THE EXPERIMENT
INTERNATIONAL JOURNAL OF SCIENCE AND TECHNOLOGY

ISSN-2319-2119

RESEARCH ARTICLE

Dr. Laltanpuii Sailo *et al*, The *Experiment, 2015., Vol. 30(1), 1970-1976*

TO COMPARE THE HAEMODYNAMIC CHANGES BETWEEN COLLOID PRELOAD AND CO-LOAD IN PREVENTING MATERNAL HAEMODYNAMIC CHANGES DURING SPINAL ANAESTHESIA FOR ELECTIVE CAESAREAN DELIVERY.

ABSTRACT:
Spinal (subarchanoid) anaesthesia is considered as the "Gold standard" technique for caesarean section. Hypotension is the most common side effect of neuraxial blocks in the obstetric patients. Prehydration is being commonly used as a preventive measure for hypotension. Colloid remains for a longer period within the intravascular space and colloid preload provides a sustained increase in central venous blood volume and cardiac output. The present study was aimed to compare haemodynamic changes following colloid preload and colloid co-load in patients who undergo elective caesarian section in preventing maternal hemodynamics following spinal anaesthesia.

After approval from IEC and obtaining informed consent from the participants, 75 (seventy five) parturient of ASA (American Society of Anesthesiologist) – I and II who were scheduled to undergo caesarean section under spinal anaesthesia were taken for this study and divided in to 3 groups based on receiving colloid preload, co-load and crystalloid drip. Data collected were analyzed using SPSS version 16 software for statistical significance and p <0.05 was regarded as significant.

Clinicodemographically all three groups were comparable. The incidence of hypotension with either Colloid Preload or Co-load is lower than the Control Group who received crystalloid drip (28% & 8% vs. 64% X^2= 18.12 and p <0.05. However difference between Colloid Preload (28%) and Colloid co-load (28%) was not statistically significant (p > 0.05).

KEYWORDS: Spinal anaesthesia, Hypotension, Prehydration, Colloid, caesarian section.

1. INTRODUCTION

Caesarean section is very common and accounts for 7 to 32 per 100 hospital deliveries[1]. Spinal (subarchanoid) anaesthesia is considered as the "Gold standard" technique for caesarean section. Hypotension is the most common side effect of neuraxial blocks in the obstetric patient with an incidence rate reported is as high as 83%[2]. This has remained a significant concern for the anesthesiologist during management of such patients. Prevention of hypotension has also been attempted over the years and colloid, crystalloid preloading has been used for this. Recent research supports decreased use of crystalloid prehydration and ephedrine and increased use of cohydration, colloids.[3] Subsequently co-loading of fluid has also been tried. It is known that colloid remains for a longer period within the intravascular space and colloid preload provides a sustained increase in central venous blood volume and cardiac output.[4] based on this, the present study was designed to evaluate haemodynamic changes following colloid preload and colloid co-load in patients who undergo elective caesarian section to find out which method is more effective to prevent hypotension following spinal anaesthesia and compare it with crystalloid prehydration.

2. MATERIALS AND METHODS

The study was conducted in the Department of Anaesthesiology, Regional Institute of Medical Sciences Hospital, Imphal, Manipur, India. After approval by the Institutional Ethical Committee (IEC), 75 (seventy five) parturient of ASA (American Society of Anesthesiologist) – I and II who are scheduled to undergo caesarean section under spinal anaesthesia were taken for this study. Written informed consent was obtained from all patients. The study group were divided into 3 (three) groups of 25 (twenty five) parturient in each group. Group P (n = 25) – preloaded with 500 ml of 6% HES (Hydroxy ethyl starch solution130/0.4) 15 to 20 minutes before giving spinal anaesthesia, Group C (n = 25) – were co-loaded with 6% HES after identification of cerebrospinal fluid (CSF) and Group CT (n=25) – were control group and had a ringer's lactate on flow.

THE EXPERIMENT
INTERNATIONAL JOURNAL OF SCIENCE AND TECHNOLOGY

ISSN-2319-2119

RESEARCH ARTICLE

Dr. Laltanpuii Sailo *et al*, The *Experiment*, *2015.*, *Vol. 30(1), 1970-1976*

Preanaesthetic examination was done for all the parturient the day before the operation. Women with hypotension or hypertension, asthma, diabetes mellitus, cardiac diseases, coagulopathy, neuropathy, renal or liver diseases, local infection or septicemia were excluded. All parturient received oral premedication with tab. Ranitidine 150mg the night before the operation. On the day of operation, intravenous line was started in the pre-operative room. Intravenous injection of Metoclopramide 10 mg and intravenous injection. Ranitidine 50 mg was given few minutes prior to the surgery in all the groups.

