



Comparison of incidence of hypotension with crystalloid pre-hydration and co-hydration in pregnant women undergoing caesarean section

*1 **Kathana panmei Basnet**

Lecturer in the department of Anaesthesia
National Medical College, Birganj, Nepal

Abstract:

Caesarean delivery is now one of the most common practices throughout the world. The most common serious side effect of spinal anaesthesia is maternal hypotension. The aim of the current study was to compare the incidence of hypotension with crystalloid pre-hydration and co-hydration in pregnant women undergoing caesarean section. This prospective study was conducted on 50 pregnant women in Parsa, Nepal. The study patients were divided into two groups (crystalloid pre-hydration group and co-hydration group) consisting of 25 patients in each group. Haemodynamic parameters such as heart rate, respiratory rate, and blood pressure were monitored. In the present study after the induction of spinal anaesthesia both systolic and diastolic blood pressure were gradually decreased from baseline among the pregnant women. Blood pressure of the pregnant women with crystalloid co-hydration was significantly higher than that of pregnant women with crystalloid pre-hydration. The occurrence of hypotension among the women with crystalloid co-hydration was significantly lower than of women with crystalloid pre-hydration. Our study shows crystalloid co-hydration administered immediately after the induction of spinal anaesthesia for caesarean section is associated with a lesser incidence of hypotension than crystalloid pre-hydration.

Key words: Spinal anaesthesia; maternal hypotension, crystalloid pre-hydration, co-hydration

Introduction:

Caesarean delivery is now one of the most common practices throughout the world. For caesarean section, both regional and general anaesthesia are acceptable [1]. However, the use of general anaesthesia has decreased significantly in the past few decades due to a higher risk of general anaesthesia related maternal mortality [2,3]. Regional anaesthetics such as spinal, epidural, and a combination of spinal/epidural anaesthetics have gained widespread popularity among the surgical fraternity [4]. Spinal anaesthesia is now the technique of choice for caesarean section [3,5].

Although spinal anaesthesia is generally most common choice of anaesthetists, it is still associated with considerable side effects. The most common serious side effects of spinal anaesthesia are maternal hypotension and bradycardia, potentially endangering both mother and neonate [6,7]. Spinal anaesthesia induced intra-operative hypotension in caesarean section, a long-time topic of study, still challenges of anaesthetists. Maternal intra-operative hypotension can lead to a number of severe complications for both mother (nausea, vomiting, dizziness, and decreased consciousness) and neonate (decreased utero-placental blood flow, foetal acidosis) [8]. Reynolds and Seed [9] and Mitra et al. [5] reported that since there is no autoregulation for the placental vascular bed, prolonged maternal hypotension can be detrimental to the foetus, induce lower foetal Apgar scores, foetal acidosis and hypoxia. In last few decades extensive research had been efforts to devise the optimal regimen for prevention or treatment of spinal anaesthesia-induced hypotension, many interventions have been suggested to reduce the incidence and mitigate the severity of hypotension such as intravenous fluid pre-hydration, patient positioning, vasopressor drugs (ephedrine, phenylephrine), physical methods such as leg bindings and compression stockings, etc [10]. However,

none of these techniques alone was effective in eliminating hypotension [10]. The aim of the current study was to compare the incidence of hypotension with crystalloid pre-hydration and co-hydration in pregnant women undergoing caesarean section.

Method:

This prospective study was conducted between March 2019 to September 2019 in National Medical College, Birgunj, Parsa, Nepal. This study included 50 full-term pregnant women (gestational age: 37–42 weeks) who were 18 to 40 years old. The study was approved by the Institutional Review Board. Written informed consent was obtained from the participants. Exclusion criteria of the present study were included obesity, diabetes, chronic hypertension, pregnancy-induced hypertension, heart disease and hypotension.

The study patients were divided into two groups consisting of 25 patients in each group according to computer-generated random numbers. Patients and investigators were not blinded to group allocation. In group P (crystalloid pre-hydration group), the pregnant women had received 20ml/kg of lactated ringer's solution during the period of 20 minutes prior to induction of spinal anaesthesia. In group C (crystalloid co-hydration group) rapid infusion (20ml/kg of lactated ringer's solution) was given by fully opening the clamp of the infusion administration set immediately after administration of anaesthesia.

