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A Comparative Study on Prevention of Hypotension after Spinal Anaesthesia in Hysterectomy Cases: Crystalloid (Ringer Lactate Solution) versus Colloid (Haestryl 6%)

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Abstract

Background: *Different strategies have been attempted to prevent spinal –induced hypotension. Prophylactic measures include pre-hydration with crystalloid or colloid or administration of vasoactie agents. Study compared two methods i.e. crystalloid & Colloid group for reducing hypotension during spinal anaesthesia in hysterectomy patients.*

Method: *Prospective randomized controlled study carried out at anaesthesia department during the period of six months. 60 patients scheduled for elective hysterectomy under spinal anaesthesia included for the study purpose. Cases were randomly divided into two groups i.e. Crystalloid group and colloid .Age, height and weight characteristic were comparable between two group. Mean pulse rate and SBP recorded at intervals. All data entered and analyzed.*

Result: *The incidence of hypotension was 12 out of 30 (40%) in the crystalloid i.e.RL group and 4 out of 30 (13.3%) in colloid group. Mean SBP with S.D. was 90.0mmhg +9.27 &104 mmhg +6.8 in crystalloid group and colloid group respectively.*

Conclusion*: The incidence of hypotension was significantly lower among the colloid group i.e.6% Haestryl as a preload for spinal induced anaesthesia. Hence colloid can be preferred preload solution in spinal anaesthesia.*

INTRODUCTION

Spinal anaesthesia is the preferred technique for elective procedures like elective caesarean section, hysterectomy, inguinal hernia and so on. Hypotension and bradycardia are the most common side effect along with nausea and vomiting. Hypotension occurs from decreases in systemic vascular resistance and central venous pressure from sympathetic block with vasodilaltation[1] Systematic hypotension is most common complication with incidence of 25-82 % in elderly, 33% in non obstetric patients and 13 % in obstetric patients.[2]

Different strategies have been attempted to prevent spinal –induced hypotension. Prophylactic measures include prehydration with crystalloid or colloid or administration of vasoactie agents.[2] D.J. buggy et al mentioned in their study the practice of volume loading that is rapid infusion of crystalloids before induction of spinal anaesthesia, in which such an infusion apparently reduced the high incidence of hypotension in obstertric patients. More recent work from this decade has cast doubt on the efficacy and benefit of this practice. Several studies in women undergoing spinal anaesthesia for caesarean section or tubal ligation have found that volume administration produces marginal, if any reduction in the incidence of hypotension.[3]

Although recent studies have shown that colloids are more effective in prevention of hypotension than crystalloids.[4] Crystalloids do not remain in intravascular space but distributes rapidly into the extracellular fluid and the time remaining in intravascular space is much shorter in crystalloids compared with colloids.[5]

Hence, We have compared two methods of reducing hypotension during spinal anaesthesia in hysterectomy patients, crystalloid group ringer lactate (10ml/kg Body Weight) and colloid group i.e. Haestryl 6 % (8ml/kg Body Weight).

METHODS

The present prospective randomized controlled study carried out at anaesthesia department of tertiary care hospital located at a rural area of Maharashtra.

The study included the cases with age group (40-55 yrs), weight (45-65kg), height (150-17-cm) and ASA grading I & II, normotesive patients and undergoing elective hysterectomy. Those who having contraindications to subarachnoid block (patient refusal, unstable hemodynamic, coagulation abnormality), spinal deformities, medical disorder like cardiovascular insufficiency, Diabetic mellitus, anemia, hypertension, bronchial asthma were excluded from the study. Institutional Ethical Committee approval was taken before conduction of the study.

A total of 60 cases scheduled for elective hysterectomy under spinal anaesthesia were enrolled for the study purpose during the period of six months. Informed and valid consent was obtained from each patient.

All selected patients were gone under all routine investigation which includes Haemoglbulin, Complete Blood Count, Blood Sugar Level (Random), Bleeding time, Clotting Time, urine examination, Electro-Cardiogram, chest X ray.