ASA standard monitoring were applied in all parturient. Base line blood pressure, heart rate and SPO_2 were recorded. For the subarachnoid block, lumbar L_3-L_4 interspace was used in each patient for all the groups with the midline approach. Using Quinke's needle (spinocaine) B' Braun 25G, dural puncture was confirmed by the identification of CSF. After confirming the free flow of the CSF 2ml of 0.5% Bupivacaine (heavy) was injected into the subarachnoid space at the rate of 0.2 ml/sec.

Immediately after the procedure is finished, the parturient were made to lie supine. The level of block was checked and operation table were adjusted to slight head down position to make the level of block up to T_5-$_6$.

In the meantime blood pressure readings and heart rate and SPO_2 were taken by the machine automatically every 2 minutes till the next 10 minutes, followed by every five minutes till the end of surgery that was usually extending up to 40 to 50 minutes. Left uterine displacement was done by placing a wedge under the right buttock. If there is persistent fall in blood pressure towards the end of the surgery after adequate hydration is being given then the foot end of the table was raised by adjusting the table to increase the venous return.

Incidence of hypotension was recorded if fall of BP was to < 80% of baseline values. Injection Mephentermine 3 mg and an extra 100 ml of ringer's lactate were given for treating the hypotension. After delivery of the baby all parturient received injection Oxytocin 20 units/L in normal saline and injection Methylergometrine 0.2 mg intramuscularly.

3. RESULTS AND DISCUSSION

All the three groups were comparable in terms of age, weight, height and ASA physical status (p> 0.05) (Table 1). In the present study the incidence of hypotension in the Preloading Groups (P) was 28% and in the Co-loading Group (C) was 8% (Table 2).

The incidence of hypotension with either Colloid Preload (P) or Co-load (C) is lower than the Control Group (CT) (P 28%, C 8% and CT 64%: $X^2 = 18.12$ and $p < 0.05$ (Figure 1). However there was no statistically significant difference between Colloid preload (7/25; 28%) and Colloid co-load (2/25; 8%) with p value of 0.06. But when preload (P) or co-load (C) was compared with the Control (CT) groups the difference was highly significant ($p < 0.0001$). (Table 3)

The present finding is comparable to the findings of Siddik Syed et al[5]. In their study, they also found no difference in the incidence of Colloid Co-load and Preload for elective caesarean delivery under spinal anaesthesia.

Several previous studies were conducted in favor of using fluids as a means to correct hypotension after spinal anaesthesia for caesarean section. The rapid administration of crystalloid solution to correct established hypotension was first allocated by Greiss and Crandell in 1965[6]. They showed that 500ml of intravenous fluid partly restored uterine blood flow in gravid ewes under spinal anaesthesia. Two subsequent studies from Marx and co-workers [7] demonstrated that hypotension could be eliminated by the use of 1 L of 5% glucose in Lactated Ringer's solution (D5RL) before spinal anaesthesia. Another study was conducted where a rolled up blanket was used under the right buttock along with fluid administration to correct hypotension. The authors concluded that the key to prevention of spinal hypotension was the use of prophylactic fluid administration.[7,8] The first study conducted by Clark, Thompson and Thompson[8] documented that lateral tilt and fluid preloading lowered the incidence of hypotension

ISSN-2319-2119
RESEARCH ARTICLE
Dr. Laltanpuii Sailo *et al*, The *Experiment, 2015., Vol. 30(1), 1970-1976*

but was still associated with a significant incidence of spinal hypotension.

On the other hand, several studies have questioned the value of crystalloid administration before the initiation of spinal anaesthesia for caesarian section; suggesting that it is relatively ineffective with up to 85% of patients developing hypotension.[9] Preloading with crystalloid is relatively ineffective since it is rapidly redistributed [9,10.] Since then studies comparing crystalloid Preload and Co-load were conducted. Some found that crystalloid Co-load had lesser incidence of hypotension others found that there was no difference[11,12].

Meanwhile Mac Lennan FM, and Mac Donald A F[13] opined that while there were several advantages of crystalloid Preload and Co-load there were several disadvantages as well for example increased maternal risks, decreased fetal oxygen carrying capacity and the increased risk of pulmonary edema. Dyer RA[11] and Mojica JL[12] had conducted studies stating that a Co-load provides additional intravascular fluid at the time of maximum vasodilatation. Studies conducted by Malthru et al[14], Baraka et al[15] and Sharma et al[16] had supported the superiority of colloid over crystalloid.

