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Comparison of Hetastarch and Hartman's Solution for Volume Preloading For Elective Caesarian Section- A Tertiary Care Teaching Centre Experience

Authors
Sreekala Devi K S[1], Sobha S[2], Jamuna Rani J[3]
[1,3]Assistant Professor, Dept of Anaesthesia, Govt Medical College, Thiruvananthapuram, Kerala, India
[2]Associate Professor, Dept of Anaesthesia, Govt Medical College, Thiruvananthapuram, Kerala, India
Corresponding Author
Jamuna Rani J
Assistant Professor, Department of Anaesthesia, Government Medical College, Thiruvananthapuram, Kerala, India 695011
Email: *yamunaj@rocketmail.com, phone: 919961401288*

Abstract

Introduction: *Today lumbar subarachnoid block is the anesthetic technique (Spinal anaesthesia) often selected for an elective caesarian section. It has definite advantages that it permits the mother to be awake, minimize the likelihood of maternal pulmonary aspiration, technical ease, rapid onset of action, profound sensory and motor block and high success rate. Maternal Hypotension has to be avoided since it can cause a comparable fall in uterine perfusion and placental perfusion leading to foetal hypoxia and acidosis. The foetal outcome in caesarian under spinal anaesthesia is most often rewarding since it avoids drug depression of the foetus from general anaesthetics or a high dose of local anaesthetic. Study was undertaken with a view to evaluate the maternal haemodynamic changes in elective caesarian sections under spinal anaesthesia with preloading of the circulation, and to compare the efficacy of the two different preloading solutions.*

Materials and Methods: *a randomised prospective study in which forty parturients included were randomly allocated to two groups of twenty each to receive either a crystalloid or colloid preloading in the operation theatre.the age limit of 20 to 30 yrs and had comparable height and weight.*

Inclusion criteria: *Only healthy ASA Grade I parturients at term with single normal pregnancies and scheduled for elective caesarian section were included in the study. The indication for caesarian section included repeat caesarian section, foeto pelvic disproportion or breech presentation.*

Exclusion criteria: *Those patients with multiple pregnancies, intrauterine growth retardation, pre-eclamptic toxaemia, anaemia, hypertension, any other systemic disorders or past history of renal disease, coagulation disorders or bleeding tendencies or allergic reactions were excluded from the study. Any parturient in labour, or with spinal deformity or not willing for regional anaesthesia were excluded from the study.*

Observation and results: Maternal heart rate was recorded every 2 minutes and was found that there were no significant differences in the heart rates and maternal oxygen saturations (SpOz) in the 2 groups. Neonatal Apgar scores were noted at 1 minute and 5 minutes. It was observed that there was no significant difference in the 2 groups.

Conclusion: *spinal hypotension in the parturients could not be avoided, colloid preloading of 500 ml could prevent the most severe form of hypotension. The 6% hydroxyethyl starch solution was found to be not only effective but also without adverse effects in this study.*

Introduction

Soon after August Bier gave the first planned intradural block in 1989, it was used in labour. Today lumbar subarachnoid block is the anesthetic technique (Spinal anaesthesia) often selected for an elective caesarian section. It has definite advantages that it permits the mother to be awake, minimize the likelihood of maternal pulmonary aspiration of the stomach contents, avoids drug depression of the foetus, and permits the administration of high inspired concentrations of oxygen to the mother, thereby improving fetal oxygenation during caesarian section. The other advantages of spinal anaesthesia such as its technical ease, rapid onset of action, profound sensory and motor block and high success rate are desired features for obstetric anaesthesia. However a high incidence of hypotension reflecting the abrupt onset of peripheral sympathetic nervous system blockade is a major disadvantage of spinal anaesthesia.

Maternal Hypotension has to be avoided since it can cause a comparable fall in uterine perfusion and placental perfusion leading to foetal hypoxia and acidosis in severe cases. The incidence and magnitude of hypotension Vmay be minimised by continuous left lateral uterine displacement to relieve the caval compression and decreased venous return; volume preloading of maternal circulation with crystalloids or colloids to improve the blood volume and cardiac output and by prophylactic or therapeutic administration of ephedrine.