The age, height, weight variables the presences of nausea, vomiting, discomfort or inadequate analgesia is collected in the anaesthesiology records.

Patients scheduled for hysterectomy under spinal anaesthesia were randomly allocated to receive either crystalloid Group I- Ringer lactate (10ml/kg Body Weight) or colloid group i.e. Haestryl 6 % (8ml/kg Body Weight) as preloading solution over 30 min. before anaesthesia. Before starting spinal anaesthesia, systolic blood pressure and heart rate were measured in the supine position. All cases have given subarachnoid block. Spinal anaesthesia was conducted in the right lateral decubitus position. After skin infiltration with1-2% lignocaine, a 25-gauge spinal needle was inserted at the L3-4 interspace. After appearance of clear cerebrospinal fluid, 0.5% hyperbaric bupivacaine 3ml was injected. The extent of sensory block was checked with pinprick at 3 min interval.

Heart rate (HR), systolic blood pressure (SBP) were recorded at time of spinal anaesthesia and at 5-min intervals till 15 min. then every 15 minutes till one and half hour with Pulse oximetry and Non-invasive BP monitoring(NIBP). Hypotension as primary outcome, was defined as a decrease of systolic blood pressure by 30% or more from the baseline value or < 90 mmhg hypotension was treated with 3mg in increment doses of IV mephentermine. HR < 60 beats/min was treated with IV Atropine 0.6 mg.

Highest level of anaesthesia was noted after 15 min by loss of pin trick sensation. Level maintained upto T8-T6. Post operatively side effects of spinal anaesthesia were recorded for nausea, vomiting, hypotension & bradycardia.

Statistical analysis: All the data entered, cleaned and analyzed using MS Excel & SPSS 16. Data were expressed as mean ± standard deviation and frequencies. Paired Student's test was used for comparing measures of SBP with baseline value as the control. All analysis was 2 - tailed. $P < 0.05$ was considered statistically significant.

OBSERVATION

Total 60 cases were included during the study period. The participants characteristics including mean age with Standard Deviation (44.13± 1.96 Vs 45.53± 2.28), mean weight with standard deviation (54.16± 1.77 Vs54.5± 2.37) and mean height (156± 9.83Vs 157.73± 5.95) were almost comparable for Crystalloid group - RL and Colloid group II- 6 % haestryl respectively as shown in table 1.

The table 2 shows Mean pulse rate per minute with standard deviation at different time interval during spinal anaesthesia in both groups. It was comparatively higher (85 +/- 7.52 vs. 83.2 +/- 7.71) among crystalloid group-RL in relation to colloid group-haestryl 6% . This was statistically significant ($p<0.05$). Mean pulse rate per minute at interval is shown in graph 1.

Table 3 shows mean systolic blood pressure with S.D.at different time interval from base line. Mean SBP with S.D. was 90.0+9.27 in Crystalloid-RL Group as compared to 104±6.8mmhg in Colloid group –Haestryl 6% at different intervals. This was statistically significant ($p<0.05$). Mean SBP at different time interval was comparatively lower

among crystalloid group-RL in relation to colloid group-haestryl 6% as shown in graph 2.

Intra-operatively Mephentermine dose requirement was significant low in colloid group(3.0 mg) as compared to crystalloid group (4.2mg).Table 4 shows 12 (40%) of the cases from crystalloid group were having hypotension as compared to 4 (13.3 %) cases of hypotension form colloid group ($p<0.05$).

Table 1: Characteristics of the elective hysterectomy cases from both the group during the study period.

Variables	Groups	
	Crystalloid –RL	Colloid-Haestryl 6%
Age (Yrs.)	44.13± 1.96	45.53± 2.28
Weight (Kg.)	54.16± 1.77	54.5± 2.37
Height (Wt.)	156± 9.83	157.73± 5.95

Table 2: Mean pulse rate per minute with S.D. of elective hysterectomy cases at different time interval during spinal anaesthesia.

