www.jmscr.igmpublication.org
Index Copernicus Value: 79.54
ISSN (e)-2347-176x ISSN (p) 2455-0450
crossref DOI: https://dx.doi.org/10.18535/jmscr/v7i6.160

IGM Publication
Journal Of Medical Science And Clinical Research
An Official Publication Of IGM Publication

Comparison of the effect of induction position in spinal anaesthesia on sensory block in pregnant women undergoing elective lower segment caesarean section with hyperbaric bupivacaine

Authors
Dr Pallavi Mutreja[1], Dr Vineeta Dwivedi[2], Dr Jayita Sarkar[3]
[1]PG Resident, Dept. of Anaesthesia, JLNHRC, Bhilai, Chhattisgarh
[2]HOD, Dept. of Anaesthesia, JLNHRC, bhilai, Chhattisgarh
[3]Consultant, Dept. of Anaesthesia, JLNHRC, Bhilai, Chhattisgarh

Abstract
Aims and Objective: *The aim of the study was to compare the characteristics of sensory blockade, intraoperative hemodynamic changes and the need for vasopressors when spinal anaesthesia was induced in the left lateral decubitus position and sitting position in Elective Lower Segment Caesarean Section cases in hospital setting.*
Methods: *64 parturient of ASA I /II at full term gestation and presenting for Elective Lower Segment Caesarean Section surgery were enrolled and allocated to either of two groups, Group 1:((Parturient in sitting position during induction of spinal anaesthesia (n=32)) and Group 2(: Parturient in left lateral decubitus position during induction of spinal anaesthesia (n=32)) using computer generated random numbers in this prospective randomised double blind study.2ml of 0.5% hyperbaric bupivacaine was injected into intrathecal space while the patients were in sitting or left lateral decubitus position at L3-L4 level. Sensory block characteristics and hemodynamic parameters were recorded and analysed.*
Result: *Demographic profile were comparable in both groups. No statistical significant differences were observed between the two study groups in sensory block characteristics and haemodynamic parameters during entire observation period during induction of spinal anaesthesia.*
Conclusion: *The study concludes that spinal anaesthesia with 2mL of 0.5% hyperbaric bupivacaine in both sitting position and left lateral decubitus position provides effective anaesthesia for Lower Segment Caesarean Section ensuring good hemodynamic stability and comparable sensory block characteristics.*

Introduction

The delivery of a baby to a conscious and pain free mother is one of the most exciting and rewarding moments in medicine.[1] Quality and choice in anaesthesia for caesarean section have significantly improved over the last two decades. This change in practice may have been responsible for the fall in anaesthetic deaths in pregnant women that had occurred over the same period.[2]

In the recent decades there has been a worldwide shift in obstetric anaesthesia practice in favour of regional anaesthesia.[3,4] Regional anaesthesia is more preferred because of less risk of gastric aspiration, failed intubation and depressant effects of anaesthetics drugs on foetus.[5] The boom in

regional anaesthesia has improved the aesthetics of childbirth by caesarean section, women's peri-operative comfort and post-operative analgesia[2], withspinal anaesthesia being the most popular among regional anaesthesia.[3,4]

However, the greatest challenge of this technique is to control the spread of the local anaesthetic through the cerebrospinal fluid (CSF), to provide a block that is adequate (in both extent and degree) for the proposed caesarean section surgery but without producing unnecessary extensive spread and increasing the risk of complications.[5]

The three most important factors for determining spread of local anaesthetic drug in the subarachnoid space are baricity of the local anaesthetic solution; position of the patient during and just after injection; and dose of the anaesthetic drug injected.[6]

The variations in positioning have direct influence on the effect of anaesthesia, either to potentiate or to delay the onset of blockade and its level, as well as regarding the physiological changes in the mother such as hypotension and nausea.

Hence, the present study was designed to compare the characteristics of sensory blockade, intraoperative hemodynamic changes and the need for vasopressors when spinal anaesthesia was induced in the left lateral decubitus position and sitting position in Elective Lower Segment Caesarean Section cases in hospital setting.

