VOLUME - 12, ISSUE - 06, JUNE - 2023 • PRINT ISSN No. 2277 - 8160 • DOI : 10.36106/gjra

Original Research Paper

Anaesthesiology

TO STUDY THE EFFECT OF 6% HYDROXYETHYL STARCH AS PRE LOADING FLUID FOR PREVENTION OF HYPOTENSION FOLLOWING SPINAL ANAESTHESIA

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ABSTRACT

Purpose- To study the effect of 6% hydroxyethyl starch as pre loading fluid for prevention of hypotension following spinal anaesthesia. **Material & method-** An observational cross –sectional clinical study was carried out in 100 subjects. Parturients belonging to 20 to 35 years of age, belonging to ASA physical status class 1 and 2, undergoing caesarean section under subarachnoid block (spinal anaesthesia) were included & divided into 2 groups. Group A involved 50 Parturients receiving 500ml of Ringer's lactate as preloading fluid and group B involved 50 Parturients receiving 500 ml 6% Hydroxyethyl starch (hestrarch) as preloading fluid. Heart rate, systolic blood pressure, diastolic blood pressure and mean arterial pressure (MAP) were recorded at 0, 1, 2, 5, 10, 15, 30, 45, 60, 75, 90 minutes interval in all 100 parturients. **Result-** The mean systolic blood pressure, mean diastolic blood pressure, mean MAP at baseline, at 1 minute and at 90 minutes was comparable between the two groups while at all the other time intervals these values were higher in the Hestarch group. Overall the mean heart rate was higher in the Hestarch group. No adverse events were seen in this study in both the groups. **Conclusion-** This study concludes that preloading of parturients planned for caesarean section under spinal anaesthesia with 6% hydroxylethyl starch, 20 minutes before induction prevent spinal anaesthesia induced hypotension better than preloading with Ringer's lactate solution.

KEYWORDS : hydroxylethyl starch, ringer lactate, caesarean section, Spinal anaesthesia

INTRODUCTION

Subarachnoid Block (spinal anaesthesia) is the most widely practiced anaesthetic technique particularly for lower abdominal and lower limb surgeries. The most common potential hazard with spinal anaesthesia is arterial hypotension due to paralysis of sympathetic vasoconstrictor fibres supplying to the blood vessels. [1] To reduce the incidence and severity of spinal hypotension various manoeuvres have been used which include Trendelenberg (head down) position, leg elevation and strapping, use of inflatable boots, prophylactic vasopressors and preloading with intravenous fluids with either crystalloid or colloid solution. Crystalloid solutions are of lower molecular weight and enter the interstitial space whereas colloids have higher molecular weight than crystalloids and similar osmolality as plasma with little expansion of interstitial space. Our study is planned to explore and compare the effect of crystalloids and colloids preload on hemodynamic stability in parturients scheduled for caesarean section under spinal anaesthesia.

MATERIAL AND METHOD

Study design:

This was an observational cross –sectional clinical study conducted under the Department of Anaesthesiology, Index Medical College, Hospital and Research Centre, Indore (MP) after approval of institutional ethical committee.

Material: The study population included 100 subjects.

Inclusion Criteria:

- Parturients between 20 to 35 years of age belonging to ASA physical status class 1 and 2 undergoing caesarean section under spinal anaesthesia

Exclusion Criteria:

- Patient's refusal
- Severe anaemia, coagulation abnormalities and bleeding disorders
- Patients with previous history of surgeries on the spine
- Patients with spinal deformities
- Patients with history of chronic backache
- Patients with active skin lesions over lumbosacral region
- Patients with obesity, chronic hypertension, diabetes, heart disease, respiratory and CNS disorder

The study population was randomly divided into 2 groups.

Group A: 50 Parturients receiving 500ml of Ringer's lactate as preloading fluid

Group B: 50 Parturients receiving 500 ml 6% Hestarch as preloading fluid

Iv Fluids:

- Ringer's lactate solution
- Hydroxyethyl starch 6% (130/0.4)

Drugs: Hyperbaric Bupivacaine (0.5%)

Methods:

100 ASA I and II patients posted for caesarean section under SAB were randomly allocated to receive either 500 ml of Ringer's Lactate (Group A) or 500ml of Hestarch 6% solution(Group B) as preloading solution prior to sub-arachnoid block(SAB). Heart rate, systolic blood pressure, diastolic blood pressure and mean arterial pressure were recorded at 0, 1, 2, 5, 10, 15, 30, 45, 60, 75, 90 minutes interval.

