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RESEARCH ARTICLE

EVALUATION OF EFFICACY OF RINGER LACTATE IN PRE- LOADING AND CO-LOADING FOR PREVENTION OF HYPOTENSION AND BRADYCARDIA DURING SPINAL ANAESTHESIA IN LOWER ABDOMINAL AND LOWER EXTREMITY SUGERIES: A RANDOM CONTROLLED STUDY

Appoorva Kaul., Biren Suri and Madhvi Santpur

Department of Anaesthesia Maharishi Markendeshwar Institute of Medical Science and Research, Mullana (Ambala) Haryana, India

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ABSTRACT

Background & aims: To evaluate the background of Ringer Lactate in pre- loading and co- loading for prevention of hypotension and bradycardia during
spinal anaesthesia in lower abdominal and lower extremity surgeries.
Method: Totally 100 ASA Grade 1 and 11 adult patients who underwent and lower limb surgery under spinal anaesthesia were randomly allocated to two group, confirming 50 patients in each group. Group 1 (n-50): Pre-loading with ringer lactate 12 ml) kg body with 30 minutes before giving the spinal anaesthesia with 18G cannula.
Group 11 (n-50): Co-loading with ringer lactate 12m1/kg body weight immediately after induction of spinal anaesthesia with 18G Cannula. Baseline BP Heart rate SPO2 were recorded before operation subsequent reading was taken at 1, 5, 10 minutes and every 10 minutes till 1st hour.
After completion of the mentioned infusion, intra venous fluid was administered, at a rate of rate 8m1/kg/hr in both the groups.
Result: There was no statistically significant difference in pro-operative systolic Blood pressure, diastolic blood pressure mean arterial blood pressure heart rate and SPO2 between two groups.
Conclusion: Co-loading with 12 ml/kg of lactated ringer solution is as effective as pre-loading with same solution is an effective as pre- loading with same volume over 30 minutes before sub-arachnoid block to prevent hypotension and bradycardia. So it is unnecessary to advocate traditional practice of crystalloid over loading.

INTRODUCTION

Spinal anesthesia is one of the most versatile regional anaesthesia techniques available today. Regional anesthesia greatly expands the horizon of anaesthesit in providing alternative to general anaesthesia when appropriate.

It is the technique of choice due to the distinct advantage. Offered. As compared to general anaesthesia spinal anaesthesia blunts the response to surgery and decreases intra-operative blood loss. There is early ambulation of patient which lowers the complication. In spinal anaesthesia there is decreased risk of aspiration of gastric contents. Block offers good surgical

anaesthesia good muscle relaxation and is easy to administer. Spinal anaesthesia is a low cost technique.

METHODS

A prospective radomised study was carried out in 100 ASA, grade 1 and 11 adult patients who underwent lower abdominal and lower limb surgery under spinal anaesthesia at MMU Muliana, Ambala. All the patients were selected randomly and were allocated into two groups. The procedure details regarding the spinal anaesthesia was explained to every patient. They were divided into two groups, comprising 50 patients in each group.

Group 1: (N-50) Pre loading with ringer lactate 12 ml/kg body weight 30 minutes before giving the spinal anaesthesia with 18g cannula.

Group 11: (N-50) Co-loading with ringer lactate 12 ml/kg body wt. immediately after induction spinal anaesthesia with 18g cannula.

Inclusion Criteria: ASA group 1 8611 of either gender Age 21-50 years, schedule for lower limb and lower abdominal surgeries.

Exclusion Criteria: Patient refusal, patient infection at side of needle insertion, ASA III and IV.

METHODOLOGY

PRE- Anaesthesic Check-up A detailed history was taken from all the patients and medical examination of each patient was done. All patients were thoroughly investigated as per the requirement of the surgery apart from the routine investigation which included:

- Hemoglobin
- Bleeding time
- Clotting time
- Blood sugar
- Urine complete examination
- Electrocardiogram
- Chest X-ray

All patient were kept fasting over night, tab ranitidine 150 mg and tab alprazolam 0.25 mg was given to all patients on the night before surgery and early morning at 6 a.m. on the day of surgery. Patient was shifted to pre-operative room and intravenous line was secured with 18G cannula.

In group 1 pre-loading was done with ringer lactate 12m1/kg thirty minutes before shifting the patient to O.T.

Patient was shifted to operation theatre and standard monitoring was instituted. Baseline HR, SBP, DBP, MAP were recorded. Left lateral position was given and under all aseptic precautions, lumbar puncture was performed with 25G Quincke's needle by using the midline approach at L3-L4 interspace. Once the free flow of CSF was confirmed then drug i.e. Injection bupivacaine 0.5% (Heavy) 15 mg was injected at the rate of 0.2m1/sec and the patient was made supine.

