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Original Research Article

Comparison between the Effects of Ringer`s Lactate and Hydroxyethyl Starch on Pulse Rate and Systolic Blood Pressure after Spinal Anesthesia: A Randomized Clinical Trial

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Abstract

Background: Hypotension during spinal anesthesia is common and can lead to severe injuries and even death. Administration of crystalloid fluids is advised to prevent occurrence of hypotension; however its effectiveness is still the matter of arguments.

Objectives: This study was designed to compare the effects of Ringer`s lactate and hydroxyethyl starch 6% on hemodynamic parameters after spinal anesthesia in patients undergoing orthopedic surgeries on lower limbs.

Methods: This randomized clinical trial was performed in MLB Medical College Jhansi. 75 patients undergoing elective obstetrics and orthopedics surgeries with spinal anesthesia were included in this study. Fitted patients were randomly divided into two equal groups. After entrance to the operation room and before spinal anesthesia, patients' hemodynamic parameters including systolic blood pressure (SBP) were evaluated using monitoring electro-velocimetry set.

Results: The baseline values of mentioned variables did not show a significant difference between two groups using t-test ($P > 0.05$). Also SBP after intervention was not significantly different between two groups using t-test ($P > 0.05$).

Conclusion: The result of present study on patients undergoing femoral fracture surgeries who received Hetastarch or Ringer`s lactate solutions showed that Hetastarch was not significantly more effective in compensation of hypotension induced by spinal anesthesia.

Keywords: Hetastarch, Ringer`s Lactate, Spinal Anesthesia, Hypotension.

Introduction

Spinal Anaesthesia is used widely for various elective as well as emergency surgeries. Its advantages include more rapid onset of action, better quality of sensory and motor block and ease of use compared with extradural anaesthesia [1]. The benefits of the safety of spinal anaesthesia have led to a renewed appreciation of its utility and escalation of its use even in those parts of world in which it was not frequently used before [2].

Its disadvantages are shorter duration of block and lack of top up facility unless using a catheter. Hypotension is one of the most common accompaniments of spinal anaesthesia. It is imperative to know about the

techniques applied to counter the predictable hypotension [3].

The most commonly applied techniques are:

1. Volume preloading.
2. Pneumatic compression of the lower limbs.
3. Prophylactic use of vasopressor infusion.
4. Use of wedge, as in pregnant woman.

Of these volume preloading with either crystalloid or colloid has emerged as the clear leader and the single most important and effective way to counter the resultant hypotension. The preloading is necessary due to the fact that the vasoconstrictor reflexes produced by haemorrhage are abolished by spinal block in proportion to the height of block so that the patient is unable to protect himself against stress [4].

There is a growing body of evidence that colloid preloading offsets hypotension and hypovolemia more effectively than achived with crystalloid solutions in patients scheduled for elective or emergency surgery under spinal anaesthesa. It may be possible to selectively use a combination of both crystalloid sulutions and colloid sulutions in healthy young females take up for cesarean section [5].

Material and Methods

The present study was carried out on patients admitted in surgical, gynaecology and obstetrics and orthopaedic units of M.L.B Medical college and Hospital Jhansi.

Selection of Patients: The patients selected for this study were adults of either sex kept for surgery (lower abdominal, perineal or lower limb surgery) as a routine or emergency. The patients selected were of ASA Grade I. Patients name, age, sex, weight and M.R.D, number noted and clinical history was obtained.

The patients who excluded from the study were

1. Patients with respiratory disorder.
2. Patient with cardiovascular disorder.
3. Patients with neurological disorder.
4. Patients with disease of spine.
5. Patients with skin lesion at the site of lumbar puncture.
6. Patients with any bleeding disorder.
7. Patients with diabetes mellitus and renal impairment etc.

Preparation of Patients: A thorough pre-anaesthetic check up was done specially to exclude cardiovascular, respiratory and neurological disorder and supplemented by routing and special investigations as and when needed. Following parameters such as pulse rate, blood pressure and CVP were recorded; informed consent for spinal analgesia was taken,

Preload fluids

1. Ringer's Lactate
2. Hydroxyethyl Starch

Material

The material comprised of

1. 22-24 G spinal needle.
2. I/V sets.
3. Sphygmomanometer.
4. C.V.P. Line with water manometer.
5. Drugs-Sensorcaine 0.5%
6. Boyles anaesthesia machine with all emergency drugs, laryngoscopes and endotracheal tubes were kept as stand by before under taking the procedure.