Material and Methods

After approval by the Ethical Committee and written informed consent, sixty four parturient of ASA physical status I /II at full term gestation and presenting for Elective Lower Segment Caesarean Section surgery were enrolled and allocated to either of two groups, Group 1:((Parturient in sitting position during induction of spinal anaesthesia (n=32)) and Group 2(: Parturient in left lateral decubitus position during induction of spinal anaesthesia (n=32)) using computer generated random numbers in this prospective randomised double blind study. To ensure that the procedure was completely blind, one anaesthesiologist performed the spinal procedure and second anaesthesiologist, who remained outside the operating room during induction of spinal anaesthesia was responsible for preoperative and intraoperative data collection. All patients were assessed a day before surgery. After arrival in Operation theatre, Electrocardiography, pulse oximeter and non-invasive blood pressure cuff measurements were attached and the base line heart rate and blood pressure was noted.

Intravascular access with 18G cannulae was established. Each patient was preloaded with 500ml Ringer lactate over 10 minutes. Then, using computer generated random numbers, patient was placed either in sitting position or left lateral decubitus position. In sitting position, the patient was asked to stretch their legs on the operating table with maximum extension of knees, adduction of hips and forward bending with back towards the anaesthesiologist. In left lateral decubitus position, the patient was placed with their back parallel to the edge of the operating table nearest the anaesthesiologist, thigh flexed on abdomen and neck flexed to allow the forehead to be as close as possible to the knees.

After aseptic precaution, the L3-L4 inter-space was identified and Spinal anaesthesia was given using 26 gauge Quincke needle. After ascertaining free clear flow of CSF (cerebrospinal Fluid), 2ml of 0.5% hyperbaric bupivacaine was injected. Patient was positioned supine immediately with 15 degree left lateral tilt to prevent aortocaval compression. Oxygen via mask at rate of 4L/min was given to all the patients.

Sensory Block level was assessed by loss of sensation to spirit swab every thirty seconds till two consecutive levels were constant .This was taken as highest level of sensory block. The time taken to reach highest level of sensory block was also noted.

Heart Rate, Blood pressure and SPO_2 were continuously monitored and recorded every 2minutes for first 10 minutes, followed by 5 minutes for the next 20 minutes and every 10

minutes thereafter till the end of the surgery. Surgery was allowed to commence after sensory block height of T6 dermatome was achieved.

Incidence of hypotension and bradycardia were assessed and analysed. For the study, maternal hypotension was defined as fall of systolic blood pressure more than 20% from the baseline value or systolic blood pressure less than 80 mm Hg and was treated with intravenous fluids and 3mgi.v. ephedrine. Bradycardia was defined as heart rate below 50 beats per minute and was treated with 0.5mg of Atropine.

After the surgery was over, patient was shifted to PACU and monitored for haemodynamic indicators. Regression of spinal anaesthesia was assessed as the appearance of pain at incision site.

The statistical analysis was performed by using SPSS version 22. Statistical test was used to test for possible significant differences in ordinal and continuous variables. Variables with continuous data were coded into category for analysis. Variables were analysed using independent Student t test. Chi-square test was carried to see association between categorical variables. A p-value <0.05 was considered statistically significant.

