space as per institutional protocol. The drug used was 2 ml of 0.5% hyperbaric bupivacaine with 25µg fentanyl. The head-up tilt was measured using a goniometer. After completion of the subarachnoid block, patients were turned supine.

The success of subarachnoid block ie free flow of CSF in the first attempt,(taken as a single attempt or needle redirected without withdrawing from skin), time to subarachnoid block (time from completion of skin infiltration to the appearance of free-flowing clear CSF at Quincke's needle hub), time for sensory blockade (time from completion of subarachnoid injection to the time of loss of sensation at T6 dermatome),the time to motor block (time from completion of subarachnoid injection to the time of achieving score 3 of Modified BromageScale),[14] the highest level of sensory block (in terms of number of patients developing sensory block above T6), recovery of sensory block (the time from onset to sensory block recession to T10 level), recovery of motor block(the time from onset to the return of motor power to Modified Bromage scale[14] score'0'), need for analgesic supplementation, bradycardia or hypotension needing pharmacological correction, nausea, vomiting, and any other complication, and APGAR score of the baby at 5 minutes after clamping of umbilical cord were noted. The sensory loss was assessed using the loss of sensation to pinprick. Motor blockade was assessed using a modified Bromage score.[12,13] Haemodynamic parameters ie HR, SBP, DBP, and MAP were noted at baseline, immediately after subarachnoid injection, 5 minutes after subarachnoid injection, and thereafter every 10 minutes till the end of surgery. Bradycardia was defined as a fall of ≥ 20% of baseline heart rate or a heart rate < 55 beats /min. It was treated with incremental doses of 0.3 mg atropine. Hypotension was defined as a fall in SBP ≥ 20% of the baseline SBP value. Hypotension non-responsive to the fluid challenge was treated with incremental doses of 3 mg of mephentermine, as per institutional protocol and noted. Analgesia was supplemented with fentanyl 1µg/kg. Further supplementation if required was to be given with ketamine and such patients were excluded from study.

The sample size was calculated from the results of a previous study.[13] Their first attempt success rate was 65%in the lateral group and 85% in the 45-degree head-up group. The formula given by Sahai and Khurshid was used for calculating sample size.[15] Taking the power of study 90% and alpha 0.05 calculated sample size was 94 in each group. For more accurate results 90% power was chosen. Statistical analysis was done using an SPSS 16.0 version. Data was checked for normality. For categorical variables chi squared test. Fisher exact test was used where number was small. For continuous variables, where distribution of data was normal parametric test (student's t test) was applied and at places where data distribution was not normal nonparametric test (Wilcoxon Mann Whitney U test) was applied. The p value of < 0.05 was considered statistically significant.

3. Results

The mean age of parturients was 26.38±3.87 in group L and 26.52±4.30 years in group LH (p=0.719). Group L consists of parturients undergoing spinal tap in lateral decubitus position and group LH in lateral decubitus position with 45-degree head-up tilt. The mean age in both groups was comparable. (**Table 1**)

A successful tap of CSF in the first attempt was noted in a significantly more number of parturients in the LH group. In the rest of the parturients, CSF tap was successful in more than one attempt. The mean time taken to perform the spinal tap was significantly faster in group LH. Incidence of the bloody spinal tap was comparable in both groups.(**Table 2**)

The mean time for the onset of sensory block was less in group L than in group LH. Sensory blockade to the level of T6 was achieved in all parturients A significantly higher number of parturients achieved a sensory blockade of more than T6 level in group L as compared to only one case in the LH group. Recovery from sensory blockade was recorded earlier in group LH.

Onset and recovery of motor block was comparable in both groups.(**Table 2**)

There was no significant difference in the requirement for analgesic supplementation in both groups. (**Table 2**)

All parturients in both groups remained hemodynamic stable. (**Figure 1**, **Figure 2**) Baseline heart rate and systolic blood pressure were comparable in both groups.(**Table 1**)

The incidence of hypotension as measured by SBP was less in LH group.(**Figure 2**) The incidence of nausea and headache were comparable in the two groups. However, bradycardia and vomiting were more frequently encountered in group L (**Table 3**).

All the babies born were healthy and had good APGAR scores at 5 minutes.

