Original Article

Hypotension in Caesarean Section

Prevention of hypotension in Patients Undergoing Elective Caesarean Section under Spinal Anesthesia: Effect of Preloading with Crystalloid versus Colloid Infusion

Zaid Jawaid[1],Gul Bano Tariq[1], Rizwan Ahmad[1], Imran ul Haq[1], Saba Saeed[2] and Sher Bahadur[3]

ABSTRACT

Objective: To compare effect of crystalloid and colloid in prevention of hypotension among patients undergoing elective C-section under spinal anesthesia.

Study Design: Comparative interventional study

Place and Duration of Study: This study was conducted at the Operation Theater of a tertiary care hospital, Peshawar during Aug to September 2019.

Materials and Methods: After taking the inform consents from patients (n=96) they were divided into two group using consecutive sampling technique. Before the spinal anesthesia group "A" (n=48) comprised of patient who received 1000ml crystalloid (Ringer Lactate) infusion, while group "B" (n=48) received 500 ml of colloid (haemaccel) infusion as pre-load. The outcomes were measure in term of mean arterial pressure (MAP) determined by formula MAP = Systolic BP+ 2(Diastolic PB)/3, where MAP ≥65 were considered normal. Both of the groups received 1000ml RL as routine during the operation. The data were recorded on structure Performa and analyzed using SPSS 20. Data were subjected to mean, SD, frequencies and percentages. For comparison of MAP student's t-test and chi square test were used where p-value <0.05 was considered as significant.

Results: A total of 96 patients were included in the study out of them 48 had Crystalloid infusion and 48 Colloid solutions respectively. All these patients had normal mean arterial pressure before giving them spinal. Post spinal the incidence of hypotension was among 37(38.5%) of patients within 15 minutes. This decline in MAP was statistically significant (p=0.001) when it is compared between two groups; group 'A' with crystalloid and group 'B' with colloids. The incidence was 26 (55.2%) among patients with crystalloid infusion as compare to 11 (22.9%) among patients preloaded with colloid infusion.

Conclusion: Incidence of hypotension is common among patients with C-Section through spinal anesthesia. Colloid preloading could prevent hypotension efficiently as compared to crystalloid infusion. However the need of Phenylephrine was observed in both groups, where MAP was less than 65. It is recommended to give preference to colloid over crystalloid for preloading among patient undergoing through C-section under spinal anesthesia.

Key Words: Mean Arterial Pressure, Blood Pressure, C-Section, Crystalloid and Colloid solution

Citation of article: Jawaid Z, Tariq GB, Ahmad R, Haq I, Saeed S, Bahadur S. Prevention of hypotension in Patients Undergoing Elective Caesarean Section under Spinal Anesthesia: Effect of Preloading with Crystalloid versus Colloid Infusion. Med Forum 2019;30(11):128-131.

INTRODUCTION

Cesarean section is one of the safe methods of delivery in patients with probable pregnancy related complications.

[1.] Department of Anesthesia, KTH, Peshawar.
[2.] Department of Anesthesia Rehman Medical Institute
[3.] Department of Research, KICH, Peshawar.

Correspondence: Dr. Gul Bano Tariq, Department of Anesthesia Khyber Teaching Hospital Peshawar.
Contact No: 0314 9093324
Email: gulbanotariq3565@gmail.com

Received: October, 2019
Accepted: October, 2019
Printed: November, 2019

Both General anesthesia and spinal anesthesia are practiced for C-section. In current Era spinal anesthesia is considered to be more acceptable where there is less chance of complications.[1] Due to deep motor and sensory nerve blockage it takes lesser time for action. Studies indicate that pregnant women prefer spinal anesthesia over general anesthesia because they feel better when they see the fetus delivered. There are less chances of DVT. Despite of these benefit spinal anesthesia still have side effects especially hypotension and its associated complications. The hypotension occurs due to blockage of sympathetic nerves and the condition become verse when the patient is not well hydrated before operation which leads to adverse maternal and neonatal outcomes.[2] the proportion of hypotension after spinal anesthesia is ranged from 25-

