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Comparision Of Crystalloid - Ringer Lactate Versus Plasmalyte During Co-Loading on Spinal Anaesthesia Induced Hypotension in Lower Abdominal Surgeries"

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ABSTRACT:
Aim *:*
Spinal anaesthesia is frequently used for lower abdominal surgeries because of its rapid onset , a dense neural block , little risk of local anaesthetic toxicity as well as little risk of failure.However, one of the disadvantages of this technique is a higher incidence of hypotension due to sympathetic blockade. Intravenous administration of fluids and vigilant monitoring of blood pressure at frequent intervals are the measures to decrease risk of hypotension to varying degrees.This study is undertaken to compare the efficacy of crystalloid Ringer lactate versus Plasmalyte co loading on prevention of spinal induced hypotension in Lower Abdominal surgeries.
METHODS*: This Prospective Comparitive Randomised Controlled Study was conducted at Sapthagiri Institute of Medical Sciences and Research Centre, Bengaluru, Karnataka for the period of 6 months. The sample size in each group sample size calculated was 37. Patients were randomised into one of two groups - P group and R group. R group received rapid infusion of 15 ml/kg of Ringer Lactate solution and P group received rapid infusion of 15 ml/kg of Plasmalyte just after intrathecal administration of local anaesthetic solution for spinal anaesthesia. Baseline vitals and hemodynamic parameters at regular intervals after spinal anaesthesia were noted. Hypotension as primary outcome was defined as a decrease of systolic blood pressure by 20% or more from the baseline value and was treated with IV Ephedrine in increments of 6 mg.*
Results*: The mean age in group P and Group R were 47.62 and 45.29 years respectively and there was male predominance in both the groups. In both the groups, SBP, DBP and MAP showed statistically significant result in 1,3,5,10,20,30,60 and 90 minutes respectively. In both the groups, Heart rate showed statistically significant result in 1,3,5,10,20,30,60 and 90 minutes respectively. There was more hypotension and administration of Ephedrine 6mg was more in group R when compared to group P.*
CONCLUSION*: It was shown that Co-loading with Plasmalyte at 15 ml/kg just after intrathecal administration of local anaesthetic solution for spinal anaesthesia lowers the incidence of hypotension and provides more hemodynamic stability when compared to Co loading with Ringer Lactate after spinal anaesthesia.*
KEYWORDS: *Co-Loading, Plasmalyte, Ringer Lactate, Hypotension, Hemodynamic parameters*

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I. Introduction

Spinal anaesthesia is frequently used for lower abdominal surgeries because of its rapid onset, a deep sensory and motor block ,low risk of local anaesthetic toxicity, reliability as well as low risk of failure of block.Despite the benefits of SAB, one of the disadvantages of this technique is a higher incidence of hypotension due to sympathetic blockade leading to peripheral vasodilation and venous pooling of blood, which may increase the risk of cardiovascular complications like ischemia and heart failure.Different methods have been tried to prevent and treat hypotension.Some studies suggest that Co loading with crystalloids immediately after injection of local anaesthetic coincides with the onset of spinal nerve blockade when hypotension mostly occurs.Ringer lactate is the commonly used crystalloid for co-loading. Ringer s lactate contains 131 mEq/L sodium ions, 111 mEq/L chloride ions , potassium content is 5 mEq/L , calcium content is 2 mEq/L , and lactate content of 28 mEq/L . pH of Ringer s lactate is 6.5 and osmolarity is 278 mOsm/L.Plasmalyte-A contains 140 mEq/L sodium ions, 98 mEq/L chloride ions, potassium content content is 5 mEq/L , magnesium content is 3mEq/L , acetate content of 27 mEq/L , and glauconate content of 23 mEq/L. The pH of plasmalyte -A is 7.4

and osmolarity is 294 mOsm/L which is same as plasma osmolarity.The aim of the study prevent of spinal induced hypotension in lower abdominal surgeries

II. MATERIALS AND METHOD

SOURCE OF DATA: Patients scheduled for Spinal Anaesthesia in Sapthagiri institute of medical sciences and research centre.
STUDY DESIGN: Prospective comparative Randomised Controlled Study
PLACE OF STUDY: Sapthagiri institute of medical sciences and research centre, Bengaluru, Karnataka.
INCLUSION CRITERIA
ASA 1 and 2 patients undergoing lower abdominal surgerie
EXCLUSION CRITERIA
Contraindications of spinal anaesthesia
Coagulopathy diseases
Hematocrit <30 %

III. METHODOLOGY:

ETHICAL CONSIDERATIONS : Ethical approval from Ethical committee of our Institute and Informed consent taken from all participants
RANDOMISATION:
GROUP P: received rapid infusion of 15 ml/kg of Plasmalyte
GROUP R : received rapid infusion of 15 ml/kg of Ringer lactate
PREPARATION
-Venous access with 18 gauge intravenous catheter -Standard monitoring including electrocardiogram, noninvasive blood pressure and pulse oximetry applied and Baseline vitals were noted.SPINAL ANAESTHESIA -conducted in the sitting position-skin infiltration done with lidocaine - 25 gauge spinal needle inserted at L3-L4 interspace. Confirmed with appearance of clear csf-0.5% 3mL(15 mg) hyperbaric bupivacaine injected accordingly..-Study drug was administered immediately after intrathecal administration of spinal drug.
POSITIONING
-Immediately patient placed in supine position -extent of sensory block checked with pinprick at 3 minutes interval after intrathecal injection until level stabilised.