Time Interval	Groups	
	Crystalloid- RL . Mean ±S.D	Colloid-Haestryl 6% Mean ±S.D
Pre induction	80.7± 5.49	80.43±12.8
5 min	85.53±7.52	83.2±7.71
10 min	85.26±7.79	83.4±3.42
15 min	84.73±6.08	82.27±4.69
30 min	81.5±4.83	83.3±6.33
45 min	85.53±6.24	81.96±4.89
60 min	82.73±5.76	84.76±6.10
90 min	83.43±4.32	84.73±4.43

($p<0.05$)

Table 3: Mean Systolic Blood Pressure with S.D. of elective hysterectomy cases at different time interval during spinal anaesthesia.

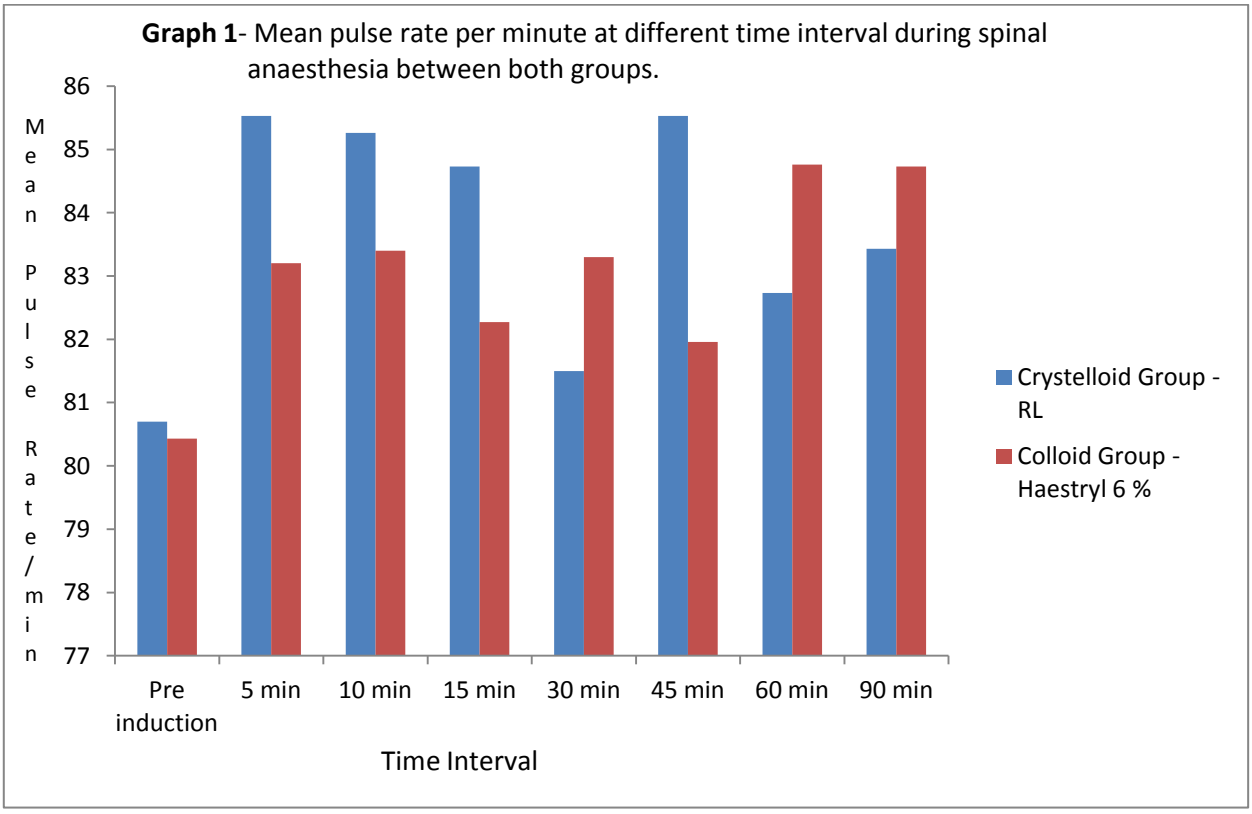
Time Interval	Groups	
	Crystalloid- RL . Mean ±S.D (mmhg)	Colloid-Haestryl 6% Mean ±S.D (mmhg)
Pre induction	117.93±7.65	117.13±7.42
5 min	88.46± 5.11	90.4±6.80
10 min	99.0±9.27	104±6.8
15 min	106±7.65	108.66±4.99
30 min	106.53±5.81	111.93±5.10
45 min	111.6±6.27	112.3±6.58
60 min	112.3±7.59	114.26±5.93
90 min	111.93+7.86	114.06+6.04