Preloading or compensatory intravascular volume expansion using crystalloid or colloid solutions is practiced to compensate for the vasodilatation caused by peripheral sympathetic blockade of spinal anaesthesia. Recent studies have question the efficacy of preloading in preventing the incidence and magnitude of hypotension of spinal anaesthesia in parturients during caesarian section.[18 59]

Crystalloids were used for preloading as early as 1965 and still are the most commonly used solutions. The ultimate volume of distribution for water is total body water and for sodium is the extracellular space with an intravascular half life of about 15 minutes. The volume replacement requirement of crystalloid solution is threefold the volume to be replaced since only 25% of the infused volume retain in the intravascular space. Isotonic saline and lactated Ringer's solution are the commonly used crystalloids for preloading. Crawford[13] (1984) recommended that at least one litre of Ringer's lactate solution should have been infused before the spinal block become fully established.

Colloid solutions have also been studied as preloading fluids and shown to produce a lower incidence of hypotension as compared to crystalloid preloading in spinal anaesthesia for caesarian section. J. Karinen et al (1995) found that incidence of maternal hypotension in the crystalloid group was 62% as compared to 38% in the colloid group. Colloid preloading has been suggested earlier (Twigly- 1985)[66] and tried effectively by many others too.

Theoretically colloid solutions are the more logic choice to preload the circulation since they remain in the intravascular space for a longer time than crystalloids, depending on their physical properties. Only 1/3 the volume of a colloid is required as compared to achieve the same degree of plasma volume expansion. Human albumin, dextran, hydroxyethyl starch and polygelatin are the colloid solutions used for preloading. Hydroxyethyl starch is 3%, 6% or 10% solution of polymerised polysaccharide of starch in normal saline, with a structural similarly to glycogen. It causes an increase in colloid osmotic pressure of plasma and increases the plasma volume by approximately 100% of he volume infused and remain effective over a period of about 4 to 8 hours. The incidence and severity of allergic reaction is very low with hydroxyetheyl starch; and no significant transplacental transfer of hydroxyethyl starch has been shown.[22,39] Besides, 47% of the starch is excreted in urine within 24 hours of infusion

The foetal outcome in caesarian under spinal anaesthesia is most often rewarding since it avoids drug depression of the foetus from general anaesthetics or a high dose of local anaesthetic. Transient maternal hypotension does not seem to harm the foetus or newborn if corrected promptly [11,29,32,33] even if the induction to delivery interval (ID interval) is prolonged. The use of 100% oxygen[5173] together with compensatory volume preloading compensate for hypotension of sympathetic blockade in spinal anaesthesia and maintain utero placental perfusion and thus avoids foetal hypoxia and acidosis.

The present study was undertaken with a view to evaluate the maternal haemodynamic changes in elective caesarian sections under spinal anaesthesia with preloading of the circulation, and to compare the efficacy of the two different preloading solutions used. The solutions used were lactated Ringer's solution, a crystalloid , and 6% hydroxy ethyl starch, a colloid. The foetal outcome under the effect of the two preloading solutions were also evaluated.

Objectives

Primary Objectives

- To evaluate the changes in maternal hemodynamic state and the fetal outcome during spinal anaesthesia for elective caesarian section.
- To compare the effect of crystalloid and colloid preloading on the maternal hemodynamic state during spinal anaesthesia.
- To compare the foetal outcome during elective caesarian section under spinal anaesthesia done after preloading with crystalloid and colloid solution.

Secondary Objectives

- To look for any other complications like allergic reactions or increased bleeding during the post operation period in response to colloid preloading.

Methodology

This was a randomized study aimed at evaluating the maternal hemodynamic changes and foetal outcome during spinal anaesthesia for caesarian section and also to compare the effects of preloading with either crystalloid or colloid solutions, on the maternal hemodynamic state and on the foetal outcome in elective caesarian section done under spinal anaesthesia.

The study was conducted in the operation theatre under the Department of Anaesthesiology and department of Obstetrics and Gynaecology. A population of forty healthy parturients are term with normal pregnancies and scheduled for elective caesarian section were selected for the study. They belonged to the age limit of 20 to 30 yrs and had comparable height and weight. They were randomly allocated to two groups of twenty each using sealed envelopes.

Group A- 20 parturients who received preloading with Ringer's lactate solution.

Group B- 20 parturients who received preloading with 6% Hydroxyethyl starch solution.

Inclusion criteria

Only healthy ASA Grade I parturients at term with single normal pregnancies and scheduled for elective caesarian section were included in the study. The indication for caesarian section included repeat caesarian section, foeto pelvic disproportion or breech presentation.

