

A Comparison between Ringer's Lactate (RL) Solution and 6% Hydroxy Ethyl Starch (HES) in the Prevention of Hypotension in Patients Undergoing Cesarean Section under Spinal Anaesthesia

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Abstract: **Background:** Arterial hypotension is the leading cause for maternal mortality and morbidity following spinal anaesthesia in parturients undergoing cesarean section. Active management of hypotension following spinal anaesthesia and its prevention is vital for patient's safety. Preloading with either colloid or crystalloid prevents the severity of hypotension following spinal anaesthesia. Objectives of our study was to compare the efficacy of Ringers lactate solution preloading (1000 ml) and 6% hydroxyl ethyl starch preloading (500 ml) in the prevention of hypotension following spinal anaesthesia in caesarean section. ¹ **Materials and methods:** 150 parturients of age between 18 - 40 years and of ASA physical status II who were posted for cesarean section under spinal anaesthesia was taken for the study. The patients were randomly allocated into 2 equal groups. Group A received 500 ml of 6% hydroxyl ethyl starch (HES) and group B received 1000 ml of ringer's lactate (RL) solution just prior to administration of spinal anaesthesia. The incidence of hypotension in two groups were compared. Mean systolic blood pressure, mean diastolic blood pressure, mean arterial blood pressure, vasopressor requirement and mean heart rate were measured in both the groups. **Results:** Incidence of hypotension was significantly more in ringer lactate group. Vasopressor requirement was also low in hydroxyl ethyl starch group compared to ringer lactate group. **Conclusions:** Preloading patients with 6% hydroxyl ethyl starch (HES) is better than preloading with lactated ringer's solution as it produces better hemodynamic stability to subjects.

Keywords: Hypotension, Hydroxyl ethyl starch, Ringer's lactate, Mean arterial pressure

1. Introduction

Hypotension occurs frequently after spinal anaesthesia, particularly in the elderly and in patients undergoing caesarean section. Spinal anaesthesia induced hypotension is caused by arterial and venous dilatation resulting from the sympathetic block as well as paradoxical activation of cardioinhibitory receptors. Administration of crystalloid is advised to prevent the incidence of hypotension¹. Bradycardia after spinal anaesthesia is also common and must always be considered as a warning sign of an important hemodynamic compromise.²

Maternal hypotension after spinal anaesthesia exposes mother and neonate to various unwanted adverse effects which may be severe like; altered mentation, Mendelson syndrome, hemodynamic instability, and adverse neonatal outcome. The use of vasopressor drugs, particularly phenylephrine, has become the most important technique to prevent spinal anaesthesia induced hypotension. The combined use of an intravenous fluid loading along with a phenylephrine - based prophylaxis is currently advocated.³

Pregnant patients develop more extensive spinal blocks than non - pregnant patients. This is related to increased sensitivity to local anaesthetic drugs as well as mechanical effects produced by epidural venous engorgement. However, this effect reverses soon after delivery of the baby.⁴

2. Materials and Methods

This study was conducted in operation theatre of Obstetrics and Gynaecology department of Assam Medical College and Hospital after obtaining approval from Institutional Ethics Committee (Human). A total number of 150 patients was enrolled for the study.

Inclusion criteria:

- 1) Age between 18 - 40 years
- 2) Healthy parturient with ASA physical status II.

Exclusion criteria:

- 1) Patients with co - morbidity
- 2) Allergy to local anaesthetics (bupivacaine)
- 3) Patients having obstetrical complications

The subjects were randomly divided into two equal groups group A and group B. Group A (n=75) received 500 ml of hydroxyl ethyl starch (HES) 6% and group B (n=75) received 1000 ml of ringer's lactate solution over a period of 20 minutes immediately before spinal anaesthesia.

After receiving the patient inside operation theatre, all the standard monitors were connected and vitals recorded. Subarachnoid block was performed under strict aseptic condition with 25 G Quincke spinal needle at L2 – L3 or L3 – L4 interspace in sitting position using 2.5 ml of 0.5% hyperbaric bupivacaine. All patients received O₂ inhalation via face mask[at]6L/min. All patients received ringers lactate as intra operative IV maintenance fluid.