Grouping of patients:

Patients were allocated at random into three groups.

Group I – No preloading

Group II- Preloading with hydroxyethyl starch (10ml/kg)

Group III- Preloading with lactated ringer's solution (20ml/kg)

Premedication: All the patients were premedicated with diazepam 10mg orally 1 ½ to 2 hours before spinal anesthesia with 20-30 ml of water. Preloading with either of the solutions was done within 20 minutes before the administration of spinal anaesthesia. Pulse

rate, blood pressure and CVP were recorded after preloading.

Spinal Anaesthesia: Patient was placed in left or right lateral position knees were flexed to the abdomen and head was also flexed. Lumbar puncture was performed between L_2L_3 or L_3L_4 intervertebral space with 23 gauze L.P. needle under all aseptic precautions, 2-2.5 ml of sensorcaine injected into subarachnoid space. The pulse rate, blood pressure and central venous pressure were recorded immediately after giving spinal anaesthesia and every minute for first five minutes then every five minutes up to twenty minutes, then at ten minutes interval till the end of surgery in all the three study groups. In the control group after taking basal values of pulse rate, B.P and C.V.P spinal anaesthesia was given and then the values of all the above mentioned data were recorded in the similar manner as in the study groups.

Results

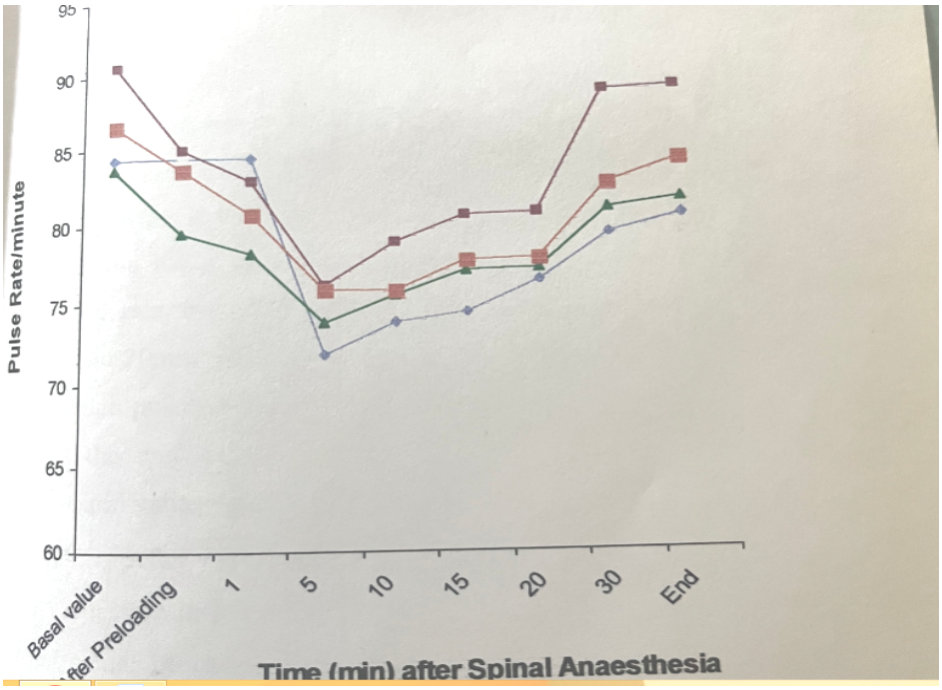

Figure 1: Changes in Pulse Rate

As per figure 1

Group I: fall in pulse rate was recorded immediately after spinal blockade in control group. At 1min. it was insignificant (P>.05) significant fall in pulse rate was seen from 5 min to 20 min but from 5 min to 15 min it was highly significant (p<.001) . At 20 min the fall in pulse rate was significant (P<.05). maximum fall in it was observed after 5 min. from 30 min onwards till the end of surgery the change in pulse rate as compared to basal value was insignificant.

Group II: after preloading with hydroxyethyl starch (10ml/kg), a highly significant reduction in pulse rate was observed as compared to basal value after spinal blockade further fall in pulse rate was recorded from the value which was recorded after pre loading. The values of pulse rate were highly significantly, less as compared to basal value upto 20 min. maximum fall in value was observed after 5 min. after which pulse rate started rising gradually and after 30 min onwards till the end of surgery the difference in pulse rate as compared to basal value was insignificant.