Table 1: Baseline characteristics in both groups

Parameters	Total n=200	Group L n=100	Group LH n=100	Mean difference(CI)	p value
Age	26.38 ± 4.08	26.38 ± 3.87	26.52 ± 4.30	-0.29 (-1.43 to 0.85)	(p=0.719)
Baseline HR	95.50 ± 12.80	93.93 ± 12.38	97.08 ± (13.09) 97.50 (88.00 - 105.25)	-3.15 (-6.70 to 0.40)	p=0.082
Baseline SBP	126.39 ± 10.74	127.81 ± 10.61	124.98 ± 10.73	2.83 (-0.15 to 5.81)	p=0.062

Data are presented as mean ± SD
P-value of < 0.05 was taken as significant.

Table 2: Parameters in both groups

Parameters	Total n=200	Group L n=100	Group LH n=100	Odd ratio/Mean Difference(95%CI)	p value
First attempt success rate of spinal tap	124(62%)	55(55%)	69(69%)	1.82 (1.02-3.25)	0.041
Time to perform CSF tap (seconds)	37.42 ± 17.39	42.00±20.08	32.85±12.74	9.15 (4.46 to 13.84)	<0.001
Incidence of blood in CSF	18(9%)	10 (10%)	8(8%)	0.78 (0.3-2.07)	0.621
Sensory block					
Time for the onset of sensory block (minutes)	3.10 ± 1.21	2.85±1.19	3.36±1.19	-0.51 (-0.85 to -0.18)	0.002
Highest level of block >T6	11(5.5%)	10(10%)	1(1%)	0.09 (0.01-0.72)	0.005
Regression of sensory block to T10 (minutes)	124.45 ± 26.45	130.60±26.37	118.30±25.22	12.30 (5.11 to 19.49)	0.002
Motor block					
Time for the onset of motor block (minutes)	6.72 ± 1.81	6.46±1.67	6.98±1.92	-0.52 (-1.02 to -0.02)	0.064
Regression of motor block to bromage 0 (minutes)	225.50 ± 38.68	231.30 ± 38.58	219.70 ± 38.09	11.60 (0.91 to 22.29)	0.055
Analgesic supplementation	12(6%)	3(3%)	9(9%)	3.2 (0.84-12.18)	0.074

0- Data is presented as mean ± SD or number (% percentage) A P-value of < 0.05 was taken as significant.

Table 3: Complications in both groups

Variables	Total n=200	Group L n=100	Group LH n=100	p value
Bradycardia	3(3%)	3(3%)	0	0.246
Hypotensive episodes	54(27%)	32(32%)	22(3%)	0.111
Nausea	9(4.5%)	5(5%)	4(4%)	1.000
Vomiting	13(6.5%)	10(10%)	3(3%)	0.045
Headache	3(1.5%)	2(2%)	1(1%)	1.000

A p value of < 0.05 was taken as significant.