Intraoperatively systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), heart rate were observed and recorded.

Hypotension is defined as decrease in systolic blood pressure by more than 20% of the baseline or < 90 mmHg. Hypotension was managed by increasing IV fluid infusion rate and injection mephentermine 6 mg intravenously.

Bradycardia is defined as heart rate < 55 beats per minute (BPM) and was managed by injection atropine.

Incidence of adverse effects of HES such as pruritus, anaphylactoid reaction, bronchospasm bleeding from surgical wound etc. were also recorded.

3. Results and Observations

Results and observations were recorded and tabulated as follows:

Table 1: Table showing age distribution

Age in years	Group A (HES)		Group B (RL)	
	Number	% in group	Number	% in group
18 - 25	42	56%	33	44%
26 - 30	29	38.67%	35	46.67%
31 - 35	4	5.33%	7	9.33%
36 - 40	0	0%	0	0%
Mean ± SD	25.28 ± 3.01		26.04 ± 3.27	
p value	0.1411			

Age of the patients in both the groups were comparable (p value > 0.05).

Table 2: Mean arterial pressure

MAP (mmHg)	Group A n=75		Group B n=75		p – value
	Mean	SD	Mean	SD	
Baseline	92.0	6.4	93.1	4.12	0.232
After preloading	93.55	4.08	93.48	3.35	0.9131
After 5 minutes	89.72	6.35	85.49	10.18	0.0027
After 10 minutes	86.56	8.54	76.65	10.25	<0.0001
After 15 minutes	86.25	8.03	79.96	5.57	<0.0001
After 20 minutes	86.69	7.58	83.36	8.08	0.0101
After 25 minutes	86.16	7.01	83.36	4.83	0.005
After 30 minutes	86.97	7.37	83.87	5.87	0.0049
After 40 minutes	85.76	5.95	81.16	7.87	<0.0001
After 50 minutes	90.33	6.58	86.69	5.59	0.004
After 60 minutes	91.11	4.06	87.77	5.72	<0.0001

The baseline mean arterial pressure (MAP) was comparable between the groups. The trend was also maintained throughout preloading. It was observed that there was reduction in MAP in both the groups after spinal anaesthesia. There was statistically significant decrease in MAP between the groups at 5 minutes, 10 minutes, 15 minutes, 20 minutes, 25 minutes, 30 minutes, 40 minutes, 50 minutes and 60 minutes after spinal anaesthesia (p value < 0.05)

Table 3: Heart rate (beats per minute)

Heart rate (bpm)	Group A		Group B		p value
	Mean	SD	Mean	SD	
Baseline (preoperative)	79.42	5.76	79.86	5.11	0.6184
After preload	77.8	4.63	78.21	5.91	0.6342
5 minutes after SA	78.76	4.23	79.45	5.82	0.4052
After 10 mins	78.05	3.42	79.38	6.66	0.1250
After 15 mins	77.05	2.82	78	4.77	0.1409
After 20 mins	77.09	6.33	78.63	4.7	0.0974
After 25 mins	76.17	2.99	77.38	5.55	0.0978
After 30 mins	76.72	8.78	77.07	4.62	0.7626
After 40 mins	76.51	8.31	77.2	5.86	0.5559
After 50 mins	76.25	6.65	76.95	3.93	0.4380
After 60 mins	75.61	6.38	76.27	4.75	0.4780

The heart rate was comparable in both the groups throughout the period.

Table 4: Requirement of vasopressor (mephentermine):

Groups	Mephentermine required (number of patients)	Mephentermine not required (number of patients)	p value
Group A	9	66	0.0031
Group B	25	50	

9 patients in group A required injection mephentermine in comparison to group B where 25 patients required injection mephentermine. This showed a statistically significant requirement of injection mephentermine between the groups (p value < 0.05).

4. Discussion

Hypotension is one of the commonest problem encountered during spinal anaesthesia for cesarean section. Preloading is one of the safe and effective method of preventing hypotension following spinal anaesthesia. Both crystalloid and colloids can be used for preloading to prevent spinal induced hypotension.