Group III :- after preloading with ringer's lactate (20ml/kg), a significant reduction in pulse rate was observed as compared to basal value. After spinal blockade further fall in pulse rate was recorded from the value which was recorded after preloading. The values of pulse rate were highly significantly, less as compared to basal value upto 20 min. Maximum fall in pulse rate was observed after 10 min. after which pulse rate started rising gradually and after 30 min onwards till the end of surgery the difference in pulse rate as compared to basal value was insignificant.

Table 1: Changes in Systolic arterial pressure (mmHg) Mean+S.D

	I	II	IV
Basal values	113.28±10.1	111.2±13.19	109.68±12.23
After preloading	-	121.92±8.71**	121.44±8.18
1 Min	112.88±13.12	113.84±8.68	112.96±7.28
5 Min	90.00±13.64**	102.24±16.28	95.44±16.48**
10 Min	96.00±9.56**	106.96±12.37	99.52±12.02*
15 Min	104.48±5.61**	110.72±9.22	106.88±6.91
20 Min	105.44±4.81**	113.92±7.82	111.12±4.66
30 Min	110.08±2.68	114.56±8.90	111.44±3.94
End of Surgery	111.6±5.35	114.72±8.48	112.64±6.96

Highly significant P = <0.001(**)

As per table 1

Group I: In control group immediately after spinal blockade the systolic arterial pressure (SAP) started declining. 1 min after spinal blockade the change in it was insignificant ($p>0.05$) although it was less as compared to basal value. Maximum fall in value which was highly significant ($p<0.001$), was observed after 5 min. although after 5 min SAP started rising gradually but upto 20 min the difference in it was highly significant as compared to basal value from 30 min onwards till the end of surgery the difference in SAP was insignificant as compared to basal value.

Group II: After preloading with hydroxyethyl starch (10 ml/kg) rise in SAP was observed which was highly significant after spinal blockade it started decreasing. At 1 min the change in SAP was insignificant. At 5 min maximum fall in SAP was recorded, which was significant ($p<0.05$). After maximum fall at 5 min SAP started rising gradually but till 15 min it was less as compared to basal value although the difference at 10 & 15 min was insignificant.

Group III: After preloading with ringer's lactate (20 ml/kg) rise in SAP was observed which was highly significant. After spinal blockade it started decreasing. At 1 min the change in SAP was insignificant at 5 min maximum fall in SAP was recorded, which was highly significant after maximum fall at 5 min it started rising gradually but till 15 min the SAP was less as compared to basal value.

Discussion

Hypotension during spinal anesthesia is the result of sympathetic blockade leading to relative hypovolemia and decreased venous return. The prophylactic administration of crystalloid before regional anesthesia has been considered a safe and effective method of reducing the incidence of hypotension. However, recent reports have suggested that the prophylactic administration of crystalloid is ineffective in eliminating spinal anesthesia-induced hypotension in patients undergoing cesarean section [3-6]. There is evidence to suggest that postpartum patients might be more susceptible to pulmonary edema after the rapid administration of crystalloid, possibly because

of an increase in lung water during pregnancy [7]. During cesarean section under spinal anesthesia, LR solution 15 mL/kg with 5% glucose was compared with the same solution containing 5% albumin [8]. Hetastarch 6% in 0.9% saline is a synthetic colloid solution with a mean molecular weight of 450,000. The pH of hetastarch is 5.5, the osmolarity is 310 mOsm/L, and the colloid oncotic pressure (34 mm Hg) is similar to that of serum [9].

Its intravascular half-time is 25.5 hours and it has the capacity to expand plasma volume to a volume that is greater than the volume infused [10]. Advantages of hetastarch include a lower incidence of anaphylactic reactions as compared to other colloids such as dextran and a better efficacy in preventing venous thrombosis. However, disadvantages related to its use include increased expense, the potential for anaphylactic reactions, and a decreased hemoglobin concentration as well as coagulopathy if infused in excess of 2 L.

Conclusion

The present study was done in 100 adult patients of either sex of ASA Grade-I randomly allocated to four grops- groups –I control group (no preloading done), group-II preloading with hydroxyethyl starch 10 ml/kg, Group –III preloading with ringer's lactate 20ml/kg. Hence according to the results of present study preloading seems to be beneficial in reducing the incidence and severity of hypotension and for maintenance of better haemodynamic status after spinal anaesthesia. Colloids are better than crystalloid as they stay in circulation for a longer time which may help in the after effects of hypotension induced by spinal anesthesia.

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