75% in general population whereas; the incident reported patients under C-section under spinal anesthesia are higher.[3] Studies have reported that intravenous infusion of crystalloid reduces the incidence and severity of hypotension among patients undergone through spinal anesthesia.[4 5] However some other studies shown that increasing amount of crystalloid does not provide guarantee for elimination or prevention of hypotension in spinal anesthesia, but it requires addition of ephedrine.[6 7] The efficacy of crystalloid is questioned because it redistributes in extra-vascular space very easily which in-turn result into offsetting the increase in intracellular volume of the fluid.[3] on other hand colloid infusion found more effective pre-loading fluid for the prevention of post spinal anesthesia hypotension. However, it is also reported that a single technique not always sufficient to control hypotension and it is therefore recommended the co-administration of vasopressors. The outcome in this regard could be best determined by mean arterial pressure (MAP) which is the average pressure created by one cardiac cycle (systole and diastole). It is the best indicator assessing the tissue perfusion.[8] Blood supply to the vital organs needs the MAP above 65 mmHg. The MAP below this level may lead to hypoxia of the end organs thus needs prompt action.[9] At this point most physicians administer Phenylephrine as it increase the MAP in dose-dependent manner.[10]

As the aim of fluid preload during spinal anesthesia is to maintain the intra-vascular volume so that hypo-volemia due to this method of anesthesia could be neutralized, however result of the studies conducted showed a wide controversies. Therefore it necessitates comparing the effect of crystalloid VS Colloid for prevention of hypotension among women undergoing elective C-section under spinal anesthesia**.**

MATERIALS AND METHODS

This was comparative interventional study where mean arterial pressure was compared at different interval after pre-load of crystalloid and colloid infusion in elective C-section patients under spinal anesthesia. This study was conducted in Operation Theater of tertiary care Hospital Peshawar during Aug to September 2019. The calculated sample size was 96 by assuming Confidence interval 95%, anticipated population 0.50 and study power 0.1. Consecutive sampling technique was used for recruitment of the patients. All patients (ASA I & II) undergone through elective C-section were included while those with known hormonal disease or with known cardiac diseases were excluded. Data collection was started after approval of Ethical Review Committee of the corresponding Teaching Hospital. After informed consent, patients were divided into two groups and each group was comprised of 48 individuals. Before spinal anesthesia the patients received the following treatment protocol.

Group A: Received 1000 ml of Ringer Lactate (crystalloid) infusion

Group B: Receive 500 ml of colloid solution (haemaccel) infusion

Afterward both groups were given 1000 ml Ringer Lactate as routine care during operation.

The data were analyzed using SPSS 20. Data were subjected to mean, SD, frequencies and percentages. For comparison of mean systolic and diastolic blood pressure was compared using student's t-test while chi square test was used for comparing the frequency of hypotension among two groups. P--value <0.05 was considered as significant**.**

RESULTS

A total of 96 patients with mean age 27.80 ± 4.750 (ranged 18 to 39 years). Out of them 48(50%) had received Ringer Lactate and 48(50%) received Haemaccel. An overall picture of the whole data indicates that MAP decreased in both groups with passage of time. As mean MAP at base line was 90.01 ± 6.3 mmHg which was declined to 81.67±5.4 mmHg at 5 minutes of spinal anesthesia. This decrease of MAP was statistically significant (p=0.003). Similarly, the MAP further declined to 73.96±6.3 at 10 minutes of spinal anesthesia followed by 67.85±7.3 at 15 minutes of spinal anesthesia revealing significant difference (p=0.001).

Results of present study further indicated that all patients had normal MAP (>65 mmHg) at baseline and after 5 minutes of spinal anesthesia.

Table No.1: Comparison of Mean Arterial Pressure at different interval among patients undergoing to C-section

Status of MAP at different interval		Mean ± SD	Std. Error	95% Confidence Interval		P-value
				Lower	Upper	
Pair 1	MAP before pre-load	90.0 ± 6.3	0.63	88.60	91.09	0.003
	MAP at 5 minutes of spinal anesthesia	81.6±5.4	0.55	80.61	82.78	
Pair 2	MAP at 10 minutes of spinal anesthesia	73.9±6.3	0.64	72.75	75.20	0.001
	MAP at 15 of spinal anesthesia	67.8±7.3	0.74	66.44	69.31	

Table No.2: Comparison of hypotension among patients who received Crystalloid VS Colloid infusion as preload