MONITORING
Blood Pressure,heart rate and SpO2% were recorded at regular intervals.Hypotension as primary outcome was defined as a decrease of systolic blood pressure by 20% or more from the baseline value and was treated with IV Ephedrine in increments of 6 mg. The lowest blood pressure was checked was recorded .Bradycardia as secondary outcome was defined as a decrease of Heart ratepressure by 20% or more from the baseline value and was treated with IV Atropine 0.6 mg.

IV. Results

There was no significant differences observed in the demographic parameters such as age, BMI, ASA grade and Maximal block level between the two groups.Significant differences in mean systolic pressures were noted at 5 and 20 minutes (P=0.04 and P = 0.03), mean diastolic pressures at 3,10 and 30 minutes (P=0.006, P=0.006 and P=0.001) and mean arterial pressure at different times studied at 3,5, 20 and 30 minutes (P<0.01, P=0.01, P=0.001 and P= 0.006) respectively and patients in group R had these parameters low. On comparison between the two groups, significant difference was observed in mean heart rate at 10 min (P=0.03) and the patients in group R had lower heart rate.The readings of SpO2% were almost similar to each other in both the groups and was not statistically significant.30 % patients in group R compared to 6% in group P required Ephedrine for the treatment of hypotension and found significant. (p value= 0.004)

Comparison of mean Systolic Blood Pressure (mmHg) between 2 groups at different time intervals using Independent Student t Test						
Time	Group	N	Mean	SD	Mean Diff	p-value
Baseline	Group P	37	126.31	7.04	-0.67	0.78
	Group R	38	126.97	12.68		
T0	Group P	37	129.73	12.46	1.19	0.53
	Group R	38	128.54	11.05		
T1	Group P	37	120.05	9.99	1.74	0.48
	Group R	38	118.32	11.35		
T3	Group P	37	111.78	9.05	1.55	0.50
	Group R	38	110.24	10.44		
T5	Group P	37	111.11	9.24	5.00	0.04*
	Group R	38	106.11	12.24		
T10	Group P	37	111.78	8.47	2.55	0.32
	Group R	38	109.24	13.02		
T20	Group P	37	115.70	7.49	4.81	0.03*
	Group R	38	110.90	11.21		
T30	Group P	37	119.30	8.35	1.88	0.41
	Group R	38	117.42	11.02		
T60	Group P	29	121.69	8.09	-0.26	0.91
	Group R	38	121.95	10.04		
T90	Group P	9	122.89	9.55	5.91	0.06
	Group R	38	116.97	7.69		

Significant difference in mean systolic pressure were noted at 5 and 20 minutes (P =0.04 and P =0.03)

Comparison of mean Diastolic Blood Pressure (mmHg) between 2 groups at different time intervals using Independent Student t Test						
Time	Group	N	Mean	SD	Mean Diff	p-value
Baseline	Group P	37	82.81	8.35	2.68	0.16
	Group R	38	80.13	8.08		
T0	Group P	37	81.60	6.73	2.05	0.31
	Group R	38	79.55	8.54		
T1	Group P	37	76.43	5.92	3.04	0.07
	Group R	38	73.40	8.12		
T3	Group P	37	71.68	6.20	4.83	0.006*
	Group R	38	66.84	8.33		
T5	Group P	37	70.35	6.18	0.19	0.94
	Group R	38	70.16	13.20		
T10	Group P	37	72.19	7.77	6.29	0.006*
	Group R	38	65.90	11.26		
T20	Group P	37	76.78	7.78	6.94	0.001*
	Group R	38	69.84	9.89		
T30	Group P	37	78.78	7.04	3.81	0.03*
	Group R	38	74.97	7.81		
T60	Group P	29	79.45	6.87	2.16	0.26
	Group R	38	77.29	8.26		
T90	Group P	9	78.22	8.09	1.09	0.71
	Group R	38	77.13	7.68		

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Significant difference in mean arterial pressure at different times studied at 3,5, 20 and 30 minutes (P<0.01, P=0.01, P=0.001 and P= 0.006

