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EFFECT OF PRELOADING, COLOADING, AND NO LOADING IN PREVENTION OF HYPOTENSION FOLLOWING SPINAL ANESTHESIA IN CESAREAN SECTION

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ABSTRACT

Background: Spinal anesthesia is the gold standard for obstetric anesthesia due to its rapid onset and reduced maternal morbidity. However, it can cause hypotension, a common cardiovascular response, affecting 20%-70% of patients. Factors like older age, obesity, and pregnancy can influence SAIH. Techniques to prevent hypotension include lowering anesthesia doses, avoiding high-level block, and slow injection. Proper anesthetic techniques and vigilant monitoring are crucial for fetal well-being.

Aim and Objective: The study aims to evaluate the effectiveness of preloading, coloading, and no loading in preventing hypotension in a cesarean section following spinal anesthesia.

Material and Methods: A prospective, randomized, single-blinded comparative study compared three groups of participants before and after spinal anesthesia. Participants were divided into three groups: Group A, which was preloaded with 1000ml of Ringer Lactate fluid within 15 minutes before spinal anesthesia, Group B, which was co-loaded with Ringer Lactate fluid within 15 minutes, and Group C, which was not preloaded or coloaded with fluids. Participants were shifted to the operating room, and their baseline heart rate, blood pressure, respiratory rate, and oxygen saturation were recorded. Spinal anesthesia was administered using a 25 gauge Quincke's needle, and oxytocin infusion was given at the time of baby delivery. The total requirement of vasopressors was noted, and hypotension was treated with an intravenous bolus dose of Mephentermine 6 mg until the MAP was above 65 mmHg.

Results: The majority of patients were aged 25-30. Heart rate variation did not show a typical pattern between the three groups. Mean systolic blood pressure, diastolic blood pressure, and arterial pressure were significantly higher in Group B compared to Groups A and C. Vasopressor usage was more common in Group C (No-loading) than in Groups B and A (pre-loading), with a significant correlation at 6,8,10,12,14,16,18,20, and 25 minutes. This

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suggests that vasopressor usage correlates more significantly with Group C (No-loading) than Group A (Pre-loading) and Group B (Co-loading). **Conclusion:** The study found that the incidence of Spinal Anesthesia induced hypotension was higher in no loading group (38%) than in preloading group (29%), than in Coloading group (19%). Systolic and diastolic blood pressure significantly decreased in the No-loading group, and mean arterial pressure decreased more commonly in the No-loading group. The need for a vasopressor was also higher in the No-loading group. The study suggests that co-loading is a better strategy for preventing spinal hypotension in Cesarean section patients under spinal anesthesia.
Key words: Preloading, Coloading, No loading, hypotension & Spinal Anesthesia

INTRODUCTION

Spinal anesthesia is the gold standard technique for obstetric anesthesia due to its rapid onset, dense neural block, and reduced maternal morbidity and mortality. It avoids neonatal exposure to depressant anesthetic drugs and allows the mother to remain awake during delivery. However, hypotension is a common cardiovascular response with spinal anesthesia, mainly due to sympathetic blockade [(1)]. The incidence of spinal anaesthesia induced hypotension (SAIH) varies between 20% and 70%, depending on patient demographics, surgery type, and definitions used. The incidence is particularly high in elderly and critically ill patients, necessitating careful monitoring and management. Studies have reported hypotension in 60% of patients undergoing elective cesarean sections under spinal anesthesia, 45% in non-obstetric surgeries under spinal anesthesia, and 55% in South India among elderly patients during various surgical procedures [(2)].

Spinal anaesthesia induced hypotension (SAIH) is influenced by factors such as older age, obesity, co-morbidities like diabetes and hypertension, pregnancy, anesthesia factors like dose, volume, baricity, injection speed, positioning, type and duration of surgery, and intraoperative fluid management[(3)]. Pregnant women undergoing cesarean section surgery with block levels as high as 4th thoracic segment dermatome are at higher risk due to anatomic and physiological changes. Hypotension can cause adverse effects on both the mother and fetus, including symptoms like dizziness, nausea, vomiting, aspiration, syncope, and cardiac arrhythmias. Prolonged maternal hypotension can cause uteroplacental hypoperfusion, resulting in less oxygen and nutrient delivery to the fetus, potentially leading to fetal hypoxia and metabolic acidosis. Infants born to mothers experiencing SAIH may have lower Apgar scores, potentially causing adverse neurological outcomes in the foetus [(4)].