Exclusion criteria

Those patients with multiple pregnancies, intrauterine growth retardation, pre-eclamptic toxaemia, anaemia, hypertension, any other systemic disorders or past history of renal disease, coagulation disorders or bleeding tendencies or allergic reactions were excluded from the study. Any parturient in labour, or with spinal deformity or not willing for regional anaesthesia were excluded from the study.

Time and Duration of Study: Duration of study was 5 months from oct/2014 to feb/2015

Intervention: An interventional study was conducted in fourty healthy parturients in the study group scheduled to undergo elective caesarian section under spinal anaesthesia. They were randomly allocated to two groups, group A and group B, to receive preloading prior to induction of spinal anaesthesia as follows:

Group A- 20 parturients who were to receive preloading with 1 litre Ringer's lactate solution over a period of 15 to 20 minutes.

Group B- 20 parturients who were to receive preloading with 0.5 litre of 6% hydroxy ethyl starch solution over a period of 15-20 minutes.

All the parturients were fasting overnight and were premedicated with metoclopramide 10 mg intravenously 30 minutes prior to the procedure. A brief explanation of the technique and reassurance were given to the patients and in the operation theatre they were put in the supine position with left lateral uterine tilt. Baseline recordings of maternal heart rate (HR), non invasive arterial pressure, AP), arterial oxygen saturation (Sa02) and foetal heart rate were also done. Next, preloading with either Ringer's lactate 1 litre or 6% hydroxyethyl starch 0.5 litre was done according to the group to which each parturient belonged. Preloading was done over a period of 15-20 minutes. The maternal heart rate, [r] AP and Sa02, once again monitored at the completion of preloading. All the necessary equipments like working laryngoscopes, different and adequately sized endotracheal tubes, airways, syringes and required drugs were kept ready for the mother and newborn.

The parturients were then turned to the right lateral position and under aseptic precautions, lumbar subarachnoid block (spinal anaesthesia) was administered using 1.8 - 2 ml of 0.5% Bupivacaine (heavy) at L3-4 interspace with a 23 G Quincke tip spinal needle. Patients **50** were soon positioned in the supine position with a small pillow under the right buttock to provide a left lateral uterine tilt to prevent aortocaval compre-ssion. Oxygen was administered to all parturients through face mask and the level of sensory block assessed. A block ranging from T6- T4 was achieved. A maintenance IV fluid infusion with normal saline was continued in all the parturients following spinal anesthesia and the rate of infusion adjusted according to the AP of the parturients to maintain it within normal limits. Recording of maternal HR, and Sa02, were done at 2 min interval and. AP at 1 minute interval were done after the administration of spinal anaesthesia till the clamping of umbilical cord was done. Subsequently maternal monitoring continued at every 5 minutes upto the end of first hour and thereafter done every 15 minutes till the end of 3 hours. Hypotension was considered as a decrease in SAP to 80% or less of the baseline value or to less than 90 mm Hg. Any fall in blood pressure upto 80% of base line was managed by increasing the rate of crystalloid infusion and a value of less than 90 mm Hg was treated with injection mephentermine 3 to 6mg dose intravenously. The time from induction of spinal anaesthesia to delivery of baby (I-D interval and the time from uterine incision to delivery of the baby (U-D interval) were noted in all cases.

The condition of the neonate at delivery was assessed using Apgar score at 1 and 5 minutes of birth and dealt with accordingly. All the mothers received 10 units of oxytocin in 500 ml of 5% dextrose and sedation with pethedine 25 mg and phenergan 12.5 mg intravenously after the delivery of the baby. Any incidence of vomiting or more than normal blood loss was observed for during the procedure. After the surgery, the patient was shifted to the recocery room and monitoring continued a4 specific intervals till the end of three hours by an independent observer.

Volume of crystalloid infusion given after the induction of spinal anaesthesia during the intra operative period and upto end of 3 hours in the post operative period noted. Postoperative assessment of SAP and HR in the 4 post operative days were done. Any post operative complication including head ache, vomiting, increased maternal bleeding pervagina or allergic manifestations or reduced urine output were enquired into. All the data from patients and neonates were collected in to a prestructured proforma and statistical analysis done.