All patients were examined in the pre-operative period and written informed consent was taken.

- All Patients were fasted for 8 hours for solid food and 4 hours for clear fluids. Intravenous line was obtained with 18G cannula and received either 500 ml of Ringer's Lactate (Group A) or 500 ml of 6% Hestarch solution (Group B) as preloading solution 20 miniutes prior to SAB.
- All patients received injection Rantidine 50mg IV and Injection Metoclopramide 10mg IV for aspiration prophylaxis before surgery.

Technique Conducted:

- In the operating room, patients were monitored with electrocardiography (ECG), oxygen saturation (SPO_2), noninvasive blood pressure (NIBP) and pulse rate by using Phillips monitor and pulse Oximeter.
- Under all aseptic precautions, in sitting position, using 23/25 G Quincke's spinal needle, subarachnoid block was performed at L3-L4 level through midline approach and dose of 2.5 ml of 0.5% hyperbaric bupivacain was injected after confirmation of needle tip in the subarachnoid space by clear and free flow of Cerebrospinal Fluid (CSF).
- Subjects were made to lie down in the supine posture immediately. The table was kept flat horizontally, wedge kept under right hip and supplemental oxygen was given.
- Intra operatively all patients were given 1litre of Ringer's lactate and 500ml of Dextrose in normal saline solution as Iv fluid.

The following parameters were observed and recorded :
Systolic Blood Pressure, Diastolic Blood Pressure, Mean arterial pressure and Heart Rate at 0 (Baseline), 1, 2, 5, 10, 15, 30, 45, 60, 75 and 90 minutes after induction.Any fall in MAP (Mean arterial pressure) of more than 20% of pre induction value was treated with an I.V. bolus of vasopressor drug and by pushing the I.V. fluids. Any episode of bradycardia (HR less than 50 beats/min.) was treated with increments of 0.02mg/kg of I.V. Atropine.

Data analysis:
Unpaired 't' test was applied for comparing the mean values between the two groups. A p value of < 0.05 was taken as statistically significant.

RESULT

100 parturients were included in the analysis. The mean age in the Hestarch group was 24.18 ± 3.09 years, while in the RL group it was 23.94 ± 2.53 years. The difference was found to be statistically not significant (p>0.05).

The mean systolic blood pressure at baseline, at 1 minute and at 90 minutes was comparable between the two groups (p>0.05), while at all the other time intervals the mean systolic blood pressure was higher in the Hestarch group in comparison to the RL group, which was statistically significant (p<0.05). (Table 1)

Table 1- Comparison of mean systolic blood pressure between the two groups at different time intervals

Time Interval	HestarchGroup [Mean±SD]	RL Group [Mean±SD]	't' value	P value
Baseline	113.92 ± 11.52	116.92 ± 10.78	-1.345, df= 98	0.182, NS
1 minute	112.88 ± 11.2	113.92 ± 10.49	-0.479, df= 98	0.633, NS
2 minutes	105.36 ± 10.73	96.24 ± 11.13	4.171, df= 98	0.000*
5 minutes	103.02 ± 9.24	80.64 ± 8.5	12.607, df= 98	0.000*
10 minutes	105.84 ± 8.15	83.26 ± 11.5	11.332, df= 98	0.000*
15 minutes	112.36 ± 9.8	96.8 ± 12.25	7.014, df= 98	0.000*
30 minutes	113.3 ± 10.93	107 ± 9.56	3.069, df= 98	0.003*
45 minutes	114.1 ± 9.6	109.66 ± 7.77	2.542, df= 98	0.013*
60 minutes	114.34 ± 8.96	111.1 ± 6.85	2.032, df= 98	0.045*
75 minutes	116.52 ± 8.19	113.14 ± 8.62	2.01, df= 98	0.047*
90 minutes	117.76 ± 8.3	115.06 ± 8.42	1.615, df= 98	0.109, NS

The mean diastolic blood pressure was comparable at baseline and at 1 minute between the two groups (p>0.05), while it was statistically significantly higher in the Hestarch Group in comparison to the RL group at all the other time intervals (P<0.05). Table -2