Various techniques and methodologies have been used to prevent spinal anesthesia-induced hypotension (SAIH) during elective caesarean sections. Side factors such as lowering the dose of anesthesia, avoiding high-level block, and slow injection of anesthetic agents can reduce the prevalence of SAIH [(3)]. Techniques to prevent maternal hypotension include intravenous volume expansion using i.v. fluids (preload), left lateral tilt or manual uterine displacement, leg wrapping, elastic stockings, co-loading, and administration of i.v. fluids during spinal anesthesia (co-loading) and vasopressor drugs (Ephedrine bolus 5-15 mg, mephentramine 6mg, or Phenylephrine 25-50 mcg). Proper anesthetic techniques and vigilant monitoring are crucial for ensuring maternal and fetal well-being [(5)]. Training healthcare providers to recognize and manage SAIH promptly can improve outcomes. Understanding physiological changes during pregnancy and the specific needs of pregnant women undergoing cesarean sections is crucial.

Aim and Objectives

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AIM

To assess the Effect of Preloading, Coloading, and No loading in Prevention of Hypotension Following Spinal Anesthesia in Cesarean Section.

OBJECTIVES

- To assess if the volume preloading or volume coloading or Noloading is more beneficial in preventing the adverse hemodynamic changes in caesarean section under spinal anesthesia.
- To assess the requirement of vasopressor

MATERIAL AND METHODS

Prospective, Randomized, single blinded comparative study was conducted in Department. of Anesthesia, Santosh Medical college hospital Ghaziabad. Around 93 patients, who satisfied the inclusion criteria will be included in the study. At the end of the study the patients will be classified as Group A, Group B and Group C.

- Group A- Parturient is Preloaded with 1000ml of RL which is spent within 15 min before spinal anesthesia (N = 31)
- Group B - Parturient is Co-loaded with 1000 ml of Ringer lactate fluid which was spent within 15 min together with spinal anesthesia (coloading) (N = 31)
- Group C - Participants who were not given preloading or coloading fluids (N=31)

Sample Size: Open epi version 3.0 was used to calculate sample size. Totally 93 Sample Size was calculated using sample size for comparing two means. According to Artawan*et al.*[7], mean and standard deviation of preloading, coloading and control groups were 105.2 ± 6.2, 109.7 ± 6.3 and 104 ± 6.9 respectively. Ratio of sample size (Group 2/Group 1/group 3) was 1, Confidence Interval (2-sided) 95% and Power 80% was taken into consideration.

Inclusion Criteria

- Gravida with term gestation
- Singleton pregnancy
- ASA physical status 2
- Uncomplicated pregnancy
- Undergoing elective LSCS under spinal anesthesia
- Normal fetal heart rate
- Age group 18 -30 years

Exclusion Criteria

- Patient refusal to the study.
- Multiple gestation
- Preterm gestation
- Chronic hypertension or PIH,
- Fetal distress, APH, eclampsia,
- Cardiovascular disease, anemia
- ASA physical status 3 & above
- Contraindications to neuraxial analgesia

Methodology

Pre-Operative Assessment: Patient history, general and systemic examination & routine investigations were carried out. Informed consent was obtained. After overnight fasting, all the parturients were pre-medicated in the ward with Inj. Ranitidine 50 mg i.v 45 min prior to shifting to the operation theatre complex. Intravenous access was secured with an 18 gauge cannula in hand. Parturients were randomised by a computer program generated

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numbers into 3 study groups. Group A - Participants is Preloaded with 1000ml of RL which is spent within 15 min before spinal anesthesia (N = 31), Group B – Participants is Co-loaded with 1000 ml of Ringer lactate fluid which was spent within 15 min together with spinal anesthesia (coloading) N = 31) and Group C - Participants who were not given preloading or coloading fluids, but were given maintenance IV fluid as per Holliday – Segar formula.