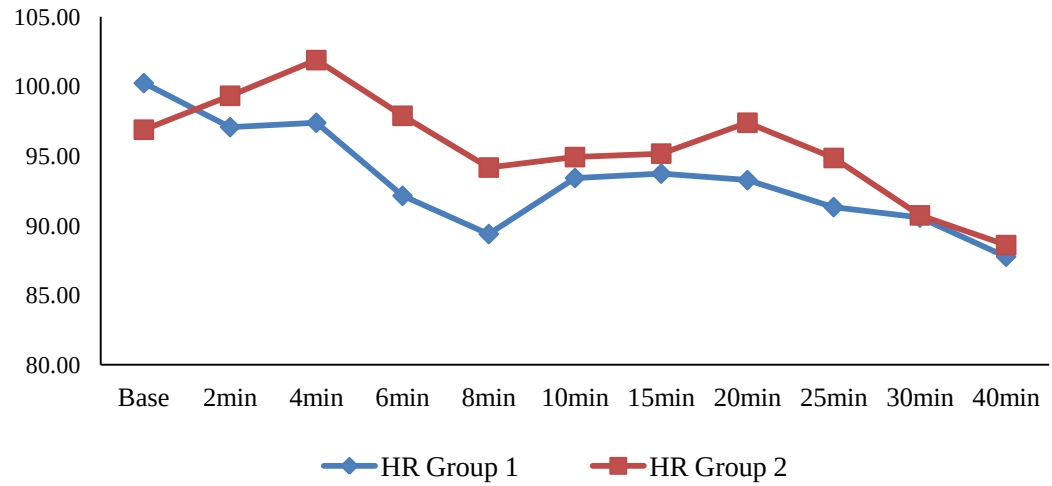
Result

Table 1 presents the demography of the patients participated in the study. No significant difference were observed in terms of mean age, height and weight of the patient between two study groups. . The mean age of patients in Group 1 was 28.90 ± 4.41 years while in Group 2, the mean age was 27.81 ± 3.52 years. The mean height of patient in Group 1 was 159.42 ± 7.46 cm while in group 2 patients the mean height was 159.68 ± 7.46 cm. The mean weight in Group 1 was 66.21± 5.86 kg and mean weight in Group 2 was 67.68 ± 5.94 kg.

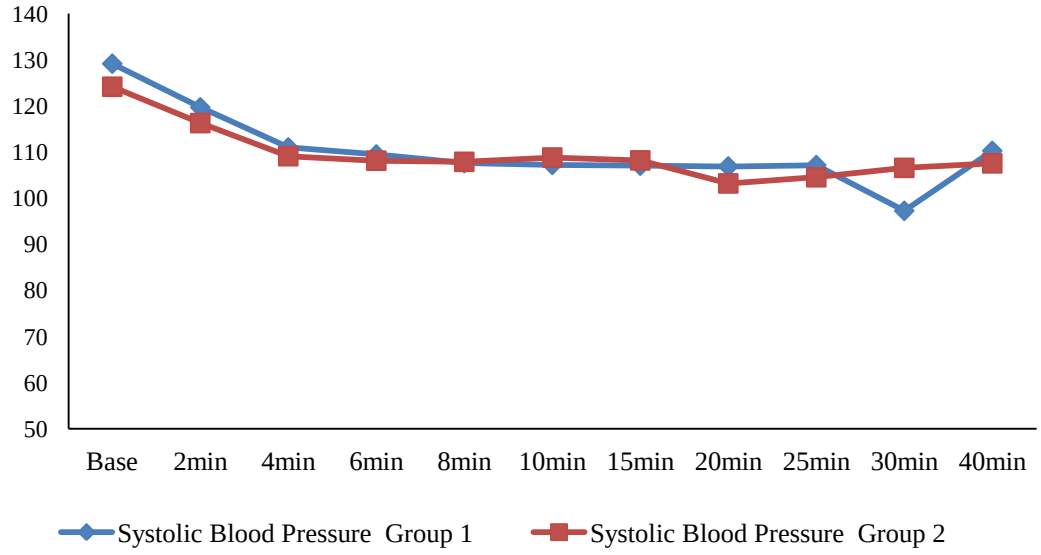
	Age (years)	Height (cm)	Weight (kg)
Group 1	28.90 ± 4.41	159.42 ± 7.46	66.21± 5.86
Group 2	27.81 ± 3.52	159.68 ± 7.46	67.68 ± 5.94
P value	0.278	0.887	0.324

No statistical significant differences were observed between the two study groups in parameters of mean heart rate, systolic and diastolic blood pressure of patients during entire observation period during induction of spinal anaesthesia. This observation signifies that the induction position whether sitting or lateral does not affect the haemodynamic parameters as given in graph 1-3.