Results and Observations

It was observed that in patients who were preloaded with Ringer lactate, the fall in arterial pressure was more rapid than those who were preloaded with hydroxyethyl starch. The blood pressures they recorded every minute, the mean arterial pressures were calculated and tabulated (Table 1 & 2).

Fall of systolic blood pressures below 80% of normal or to <90mm of Hg was promptly corrected with normal saline infusion and injection/Mephentermine.

Maternal heart rate was recorded every 2 minutes (Table 3 & 4). It was found that there were no significant differences in the heart rates in the two groups. There were no differences in maternal oxygen saturations (SpO_z) in the 2 groups.

Effect on Fetal outcome

Neonatal Apgar scores were noted at 1 minute and 5 minutes. It was observed that there was no significant difference in the 2 groups (Table 5 & 6).

Post operative Monitoring

The parturients were under observation for the next 4 days after caesarian section. The detail of the recorded BP are given in Table-7. It was noted that there has been no significant difference in the diastolic and systolic pressures of the parturients for the next 4 days after caesarian section.

Data Analysis

Study includes 40 patients admitted for elective caesarian section. These 40 patients were randomized into groups. For the volume preloading in spinal anaesthesia one group was anaesthetized using Heta Starch (6%) and the other group was given Hartmann's solution.

Data entry was made using Dbase programs and for the analysis Epi-info programs (a program for the analysis of Epidemiological studies by CDC Atlanta, USA and WHO, Geneva) and SPSS programs were used.

The baseline characteristics measured were age, heart rate and arterial pressure. Arterial pressure was measures every one minute after the fluid was given until the umbilical cord was clamped. Maternal hearts rate every 2 minutes and fetal Apgar scores at 1 minute and 5 minutes were also recorded. Efficacy of the fluid was assessed by the Arterial Pressure reduction and the rate of fall of Arterial Pressure. Better fluid will be the one which has lower rate of fall in AP. For describing the baseline characteristics of the data observed, we used the descriptive statistics viz Mean and standard deviation. For comparisons of the AP and AP reduction of the two groups we used students 't' test Mann- Whitney test and the modified 't' test respectively. Significant levels were fixed at 0.05 (5%) level before starting the experimentation. Where ever the variances are unequal, we used either Mani-Whiteny test (on parametive equivalent of students Y test or the modified 't' test with modified degrees of freedom. The condition for using a 't' test for the comparisons of two groups, is that the variances of the groups should be equal.

Results

Baseline characteristics

Fluid 1 = Ringer Lactate group

Fluid 2= Hydroxy ethyl Starch group

	n= 20	n= 20		
	Fluid 1	Fluid 2	t	p
Age Mean	26.75	25.35		
SD	2.468	1.672	2.02	0.0503

No significant difference could be detected between the average values of Age between the group, indicating that the groups were comparable.

			t	p
HR Mean	89.05	85.45		
SD	4.979	7.28	1.83	0.076

No Significant difference between the groups in average Heart Rate. Therefore groups were comparable

AP (Initial value)

Mean	93.55	89.85
SD	3.94	7.169

Here since the variances are (square of SDs) Significantly different, Mann- Whitny test was used for the comparison of the average Arterial Pressure of the two grops. Mann-Whitney test value is 1.944 and the corresponding P value is 0.16 indicating that there was no difference between the average arterial pressure of the groups. Therefore the groups were comparable.

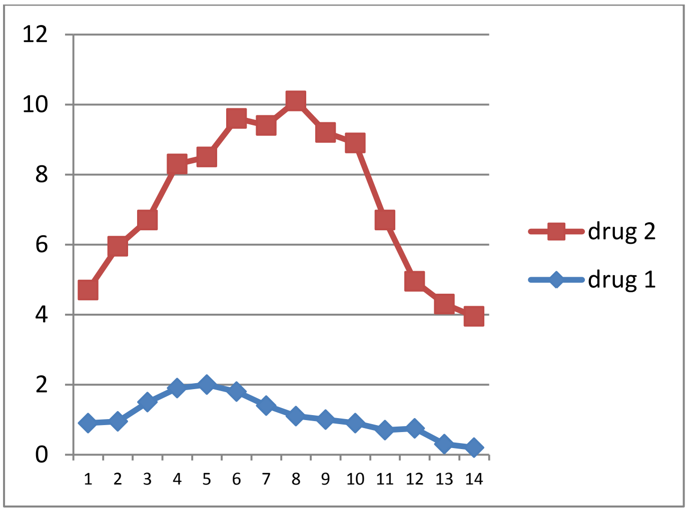
The main outcome variable indicating the efficacy of the anaesthetic drug is the Arterial Pressure reduction measures as the difference in the Arterial Pressure before administering the fluid and the Arterial Pressure measures at the time when the umbilical cord was clampes. The average Arterial Pressure reduction in the two groups and its significance was as shown below.