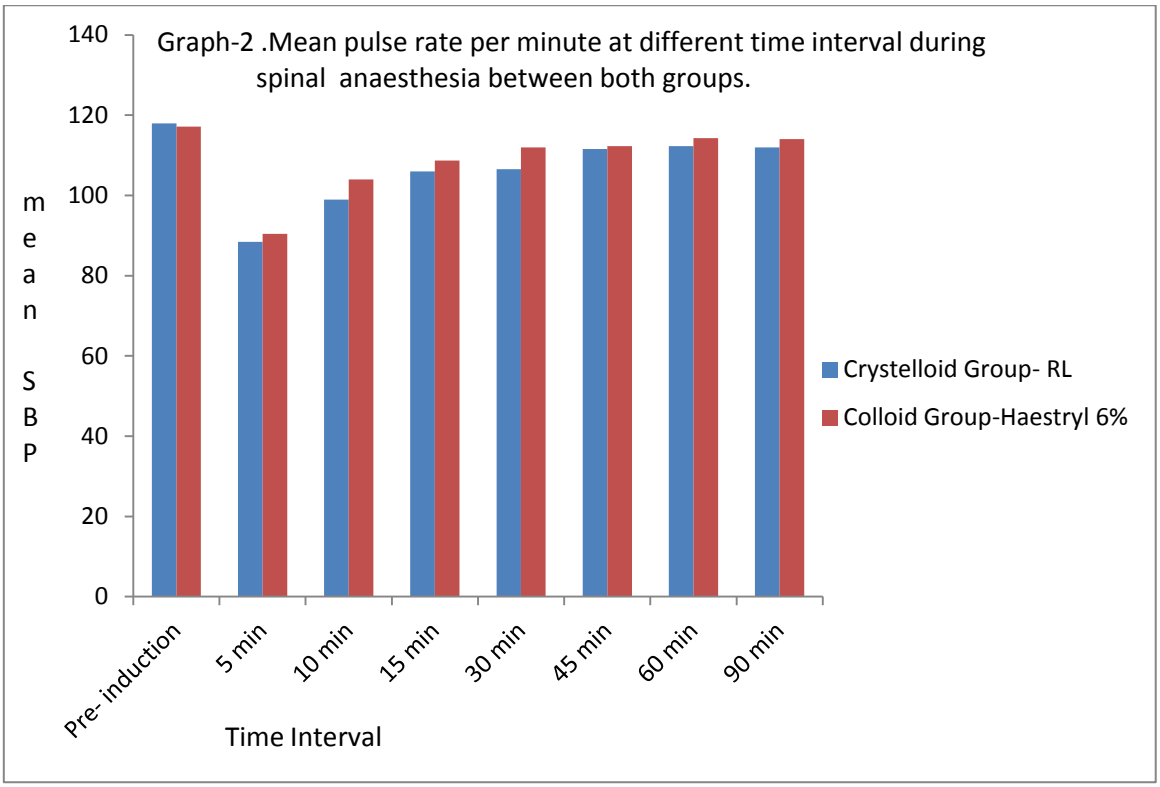
($p<0.05$)

Table 4: Incidence of hypotension among the elective hysterectomy cases between two groups during spinal anaesthesia

Groups	Systolic Blood Pressure		Total
	<90mmhg Numbers (%)	>90 mmhg Numbers (%)	
Colloid Haestryl 6%	4 (13.3%)	26 (86.7)	30
Crystalloid - RL	12 (40.0)	18 (60.0)	30
total	10	50	60

P <0.05.