Table 2- Comparison of mean systolic blood pressure between the two groups at different time intervals

Time Interval	Hestarch Group [Mean±SD]	RL Group [Mean±SD]	't' value	P value
Baseline	113.92 ± 11.52	116.92 ± 10.78	-1.345, df= 98	0.182, NS
1 minute	112.88 ± 11.2	113.92 ± 10.49	-0.479, df= 98	0.633, NS
2 minutes	105.36 ± 10.73	96.24 ± 11.13	4.171, df= 98	0.000*
5 minutes	103.02 ± 9.24	80.64 ± 8.5	12.607, df= 98	0.000*
10 minutes	105.84 ± 8.15	83.26 ± 11.5	11.332, df= 98	0.000*
15 minutes	112.36 ± 9.8	96.8 ± 12.25	7.014, df= 98	0.000*
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75 minutes	116.52 ± 8.19	113.14 ± 8.62	2.01, df= 98	0.047*
90 minutes	117.76 ± 8.3	115.06 ± 8.42	1.615, df= 98	0.109, NS

The mean MAP was comparable at baseline and at 1 minute between the two groups (P>0.05), while the mean MAP was statistically significantly higher in the Hestarch Group in comparison to the RL Group at all the other time intervals (P<0.05). Table-3

Table 3- Comparison of mean of mean arterial pressure (MAP) between the two groups at different time intervals

Time Interval	Hestarch Group [Mean±SD]	RL Group [Mean±SD]	't' value	P value
Baseline	88.06 ± 7.92	89.3 ± 8.16	-0.771, df= 98	0.443, NS
1 minute	86.92 ± 8.85	85.1 ± 7.7	1.097, df= 98	0.275, NS
2 minutes	80.98 ± 6.76	73.34 ± 9	4.8, df= 98	0.000*
5 minutes	80.46 ± 7.23	61.42 ± 7.03	13.349, df= 98	0.000*
10 minutes	81.68 ± 4.85	62.62 ± 7.62	14.923, df= 98	0.000*
15 minutes	85.1 ± 6.27	74.64 ± 12.54	5.278, df= 98	0.000*
30 minutes	86.46 ± 6.58	80.04 ± 6.8	4.8, df= 98	0.000*
45 minutes	87.62 ± 6.03	81.6 ± 5.98	5.013, df= 98	0.000*
60 minutes	87.56 ± 6	83.96 ± 5.44	3.141, df= 98	0.002*
75 minutes	89.04 ± 5.61	85.7 ± 5.44	3.021, df= 98	0.003*
90 minutes	89.76 ± 6.02	86.82 ± 4.91	2.677, df= 98	0.009*

The mean heart rate at baseline was comparable between the two groups (p>0.05). Overall the mean heart rate was higher in the Hestarch group in comparison to the RL group. It was significantly higher at 2, 10, 15, 60, 75 and at 90 (p<0.05), while at all the other time intervals the mean heart rate was comparable between the two groups (p>0.05).Table- 4

Table 4 -Comparison of mean heart rate between the two groups at different time intervals

Time Interval	Hestarch Group [Mean±SD]	RL Group [Mean±SD]	't' value	P value
Baseline	92.56 ± 9.6	93.68 ± 8.49	-0.618, df= 98	0.538, NS
1 minute	95.6 ± 11.7	95.88 ± 10.03	-0.128, df= 98	0.898, NS
2 minutes	78.82 ± 11.4	83.92 ± 9.38	-2.443, df= 98	0.016
5 minutes	76.6 ± 8.16	75.4 ± 8.13	0.737, df= 98	0.463, NS
10 minutes	84.02 ± 11.74	78.4 ± 12.94	2.274, df= 98	0.025*
15 minutes	93.62 ± 12.02	87.86 ± 12.77	2.322, df= 98	0.022*
30 minutes	91.8 ± 11.28	88.96 ± 9.14	1.383, df= 98	0.170, NS
45 minutes	91.56 ± 9.78	88.72 ± 7.44	1.634, df= 98	0.105, NS
60 minutes	91.3 ± 8.73	86.94 ± 8.16	2.58, df= 98	0.011*
75 minutes	90.46 ± 7.93	87.18 ± 7.27	2.156, df= 98	0.034*
90 minutes	90.56 ± 7.95	87.46 ± 6.35	2.154, df= 98	0.034*

There were no adverse events seen in our study in both the groups.