Mean	SD	P	Value
Fluid	3.95	1.572	0.000000

Here the variances (square of SD) are significantly different. Therefore Mann- Whitney test was used for the comparisons

Mann- Whitney test- 27.664 P= 0.000000

This P= 0.000000 Says that the result is highly significant. It means the maximum reduction has happened in Ringer lactate group and the very slow fall rate in Hetastarch group. Essence is that fluid 2 hecta starch is the better one for keeping the Arterial Pressure with a very slow fall rate compared to the fluid 1 (Ringer lactate) (see. Fig below)



The Arterial pressure reduction (fall) at all follow up time intervals were compared between fluid 1 and fluid 2 and it was found that all the fall rates were significantly slow in fluid 2 indicating that fluid 2 is the better one in keeping the arterial pressure with slow rate of fall throughout the observation times. The mean S.D, and the test values with p values for all the comparisons were highly significant. These values are shown in the table appended. For all the comparisons, modified 't' test was used with modified degrees of freedom because the conditions do not satisfy the use of a students 't' test.

Discussion

Spinal anaesthesia is the more commonly administered anaesthetic for caesarian section. Despite many advantages it offer, hypotension continues to be a significant problem during spinal anaesthesia in the parturients. Preloading is routinely practised to expand the intravascular volume as a measure for prevention of spinal hypotension during caesarian section, but the nature of the preloading solution, its volume, and rate of infusion are still, subjects of controversy. The commonly used other methods include prophylactic use of a vasopressor infusion or bolus dose (commonly ephedrine) and left lateral uterine tilt to avoid aorto caval occlusion by gravid uterus. When aortocaval compression is avoided and maternal blood pressure is maintained, uterine perfusion is not altered[32].

The commonly used prophylactic administration of crystalloid preload or reduced crystalloid preload with ephedrine infusion could not decrease the incidence of maternal hypotension but could have decreased the severity of it[58-59-34]. Maternal hypotension is hazardous since it could be associated with comparable fall in uterine blood flow and placental perfusion leading to foetal hypotension and acidosis if not promptly corrected[1112]. Abnormal apgar and neurobehavioural scores were noted when maternal systolic blood pressure dropped by more than 30% of baseline value or stayed less than 80 mm Hg for more than four minutes. Therefore adequate prehydration, uterine displacement laterally and prompt diagnosis and correction of hypotension appear to be important. Since vasodilatation is the major cause for arterial pressure reduction in spinal anesthesia, it seems logical to use vasopressors to correct it[71]. Despite preloading, many patients require vasopressors too to correct the fall in blood pressure.

This study evaluated the maternal haemodynamic effects during spinal anaesthesia for caesarian section done after preloading using either a crystalloid solution (Ringer's lactate) or a colloid solution (6% hydroxyethyl starch). The study evaluated the incidence and degree of hypotension each group experienced and the effect it had on the outcome of the newborns, born to these mothers.

Individual maternal haemodynamic response to anaesthesia varies widely, depending upon the effective blood volume, prior sympathetic tone, degree of aortocaval occlusion and the cardiac status of the parturient. In a parturient with caval occlusion alone the cardiac output may fall by 30% from baseline[62]. Hence a population of fourty healthy parturients at term posted for elective caesarian section, having comparable baseline data of ASA status, height, body weight, term of gestation, and intra uterine foetal status, were only included in the study and the aortocaval occlusion avoided by left lateral uterine tilt. All of them received the same premedication with injection metoclopramide 10 mg intravenously 30 minutes prior to the procedure and all mothers received 100% oxygen through face mask after administration of sub arachnoid block to maintain an arterial oxygen saturation of more than 97% in all of them throughout the surgery. So it could be concluded that there was no influence of maternal hypoxia as an aggravating factor in the haemodynamic variation between the two grouips of parturients. This maternal oxygen status could have resulted in the good foetal outcome in both the groups. Besides there was no excessive blood loss observed, or vomiting in any of the parturients during caesarian section in this study.