Comparison of mean MAP levels between 2 groups at different time intervals using Mann Whitney Test						
Time	Group	N	Mean	SD	Mean Diff	p-value
Baseline	Group P	37	82.49	10.28	3.14	0.11
	Group R	38	79.34	6.23		
T0	Group P	37	81.62	8.19	3.34	0.09
	Group R	38	78.28	8.23		
T1	Group P	37	77.51	6.91	2.96	0.07
	Group R	38	74.55	6.82		
T3	Group P	37	72.89	7.29	7.50	<0.001*
	Group R	38	65.40	5.48		
T5	Group P	37	72.38	6.21	5.83	0.001*
	Group R	38	66.55	8.72		
T10	Group P	37	72.78	6.22	4.10	0.03*
	Group R	38	68.68	9.78		
T20	Group P	37	76.14	6.88	5.98	0.001*
	Group R	38	70.16	8.23		
T30	Group P	37	78.03	6.57	4.90	0.006*
	Group R	38	73.13	8.19		
T60	Group P	29	78.21	7.31	1.60	0.45
	Group R	38	76.61	9.51		
T90	Group P	9	80.67	5.72	8.90	<0.001*
	Group R	38	71.76	6.22		

On comparison between the two groups, significant difference was observed in mean heart rate at 10 min (P=0.03) and the patients in group P had higher heart rate.

Comparison of mean Heart Rate (bpm) between 2 groups at different time intervals using Independent Student t Test						
Time	Group	N	Mean	SD	Mean Diff	p-value
Baseline	Group P	37	84.38	11.48	3.56	0.13
	Group R	38	80.82	8.62		
T0	Group P	37	82.03	11.13	2.42	0.27
	Group R	38	79.61	9.35		
T1	Group P	37	82.27	9.29	3.45	0.10
	Group R	38	78.82	8.91		
T3	Group P	37	79.73	8.58	3.15	0.15
	Group R	38	76.58	9.99		
T5	Group P	37	79.87	8.89	2.50	0.25
	Group R	38	77.37	9.72		
T10	Group P	37	77.89	9.54	4.60	0.03*
	Group R	38	73.29	8.62		
T20	Group P	37	77.84	8.53	-1.08	0.61
	Group R	38	78.92	9.64		
T30	Group P	37	81.30	9.14	3.01	0.18
	Group R	38	78.29	10.18		
T60	Group P	29	78.66	6.60	0.29	0.88
	Group R	38	78.37	8.41		
T90	Group P	9	80.33	6.20	2.54	0.50
	Group R	38	77.79	10.68		

V. Discussion

Spinal anaesthesia is widely employed in lower abdominal surgeries due to its rapid onset, effective sensory and motor blockade, and low risk of systemic toxicity. However, spinal anaesthesia-induced hypotension remains a common and clinically significant complication, primarily due to sympathetic blockade resulting in peripheral vasodilation and decreased venous return. Effective strategies to prevent this hemodynamic instability include volume preloading or co-loading with intravenous fluids.The present study aimed to compare the efficacy of two commonly used crystalloids□Ringer Lactate (RL) and Plasmalyte-A (PL)□when administered as co-loading fluids immediately after intrathecal local anaesthetic injection. Our results demonstrated that co-loading with Plasmalyte-A resulted in a significantly lower incidence of hypotension and reduced requirement for vasopressor support compared to Ringer Lactate.In our study, systolic, diastolic, and mean arterial pressures were consistently higher in the Plasmalyte group across various time points, with statistical significance noted particularly at 3, 5, 20, and 30 minutes. Furthermore, only 6% of patients in the Plasmalyte group required ephedrine compared to 30% in the Ringer Lactate group ($p = 0.004$), clearly indicating better hemodynamic stability. These findings suggest that Plasmalyte is more effective in maintaining circulatory stability during spinal anaesthesia.The superior performance of Plasmalyte can be attributed to its balanced electrolyte composition and physiological pH. Plasmalyte has a pH of 7.4 and an osmolarity of 294 mOsm/L, closely resembling human plasma, thereby reducing the risk of fluid-induced acid-base disturbances. In contrast, Ringer Lactate has a more acidic pH (6.5) and a slightly lower osmolarity (278 mOsm/L). Additionally, the lactate in Ringer Lactate requires hepatic metabolism to bicarbonate, which may be less efficient in certain patient populations, potentially exacerbating acidosis and hypotension. In comparison, Plasmalyte contains acetate and gluconate as buffering agents, which are more rapidly and efficiently metabolized, contributing to better acid-base homeostasis and vascular tone.These results are consistent with previous studies. Sharma et al. (2014) and Jacob et al. (2012) reported improved hemodynamic profiles and reduced vasopressor requirements with Plasmalyte during spinal anaesthesia. The current study reinforces these findings and supports the clinical utility of Plasmalyte in intraoperative fluid management.From a clinical standpoint, using Plasmalyte for co-loading may reduce the need for vasopressors, minimize fluctuations in hemodynamic parameters, and improve overall patient safety. This has particular relevance in high-risk populations where cardiovascular stability is critical.

VI. Conclusion

Both Ringer s Lactate and Plasmalyte are commonly used for Co-loading in hypotension management during surgeries under SAB. This study found that Co - loading with 15 mL/kg of Plasmalyte was more effective than 15 mL/kg Ringer lactate in preventing hypotension in patients undergoing lower abdominal surgeries. These results underline the potential for Plasmalyte use during Co- loading because of its balanced composition, which may lead to better hemodynamic stability in terms of reducing the need for additional vasopressin support during surgery and post-surgical recovery and fewer electrolyte imbalances.

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