PROCEDURE

Participants in Group A were preloaded with 1000ml of RL which is spent within 15 min before spinal anesthesia. Participants was shifted to operating room and placed in supine position with slight left lateral tilt on the operating cot. Patients' baseline heart rate, blood pressure, respiratory rate and oxygen saturation (SpO2) were recorded preoperatively using multi parameter monitor. Under strict aseptic precautions, spinal anaesthesia was administered using a 25 gauge Quincke's needle injecting 2.0 ml of 0.5% hyperbaric bupivacaine in the subarachnoid space at L3-L4 intervertebral space. Parturient was then immediately placed supine with slight Left lateral tilt. Fluid administration for the Group B were given 1000ml of the crystalloid - Ringers Lactate over 15 minutes immediately following the spinal anaesthesia. The level of block was assessed 5 min after the block was given by bilateral pin prick method along Midclavicular line using 26 G hypodermic needle. Skin incision time noted, baby delivery time were noted. At the time of baby delivery 20 units of oxytocin infusion was given through a separate iv line. Vasopressor InjMephentramine 6mg i.v given if MAP is less than 65mmHg. At the end of procedure, parturient was shifted to recovery room. Patient's heart rate, respiratory rate, Systolic Blood Pressure, Dystolic Blood Pressure, Mean arterial PressureAP, SpO2 were monitored by a blinded investigator every 2min for the first 20 min and every 5 min till 30 min and every 10 min till the end of one hour, from the start of spinal anaesthesia. ECG and SpO2 were monitored continuously. The total requirement of vasopressors was noted. Hypotension was defined as MAP < 65 mmHg recording. Hypotension was treated by I/V bolus dose of Mephentermine 6 mg until the MAP > 65 mmHg.

Statistical Analysis

Descriptive and comparative analysis will be performed with the IBM SPSS Statistics version 16 (IBM, Armonk, NY, USA) software. Quantitative variables will be described using mean (±standard deviation (SD)) and median [interquartile range (IQR)], and qualitative variables as number (%). Univariate comparisons between cases and controls will be done using Student's t-tests or Mann–Whitney tests, as appropriate, for quantitative variables and Pearson's $\chi 2$ tests or Fisher's exact tests, as appropriate, for qualitative variables. A value of $p < 0.05$ will be considered as significant.

Ethical consideration:

Ethical principles such as respect to the patient, beneficence and justice were strictly adhered. The approval to conduct the present study was obtained from the "Institutional Ethics Committee "(IEC). Informed written consent was obtained from all the study participants before administering questionnaire, after explaining the risks and benefits in a language comfortable to them. All the intervention was done under the supervision of a trained and experienced guide. Confidentiality of the study participants was maintained throughout the study.

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RESULTS

Table 1: Age distribution namong study group

AgeGroup	GroupA		GroupB		GroupC	
	Noofcases (N)	Percentage (%)	Noofcases (N)	Percentage (%)	Noofcases (N)	Percentage (%)
20-25	3	9.68%	5	16.13%	6	19.35%
25-30	24	77.42%	22	70.97%	21	67.74%
>30	4	12.90%	4	12.90%	4	12.90%
Grand Total	**31**	**100.00%**	**31**	**100.00%**	**31**	**100.00%**

Majority of our patients belong to 25 -30 years of age category in all of our groups, hence matched for age distribution.

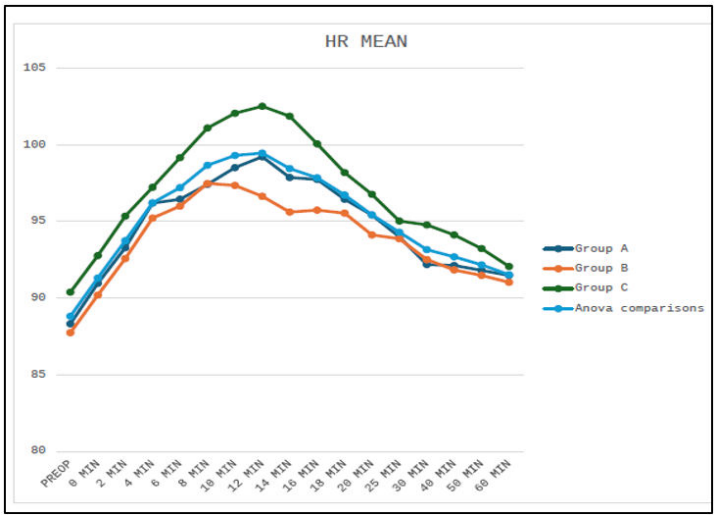

Figure 1: Line diagram shows distribution of heart rate among our study groups

Figure 1 shows the mean pre-operative heart rate among group A was 88.32 ± 5.47, Group B was 87.75 ± 5.81 and group C was 90.39 ± 4.27. There is no significance difference of mean pre-operative heart observed between three groups with the p value shows 0.1174. The mean 60 mins heart rate among group A was 91.48 ± 5.70, Group B was 91.03 ± 5.82 and group C was 92.06 ± 6.74. There is no significance difference of mean pre-operative heart observed between three groups with the p value shows 0.801. Heart rate variation does not show any typical pattern between these three groups in various time line and there is no statistical correlation.