Demographic characteristics of the study participants such as age, height and weight were noted. Haemodynamic parameters such as heart rate, respiratory rate, and non-invasive blood pressure were monitored. A peripheral vein on the dorsum of hand of the study participants was cannulated for administration of intravenous fluid. The intravenous fluid was administered according to the group allocation. The study participants were placed in the sitting position, and dural puncture was performed at L3–L4 or L2–L3 inter-space using a standard midline approach with a 25-G Quincke spinal needle. 0.5% bupivacaine 2.2ml was injected intrathecally. The study participants received oxygen through ventura's face mask throughout the procedure at the rate of 4 L/min. Systolic and diastolic blood pressures, heart rate, and respiratory rate of both groups were recorded at 2-minute interval for first 15 minutes and 5-minute interval thereafter till the completion of the surgery and then at 10 min interval for 1 hr in the recovery room. For maintenance of post operational fluid volume of the participants, lactated Ringer's solution was given intravenously at the rate of 6ml/ kg/hr following administration of pre-hydration or co-hydration of both the groups. Hypotension was defined as systolic pressure of <90 mmHg.

Statistical analysis was done using SPSS version 20. The level of significance was set at $p < 0.05$. Mean and standard deviation were used for continuous variables and frequency and percentage were used for categorical variables to summarize data. To test the significant difference of different continuous variables t test was performed and for categorical variables, Chi-square test was performed.

Results:

The physical characteristics of the study participants were shown in Table 1. The average age of the pregnant women was 23.63 ± 3.21 years. The height and weight of the women were 154.13 ± 8.59 cm and 58.27 ± 5.58 kg at the time of caesarean delivery. The study participants were grouped into Group P and Group C and the average age of Group P and Group C were 23.54 ± 3.17 years and 23.71 ± 3.24 years respectively. The age and physical characteristics of two groups were not significantly differ.

Table 1: physical characteristics of the study participants

Parameters	All together (n=50)	Group P (n = 25)	Group C (n = 25)	t (p)
Age (years)	23.63 ± 3.21	23.54 ± 3.17	23.71 ± 3.24	0.188 (NS)
Height (cm)	154.13 ± 8.59	154.28 ± 8.73	153.98 ± 8.45	0.123 (NS)
Weight (kg)	58.27 ± 5.58	57.93 ± 5.74	58.6 ± 5.41	0.425 (NS)

The haemodynamic characteristics of the pregnant women were shown in Table 2. The average systolic and diastolic blood pressure of the pregnant women were 122.78 ± 7.39 mmHg and 82.88 ± 4.89 mmHg which indicated that the average blood pressure of the study participants was belongs to normotensive category. The heart rate and respiratory rate of the pregnant women were also in normal range. The average systolic and diastolic blood pressure of Group P were 123.11 ± 7.58 mmHg and 83.11 ± 4.92 mmHg and for Group C these were 122.45 ± 7.19 mmHg and 82.65 ± 4.85 mmHg respectively. There was no statistically significant difference in haemodynamic characteristics between the groups.

Table 2: Haemodynamic parameters of the study participants

Parameters	All together (n=50)	Group P (n = 25)	Group C (n = 25)	t (p)
Heart rate (bpm)	78.13±8.08	77.84±8.61	78.42±7.54	0.253 (NS)
Respiratory rate (breath/min)	19.18±3.48	19.24±3.41	19.12±3.54	0.122 (NS)
SBP (mmHg)	122.78±7.39	123.11±7.58	122.45±7.19	0.316 (NS)
DBP (mmHg)	82.88±4.89	83.11±4.92	82.65±4.85	0.333 (NS)

After the induction of spinal anaesthesia blood pressure of both groups was noted and compared with the baseline values Table 3. From the results it was revealed that both systolic and diastolic blood pressure were gradually decreased from baseline after the induction of spinal anaesthesia in both the Groups. In case of Group C, statistically significant difference in blood pressure was noted during the period of 30 minutes; whereas in case of group P, all the measured blood pressure values after the induction of spinal anaesthesia were significantly differ from baseline values. The result of the present study was also revealed that all the measured blood pressure values of Group C was significantly higher than that of Group P.

After the induction of spinal anaesthesia, the occurrence of hypotension among the groups was also studied and from the results it was noted that the incidence of hypotension among the Group P and Group C was 52% and 20%. The occurrence of hypotension among the Group C was significantly lower (χ^2 5.556; $p < 0.05$) than of Group P.