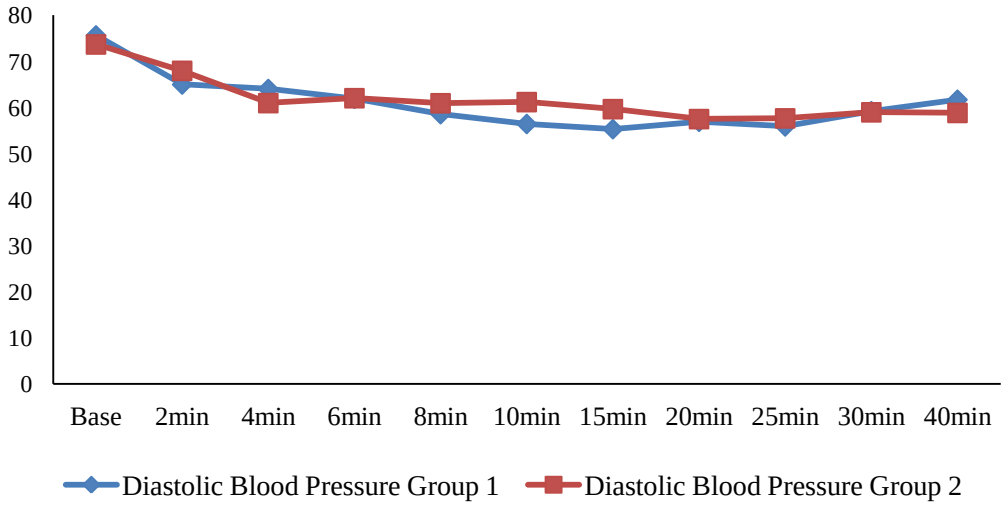
Graph 1: Graphical Representation comparing Mean Heart Rate among Group 1 and Group 2



Graph 2: Graphical Representation comparing Mean Systolic Blood Pressure among Group 1 and Group 2



Graph 3: Graphical Representation comparing Mean Diastolic Blood Pressure among Group 1 and Group 2



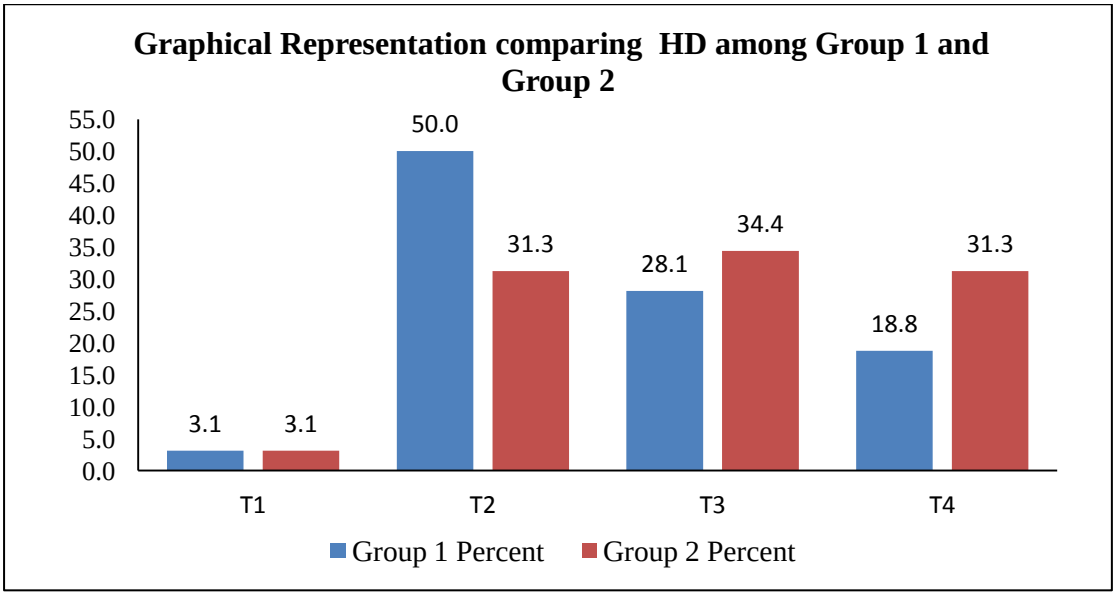
1. Time Taken to Achieve T6 Dermatome

The mean time to reach T6 dermatomal level in Group 1 was 105.00± 52.24 seconds while in Group 2, the mean time was 120.94 ± 51.40 seconds.The mean difference being statistically not significant (p>0.05).