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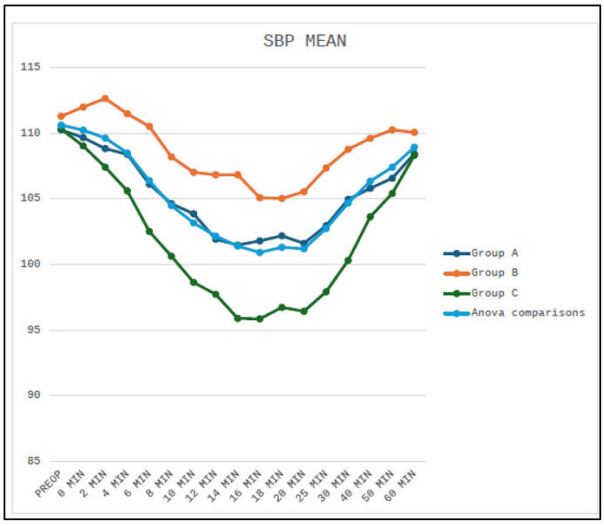

Figure 2: Line diagram shows distribution of systolic blood pressure among our study groups

The mean pre-operative systolic blood pressure among group A was 110.26 ± 5.26, Group B was 111.29 ± 4.82 and group C was 110.32 ± 5.64. There is no significance difference of mean pre-operative systolic blood pressure observed between three groups with the p value shows 0.688. The mean 60 minutes systolic blood pressure among group A was 108.15 ± 5.53, Group B was 110.06 ± 5.07 and group C was 108.32 ± 5.59. There is no significance difference of mean pre-operative systolic blood pressure observed between three groups with the p value shows 0.688. The mean systolic blood pressure on 2 minutes, 4 minutes, 6 minutes, 8 minutes, 10 minutes, 12 minutes, 14 minutes, 16 minutes, 20 minutes, 25 minutes, 30 minutes, 40 minutes and 50 minutes was significantly higher in Group B when compared to Group A and Group C with the p value shows less than 0.05.

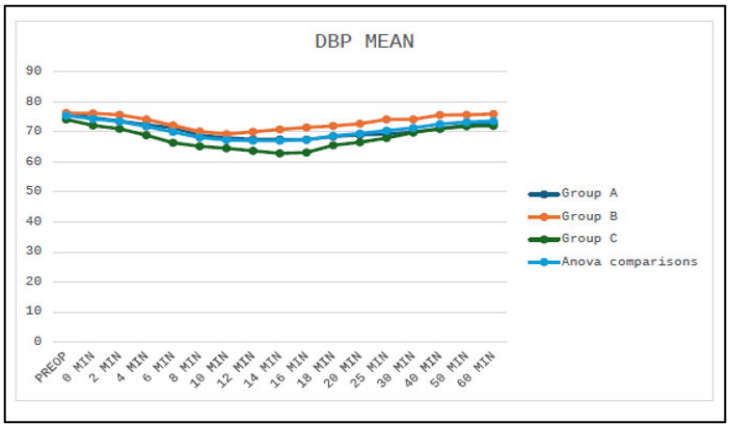

Figure 3: Line diagram shows distribution of Diastolic blood pressure among our study groups

Figure 3 shows The mean pre-operative diastolic blood pressure among group A was 75.93 ± 4.27 mm hg, Group B was 76.19 ± 3.91 mm hg and group C was 74.06 ± 4.77 mm hg. There is no significance difference of mean pre-operative diastolic blood pressure observed between three groups with the p value shows 0.114. The mean 60 minutes diastolic blood pressure among group A was 72.84 ± 4.61 mm hg, Group B was 75.61 ± 3.65 mm hg and group C was

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71.90 ± 5.38 mm hg. The mean diastolic blood pressure was significantly higher among group B when compared to group A and Group C with the p value shows 0.003. The mean diastolic blood pressure on 0 minutes, 2 minutes, 4 minutes, 6 minutes, 14 minutes, 16 minutes, 20 minutes, 25 minutes, 30 minutes, 40 minutes, 50 minutes and 60 minutes was significantly higher in Group B when compared to Group A and Group C with the p value shows less than 0.05.