In group 11 co-loading was done with ringer lactate 12m1/kg immediately after giving spinal anaesthesia at the level L3-L4. Parameters were recorded at fixed intervals and data was collected from each patient after giving spinal anaesthesia.

Following observation were made during the intraoperative period:

Baseline blood pressure, heart rate, SPO2 were recorded before operation. Subsequent reading were taken at 1, 5, 10 minutes and every 10 min till 1st hour and then every 15 min for the next 1 hour. After completion of the mentioned infusion, intravenous fluid was administered at a rate of 8 ml/kg/hour in both the groups. Fall in BP>30% of the baseline or decrease in systolic blood pressure to less than 90 mmHg whichever is earlier was taken as hypotension and pulse rate of <50/min was taken as bradycardia. To correct hypotension injection mephentermine 0.4mg/kg was given was given intravenously and injection atropine 0.02-0.04 mg/kg was given for bradycardia. A careful watch was kept on all the patients for any side effect of local anaesthesia drug.

All the data was recorded in the Proforma attached and was analysed statistically at the end of the study.

The present study did not impose any financial burden to the participants. Informed and written consent was obtained from the participants before conducting the study. Permission was taken from the institutional Ethical Committee (IEC) before starting the study.

RESULTS

There was no statistically significant difference in height and weight of the patients between the two groups.
There was no statistically significant difference in pre-operative systolic blood pressure (SBP) diastolic blood pressure (DBP) (MAP), heart rate (HR) and SPO2 between two groups.

The pre-operative heart rate in group 1 was 86.88 _ 10.55/min. The mean heart rate after one minutes of administration of block in group 1 was 90.98 + 9.892/min.

During the next 5 minutes mean heart rate was decreased to 85.20 + 12.095/min. After 10 minutes, mean heart rate reached 79.54 _+ 11.834/min. Maximum fall in heart rate observed after 30 minutes was 72.26 + 9.402/min. At the end of the observation period of 120 minutes mean heart rate was 82.17 _± 5.23/min.

The pre-operatve heart in group 11 was 86.16 _+ 6.44/min. The mean heart rate after 1st minute of administration of block was 90.08_+ 1-.560/min.

During the next 5 minutes after sub-arachnoid block, there was decrease in heart rate to 89.36 _+ 13.953/min. At 10 minutes, mean heart rate reached rate reached to 82.74_+ 11.892 per min. Maximum fall in heart rate after 30 minutes was 76.10 + 12.174/min. At the end of obserration period of 120 minutes the mean heart rate was 82.50_+ 14.08/min.

No statistically significant difference in heard rate between the two group was there in pre-operative period, after 5 mins. after 30 mins. and after 120 minutes.

There was no statistically significant difference in systolic blood pressure in pre-operative period after 5 minutes, after 30 minutes and after 90 minutes in both groups.

There was no statistically significant difference in diastolic blood pressure pre-operative period, after 5 minutes, after 30 minutes and after 90 minutes. Maximum fall in blood pressure was seen after 30 minutes in both the groups.

There was no statistically significant difference in MAP. After 5 minutes, after 30 minutes and after 90 minutes between twogroups. In both the groups, maximum fall in MAP was seen after 30 minutes of sub arachnoid block

DISCUSSION

Ever since spinal anesthesia was first introducing in 1898, this modality of anesthesia has gained immense popularity and acceptance. It is easy to perform and has potential conditions for the lower limb and lower abdominal surgeries. Spinal anesthesia is the preferred technique of choice as it offers rapid recovery, decreased hospital stay and fewer side effects. It is not only in economical but also has other benefits like rapid onset of action, better quality of sensory and motor block and decrease in the incidence of complications. It has been shown that spinal anaesthesia decreases the morbidity and mortality in high risk patients.

Spinal anesthesia has its own adverse effect which include –

- **Hemodynamic changes (hypotension and bradycardia)**
- **Postdural puncture headache**
- **Neurological damage**

Spinal anaesthesia commonly causes hypotension with incidence of 10% to 40% in non-obstetric patients[3]. Various theories have been proposed for haemodynamic changes. Direct circulatory effect of local anasethetics,[47] skeletal muscle paralysis, asecending medullary vasomotor block[54] to explain arterial hypotension due to spinal anaesthesia. These theories when taken separately are unable to explain spinal including hypotension.