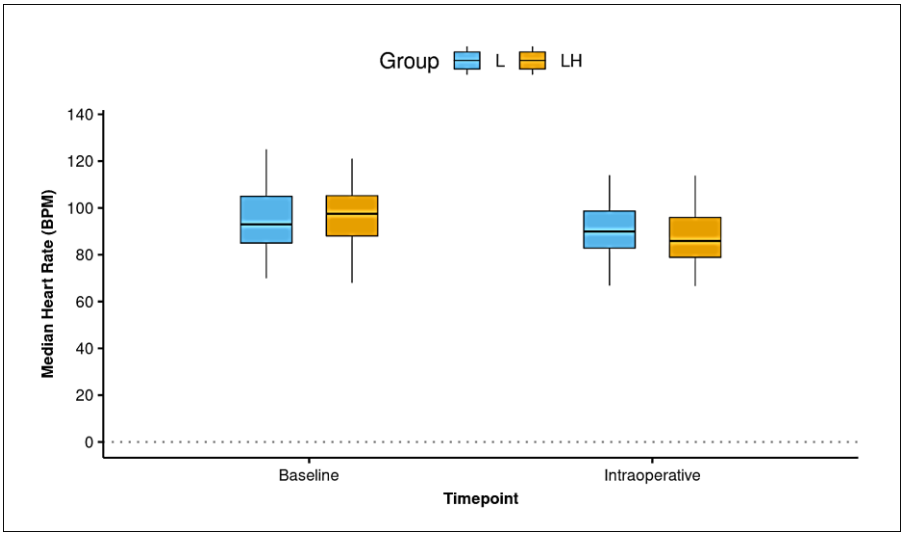

Figure 1: Change in heart rate over time

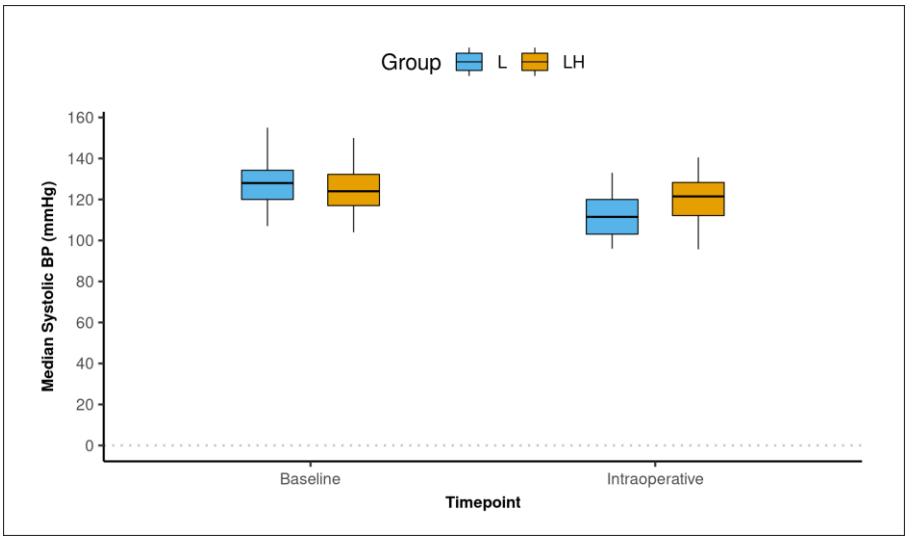

Figure 2: Change in systolic BP over time

Modified Bromage Scale[14]

0- No motor block
1- Inability to raise extended leg; able to move knees ad feet
2- Inability to raise extended leg and knee able to move feet
3- Complete motor block of limb

4. Discussion

The role of regional anaesthesia particularly subarachnoid block for anaesthesia in patients undergoing LSCS is well established. These patients are prone to gastric regurgitation and pulmonary aspiration even when operated on electively, and those coming for emergency surgery are at higher risk, with two lives at stake. The use of regional anaesthesia involves both technical skills and understanding of regional anatomical relationship.[3] Levy General Anaesthesia with its

inherent risks is the only option when there is failure of SAB. Performing subarachnoid block is more difficult in pregnant patients due to exaggerated lumbar lordosis, often the patient is in labour and uncooperative; hence a good position is imperative for the first attempt success of subarachnoid block.

This study was planned to compare lateral decubitus knee-chest position (L) alone with lateral decubitus knee-chest position with a 45-degreehead-uptilt (LH) for the success rate of subarachnoid block in parturients undergoing cesarean section.

We were able to tap CSF in 69% of patients in the first attempt in the LH group as compared to 55% in the lateral decubitus position. Head up position results in increased CSF pressure due to the effect of gravity and widens interspinous space. Radiologic and ultrasound studies have reported wider interspinous spaces,[16] and a lesser skin-to-dura mater distance[17] in the head-up position as compared to the lateral decubitus position. Hip flexion has been reported to facilitate subarachnoid block[18,19] Head up position with table support helps in maintaining hip flexion along with retaining the advantage of upright positioning. Therefore 45-degree head up is expected to improve the first attempt success rate of CSF tapping.