Table 2: Distribution of Mean Arterial Pressure among the Study Groups

MAP	GroupA		GroupB		GroupC		Anova comparisons		p value
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
PREOP	87.38	3.79	87.89	3.79	86.15	4.46	87.14	4.05	0.222
0MIN	86.32	4.17	88.09	4.29	84.39	4.61	86.27	4.57	0.005
2MIN	85.31	3.98	87.96	5.11	83.10	5.97	85.46	5.41	0.001
4MIN	84.34	4.96	86.54	6.43	81.10	8.42	83.99	7.04	0.008
6MIN	82.90	6.44	84.88	7.26	78.39	10.28	82.06	8.52	0.008
8MIN	80.77	8.21	82.77	8.18	76.99	12.08	80.18	9.86	0.062
10MIN	79.96	9.27	81.76	9.28	75.87	13.25	79.20	10.93	0.093
12MIN	78.92	10.61	82.24	9.46	74.99	14.20	78.72	11.85	0.053
14MIN	78.77	11.91	82.75	9.61	73.82	13.83	78.45	12.34	0.533
16MIN	78.84	11.96	82.65	9.15	74.00	14.05	78.50	12.29	0.020
18MIN	79.66	12.26	82.97	7.84	75.88	13.92	79.50	11.86	0.061
20MIN	79.85	11.51	83.61	6.57	76.47	12.60	79.98	10.85	0.033
25MIN	80.43	10.08	85.16	5.43	77.89	10.82	81.16	9.49	0.008
30MIN	81.57	9.21	85.63	4.52	79.94	8.27	82.38	7.90	0.012
40MIN	82.58	7.00	86.90	3.91	81.90	6.38	83.80	6.26	0.002
50MIN	83.66	5.25	87.16	3.50	83.01	5.28	84.61	5.05	0.002
60MIN	84.71	3.63	87.27	3.25	84.04	4.70	85.34	4.11	0.004

The mean pre-operative Mean arterial pressure among group A was 87.38 ± 3.79 mm hg, Group B was 87.89 ± 3.79 mm hg and group C was 86.15 ± 4.46 mm hg. There is no significance difference of mean pre-operative diastolic blood pressure observed between three groups with the p value shows 0.114. The mean 60 minutes Mean arterial pressure among group A was 84.71 ± 4.61 mm hg, Group B was 87.27 ± 3.25 mm hg and group C was 84.04 ± 4.70 mm hg. The mean arterial pressure was significantly higher among group B when compared to group A and Group C with the p value shows 0.003. The mean arterial pressure on 0 minutes, 2 minutes, 4 minutes, 6 minutes, 16 minutes, 20 minutes, 25 minutes,

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30 minutes, 40 minutes, 50 minutes and 60 minutes was significantly higher in Group B when compared to Group A and Group C with the p value shows less than 0.05.

Table 3: Distribution of vasopressor usage among the study groups

VASOPRESSORS(IFANY)		GroupA		GroupB		GroupC		pvalue
		N	%	N	%	N	%	
PREOP	Vasopressor Used	0	0.0%	0	0.0%	0	0.0%	-
	Vasopressor Not used	31	100.0%	31	100.0%	31	100.0%	
0 MIN	Vasopressor Used	0	0.0%	0	0.0%	0	0.0%	-
	Vasopressor Not used	31	100.0%	31	100.0%	31	100.0%	
2 MIN	Vasopressor Used	0	0.0%	0	0.0%	0	0.0%	-
	Vasopressor Not used	31	100.0%	31	100.0%	31	100.0%	
4 MIN	Vasopressor Used	0	0.0%	0	0.0%	0	0.0%	-
	Vasopressor Not used	31	100.0%	31	100.0%	31	100.0%	
6 MIN	Vasopressor Used	0	0.0%	0	0.0%	5	16.1%	**0.005**
	Vasopressor Not used	31	100.0%	31	100.0%	26	83.9%	
8 MIN	Vasopressor Used	0	0.0%	2	6.4%	8	25.8%	**0.003**
	Vasopressor Not used	31	100.0%	29	93.5%	23	74.2%	
10 MIN	Vasopressor Used	3	9.7%	4	12.9%	12	38.7%	**0.008**
	Vasopressor Not used	28	90.3%	27	87.1%	19	61.3%	
12 MIN	Vasopressor Used	7	22.6%	3	9.7%	12	38.7%	**0.026**
	Vasopressor Not used	24	77.4%	28	90.3%	19	61.3%	
14 MIN	Vasopressor Used	7	22.6%	4	12.9%	12	38.7%	**0.058**
	Vasopressor Not used	24	77.4%	27	87.1%	19	61.3%	
16 MIN	Vasopressor Used	7	22.6%	4	12.9%	12	38.7%	**0.058**
	Vasopressor Not used	24	77.4%	27	87.1%	19	61.3%	