Hypotension is explain is mainly by paralysis of sympathetics vasoconstrictor fibres present in the arteries and vieins which lead to vasodilation and pooling of blood in the extremities.9
Bradycardia is common during spinal anaesthesia. In the absence of hypotension,bradycardia can occur independently during spinal anaesthesia, even after 30 to 35 minutes. As the level of anaesthesia reaches T-2 and cardio accelerator fibres are blocked, the action of vagus is unopposed.[54]Bradycardia may be associated with a stimulus such as traction on the peritoneum or decrease venous return. Unexplained bradycarclia asystole may occur due to Bezold-Jarish reflex, cardiac output drops to the point where myocardial perfusion becomes inadequate which leads to rapid deterioration.3

Various strategies that have been proposed to prevent hypotension after a spinal block.

1. Dose of local anaesthetic-hypotension occur less frequently and is easier to treat if the dose of local anaesthetic drug administered is lowered.[96]
2. Addition of opioids to intrathecal local anaesthetic may hasten the onset of block and reduce the severity of hypotension as dose of local anaesthetic can be lowered .[97]
3. Prophylactic use of vasopressors like ephedrine, mephentermine and phenylephrine.
4. Increase in central blood volume by

MECHANICAL INCREASE IN PRELOAD

- By raising legs of patient, this can be done manually or by tilting the lower half of the table.
- Left uterine displacement and leg wrapping with compression device in pregnant female.[37]

1. Volume preload —with crystalloid or colloid preloading is a common method to prevent spinal induced hypotension.
2. Volume co-load with crystalloid or colloid to prevent spinal induced hypotension has been advocated.

Few studies have evaluated the role of crystalloid administration before spinal block (preload) versus no crystalloids in surgical population. The practice of preloading was first challenged by a study conducted by Clarke RB, Thompson DS, Thompson CH in 1976.[23] Their study showed that fluid loading with and without uterine displacement had no effect on the incidence of spinal induced hypotension. They explained that decreased efficacy of crystalloid preloading may be due to diffusion of 75% of crystalloid into interstitial space.

In 1990, Coe AJ, Revanas 13[8]° studied crystalloid preloading in prevention of hypotension in elderly population and he found there was no significant difference seen in the incidence of hypotension between preloaded group and the group with no preloading. Similar Jackson R, Reid JA, Thornburn J[26] in 1995 conducted the study to assess role of preloading with crystalloids to prevent spinal induced hypotension in parturient. They found in their study that 10 women in preloading group showed 5 episodes of hypotension and 9 women in group with no preloading fluid showed 4 episodes of hypotension. There was no significant difference in the incidence of spinal induced hypotension between patients receiving and not receiving crystalloid preloading before spinal anaesthesia. Even large volume of crystalloid have minimal effect on incidence of hypotension perhaps due to rapid redistribution ,although there may be restriction in the severity of hypotension and the vasopressor requirements.

Increasing the central blood volume with colloids (dextran, HES and gelatine) is more efficacious than crystalloid solution for prevention of hypotension but this advantage should be weighed against the risk for anaphylactic reaction, detrimental effect on coagulation system and additional cost.[32]

Preloading though beneficial is not devoid of disadvantages. It is a time consuming process 85 early fluid loading may not effectively increase the intravascular volume at the time of maximum vasodilatation. Volunteer studies have shown that a rapid infusion of lactated Ringers solution increases the intravascular volume by about 10%. This decreases rapidly when the infusion is discontinued.[98] Moreover preloading may lead to atrial stretching, which releases atrial natriuretic peptide Since natriuretic peptide type C is a potent vasodilator produced in the endothelium of great vessels, rapid fluid administration may exacerbate peripheral vasodilatation and facilitate fluid excretion.[20] It is postulated that pre-hydration affects the distribution of local anaesthetics in the cerebrospinal fluid (CSF) by changing the CSF circulation.[99] Though role of this factor on the incidence of hypotension, has not been proved.

As fluid is rapidly lost from the intravascular compartment, it may be rational to initiate a rapid infusion immediately after induction of spinal anaesthesia. Hahn RG, Svensen Cdemonstrated that colloid and crystalloid are less efficient in expanding the functional volume than previously thought.[98] In particular, much of the blood volume may be sequestered in the legs. They also postulate that fluid does not return to the functional compartment from the interstitium in spite of central hypovolemia. Therefore, it would be desirable to rapidly infuse fluid immediately after the block has been placed to maximize the amount of fluid in the functional compartment. Fluid enhances cardiac output and stroke volume but only transiently. These parameters are comparable in preload or coload group when given within 10 min of induction of spinal anesthesia.lw

Hence a new rational approach of fluid administration came into limelight i.e. coloading. As sympathetic nerve blockade is completed within first 10 minutes after administration of subarachnoid block. Haemodynamic instability occurs during this period. Coloading allows the fluid to be available in intravascular space during this period of haemodynamic variations. It leads to timely compensatory changes in cardiovascular system and limits the fluid redistribution and excretion. It also reduces the risk of fluid overload. So, coloading is more physiological and appropriate approach of fluid administration.