DISCUSSION

To prevent the spinal anaesthesia induced hypotension, different techniques are being used. Prophylaxis measure includes pre induction hydration with crystalloid, colloid or administration of vasoactive agents during spinal anaesthesia for various surgeries. Preloading the circulation with crystalloids or colloids is aimed at the volume expansion that alleviates the vasodilatation induced by spinal anaesthesia. Allen TK et al studied that although current evidence has shown crystalloid preload not to be effective for preventing hypotension, a survey of practice shows that fluid therapy remains popular.[6] Prevention with colloid appears to be more effective than crystalloid at maintaining arterial blood pressure and perhaps decreasing incidence of hypotension.[7] Tin view of these, the present study conducted to compare the prevention of hypotension by using two methods of preload i.e. crystalloid and colloid among the elective hysterectomy cases.

In the present study total 60 cases of elective hysterectomy cases were randomly divided into two groups i.e. one group received Crystalloid – ringers Lactate and another group received Colloid -6% Haestry as a preload. Age group, weight and height were almost similar among both the groups (Table 1) which leads to minimize the bias in characteristics among the both groups. Mean pulse rate per minute was more among the crystalloid-RL group (85 +/- 7.52 vs. 83.2 +/- 7.71). In response to hypovolaemia, stimulation of cardiac sensory receptor in the left ventricle induces the BJR and results in reflex bradycardia, vasodilatation and hypotension.[8] Riley's ET et al found similar findings in which crystalloid group

had maximum heart rate (115 +/- 17 vs. 104 +/- 16) pulse per minute.[9]

Mean systolic blood pressure after spinal anaesthesia was significantly lower among crystalloid group (90.0+9.27 vs104±6.8) in present study. Graph 2 shows SBP was constantly lower at different time interval among the crystalloid –RL group which was statistically significant ($p<0.05$). These findings are similar with other studies.[3,8,10] Percentage of spinal anaesthesia induced hypotension among elective hysterectomy cases was more among crystalloid group (40% vs. 13.3%, $p<0.005$). Sharma SK et al[10] also found the incidence of hypotension more in crystalloid group (52% vs. 16%, $p<0.05$). Cyna AM et al found crystalloids were more effective than no fluid (relative risk(RR) 0.78, 95% CI)0.60 to 1.00, 140 women, sequential analysis) and colloids were more effective than crystalloid (RR 0.68,95% CI 0.52 to 0.89 11 trials , 698 women) in preventing hypotension following spinal anaesthesia.[11] The greater effectiveness of colloid is a result of effect for increasing central venous pressure and cardiac output caused by slower redistribution out of the intravascular space.[2]

A physiological explanation of the difference between crystalloid and colloid can be found in Ueyama study which showed that at 30 minutes, only 28% of the administered Lactated Ringers solution remained in the intravascular space compared with 100% of the HES solution. The requirement of mephentermine dose to maintain systolic blood pressure intra-operatively was greater in crystalloid group (4.2mg vs. 3 mg). This finding is similar with other studies[9,10] which found more dose required in crystalloid group than colloid group (15 vs. 4, $p< 0.05$) & (0 vs.2, $p<0.05$). This shows that more hypotension in crystalloid group- RL as compared to colloid group which received 6% Haestryl as a preload. No significant side effects reported in both the groups.

The only disadvantage is that it is costlier than crystalloid as well as it does not completely prevent the hypotension. That could be reason many practitioners still use crystalloid as first choice of fluid for prevention of hypotension. Though its costlier, it can be overcome by reducing the incidence of prevention of hypotension.

The study concludes that the incidence of hypotension was significantly lower among the colloid group i.e.6% Haestryl as a preload for spinal induced anaesthesia. Hence colloid can be preferred preload solution in spinal anaesthesia.

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