Table 3: Comparison of blood pressure after the induction of spinal anaesthesia

Parameters	Base line	5 mins	10 mins	20 mins	30 mins	40 mins	50 mins	60 mins	
Group P	SBP	123.11 ±7.58	117.52 ±6.98	116.58 ±6.88	114.33 ±6.22	112.65 ±6.95	111.62 ±6.34	110.88 ±6.08	110.35 ±5.81
	DBP	83.11 ±4.92	79.33 ±5.92	77.95 ±5.66	76.12 ±6.17	75.64 ±5.08	73.02 ±5.88	72.85 ±4.91	72.62 ±4.88
	t (p) ^{SBP}	-	2.712 (0.05)	3.189 (0.01)	4.477 (0.001)	5.086 (0.001)	5.814 (0.001)	6.293 (0.001)	6.68 (0.001)
	t (p) ^{DBP}	-	2.455 (0.05)	3.44 (0.01)	4.429 (0.001)	5.281 (0.001)	6.58 (0.001)	7.38 (0.001)	7.569 (0.001)
Group C	SBP	122.45 ±7.19	122.41 ±5.21	121.63 ±5.01	118.98 ±4.87	118.12 ±4.51	117.54 ±4.68	117.12 ±4.04	116.94 ±4.22
	DBP	82.65 ±4.85	82.45 ±4.55	81.95 ±4.51	80.22 ±4.25	79.98 ±4.01	78.19 ±3.85	77.89 ±3.98	77.74 ±3.58
	t (p) ^{SBP}	-	0.023 (NS)	0.468 (NS)	1.998 (NS)	2.551 (0.05)	2.862 (0.01)	3.231 (0.01)	3.301 (0.01)
	t (p) ^{DBP}	-	0.15 (NS)	0.528 (NS)	1.884 (NS)	2.121 (0.05)	3.601 (0.01)	3.793 (0.001)	4.073 (0.001)
t (p) ^{SBP} [Group P VS Group C]		2.807 (0.05)	2.967 (0.01)	2.943 (0.01)	3.301 (0.01)	3.756 (0.01)	4.274 (0.001)	4.589 (0.001)	
t (p) ^{DBP} [Group P VS Group C]		2.089 (0.05)	2.764 (0.05)	2.736 (0.05)	3.353 (0.01)	3.678 (0.01)	3.987 (0.001)	4.23 (0.001)	

Discussion:

In the present study after the induction of spinal anaesthesia both systolic and diastolic blood pressure were gradually decreased from baseline in both crystalloid pre-hydration group and co-hydration group. Decline in blood pressure after the induction of spinal anaesthesia in the pre-hydration group of women were similar to other studies where crystalloid pre-hydration was used during spinal anaesthesia for caesarean section [11-13]. All these studies showed gradual decline in the blood pressures after induction of spinal anaesthesia. This decline in blood pressure is due to vasodilatory effect of sympathetic blockade caused by spinal anaesthesia [14]. Systemic vasodilation induced by sympathetic blockade after spinal anaesthesia, resulting in venous pooling of blood and reduction in systemic vascular resistance, has been regarded as the predominant mechanism for hypotension. In addition, absence of significant reflex tachycardia after spinal anaesthesia despite the presence of hypotension also play important role in development of hypotension [15].

In the present study, both systolic and diastolic blood pressure of the pregnant women with crystalloid co-hydration was significantly higher than that of pregnant women with crystalloid pre-hydration. The occurrence of hypotension among the women with crystalloid co-hydration was significantly lower than of women with crystalloid pre-hydration. Burns et al. [16] stated that fluid preloading was routinely used in up to 87% of caesarean section carried out under spinal anaesthesia. Rout et al., [11] reported in their studies that the incidence of hypotension was reduced from 71% in patients without pre-hydration to 55% in patients who received crystalloid 20 ml/kg. Muzlifah and Choy [17] observed that infusing Ringer's Lactate before spinal anaesthesia gave similar incidence of hypotension and nausea vomiting. However, in another study by Park et al., [18] reported that there were no significant differences in the indices of hypotension when 10 ml-30 ml/kg of Ringer's Lactate was used for acute volume expansion before the induction of spinal anaesthesia. Gunusen et al., [19] reported that a crystalloid co-loading was more effective in preventing spinal anaesthesia induce maternal hypotension.

Conclusion:

In the present study after the induction of spinal anaesthesia both systolic and diastolic blood pressure were gradually decreased from baseline among the pregnant women. Blood pressure of the pregnant women with crystalloid co-hydration was significantly higher than that of pregnant women with crystalloid pre-hydration. The occurrence of hypotension among the women with crystalloid co-hydration was significantly lower than of women with crystalloid pre-hydration. Our study shows crystalloid co-hydration administered immediately after the induction of spinal anaesthesia for caesarean section is associated with a lesser incidence of hypotension than crystalloid pre-hydration.