Time taken for sensory block to reach T6 – comparison among Group1 and Group 2					
TIME (in sec)	**Group 1**		**Group 2**		**P value (chi square)**
	Number	**Percent**	**Number**	**Percent**	
60sec	13	40.6	7	21.9	0.306
90sec	2	6.3	4	12.5	
120sec	13	40.6	12	37.5	
150sec	0	0.0	3	9.4	
180sec	3	9.4	5	15.6	
300sec	1	3.1	1	3.1	
Total	**32**	**100.0**	**32**	**100.0**	
Mean±S.D	105.00±52.24		120.94±51.40		0.223

2. Highest Dermatomal Level Achieved

Among Group 1 patients after injecting anesthetic drug, the highest dermatome level was achieved at T1, T2, T3, T4 dermatome level in3.1%, 50%, 28.1% and 18.8% of the patients respectively compared to Group 2 patients, where the highest dermatome level of T1, T2, T3, T4 was achieved in 3.1%, 31.3%, 34.4% and 31.3% of the patientsrespectively.



3. Time Taken to Achieve Highest Dermatomal Level

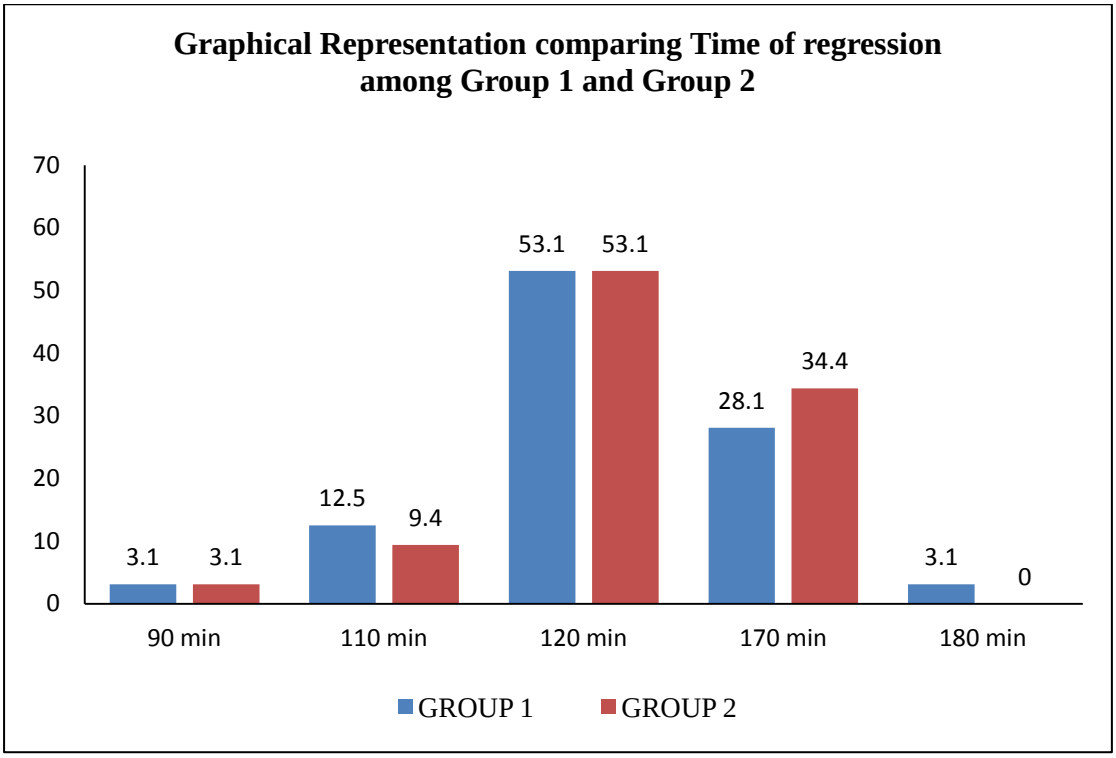
The mean time to reach highest dermatomal level in Group 1 was 253.12 ± 85.85 seconds while in Group 2, the mean time taken was 270.00 ± 96.39 seconds. The mean time being statistically insignificant (p >0.05).

