Original Article

Colloid Preload and Coload Versus Crystalloid Preload in Spinal Cesarean Delivery: The Effect of Injection Speed

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ABSTRACT

Objective: To foresee clinical effects of crystalloid pre-load versus colloid preload/co-load in spinal cesarean delivery.

Study Design: Prospective / observational study

Place and Duration of Study: This study was conducted at the Department of Anesthesia, Islam Teaching Hospital, Islam Medical College, Sialkot, from 03-4-2012 to 18-9-2012 and Rawal General and Dental Hospital, Rawal Institute of Health Sciences, Islamabad, from 19-9-2012 to 18-11-2013 respectively.

Materials and Methods: Parturients were placed in group-a, and group-b, i.e. colloid and crystalloid fluid groups respectively, given as preload /or coload alongwith injection speed variation.Data analyzed by SPSS v19.

Results: In group-a, and b, vasopressor was required in 50 (40.3%) and 68(54.4%) of cases.The correlation co-efficient(r) was 0.768(group-a) and 0.723(group-b) and significant at 0.01 level respectively.

Conclusion: Slow injection speed lowers incidence of hypotension and crystalloid or colloid fluids must be rapidly administered at time of spinal anesthesia for maximum efficacy.

Key Words: Cesarean, Speed, Spinal, Co-Load, Preload.

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INTRODUCTION

The typical response to spinal anesthesia is hypotension owing to decreased systemic vascular resistance and a resultant increase in heart rate[1] though a small proportion of patients may respond with hypotension and bradycardia[2]. Loubert C[3], studied physiological phenomenon of maternal hypotension related to spinal anesthesia, and recommended fluid regimen i.e. colloid preload and colloid or crystalloid coload and vasopressor phenyl ephrine infusion to be valuable in preventing hypotension.

Intravenous fluids given 15-20 minutes prior to spinal anesthesia is called "preload" the literature reviews it as ineffective due short intravascular half-life[4]. Jackson R, Reid JA[5] and colleagues concluded that preload crystalloid fluid regimen may consume time, risking circulatory fluid overload in parturients, cause hemodilution, and placental auto-transfusion at delivery added to it, may cause fluid overload (pulmonary edema) in parturients with myocardial insufficiency and they stated to avoid crystalloid fluid preload.

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The excessive preload crystalloid fluid administration causes release of atrial natriuretic peptide secretion which causes peripheral vasodilatation and increases renal excretion of fluid [6].

Currently pushing fluids at time of spinal block known as "coload" is being advocated as it is more helpful in maintaining cardiac output[7]. Oh AY, Hwang JW[8] et al advocated that crystalloid coload was more effective than preload for the prevention of maternal hypotension after spinal anesthesia. Ripolles Melchor J[9] and colleagues stated that colloid fluid use significantly reduced the incidence of spinal hypotension as compared to crystalloids however there was no difference in intra-operative nausea and vomiting with both fluid regimens.

Jewel JJ,Williams A[10] and colleagues observed ineffectivesness of 15ml/kg ringer lactate solution given as pre and co-load in prevention of spinal induced maternal hypotension and advised frequent monitoring of maternal blood pressure(at one minute interval) and early treatment of hypotension by vasopressors. Gunda CP, Malinowski J[11] and colleagues stated that employing phenylephrine or ephedrine to combat maternal hypotension is good choice.A retrospective study done by Cooper DW [12]and colleagues stated that both vasopressors i.e. ephedrine and phenyl ephrine usage for maintaining maternal blood pressure following sympathetic blockade, showed no difference in umbilical artery pH values .

Simon L[13] and colleagues, stated that slow injection rate (2ml/min) was effective in decreasing incidence of hypotension and hence less vasopressor need.Chiang

CF[14] and colleagues evaluated effect of fast and slow injection speed on incidence of hypotension, vasopressor need and incidence of nausea and vomiting noted no difference in both groups. Hanazaki M[15] and colleagues in their study stated that emplyment of spinal injection speed of 0.1 to 0.2 ml/seconds is advisable, to maintain a stable pulse and blood pressure (hemodynamics) following block in cesarean delivery. Singh SI, Morley-Forster PK [16] and colleagues in their study advocated that variations of injection speed in spinal cesarean delivery has no difference in clinical sensor and autonomic effects or complications like nausea. Tawfik MM, Hayes SM[17] et al observed that 1000ml of crystalloid co-load had similar effect compared to 500ml colloid preload in reducing incidence of hypotension after intra-thecal block. Unlugenc H, Turktan M[18] et al in study stated, that co-loading with both colloid /crystalloid to be equally effective in maintaining blood pressure and in vasopressor need.