Reference:

- (1). Afolabi BB, Lesi FE. Regional versus general anaesthesia for caesarean section. *Cochrane Database Syst Rev* 2012;10:CD004350.
- (2) Jadon A. Complications of regional and general anaesthesia in obstetric practice. *Indian J Anaesth* 2010;54:415-20.
- (3) Fakherpour A, Ghaem H, Fattahi Z, Zaree S. Maternal and anaesthesia-related risk factors and incidence of spinal anaesthesia-induced hypotension in elective caesarean section: A multinomial logistic regression. *Indian J Anaesth* 2018;62:36-46.
- (4) Kaur D, Khan AL, Pathak A. A comparative study of three vasopressors for maintenance of blood pressure during spinal anaesthesia in lower abdominal surgeries. *Anesth Essays Res* 2018;12:333-7.
- (5) Mitra JK, Roy J, Bhattacharyya P, Yunus M, Lyngdoh NM. Changing trends in the management of hypotension following spinal anaesthesia in cesarean section. *J Postgrad Med* 2013;59:121-6.
- (6) Carpenter RL, Caplan RA, Brown DL, Stephenson C, Wu R. Incidence and risk factors for side effects of spinal anaesthesia. *Anesthesiology* 1992; 76: 906-916.
- (7) Arndt JO, Bömer W, Krauth J, Marquardt B. Incidence and time course of cardiovascular side effects during spinal anaesthesia after prophylactic administration of intravenous fluids or vasoconstrictors. *Anesth Analg* 1998; 87: 347-354.
- (8) Rout CC, Rocke DA. Prevention of hypotension following spinal anaesthesia for cesarean section. *Int Anesthesiol Clin* 1994;32: 117-135.
- (9) Reynolds F, Seed PT. Anaesthesia for caesarean section and neonatal acid-base status: A meta-analysis. *Anaesthesia* 2005;60:636-53.
- (10) Cyna AM, Andrew M, Emmett RS, Middleton P, Simmons SW. Techniques for preventing hypotension during spinal anaesthesia for caesarean section. *Cochrane Database Syst Rev* 2006: CD002251
- (11) 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 anaesthesia for elective cesarean section. *Anesthesiology* 1993;79:262-9
- (12) Jackson R, Reid JA, Thorburn J. Volume preloading is not essential to prevent spinal induced hypotension at caesarean section. *Br J Anaesth* 1995; 75:262-5.
- (13) Dyer RA, Farina Z, Joubert IA, Du Toit P, Meyer M, Torr G, et al. Crystalloid preload versus rapid crystalloid administration after induction of spinal anaesthesia (coload) for elective caesarean section. *Anaesth Intensive care* 2004; 32:351-57.
- (14) Assali NS, Kaplan SA, Foman SJ, Douglass RA, Tada Y. The effect of high spinal anaesthesia on the renal hemodynamics and the excretion of electrolytes during osmotic diuresis in the hydropenic normal pregnant woman. *J Clin Invest* 1951; 30:916-20.

- (15) Dobson PM, Caldicott LD, Gerrish SP, Cole JR, Channer KS. Changes in haemodynamic variables during transurethral resection of the prostate: comparison of general and spinal anaesthesia. *Br J Anaesth* 1994; 72: 267-271.
- (16) Burns SM, Cowan CM, Wilkes RG. Prevention and management of hypotension during spinal anaesthesia for elective Caesarean section: A survey of practice. *Anaesthesia* 2001;56:794-8.
- (17) Muzlifah KB, Choy YC. Comparison between preloading with 10 ml/kg and 20 ml/kg of Ringer's lactate in preventing hypotension during spinal anaesthesia for caesarean section. *Med J Malaysia* 2009;64:114-7.
- (18) Park GE, Hauch MA, Curlin F, Datta S, Bader AM. The effects of varying volumes of crystalloid administration before cesarean delivery on maternal hemodynamics and colloid osmotic pressure. *Anesth Analg* 1996;83:299-303.
- (19) Gunusen I, Karaman S, Ertugrul V, Firat V. Effects of fluid preload (crystalloid or colloid) compared with crystalloid co-load plus ephedrine infusion on hypotension and neonatal outcome during spinal anaesthesia for caesarean delivery. *Anaesth Intensive Care* 2010;38:647-53.