Time taken to achieve Highest Dermatomal Level between Group 1 and Group 2

TIME (in sec)	Group 1		Group 2		p value
	Number	Percent	Number	Percent	
120 sec	0	0.0	4	12.5	0.058
180 sec	15	46.9	5	15.6	
240sec	3	9.4	4	12.5	
300sec	10	31.3	15	46.9	
360sec	2	6.3	1	3.1	
420sec	0	0.0	0	0.0	
480sec	2	6.3	3	9.4	
Total	**32**	**100.0**	**32**	**100.0**	
Mean ± S.D.	253.12±85.85		270.00±96.39		0.462

4. Time of Regression of Sensory Block

The mean time of regression in sitting group (Group 1) was 133.75± 26.24 minutes compared to left lateral decubitus position group(Group 2) was 135.31 ± 26.15 minutes. Although, the mean difference between the two groups was not statistically significant (p>0.05).



1. Intraoperative Atropine Requirement

Intra-operative Atropine requirement was observed among patients of both groups. None of the participants in Group 1 (induction position – sitting position) and Group 2 (induction position: left lateral decubitus position) required Atropine

2. Intraoperative Ephedrine Requirement

It was observed that in Group 1 (sitting position) 53.1% of the patients required ephedrine supplementation while in Group 2 (left lateral decubitus position) 40.6% patients required ephedrine supplementation (Refer Table 13 and Graph 13).

The mean ephedrine requirement in Group 1 (sitting position) was 4.78 ± 5.60 mg and in Group 2 (in left lateral decubitus position) was 2.81 ± 4.50 mg.The mean difference was not statistically significant (p>0.05).

Table 13: Ephedrine use (in mg)

Variable	Group 1		Group 2		P value (chi square)
	Number	Percent	Number	Percent	
3mg	1	3.1	5	15.6	0.339
6mg	8	25.0	4	12.5	
9mg	3	9.4	1	3.1	
12mg	2	6.3	2	6.3	
15mg	1	3.1	0	0.0	
18mg	2	6.3	1	3.1	
Not used	15	46.9	19	59.4	
Total	**32**	**100.0**	**32**	**100.0**	
Mean ± S.D.	4.78±5.60		2.81±4.50		0.126

Table 14: Ephedrine used among Group 1 and Group 2

Variable	Number of patient in Group 1	Number of patient Group 2	Total	P value (chi square)
Ephedrine Not used	15	19	30	1.000
Ephedrine Used	17	13	34	
Total	**32**	**32**	**64**	

Discussion

One of the factors that interferes with the success of spinal anaesthesia is the positioning of the patient, which should allow easy identification of midline structures, contributing to the opening of the intervertebral space, producing minimal hemodynamic compromise and be comfortable for the patient and safe for the baby. Thus, the position used for spinal block placement varies among the anaesthesiologists.

Maternal posture may affect the spread of onset of sensory blockade by influencing the spread of the local anaesthetic drug. Thus, the present clinical comparative research study was performed to assess the effect of induction position during spinal anaesthesia with 0.5% hyperbaric bupivacaine in sixty four pregnant women parturient between the age of 20 – 40 years and weighing 60 – 90 kg scheduled for Elective Lower Segment Caesarean Section.

In the present study, demographic characteristics of both the groups were compared. However, they did not seem to have anyimpact on the overall outcome of the study.