The intravenous fluid therapy concerns predominantly the intravascular compartment with regards to colloids and both intravascular and intestitial compartments with crystalloids. Most of the vitals signs such as heart rate, blood pressure, cardiac output, right atrial pressure are related to the intra vascular space and also, reflects the fluid status of the patient. And so in this study, maternal Heart Rate (HR), Arterial Pressure ^ AP), Saturation (Sa02) were the haemodynamic parameters monitored in addition to the foetal heart rate, I-D interval, U-D interval, Apgar score of new bom and birth weight of the babies. Statistical analysis showed no significant difference between the mean value of maternal or foetal characteristics (Tables 1 - 6). Therefore these variables are unlikely to have unequally affected the results in this study.

Vasodilator effects of anaesthetic agents or regional anaesthesia may be ideally managed with colloid preloading since they have longer intravascular half life than the crystalloids. Although crystalloids are the cheaper and readily available solutions without any possible adverse effects of colloids such as allergic reactions, clinical observations indicate that if in excess (one litre or more) crystalloids may create clinical problem related to expanstion of intestitial space which may manifest as peripheral or pulmonary oedema[66]. Tissue oedema could reduce tissue oxygenation too. However the 1 litre crystalloid or the 500 ml of colloid preloading together with the amount of crystalloid (normal saline) solution infused after the administration of subarachnoid block in this study, did not produce any circulatory overload in any of the parturients included.

The nature of spinal anaesthesia administered too was identical in that all of them received subarachnoid block using 1.8- 2 ml of 0.5% Bup©vaccine (heavy) L3-4 interspace using 23 g Quincke type spinal needles and achieved a mean height of sensory block to T6 level. The mean sensory level of T6 block achieved as in this study group could be associated with an abrupt onset of sympathetic block, as the height of sympathetic block usually extends to two or more dermatomes above the sensory level. The onset was found to be as early as 2 minutes after administration of spinal anaesthesia.

This study showed a high incidence of maternal hypotension during spinal anaesthesia which was found to be higher in the crystalloid group A (76%), than in the colloid group B (32%).

This observation and incidence was simlar to that reported in earlier studies.

J Karinen et al[29] (1995) observed high incidence of maternal hypotension of 62% in crystalloid group (preloading with 1 litre Ringer's lactate) and 38% in the colloid group (preloading with 0.5 litre 6% hydroxyethyl starch) during spinal anaesthesia for caesarian section.

Rout CC et al [59](1993) observed in a study group of 140 parturients that the incidence of hypotension was 55% in the crystalloid group as compared to 71% in the unpreloaded group of parturients who under ent caesarian section under spinal anaesthesia and there was no significant difference in the severity of hypotension between the two groups.

Robson and colleagues [57](1992) observed that cardiac output decreased in 12 out of 16 parturients during spinal anaesthesia in spite of crystalloid preloading and left semilateral (45°) position[97].

W.S Chan et al (1997)[71] observed higher incidence of hypotension in the

crystalloid group (85%) preloaded with Ringer's lactate, when compared to the ephedrine infusion group (65%). In all the above clinical studies including the present study, the results were obtained when hypotension was considered as a reduction in systollic arterial pressure (SAP) to 20% or greater from the baseline value prior to preloading .

The incidence of hypotension observed in this study stress the fact that hypotension during spinal anaesthesia in the parturient can not be prevented. However the crystalloid and colloid preloading showed different effects on the maternal haemodynamic state of the parturients during spinal anaesthesia for caesarian section. The difference between the incidence was found to be statistically significant.

Thus it was found from this study that there was a significant reduction ■ in the severity of hypotension when 6% hydoroxyethyl starch solution 500 ml was used for preloading where as crystalloid preloading with one litre of Ringer's lactate solution could not achieve this. It was also obseved that hypotension occured earlier in the crystalloid group than in the colloid group.

These observations could be due to the fact that crystalloids leak rapidly into the intestitial space, thereby not allowing sufficient restoration of the intravascular volume[966]. The colloid solution with greater molecular size remain intravascularly longer than the crystalloid solutions to maintain colloid osmotic pressure and expand the plasma volume, thus compensating for the peripheral vasodilation and decreased venous return of spinal block to a certain extent. Accordingly it was found in this study that the mean total volume of crystalloid infusion requirement after administration of subarchnoid block was higher in cyrstalloid group than in the colloid group.