Approximately 75% of crystalloids diffuses into interstitial space. The efficacy of crystalloids in expansion of plasma volume is transient. But administration of colloids as a pre loading fluid is a more logical choice in the prevention of hypotension following spinal anaesthesia. Colloids remains in the intra vascular space for a longer period due to its physical properties.

In our study, we have tried to observe the benefit of preloading parturients with 6% hydroxyl ethyl starch (HES) in prevention of hypotension and we compared it with ringers lactate (RL) solution.500 ml of HES was administered in one group and 1000 ml of RL was administered in the other group. The mean arterial pressure (MAP) were comparable in both the groups during preloading. But after 5 minutes of spinal

anaesthesia it was significantly higher in HES group which was maintained upto 1 hour of sub arachnoid block (SAB). These findings were similar to the studies of Samia Madi - Jebara et al⁵.

In our study 9 patients in HES group and 25 patients in RL group required vasopressors in the form of injection mephentermine. The requirement of injection mephentermine was also higher in RL group in comparison with HES group. Statistically significant difference was seen between the groups (p value < 0.05).

The mean baseline heart rates were comparable in both the groups. The heart rate remained unchanged during preloading. Following spinal anaesthesia the heart decreased and became stable. None of the patients required injection atropine for treating bradycardia. There was no statistically significant difference of heart rate between the groups.

The common side effects like nausea, vomiting, shivering occurred in similar frequencies in both the groups.

5. Summary

The present study was done to compare the efficacy of 6% HES and RL as a preloading fluid in the prevention of hypotension in spinal anaesthesia for cesarean section.

150 parturients having ASA II physical status scheduled for cesarean section under SA were selected for the study. Group A consisting of 75 participants, were preloaded with 500 ml of 6% HES and group B consisting of 75 participants, were preloaded with 1000 ml RL 20 minutes prior to SA.

After preloading SA was given with 25 G Quincke spinal needle in the L2 - L3 or L3 - L4 interspace in left lateral position with 2.5 ml of 0.5% hyperbaric bupivacaine. Immediately patients were positioned supine with left lateral tilt. All patients received oxygen by face mask[at]5 L/min till the delivery of the baby.

Hypotension following spinal anaesthesia was managed by increasing the rate of IV fluid infusion with RL. If not corrected, then injection mephentermine 6 mg IV was administered. Incidence of hypotension in HES group was 13 (17.33%) and the incidence of hypotension in RL group was 25 (33.33%). The total requirement of injection mephentermine was higher in group B in comparison to group A (p value 0.0033).

The complications such as nausea and vomiting after induction of SA were a minor problem and occurred with almost similar frequency in both the groups.

6. Conclusion

The incidence of hypotension after spinal anaesthesia is significantly lower in patients preloaded with 6% HES in comparison with the patients preloaded with RL. From our study it was seen that 6% HES is a better preloading fluid than RL for prevention of post spinal anaesthesia hypotension in patients undergoing cesarean section.

References

- [1] Fathi M, Imani F, Joudi M, Goodarzi V. Comparison Between the Effects of Ringer's Lactate and Hydroxyethyl Starch on Hemodynamic Parameters After Spinal Anesthesia: A Randomized Clinical Trial. *Anesth Pain Med.*2013; 2 (3): 127–33.
- [2] Ferré F, et al. Control of Spinal Anesthesia - Induced Hypotension in Adults. *Local Reg Anesth.*2020; 13: 39–46.
- [3] Mercier FJ, et al. 6% Hydroxyethyl starch (130/0.4) vs Ringer's lactate preloading before spinal anaesthesia for Caesarean delivery: the randomized, double - blind, multicentre CAESAR trial†. *British Journal of Anaesthesia.*2014 Sep 1; 113 (3): 459–67.
- [4] Ngan Kee WD. Prevention of maternal hypotension after regional anaesthesia for caesarean section. *Curr Opin Anaesthesiol.*2010 Jun; 23 (3): 304–9.
- [5] Madi - Jebara S et al. Prevention of hypotension after spinal anesthesia for cesarean section: 6% hydroxyethyl starch 130/0.4 (Voluven) versus lactated Ringer's solution. *J Med Liban.*2008; 56 (4): 203–7.