Sensory block characteristics

In this study, the mean time taken to reach T6 dermatomal level after the induction of spinal anaesthesia in Group 1 (sitting position) and Group 2 (left lateral decubitus position) (105.00± 52.24 seconds versus 120.94 ± 51.40 seconds) was comparable (p>0.05).Previous investigators have reported varied results: Rucklidge et al.[7] in their study observed the median onset time for sensory block at T5 dermatome level in lateral, oxford and sitting position. Sikri H et al.[8]it was observed that the time to achieve a sensory level of T6 was significantly less in the sitting group as compared to the lateral group (P<0.001). Our study results was not consistent with it. This may be due to the use of plain 0.75% Ropivacaine as compared to use of hyperbaric bupivacaine in our study

In our study, the highest dermatomal sensory block level achieved was comparable between the two groups (p>0.05).Our study results were consistent with the studies documented by Inglis et al.[9], Simin A et al.[10] In contrast, Sikri H et al.[8] observed that parturients in the sitting group had a higher sensory block as compared to the Lateral group. Tan D et al.[11] observed that the maximum dermatome level of sensory block in the cranial direction was significantly higher in right lateral decubitus position than that in sitting position at all measurement time points (p<0.05).

Regarding the time to reach highest dermatomal level, in our study it was observed that the mean time to reach highest dermatomal level in Group 1 was 253.12 ± 85.85 seconds while in Group 2, the mean time was 270.00 ± 96.39 seconds. The mean time being statistically comparable (p>0.05).Our results were consistent with those of Tan D et al.[11]and Inglis et al.[9]

The Time of Regression of spinal anaesthesia was assessed as the time of appearance of pain at incision site in postoperative period. In our study, the mean time of regression in Group1vs Group2 was 133.75± 26.24 minutes vs 135.31 ± 26.15 minutes, although the difference between the two groups was not statistically significant (p>0.05).Our results were consistent with the study conducted by Rucklidge et al.[7] and Sreekanth R et al.[12] Contrary to our study, Tan D et al.[11] documented that the time to regression of sensory block to T10 and L1 dermatomes was longer in the lateral decubitus positionin comparison to that in the sitting position. As sensory block levels was at higher dermatomes in CSE anaesthesia applied in right lateral decubitus position due to the anatomical changes in pregnancy, this affected the time to regression of anaesthesia and prolonged the time to requirement of first analgesic dose in their study.

Regarding the intraoperative haemodynamics, in our study we observed that the mean of the variables studied - Heart Rate, Systolic Blood Pressure, Diastolic Blood Pressure, Mean Arterial Pressure, SPO_2 were statistically comparable in both the groups at all points of observation. Similar finding were observed by Inglis et al.[9] and Shahzad et al.[13]. Obasuyi et al.[14] and Sikri H et al.[8]

both observed a statistically significant decrease in the MAP and SBP in parturients in thesitting group as compared to the lateral group. This may be due to the use of 0.5% plain bupivacaine and 0.75% plain Ropivacaine respectively, which act as a hypobaric solution in parturients due to variation in CSF density which would explain the greater cephalad spread and higher incidence in hypotension in the sitting group in their study.

With respect to Intraoperative Atropine and Ephedrine Requirement, our study demonstrated that there was no incidence of bradycardia in either groups and the mean heart rate was comparable in both the groups. This may be because of the parturient being young and fit with good compensatory sympathetic activity and in the presence of anxiety due to anticipation of surgery outcome, increased sympathetic discharge might counteract the effect of a high block on the hemodynamics.

In our study, it was found that in sitting position, 53.1% of the patients and in left lateral decubitus position, 40.6% of the patients required ephedrine supplementation but the difference was comparable. The ephedrine requirements were comparable in both sitting and lateral groups as documented by Gómez et al.[15], Arokyamuthu V et al[16], Kharge et al.[17] and Inglis A et al.[9] in their respective studies. Coppejans HC et al.[18] and Simin A et al.[10] evaluated that the females in the sitting group required less ephedrine as compared to lateral group. Our study findings were not consistent with it. This variation from our study may be due to different anaesthetic technique.

Conclusion

The study concludes that spinal anaesthesia with 2mL of 0.5% hyperbaric bupivacaine in both sitting position and left lateral decubitus position provides effective anaesthesia for Lower Segment Caesarean Section ensuring good hemodynamic stability and comparable sensory block characteristics. Therefore, any of the induction position among the two, sitting position and left lateral decubitus position can be selected for spinal anaesthesia along with the consideration of the factors such as anaesthesiologist preference, patient comfort and other comorbid conditions

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