We conducted study to foresee that coload/preload with colloid was more effective than crystalloid preload in lowering incidence of hypotension(vasopressor need), high spinal/respiratory distress and complications like nausea and vomiting. Also noted was effect of varying injection speed time defined as, fast 10 seconds (approx.3.2drops/sec), medium 30seconds (approx.1. 06drops/sec) and 40 seconds (approx.0.8drops/sec) on spinal hypotension. Neonatal outcome (APGAR[19]score) was also noted.The vasopressor were used for 20% decline in systolic blood pressure from baseline and supplemental oxygen given for pulse oximeter reading <96% and atropine given to treat heart rate < 45 beats/minute.

MATERIALS AND METHODS

After ethical committee consent, study was completed at Department of Anesthesia, Islam Teaching Hospital, Islam Medical College, Sialkot, from 03-4-2012 to 18-9-2012 and Rawal General and Dental Hospital, Rawal Institute of Health Sciences, Islamabad, from 19-9-2012 to 18-11-2013 respectively. Two hundred and forty nine term parturients scheduled for elective spinal cesarean, placed in American Society of Anesthesiologists (ASA) physical status[20] class 1-4, randomized by using computer generated numbers into group-a and group-b, colloid and crystalloid fluid loading as preload /or coload respectively. Also employed was injection speed variation.

Pre-anesthesia evaluation was done and informed written consent taken. Excluded were parturients with coagulopathy, eclamptic (HELLP syndome), fixed cardiac output state e.g. aortic stenosis, shock (ante-partum hemorrhage).In operating theatre after securing 18G intra-venous lines and attaching standard monitors, sub-arachnoid block was done with 0.75% hyperbaric bupivacaine via 25G quincke spinal needle using aseptic technique and placed supine with 15^{o} wedge under the right hip for few minutes.

The sensory and motor block was evaluated by pin prick in midline and modified bromage scale by Breen TW, Shapiro T[21] and colleagues at two minutes interval respectively.Sympathetic block was evaluated by temperature change.Spinal block was assessed till fourth thoracic level achievement to cold and pin prick before surgery started.Hemodynamic monitoring continued every minute for first 10 minutes thereafter at 5 minutes interval, also noted vasopressor need, nausea, associated complications and Apgar score[19]. After surgery monitoring and care continued in post anesthesia care unit. Data analyzed by SPSS version 19. Spearman Correlation test done to assess interdependence between systolic and diastolic blood pressure values in both groups and correlation coefficient(r) significance at 0.01 levels assessed.

RESULTS

Study demographics depicted in table-1.Apgar score[19] at one and five minutes in group-a being 7.26(SD of 0.77) and 8.8(SD 0.87) and in group-b being 7.18(SD 0.94) and 8.4(SD 1.08) respectively.In group-a, the mean volume in milliliters(ml) of colloid was 1498ml(SD of 492ml) whereas colloid was given as coload and preload in 18 and 106 (14.5% and 85.5%) out of 124 cases respectively.The mean crystalloid preload volume given in group-b was 1372ml(SD of 488ml). In crystalloid group-b, in 8.8% of cases (11out of 125 cases) colloids were given after spinal block to counter profound hypotension.Statistical hemodynamic data of both groups depicted in table-2.

Table No.1; Demographic data.

	Group-a	Group-b
	Age (in years)	
Mean	25.83(SD of 4.08)	27.54(SD of 4.60)
Minimum	18	19
Maximum	38	40

Table No.2: Hemodynamic data.

	Pulse/minute	Systolic blood pressure (mmHg)	Diastolic blood pressure (mmHg)
	(Group a / b)		
Mean	106.59/103.00	121.13/123.18	71.43/68.33
Median	105.00/101.00	119.00/121.00	70.00/67.00
Mode	96/96	117/106	67 / 70
Std Deviation	16.64/18.144	17.97/22.295	15.36/18.56
Minimum	45/41	43/67	18/16
Maximium	172/170	220/214	135/144

Vasopressor was used in 50 cases (40.3%) and not used in 73 cases (58.9%) in group-a, whereas same readings in group-b, being 68 cases (54.4) and 57 cases (45.6%) respectively.Atropine used is revealed in table-3.