In the present study we have used 500 ml of 6% HES (130/0.4) colloid as preload 15 to 20 minutes prior to subarachnoid block, 500ml of 6% HES as co-load started at the time of subarachnoid block and a control group with plain Ringer's Lactate just to maintain patency of the cannula. The median time to hypotension was seen only after 20 minutes of the surgery.

In the present study there is an increase in the heart rate in the first 2 to 6 minutes and later part of the surgery after 20 minutes. This early rise in heart rate at 2 to minutes which is significant without significant fall in blood pressure could be explained by patient anxiety.

In the present study the Control Group (CT) had highly significant fall in blood pressure throughout the surgery and a significant rise in heart rate. This probably can be explained by one or more of these. It is postulated that higher fluid load dilutes plasma proteins lowering Colloid osmotic pressure to a greater extent than the smaller volume, thereby leading to a greater extravasation of fluid into the extracellular fluid compartment, causing hypotension. Furthermore with crystalloid administration central venous pressure increases in the first few minutes of preloading then declines by rapidly redistributing to the extra vascular space thereby causing fall in blood pressure[17]. The volume of crystalloid, colloid administered can lead to stimulation of atrial natriuretic peptide leading to vasodilatation.[18,19]

The amount of vasopressor and fluid administered in both preload (P) and co-load (C) were not significantly different ($p>0.05$). Whereas in the control group (CT), significantly high amount of fluid and vasopressor were required to treat hypotension compared with both P and C group ($p<0.001$)**.** Same was true even for bolus RL requirements for the treatment of hypotension. (Table 4) Limitation of the present study is that we have not included the cost factor, its effects on blood coagulation profile[20] and its potency for allergic[21] reactions and effects on kidney function.[20]

THE EXPERIMENT
INTERNATIONAL JOURNAL OF SCIENCE AND TECHNOLOGY

ISSN-2319-2119

RESEARCH ARTICLE

Dr. Laltanpuii Sailo *et al*, The *Experiment, 2015., Vol. 30(1), 1970-1976*

Parameters	*Group P (n=25)*	*Group C (n=25)*	*Group CT (n=25)*	*Statistical test value*	*p value*
Age (years) (mean±SD)	28.68±4.46	27.20±6.03	28.08±4.72	ANOVA or 'F' test value of 0.53	0.59
Weight (Kgs) (mean±SD)	60.12±3.19	59.60±4.53	61.76±5.96	ANOVA or 'F' test value of 2.80	0.07
Height (Cms) (mean±SD)	159.4±3.77	158.11±3.64	158.18±3.18	ANOVA or 'F' test value of 0.94	0.40
ASA (I:II)	23:2	23:2	24:1	Chi-square value of 0.43	0.80

Table 1: showing the distribution and comparison of patient's demographic profile in the three groups. (P - Preload , C – Co-load, CT – Control, ASA – American Society of Anesthesiologist, SD- standard deviation)

Groups	Hypotension (Yes)	Statistical test value	'p' value
Preloading (P) (N=25)	7 (28%)	Chi- square value of 18.12	($p<0.05$)
Co-loading (C) (N=25)	2(8%)		
Control (CT) (N=25)	16 (64%)		

Table 2: showing the distribution and comparison of hypotension in the three groups

Intergroup	Statistical test value	'p' value
Hypotension		
Group 'P' vs Group 'C'	Chi- square value of 3.38	0.06
Group 'P' vs Group CT	Chi- square value of 6.52	0.01
Group 'C' vs Group CT	Chi- square value of 17.01	0.0001
Vasopressor requirement		
Group 'P' vs Group 'C'	Independent t test 1.18	0.24
Group 'P' vs Group CT	Independent t test 3.76 Independent t test 4.41	0.0001
Group 'C' vs Group CT		0.0001
Ringer's Lactate bolus		
Group 'P' vs Group 'C'	Independent t test 0.92	0.36
Group 'P' vs Group CT	Independent t test 3.34	0.0001
Group 'C' vs Group CT	Independent t test 3.93	0.0001

Table 3: showing the intergroup comparison of hypotension, rescue Mephentermine and Ringers Lactate solution in the three groups.