Variables		Groups of Patients		P-value
		Group A	Group B	
MAP at baseline (Before spinal anesthesia)				
	MAP ≥65 mmHg	48 (100%)	48 (100%)	--
	MAP ≤65 mmHg	--	--	
MAP at 5 minutes of Spinal Anesthesia				
	MAP ≥65 mmHg	48 (100%)	48 (100%)	--
	MAP ≤65 mmHg	--	--	
MAP at 10 minutes of Spinal Anesthesia				
	MAP ≥65 mmHg	42 (87.5%)	43(89.6%)	0.74
	MAP ≤65 mmHg	6 (12.5%)	5 (10.4%)	
MAP after 15 Minutes of Spinal Anesthesia				
	MAP ≥65 mmHg	22 (45.8%)	37 (77.1%)	0.002
	MAP ≤65 mmHg	26 (55.2%)	11 (22.9%)	

Group A: patients who received 1000 ml of Ringer Lactate (Crystalloid), Group B: Received 500 ml of colloid solution (haemaccel)

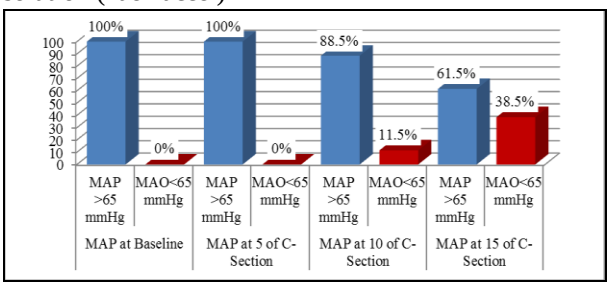

Figure No.1: Status of Mean Arterial Pressure at difference intervals

The decline (≤65 mmHg) in MAP started after 10 minutes among 11(11.5%) of patients. The proportion of patients with low MAP (≤65 mmHg) were further reported by 37(38.5%) of the patients at 15 minutes ($p < 0.05$). Drop in MAP was observed in both of the groups, However among group 'A' 6 (12.5%) of patient had MAP ≤65 mmHg as compared to 5 (10.4%) of group 'B' at 10 minute revealing (p=0.74). However the incidence of low MAP at 15 minutes of Post spinal anesthesia was observed in 26 (55.2%) patients from group 'A' as compared to 11 (22.9%) of patients from group 'B' (p=0.002). This indicate that need of Phenylephrine is more common in patients with crystalloid as compared to those who received colloid solution as pre-load.

DISCUSSION

It is evident that C-section is the most common surgical procedure practiced in the world, where nearly 80 to 90% is performed under spinal anesthesia. [11] However, this type of anesthesia could lead to maternal hypotension among majority of patients (60-70%) and its associated complications. There have been different preventive measures considered for maternal hypotension. Among these pre-load of fluid is widely in practice. The present study therefore aims to determine the role of crystalloid VS colloid in prevention of maternal hypotension among patients undergone through C-section under spinal anesthesia. Result of present study indicates that there was decrease of Mean Arterial Pressure among patients. Over all incidence of hypotension were 37(38.5%). The result of present study indicates that the incidence of hypotension was low as compared to other studies. The incidence of hypotension in patients of C-section reported by other studies ranged from 60-70%.[11 12]

The MAP at base line was 90.01 ± 6.3 mmHg. The severity of hypotension increases with time as MAP decreased to 67.85±7.3 at 15 minutes of spinal anesthesia revealing significant difference (p=0.001). The same trends are also reported by other studies where the authors also found a sequential decrease of MAP which was then treated by different methods.[13 14]

The comparative aspects in the present study indicate few patients 11 (22.9%) from group 'B' (patients with colloid infusion) has declined MAP below the threshold (MAP ≤ 65 mmHg) as compare to 26 (55.2%) of patients with crystalloid infusion (p=0.002).

It is believed that crystalloid infusion before spinal anesthesia is superior then no fluid regime, however, when it comes to comparison with the effect of colloid preloading then the outcome of colloid preloading was found more effective. The results of presents study are also supported by multiple studies. It has been reported that women with elective C-section having pre-loading of colloid infusion experienced less hypotension as compared to those who has crystalloid infusion (RR 0.68). [15] A study from India indicate there was no difference in the severity of hypotension between colloid preload and crystalloid (15.5% vs. 9.8%; P=0.31)[16]. It is further revealed that crystalloid was in practice as preloading fluid till 1993. Afterward it was found that crystalloid can reduce the incidence of hypotension among few of the individuals. In contrast

to this, colloids preloading has shown significant decreases in the incidence and severity of hypotension.[17] The present study also indicates that few of patients with colloid preloading dropped the threshold of MAP and required Phenylephrine as advance therapy for hypotension.