Table No.3: Atropine consumption.

	Prophy_lactic	After block	Prophylactic and after block	Late after delivery	Not used	For Missed beats	Dose (0.5mg)	Dose (1mg)	Dose (2mg)
Group-a (N / %)	5 / 4	43 / 34.7	2 /1.6	8 / 6.4	62 / 50	2 / 1.6	40/32.2	20/16.1	-
Group-b (N / %)	9 / 7.2	63 / 50.4	4 / 5	-	44/ 35.2	-	37/29.6	37/29.6	5/4

Table No.4: American Society of Anesthesiologist grades.

	Frequency	Percent
	(Group a / b)	
Grade-1	109/106	87.9/84.8
Grade-2	5/8	4/6.4
Grade-3	9/11	7.3/8.8
Grade -4	1/0	0.8/0

Physical status (ASA[20]) grades shown in table-4. The mean dose of bupivacaine used for spinal anesthesia being 13.59mg (SD of 0.537) in group-a, and in group-b, 13.45mg (SD of 0.492) respectively.The vasopressor used with injection speed depicted in table-5. Adjunct medications used are shown in table-6.Correlation co-efficient(r) value in group-a, was 0.768 and 0.723 in group-b, which is significant at 0.01 level (2-tailed).

Table No. 5: Vasopressor consumption.

	Injection speed(seconds)	Cases (n / %)	Vaso-pressor used (%)
Group- a	Fast (10)	12 / 9.6	66.66
	Medium (30)	106/85.4	39.62
	Slow (40)	6 / 4.8	Nil
Group- b	Fast (10)	8 / 6.4	75
	Medium (30)	96 / 76.8	55.2
	Slow (40)	19 / 15.2	42.10

Table No.6: Adjunct medications.

	Group-a	Group-b
	(n / %)	
Inj.Metoclopramide (for nausea & vomiting)	11 / 8.9	8 / 6.4
Inj.Ranitidine	6 / 4.8	1 / 0.8
Inj.Ketamine(analgesic dose after delivery)	1 / 0.8	6 / 4.8%
Inj.Nalbuphine(after delivery)	9 / 7.25	7 / 5.6
Inj.Transamine(prophylactic)	5 / 4.03	36/28.8

DISCUSSION

Parturients undergo various hemodynamic autonomic changes following sub-arachnoid[22.] Hopf HB et al[23] and Gratadour P et al[24] noted three hemodynamic patterns after spinal block; hypotension and tachycardia, hypotension and bradycardia and little or no hemodynamic change. In study marked tachycardia immediately following block was observed in three cases in group-a, and in a single case in group-b. One case of respiratory distress was observed in both groups which were immediately managed by respiratory support. In our study, no urinary retention or neurological deficit or complication was observed post operatively.Tamilselvan PI, Fernando R[25]and colleagues stated that crystalloid or colloid preload regimen cannot compensate for hypotension after block.Rout CC and Rocke DA[26] in their study,stated that sub-arachnoid block associated maternal hypotension is most prevalent complication requiring in upto 80% of cases vasopressors to correct it. Osazuwa IH and Ebague A[27] stated that crystalloid preloading showed transiently better prophylactic superiority over colloids or their combinations for first 10 minutes against hypotension following block. Thage B and Callesen T[28] stated that, injection speed and dose of bupivacaine, is important and problem of unpredictability of the sensory block level exists.The vigilance of anesthesiologist and close hemodynamic monitoring, availability of respiratory support gadgets and fluid coloading, can help significantly reduce maternal morbidity and improve neonatal outcome.

CONCLUSION

The administration of colloid preload and crystalloid coload may require less need of vasopressors to correct spinal associated maternal hypotension. The use of slow speed of injection is helpful in decreasing the incidence of hypotension.

Author's Contribution:

Concept & Design of Study:	Muhammad Salman Maqbool
Drafting:	Muhammad Umer Draz
Data Analysis:	Muhammad Umer Draz
Revisiting Critically:	Muhammad Salman Maqbool, Muhammad Umer Draz
Final Approval of version:	Muhammad Salman Maqbool, M. Umer Draz

Conflict of Interest: The study has no conflict of interest to declare by any author.

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