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18 MIN	**Vasopressor Used**	8	25.8%	2	6.4%	11	35.5%	**0.021**
	Vasopressor Not used	23	74.2%	29	93.5%	20	64.5%	
20 MIN	**Vasopressor Used**	6	19.3%	0	0.0%	10	32.3%	**0.003**
	Vasopressor Not used	25	80.6%	31	100.0%	21	67.7%	
25 MIN	**Vasopressor Used**	5	16.1%	0	0.0%	5	16.1%	**0.061**
	Vasopressor Not used	26	83.9%	31	100.0%	26	83.9%	
30 MIN	**Vasopressor Used**	2	6.4%	0	0.0%	0	0.0%	**0.129**
	Vasopressor Not used	29	93.5%	31	100.0%	31	100.0%	
40 MIN	**Vasopressor Used**	0	0.0%	0	0.0%	0	0.0%	**-**
	Vasopressor Not used	31	100.0%	31	100.0%	31	100.0%	
50 MIN	**Vasopressor Used**	0	0.0%	0	0.0%	0	0.0%	**-**
	Vasopressor Not used	31	100.0%	31	100.0%	31	100.0%	
60 MIN	**Vasopressor Used**	0	0.0%	0	0.0%	0	0.0%	**-**
	Vasopressor Not used	31	100.0%	31	100.0%	31	100.0%	

P value based on Chi Square test

Vasopressors was more commonly used in Group C (No-loading group) when compared toGroupB (Co-loadinggroup)&A(pre-loadinggroup). Vasopressorus age wasmoreinGroupA(Pre-loadinggroup)whencomparedtoGroupB (co-loadinggroup). Hence vasopressor usage correlate more significantly with Group C (No-loading) than GroupA(Pre-loading) whichin turnisgreaterthanGroupB(Co-loadinggroup).Andthisstatisticalcorrelationis significantat 6,8,10,12,14,16,18,20 &25 minuteswith p value<0.05.

DISCUSSION

The present study is a prospective study which recruited 93 patients who were posted for Cesarean section after getting their written informed consent. Our patients were age matched and grouped randomly into three groups such as Group A, B and C (each group having 31 patients). Group A patients were preloaded with Ringer Lactate before cesareansection/spinal anesthesia and Group B patients received co-loading of Ringer Lactate during spinal anesthesia. Group C did not receive any infusion prior to or during spinal anesthesia. All patients were monitored prior and during spinal anesthesia for Heart rate, systolic Blood pressure, diastolic blood pressure, Mean blood pressure at 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 25, 30, 40, 50, 60 minutes after initiation of spinal anesthesia procedure.

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Incidence of hypotension in terms of Systolic, diastolic BP, MAP was compared between these three groups as primary objective. Also, need for vasopressor usage was compared between these three groups as secondary objective.

Out of 93 patients recruited, 31 patients were grouped in each groups. Age was matched between these groups and most common age group in our study population was 25-30 years of age which is similar in all 3 groups. Out of 31 patients in each group, 9 patients in group A, 6 patients in group B and 12 patients in group C developed spinal hypotension respectively. Hence,theincidenceofSpinalhypotensionwasclearlymoreinGroupC(No-loadinggroup),when compared to Pre-loading group(group A), which in turn is greater than incidence inGroupB(Co-loadinggroup).Ourstudyresultswereincontrasttostudybyrohit*et al.*inwhichincidence was higher in co-loading group (25%) when compared to pre-loading group (10%).However, our study finding correlates with study by Dyer *et al.*[8] in which post spinalhypotension incidence was 60% in preloading group which is greater than 36% in co-loadinggroup.