Very few studies have used 45-degreehead-up position for subarachnoid block.[13,20] A first-attempt success rate of 85% was reported for subarachnoid block performed in nonpregnant population, with a 45-degreehead-up tilt in lateral decubitus position as compared to plain lateral decubitus (65%).[13] Significantly higher success rate was reported for subarachnoid block performed under GA with 45-degreehead-up tilt in less than 1-year-oldchildren as well.[20] Results of the present study are also similar, with relatively lower absolute values due to study population consisting of parturient.[1,4,21]

Obtaining head up with table adjustment makes it easier to position the patient with less manpower, and more support for the patient. By using a goniometer, we were able to standardize the extent of head up as compared to other studies using pillows or infuser bags for positioning the patient. The head-up position also gives the advantage of better FRC in pregnant population who already have a lesser reserve. One main concern in obtaining 45- degree head-up position is patient stability although position was made for short period of time, manpower is needed to support the parturient. In future studies can be done with lesser degree of head up. In this study time from skin infiltration to free flow of CSF as well as time to perform spinal block were earlier in head-up position as compared to lateral decubitus position. This may be due to higher CSF pressure in the head-up position and lesser skin dura materdistance.[14,17] However, no significant difference was reported in time from Tuohy needle insertion to spinal injection in lateral, oxford, and sitting positions by others.[12]

The incidence of bloody CSF in this study (8-10%) was similar to other studies.[4,13] There was no significant difference in the incidence of bloody CSF in both groups as reported previously as well.[13]

In this study although, there was no difference in the height of the block achieved in both the groups at 30 minutes both the onset time and time to achieve the highest level of the block were significantly more in the head-up position. Drug spread may be limited in head-up position due to the effect of gravity. In addition to that, posture independent of gravity can influence vertebral venous volume and thus affect the dermatomal spread. Similarly slower onset of sensory block[11,12,22] and lower achieved block height in head-up position[10-12,2211] have been reported earlier.

More number of patients had an unintentional higher level of sensory block in lateral position. Other authors have also reported unintentional higher block in the lateral position.[22,23] Attempts have been made to use head-up position for LSCS to prevent higher block spread and improving hemodynamics. Head elevated ramped position, 10- degree head up and Oxford position which include 3 litre infusor bag under the shoulder and pillows below the head, have been used in various studies.[10-12,22]

No patient required conversion to GA for completion of surgery as observed also in nonobstetric surgery.[13] However several studies with cesarean section report increased need for analgesic supplements for subarachnoid block as well as CSE performed with head elevated positions.[11,12,22,23] The difference may be due to the fact that the level of block required for cesarean section is high and in many studies parturients were kept in head up position for a longer time while in the present study they were made supine after completion of subarachnoid block.

Similarly, the effect of gravity on block height might be the reason for early recovery in LH group in this study. Other authors have found that two segment regression (TSR) and recovery to T10 was comparable in lateral position and head up position both in 10-degreeup and head elevation with pillow.[10,11]

In present study motor block was comparable in both groups. Very few studies have compared motor block. Motor blockade has been reported to be faster in lateral position. Also more number of patients had maximum motor blockade in lateral position compared to oxford position.[22]

Number of patients having hypotension requiring vasopressor treatment were comparable in both groups. This is consistent with other studies in head up position.[10] Studies have reported more hypotension in lateral group as well. Some authors found that hypotension was comparable in both groups however more vasopressor was required in the lateral group. More number of parturients required vasopressor in lateral position in various studies.[10,11,22,23] We observed more

number of parturients requiring vasopressors however it was not statistically significant. Incidence of nausea was comparable in both groups but vomiting was significantly higher in L group. This may be due to more parturients experiencing hypotension in that group. Studies have reported comparable nausea and vomiting in both lateral and head up position.[13,23]

All babies born in both groups were healthy and had good APGAR scores at 5 minutes which is consistent with findings of various other studies, which found good APGAR scores irrespective of the positions used for providing the neuraxial block.[22,23]

The limitation of this study is that patients were not randomized. Blinding was not feasible due to obvious difference in positioning. Spread of block may be variable in different people. Anatomical differences in patients may affect the results. The strengths of study being are prospective nature of study and more objectivity in positioning due to use of goniometer.

To conclude, forty-five-degree head-up tilt in lateral decubitus knee-chest position improves the first-attempt success rate of spinal tap with slower onset of the sensory blockade, faster recovery, fewer chances of inadvertent high block and fewer complications compared to lateral decubitus position. A 45-degree tilt with lateral decubitus position may be helpful in improving success of subarachnoid block in parturients considered difficult spinal taps.

5. Source of Funding

None.

6. Conflict of Interest

None.

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