Volume preloading with both crystalloid and colloid solutions in this study soon resulted in a mid transient increase in maternal mean percentage AP from the baseline recording (Tables 1 & 2) both of which came down soon after administration of subarachnoid block.

Hankeln K et al [21](1990) found that hypervolaemic haemodilution with hydroxyethyl starch and 5% human albumin produced significant increase in mean arterial pressure.

Robson SC et al [57] (1992) and J. Karinen et al [29](1995) too had similar observations after preloading with 1 litre crystalloids and both o.5 litre 6% hydroxyethyl starch and 1 litre crystalloid solutions, respectively, although SAP CVP started falling along with cardiac output after administration of subarachnoid block. Robson et al[56] (1993) had re-observed a mean increase in cardiac output from 7 lit/ minto 8 litre/min, after preloading with 1.5 litre Ringer's lactate, which remained unchanged after administratio of incremental spinal anaesthesia. Rout and Colleagues [58](1992) had observed a rise in CVP as high as 19 cms afer crystalloid preloading which came down after administratrion of spinal anaesthesia. The observed decrease in CVP and

SAP from the increased values caused by the preload, in both the groups immediately after induction of spinal anaesthesia, could be due to decrease in venous return to the heart and a consequent reduction in cardiac output caused by the sympathetic blockade.

This study showed a decrease in maternal heart rate after induction of spinal anaesthesia, in the crystalloid as well as colloid group. Mean maternal heart rate tended to decrease during spinal anaesthesia similarly in both the groups, which was similar to the observation by earlier studies[29,59].

The mean maximum percentage fall in heart rate showed no statistically significant difference between both the groups of parturients. However Thomas DG et al[65] (1996) had observed a 34% incidence of brady cardia with a mean maximum percentage fall of 24.2% after preloading with 1.5 litre crystalloids.

The neonatal outcome in this study was similar and uneventful in both the crystalloid and colloid group (table). The Apgar score at 1 minute and 5 minute showed similar results of above 9 and 10 respectively in both the groups. All the newborns were healthy with normal birth weight and had breathed effectively by 30 seconds after birth. This was similar to the results in most of the studies of caesarian section done under spinal anaesthesia[11,29,71]. The U-D interval which is more important to decide foetal outcome remained low in both the study groups.

The transient maternal hypotension in this study groups of parturients did not seem to have any adverse effect in the outcome of their foetus as evidenced by the high Apgar scores of all the new bom in this study belonging to either crystalloid or colloid group.

J. Karinen et al[29] (1995) too had observed that, with a 62% and 38% incidence of hypotension in crystalloid and colloid group respectively all the new born an Apgar score above 8 at 1 min, (except one with cleft palate and Apgar score 6 at 1 minute).

Cork B C et al [n](1982) had observed that transient maternal hypotension (less than 2 mins) does not seem to harm the foetus or new born if corrected promptly. Therefore adequate prehydration, lateral uterine displacement and prompt diagnosis and treatment of hypotension appear to be important

W.S. Chan et al[71] (1997) too obtained mean Apgar score of 9 at 1 minute in all the new boms inspite of greater than 30% reduction in blood pressure in 6%% of the Ringers lactate preloaded cases and in 35% of ephedrine infusion cases.

In addition the maternal oxygenation provided, improves umbilical artery oxygen tension and foetal oxygenation which is reflected as good foetal outcome in caesarian section under spinal anaesthesia[51-73]. The maternal Sa02 of 97% and above in this study group could have maintained good foetal oxygen status.

None of the parturients in this study group showed any allergic or systemic complication intra-operatively or post-operatively except for one case of post dural puncture headace (in the crystalloid group) which developed on the 2 nd post operative day. This was treated conservatively and obtained prompt relief. Thus preloading with either one litre crystalloid or 0.5 litre colloid solution and use of 23 guage Quincke type point spinal needle have proved effective in controlling post dural puncture headache in this study, the incidence of which is usually higher in the parturients nor did any patient have increased vaginal bleeding or allergic reaction in the post operative period. This could exclude any of such adverse reactions, though rarely possible with hydroxyethyl starch solutions.