The study comparedheartrate,systolicpressure,diastolicbloodpressure,meanarterialpressure,andneedforvasopressors between thesethreegroups. Heart rate does not show any specific pattern of variation between these three groups. Andthereisnosignificantcorrelationbetweenhigher/lowerheartratewithanyofthethreegroups. SystolichypotensionwastypicallymorecommonlyseeninGroupC(No-loadinggroup)thanin Group A (preloading group), which in turn is greater than in group B (co-loading group).And ourfindingis statisticallysignificant (<0.05). DiastolichypotensionwastypicallymorecommonlyseeninGroupC(No-loadinggroup)thanin Group A (preloading group), which in turn is greater than in group B (co-loading group).And ourfindingis statisticallysignificant (<0.05). Spinal hypotension (MAP < 60 mmHg) was typically more commonly seen in Group C (No-loading group) than in Group A (preloading group), which in turn is greater than in group B (co-loadinggroup).And our findingis statisticallysignificant (<0.05). Need for vasopressor was more commonly seen in Group C (No-loading group) when compared to Group A (Pre-loading group), which in tur is greater than Group B (co-loading group). And this association is statistically significant (p value <0.05). Hence, our study proves that co-loading was very much effective than pre-loading and No-loadinginpreventionofspinalhypotensionandalsoeffectivelyreducestheneedforvasopressorin patients undergoingsurgeryunderspinal anaesthesia. Theinvestigationfoundnosignificantdifferenceinneonataloutcomesormaternalhemodynamics between the two groups, suggesting that mephentermine could be as safe andeffectiveasephedrineinmanaginghypotensionduringsuchprocedures(Kansal*et al.*,2004)[9]. However, this conclusion should be interpreted with caution due to limitations insamplesizeand studydesign.

In comparison to previous studies, our findings align with some prior research suggestingcomparable efficacy between ephedrine and mephentermine in managing hypotension duringspinal anesthesia for Caesarean sections (Meydanli*et al.*, 2001; Thomas *et al.*, 2010) [10, 11].Thesestudiesalsoreportednosignificantdifferencesinneonataloutcomesormaternalhemodynamics between the two vasopressors. However, conflicting evidence exists in otherstudies, with some reporting superior efficacy of ephedrine over mephentermine (Lee *et al.*,2015;Loughrey*et al.*,2018)[12, 13]. Onenotabledifferenceinourstudyistheuseofarandomizedtrialdesign,whichaddsstrengthto the

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findings by reducing bias and confounding variables. Additionally, our study providesdetailedcomparativestatisticsonheartrate,systolicanddiastolicbloodpressure,meanarterialpressure, and vasopressor usage, enhancing the understanding of the hemodynamic effects ofdifferentvasopressors duringCaesarean sections. However, our study also has limitations. The sample size may not have been sufficient to detect small differences in outcomes between the two groups. Furthermore, the study only included patients undergoing elective Caesarean sections, limiting the generalizability of the findings to other clinical scenarios. Future research with larger sample sizes and inclusion of diverse patient populations is warranted to further elucidate the comparative effectiveness of ephedrine and mephentermine in managing hypotension during Caesarean sections.

CONCLUSION

Our prospective study compares the incidence of spinal hypotension and need for vasopressor between preloading, co-loading and No-loading group. Our study concludes that Incidence of spinal hypotension was more in No-loading group (38 %) when compared to Pre-loading group (29%) which in turn is greater than incidence of spinal hypotension in Co-loading group (19%). Heart rate variability does not exist to corelate with pre-loading, co-loading and No- loading group. Systolic Blood pressure varies significantly to develop spinal hypotension from 2-50 minutes (48 minutes duration in total) in No-loading group , being less prevalent in Pre-loading group and least prevalent in Co-loading group with p value <0.05. Diastolic Blood pressure also decreases significantly in No-loading group from 0-60 minutes (52 minutes in total) , less commonly seen in Pre-loading group, and least common in Co-loading group with significant p value (<0.05). Mean arterial pressure (<60 mmHg) decreases to develop spinal hypotension more commonly in No-loading group than pre-loading and co-loading group from 0- 60 minutes (48 minutes in total) with statistical significance (p value <0.05). Need for vasopressor was more in No-loading group when compared to Pre-loading and Co-loading group with statistical significance (p value <0.05) from 6 -25 minutes (19 minutes). Hence our study serves as a model in which co-loading proves to be a better strategy than pre- loading and No-loading in prevention of spinal hypotension in patients undergoing Cesarean section under spinal anaesthesia.

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