ISSN-2319-2119

RESEARCH ARTICLE

Dr. Laltanpuii Sailo *et al*, The *Experiment, 2015., Vol. 30(1), 1970-1976*

parameters	*Group P (n=25) (Mean±SD)*	*Group C (n=25) (Mean±SD)*	*Group CT (n=25) (Mean±SD)*	*P value*
Vasopressor (mgs)	1.08±1.70	0.48±1.87	4.20±3.77	**0.0001**
Inj. RL (in ml)	56.00±112.10	25.00±122.47	224.00±216.56	**0.0001**

Table4: showing the distribution and comparison of rescue Mephentermine and RL requirement required in the all three groups.

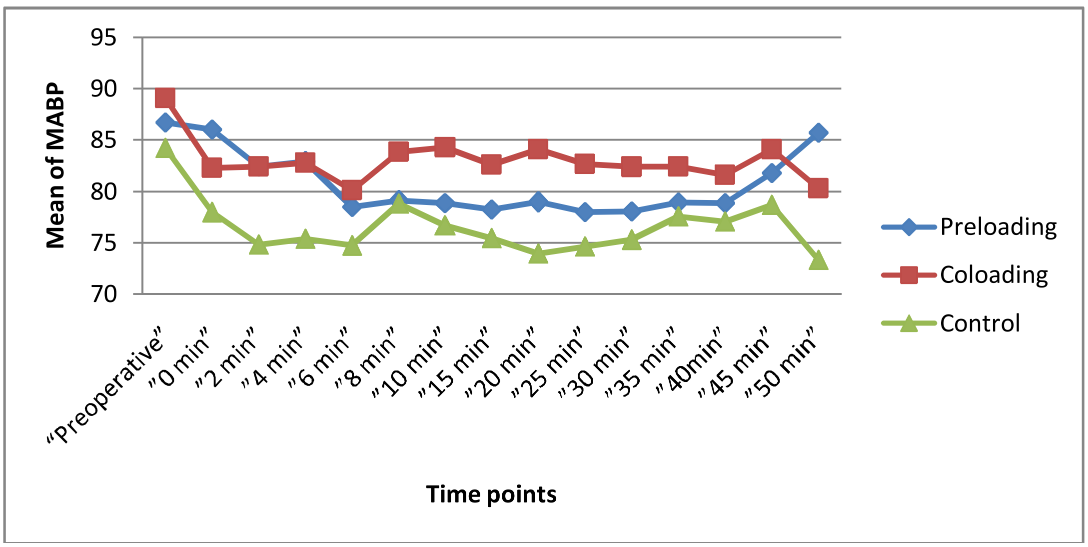

Figure 1: showing the distribution of mean arterial blood pressure (mm Hg) in the three groups

4. CONCLUSION

The Incidence of hypotension is similar after a Colloid preload versus co-load under spinal anaesthesia however it is significantly lower than crystalloid prehydration. Neonatal outcome was same in both the groups. Therefore a co-load with colloid can replace preload with colloid to shorten preparation time and avoid any delay in performing subarachnoid block which is more important in emergency cesarean section.