Summary

Spinal anaesthesia is widely used for elective as well as emergency caesarian sections, but maternal hypotension following spinal anaesthesia for caesarian section is often abrupt with a precipitous fall in blood pressure. Hence various prophylactic measures are adopted to reduce the incidence and magnitude of hypotension in the parturient, like volulme preloading with crystalloids to compensate for vasodilatation; left lateral uterine displacement to avoid aortocaval occlusion; and even prophylactic ephedrine infusion for maintanance of maternal blood pressure. Recently each of these methods were reevaluated since the incidence of hypotension in the parturient remain high still inspite of all these measures[29,59-65,71] .

The present study was undertaken to evaluate the effect of crystalloid and colloid preloading on maternal haemodynamic state and foetal outcome during spinal anaesthesia for caesarian section. Compensatory volume expansion or preloading is aimed at expanding the intravascular volume so that the deficit in volume due to vasodilatation as a result of periphreal sympathetic blockade of spinal anaesthesia can be countered to a certain extent.

In this study forty healthy ASA I parturients with normal pregnancy at term posted for elective caesarian section nunder spinal anaesthesia were taken up. They were premedicated with injection metoclopramide 10 mg intravensouly, 30 minutes prior to the procedure and randomly allocated to two groups of twenty each to receive preloading with either 1000 ml of Ringer's lactate solution a crystalloid, or 500 ml of 6% hydroxyethyl starch solution a colloid over a perid of 15 to 20 minutes. All of them were positioned supine with left lateral uterine tilt. A peripheral vein to infuse preloading fluid was cannulated. Then base line values of maternal noninvasive Arterial Pressure (AP), Heart Rate (HR), Arterial Oxygen Saturation (Sa02), The preloading was done. After preloading the haemodynamic parameters were again recorded and lumbar subarchnoid block administered with Bupivacaine using 23 g spinal needle. A third set of measurement of AP, HR and Sa02 and parturient quickly positioned with left lateral uterine tilt and 100% oxygen given through face mask. The mean sensory level of blockade. T6 was achieved. Surgery began and monitoring continued at regular intervals as follows:

HR and Sao2 recording every 2 minutes AP recorded every 1 minutes after the subarachnoid block (SAB) is administered till the end of umbilical cord clamping done.

Thereafter every 5 minutes till the end of first hour.

Thereafter every 15 minutes from the 1st hour till the end of 3 hours after SAB.

Meanwhile normal saline was infused slowly after the administration of SAB and the rate of infusion adjusted according to fall in AP- Maternal hypotension was defined as a fall in SAP to 80% or less from the baseline and less than 90 mm Hg. Any fall in SAP to 80% was corrected by increasing the infusion rate of normal saline and any fall in SAP below 90 mm Hg was trearted with injection mephentermine 3 to 6 mg intravenously. The induction Delivery interval and Uterine incision- Delivery interval were noted in all cases.

The new borns were assessed at birth using Apgar score recorded at land 5 minutes intervals and all the new born had apgar score above 8 at 1 minute and above 9 at 5 minutes . All the data collected were enterd into a prestructured proforma, and statistcial analysis done.

It was observed that one litre crystalloid preloaded or 0.5 litre colloid preload, along with the crystalloid infusion after subarachnoid block did not produce any circulatory overload in any of the parturients. Arterial oxygen saturation was maintained above 97% in all the parturients and the blood loss in all of them were within normal limits during the procedure. The post induction requirement of crystalloid varied between the two groups and the crystalloid group showed more requirement of fluid than the colloid group to correct any fall in SAP.

A higher incidence of maternal hypotension was observed in the crystalloid group but the incidence was comparatively lower in the colloid group.

The crystalloid group showed at 7.6% greater mean maximum percentage fall in SAP which was found to be statistically significant on analysis. The colloid preload seems to have caused a better reduction in the incidence and magnitude of hypotension, although crystalloid could not prevent it totally.

There was no differecne in the foetal outcome between the crystalloid and colloid group and all forty neonates were healthy with comparable mean Apgar scores in the colloid group at 1 minute of birth.

Conclusions

It has been observed from this study that although spinal hypotension in the parturients could not be avoided, colloid preloading of 500 ml could prevent the most severe form of hypotension. The 6% hydroxyethyl starch solution was found to be not only effective but also without adverse effects in this study. So volume preloading with 6% hydroxyethyl starch 500 ml for spinal anaesthesia for caesarian section is advisable.

Neonatal outcome is good when crystalloid or colloid preloading is done prior to spinal anaesthesia for caesarian section and hypotension was promptly corrected.

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