The volume kinetics of ringer's solution, suggest that central hypovolaemia may be prevented by rapid fluid administration over two mins after induction of spinal anaesthesia in non-obstetric surgery .[101]

Most of the studies done for coloading versus preloading were on obstetric patients for caesarean section. Our study was an attempt to assess the efficacy of ringer lactate in preloading and coloading in lower abdominal and lower limb surgery in non-obstetric population. As part of broader perspective we evaluated the intraoperative hemodynamics between preload and coloading group, episodes of hypotension with incidence of requirement of mephentermine, episodes of bradycardia with the dose requirement of atropine.

In this prospective randomised controlled study, we enrolled ASA1 and ASA 2 patients. Two groups with 100 patients were selected for study

Group I -50 patient received crystalloid, ringer lactate at 12m1/kg as preload

Group II -50 patient received crystalloid, ringer lactate at 12m1/kg as coload.

We evaluated the hemodynamic parameters preoperatively and intraoperatively at different interval of time up to 120 min.

Haemodynamic Data

Systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), heart rate(HR) and Sp02 were recorded at 1,5,10,20,30,40,50,60,75,90, 105 and 120 minutes and compared to the baseline. Hypotension in this study was defined as decrease in mean arterial pressure greater than 30 % from the baseline or systolic blood pressure <90 mmHg whichever was earlier. Any supplementation with vasopressor was also noted. Bradycardia was defined as heart rate below 50 per minute. It was treated with W atropine.

Demographic Data

Patients in both the groups were comparable amongst themselves as regards age, weight &, height. There were comparable number of females and males in both the groups. The duration of surgery, duration of anaesthesia and the level of blockade achieved were comparable in both the groups.

SUMMARY AND CONCLUSION

This study was conducted on 100 patients of ASA grade I 8611 of either sex, between age of 21-50 years, who underwent lower limb and lower abdominal surgeries in the department of Anaesthesiology and Critical Care at M.M.U, Mullana, Ambala. This study was conducted from Dec 2013-July 2015.

Patients were randomly divided into two groups with SO patients in each group.

Group I-received 12m1/kg of ringer lactate as preload 30 minutes before spinal anaesthesia with 18G cannula.

Group 11-received 12m1 /kg of ringer lactate as co-load immediately after induction of spinal anaesthesia with 18G carmula.

Under all aseptic precautions, lumbar puncture was perfaimed with 25G Quincke's needle in left lateral position by using the tnitiline approach at L3-L4 interspace. Once the free flow of CSF was confirmed then drug i.e. Injection bupivacaine 0.5% (Heavy) 15mg was injected at the rate of 0.2 ml/sec and the patient was made supine.

After completion of the mentioned infusion, intravenous fluid was administered at a rate of 8 ml/kg/hour in both the groups. Preoperative haemodynamic parameters were comparable in both the groups. Baseline blood pressure, heart rate, SPO2 were recorded before operation. Subsequent readings were taken at regular intervals till 120 minutes. Fall in BP>30°/0 of the baseline or decrease in systolic blood pressure to less than 90 mmHg whichever is earlier was taken as hypotension and pulse rate of 50/min was taken as bradycardia. Supplementation of vasopressor (mephentermine) and atropine were noted.

On the basis of data collected following observation were Made

1. Episodes of hypotension was comparable in both preload and co- load group.
2. Episodes of bradycardia were comparable in both group.
3. Dose of vasopressor to prevent hemodynamic disturbance was comparable in both group.
4. Does of atropine requirement was also similar in both the groups.
5. Episodes of complications like nausea, vomiting, shivering were also comparable in both the group.

Both preloading and co-loading have its own advantages and disadvantages. Based on these observations made in study, we concluded that co-loading with 12m1/ kg of lactated ringer solution is as effective as prevent hypotension and bradycardia. So, it is unnecessary to advocate traditional practice of crystalloid preloading. Crystalloid co-loading also serves as an effective technique in minimizing the spinal induced hypotension.

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