ACKNOWLEDGEMENT: None

CONFLICT OF INTEREST: None

THE EXPERIMENT
INTERNATIONAL JOURNAL OF SCIENCE AND TECHNOLOGY

ISSN-2319-2119

RESEARCH ARTICLE

Dr. Laltanpuii Sailo *et al*, The *Experiment, 2015., Vol. 30(1), 1970-1976*

REFERENCES

1. Notzon FC. International differences in the use of obstetrics intervention. Journal of American Medical Association.1990;263:3286-91.
2. Ngankee WD, Khaw KS, Ng FF. Prevention of hypotension during spinal anaesthesia for cesarean delivery: an effective technique using combination phenylephrine infusion and crystalloid cohydration. Anesthesiology 2005; 103:744-50.
3. Ngan Kee WD. Prevention of maternal hypotension after regional anaesthesia for caesarean section. Curr Opin Anaesthesiol. 2010;23:304-9.
4. Ueyama H, He YL, Tanigami H, Mashimo T, Yoshiya I. Effects of crystalloid and colloid preload on blood volume in the parturient undergoing spinal anesthesia for elective cesarean section. Anesthesiology 1999; 91:1571-6.
5. Siddik SM, Nasr VG, Taha Sk, Zbeide RA, Shehado JA, Al Alami AA et al. A randomized trial comparing colloid preload to co-load during spinal anaesthesia for elective cesarean delivery. Anesth Anal 2009; 109: 1219-24.
6. Greiss FC , Crandell DL. Therapy for hypotension induced by spinal anaesthesia during pregnancy: observation on gravid ewes. Journal of American Medical Association 1965;191:793-96.
7. Wollman SB, Marx GF. Acute hydration for prevention of hypotension of spinal anesthesia in parturients. Anesthesiology 1968; 29:374-80.
8. Clark R B, Thompson D S, Thompson C H. Prevention of spinal hypotension associated with cesarean section. Anesthes 1976; 45: 670-4.
9. Rout CC, Rocke DA, Levin J, Gouws E, Reddy D: A reevaluation of the role of crystalloid preload in the prevention of hypotension associated with spinal anesthesia for elective cesarean section. Anesthesiology 1993;79:262-91.
10. Rout CC, Akoojee SS, Rocke DA, Gouws E. Rapid administration of crystalloid pre load does not decrease the incidence of hypotension after spinal anaesthesia for elective caesarean section. British Journal of Anaesthesia 1992;68:394-7.
11. Dyer RA, Farina Z, Joubert IA, DuToit P, Meyer M, Torr G, et al. Crystalloid preload versus rapid crystalloid administration after induction of spinal anaesthesia (co-load) for elective cesarean section. Anaesth Intensive Care 2004; 32:351-7.
12. Mojica JL, Melendez HJ, Bautista LE. The timing of intravenous crystalloid administration and incidence of cardiovascular side effects during spinal anesthesia: the results from a randomised controlled trial .Anesth Analg 2002;94:432-7
13. MacLennan FM , Mac Donald AF, Campbell DM. Lung water during the puerperium. Anaesthesia 1987;42:141-7.
14. Mathru M, Rao LK, Kartha RK, Shanmugham M, Jacobs HD. Intravenous albumin administration for the prevention of spinal hypotension during cesarean section. Anesthesia and Analgesia 1980;59:655-8.
15. Baraka AS, Taha SK, Ghabach MB, Sibaii AA, Nader AM. Intravascular administration of polymerized gelatin versus isotonic saline for prevention of spinal induced hypotension. Anesth Analg 1994;78:301-5.
16. Sharma SK, Gajral NM, Sidawi JE: Prevention of hypotension during spinal anesthesia: A comparison of intravascular administration of hetastarch versus lactated ringer's solution. Anesth Analg 1997;84:111-4.
17. Carvalho JC, Mathias RS, Senra WG, Torres ML, Vasconcelos A, de Moraes JE et al. Maternal, fetal and neonatal consequences of acute hydration during epidural anaesthesia for C-section. Regional Anesthesia 1993;18:19-20.
18. Pauta AM, karinen J, Vuolteenaho OJ, Laatikainen TJ. Effect of intravenous preload on vasoactive peptide secretion during caesarean section under spinal anaesthesia. Anaesthesia 1996;51:128-32.
19. Oqata K, Fukusaki M, Mivako M, Tamura S, Kanaide M, Sumikawa K. The effects of colloid preload on hemodynamics and plasma concentration of atrial natriuretic peptide during spinal anesthesia in elderly patients. Masui 2003;52:20-5.

THE EXPERIMENT
INTERNATIONAL JOURNAL OF SCIENCE AND TECHNOLOGY

ISSN-2319-2119

RESEARCH ARTICLE

Dr. Laltanpuii Sailo *et al*, The *Experiment*, *2015.*, *Vol. 30(1), 1970-1976*

20. Jungheinrich C, Neff TA. Pharmacokinetics of hydroxyethyl starch. Clin Pharmacokinet. 2005;44:681-99.
21. Laxenaire MC, Charpentier C, Feldman L. Anaphylactoid reactions to colloid plasma substitutes: incidence, risk factors, mechanisms. A French multicenter prospective study. Ann Fr Anesth Reanim 1994;13:301-10.

Dr. Laltanpuii Sailo[*], Dr. Stephen Lalfakzuala Sailo, Dr. Habib Md Reazaul Karim, Dr. PKS Laithangbam, Dr. Debasis Pradhan

Department of Anaesthesiology. Regional Institute of Medical Sciences, Imphal and Department of Anaesthesiology and Critical Care. North Eastern Indira Gandhi Regional Institute of Health & Medical Sciences, Shillong.

Corresponding author:

Dr. Laltanpuii Sailo, A-19, Faculty Quarter, NEIGRIHMS Campus, Shillong-18. Meghalaya, India.