DISCUSSION

Arterial hypotension remains the most dreaded complication of spinal anaesthesia. The primary mechanism of hypotension is paralysis of sympathetic vasoconstrictor fibres to blood vessels.[2] Pregnant females are more susceptible to the effects of sympathetic blockade. The decrease in vasomotor tone occurs at the pre-ganglionic level and affects both arterioles and veins. Paralysis of the arteriolar bed with decreased total peripheral resistance, [3] venous dilation and stagnation associated with decreased venous return to heart and diminished cardiac output [4] best explains the hypotension.

In elective cesarean section under spinal anesthesia, hypotension has been reported in as many as 85% of the patients. Prior to spinal anesthesia preloading is recommended to reduce the incidence of hypotension.

Some studies have suggested that crystalloid preloading is not effective in reducing the incidence of hypotension after spinal anesthesia.[5] About 75% of the infused volume of crystaloids diffuse into the interstitial spaces, and it's efficacy in expanding plasma volume is only transient. Large volumes of crystalloid can also decrease the oxygen carrying capacity and is associated with the increased risk of pulmonary and peripheral edema.[6] Colloids have higher molecular weight than crystalloid. They have osmolality similar to plasma and have a higher colloid oncotic pressure (COP). These features minimize transcapillary filtration, particularly at low capillary hydrostatic pressures. This maximizes their potential intravascular plasma volume expansion effect. In our study, patients receiving 6% hetastarch had a lower incidence of hypotension when compared with those who received lactated Ringers solution.

In our present study the mean age of subjects in the Hestarch group was 24.18 ± 3.09 years, while the mean age of subjects in the RL group was 23.94 ± 2.53 years. The difference was not found to be statistically significant (p>0.05). The baseline mean systolic blood pressure and mean MAP in Ringer's Lactate group was 116.92 ±10.78 mmHg and 89.3±8.16 mmHg respectively while the mean systolic blood pressure and mean MAP in Hestarch group was 113.92 ± 11.52 mmHg and 88.06±7.92 mmHg respectively. These findings were comparable between the two study groups and no statistically significant difference was noted (P>0.05). The mean systolic blood pressure at baseline, at 1 minute and at 90 minutes was comparable between the two groups (p>0.05), while at all the other time intervals, the mean systolic blood pressure was higher in the subjects of Hestarch group in comparison to the subjects of Ringer's Lactate group. *Mandal et al (2012)*[7] *and* Mercier et al(2014)[8] *conducted a similar study by* preloading with 6% hydroxyethyl starch in elective caesarean section patients. It was noted that by preloading with 6% hydroxyethyl starch, they were able to prevent the maternal hypotension better than by preloading the patients with Ringer's lactate solution.

The baseline mean diastolic blood pressure in Ringer's Lactate group was 75.22±7.92 mmHg and in Hestarch group was 75.46 ± 7.13mm Hg. It was comparable between the two study groups and no statistically significant difference was observed in baseline mean systolic blood pressure (P>0.05) while it was statistically significantly higher in the Hestarch Group in comparison to the RL group at all the other time intervals (P<0.05). *Singh et al (2016)*[9] *found in their study that mean diastolic blood pressure was significantly lower in ringer,s lactate group subjects as compare to hestarch group subjects.*

In this study, the mean heart rate at baseline was comparable between the two groups (p>0.05). Overall the mean heart rate was higher in the Hestarch group in comparison to the RL group. It was significantly higher at 2 minutes, 10 minutes, 15 minutes, 60 minutes, 75 minutes and at 90 minutes (p<0.05). Subbalakshmi T. D (2015)[10] in their study also found higher heart rate in hestarch group as compare to RL group and control group.while *Singh et al (2016)*[66] *in their study did not found any significant difference at all intervals (p>0.05).*

CONCLUSION

This study concludes that preloading of parturients planned for caesarean section under spinal anaesthesia with 6% hydroxylethyl starch, 20 minutes before induction prevent spinal anaesthesia induced hypotension better than preloading with Ringer's lactate solution.

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