CONCLUSION

It is concluded that spinal anesthesia because hypotension among patients undergoing C-Section, however preloading with colloid can reduce post spinal anesthesia hypotension. It is recommended that there should be preference for colloid infusion over crystalloid when it comes to pre-loading of infusion in patient undergoing elective C-Section under spinal anesthesia**.**

Author's Contribution:

Concept & Design of Study:	Zaid Jawaid
Drafting:	Gul Bano Tariq, Rizwan Ahmad
Data Analysis:	Imran Ul Haq, Saba Saeed, Sher Bahadur
Revisiting Critically:	Zaid Jawaid, Gul Bano Tariq
Final Approval of version:	Zahid Jawaid

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

REFERENCES

1. Khosravi F, Alishahi M, Khanchemehr Y, Jarineshin H. A Comparison Between the Effects of Preloading with Ringer's Solution and Voluven on Hemodynamic Changes in Patients Undergoing Elective Cesarean Section Under Spinal Anesthesia. Med Arch 2019;73(1):44-48.
2. Alimian M, Mohseni M, Safaeian R, Faiz SH, Majedi MA. Comparison of hydroxyethyl starch 6% and crystalloids for preloading in elective caesarean section under spinal anesthesia. Med Arch 2015;68(4):279-81.
3. Bajwa SJ, Kulshrestha A, Jindal R. Co-loading or pre-loading for prevention of hypotension after spinal anaesthesia! a therapeutic dilemma. Anesth Essays Res 2013;7(2):155-9.
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(6):1571-6.
5. Pouta AM, Karinen J, Vuolteenaho OJ, Laatikainen TJ. Effect of intravenous fluid preload on vasoactive peptide secretion during Caesarean section under spinal anaesthesia. Anaesthesia 1996;51(2):128-32.
6. Rout CC, Akoojee SS, Rocke DA, Gouws E. Rapid administration of crystalloid preload does not decrease the incidence of hypotension after spinal anaesthesia for elective caesarean section. Br J Anaesth 1992;68(4):394-7.
7. 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(2):299-303.
8. DeMers D, Wachs D. Physiology, Mean Arterial Pressure. 2019.
9. Vedel AG, Holmgaard F, Rasmussen LS, Paulson OB, Thomsen C, Danielsen ER, et al. Perfusion Pressure Cerebral Infarct (PPCI) trial - the importance of mean arterial pressure during cardiopulmonary bypass to prevent cerebral complications after cardiac surgery: study protocol for a randomised controlled trial. Trials 2016;17(1):247.
10. Bellissant E, Annane D. Effect of hydrocortisone on phenylephrine--mean arterial pressure dose-response relationship in septic shock. Clin Pharmacol Ther 2000;68(3):293-303.
11. McDonnell NJ, Paech MJ, Muchatuta NA, Hillyard S, Nathan EA. A randomised double-blind trial of phenylephrine and metaraminol infusions for prevention of hypotension during spinal and combined spinal-epidural anaesthesia for elective caesarean section. Anaesthesia 2017;72(5):609-617
12. Loubert C. Fluid and vasopressor management for Cesarean delivery under spinal anesthesia: continuing professional development. Can J Anaesth 2012;59(6):604-19.
13. Zadeh FJ, Alqozat M, Zadeh RA. Sequential compression pump effect on hypotension due to spinal anesthesia for cesarean section: A double blind clinical trial. Electron Physician 2008;9(5): 4419-4424.
14. Sivevski A, Ivanov E, Karadjova D, Slaninka-Miceska M, Kikerkov I. Spinal-Induced Hypotension in Preeclamptic and Healthy Parturients Undergoing Cesarean Section. Open Access Maced J Med Sci 2019;7(6):996-1000.
15. Chooi C, Cox JJ, Lumb RS, Middleton P, Chemali M, Emmett RS, et al. Techniques for preventing hypotension during spinal anaesthesia for caesarean section. Cochrane Database Syst Rev 2017;8:CD002251.
16. Tawfik MM, Hayes SM, Jacoub FY, Badran BA, Gohar FM, Shabana AM, et al. Comparison between colloid preload and crystalloid co-load in cesarean section under spinal anesthesia: a randomized controlled trial. Int J Obstet Anesth 2014;23(4):317-23.
17. Mercier FJ. Fluid loading for cesarean delivery under spinal anesthesia: have we studied all the options? Anesth Analg 2011;113(4):677-80.