International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2016): 79.57 | Impact Factor (2015): 6.391

The Effect of Preload in Maintaining Cardiovascular Stability in Patients Undergoing Caesarean Section under Spinal Anesthesia

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Abstract: ***Background: Hypotension and cardiac arrest after spinal anesthesia for cesarean delivery is frequently and preload with crystalloid or colloid solution is widely used without supportive evidence. Objectives: The aim of this study was to investigate the effect of preload in maintaining cardiovascular stability in patient undergoing C.s under spinal anesthesia. Methods: This is a cross sectional case control hospital – based study; performed during the period (sep.2014 – dec.2015) in Khartoum north teaching hospital and academy teaching hospital on 30 obstetric women undergoing cesarean section by spinal anesthesia - 15 without preload (control) and 15 with preload (cases) with normal saline 500 ml. HR, BP, MABP,SPO2 were recorded. Results:It was obvious that the mean HRfor patients with preload (107.33) is better than in patients without preload (101.33) .The mean SPo2 in patients with preloadis (98.87) higher than those withoutpreload 96).The MABP in patients withpreload is higher than in patients with preload. Conclusion: There is obvious effect to reduce the incidence of hypotension following spinal anesthesia in Cs with preload crystalloid solution.***

1. Introduction

Both general and regional anaesthesia (spinal, epidural or combined spinal and epidural anaesthesia) are acceptable for use during Caesarean section. Regional anesthesia is preferred as it allows the mother to be awake and interact immediately with her baby. Other advantages of regional anesthesia include the absence of typical risks of general anesthesia: pulmonary aspiration (which has a relatively high incidence in patients undergoing anesthesia in late pregnancy) of gastric contents and Oesophagealintubation.[(1)]Regional anesthesia is used in 95% of deliveries, with spinal and combined spinal and epidural anesthesia being the most commonly used regional techniques in scheduled Caesarean section. Regional anesthesia during Caesarean section is different from the analgesia (pain relief) used in labor and vaginal delivery. The pain that is experienced because of surgery is greater than that of labor and therefore requires a more intense nerve block. The dermatomal level of anesthesia required for Caesarean delivery is also higher than that required for labor analgesia.[(1)]

General anesthesia may be necessary because of specific risks to mother or child. Patients with heavy, uncontrolled bleeding may not tolerate the hemodynamic effects of regional anesthesia. General anesthesia is also preferred in very urgent cases, such as severe fetal distress, cord prolapse placenta pravia and abruptio placentae when there is no timeto perform a regional anesthesia.[(1)]

Side effects of**spinal anesthesia** can be broadly classified as immediate (on the operating table) or late (in the ward or in the P.A.C.U. post-anaesthesia care unit).Hypotension occurs due to sympathetic nervous system blockade, usually easily treated with intravenous fluid and sympathomimetic drugs such as Ephedrine, Phenylephrine or epinephrine[(2)]. In C.S hypotension occur due to inferior vena cava and aortacompression , and prevented by turn the patient to the left side .Other side effects are postdural puncher headache (PDPH) , meningitis , hematoma urine retention, local toxicity , high spinal or total spinal and paraplegia.[(2)]

Several methods of preventing and treating spinal anesthesia-induced hypotension in obstetric patients have been used. These include left uterine displacement, IV fluid administration before the initiation of anesthesia (preload, IV fluid used to minimize degree of hypotension by giving (10-20 ml/kg) I.V fluids , colloids or crystalloids), vasopressors, and physical methods to improve venous return. Rapid infusion of a large volume of fluid is commonly used as prophylaxis. The goal of administering fluid before spinal block is to increase venous return and preserve central blood volume and cardiac output, both of which decrease after subarachnoid block. However, several studies have questioned the value of crystalloid administration before the initiation of spinal anesthesia for cesarean delivery, suggesting that it is relatively ineffective, with up to 85% of patients developing hypotension. Crystalloid preload is rapidly distributed and may induce atrial natriuretic peptide secretion, resulting in peripheral vasodilation followed by an increased rate of excretion of the fluid. In contrast, more recent data suggest that fluid administration immediately after induction of spinal anesthesia may be useful to prevent hypotension.[(3)(4)]

In 2009 study on effect of preload in maintaining cardiovascular stability in patients undergoing C.s under spinal anesthesia done by: Siddik-Sayyid et al [(5)] theyconcluded that there was a little effect of preload with colloid or crystalloids fluids administration to prevent hypotension that is occur after spinal anesthesia in cesarean section.[(5)]

In 2001Randomized controlled study of colloid preload before spinal anesthesiafor Caesarean section performed byNganKee et al [(6)]they found that when maternal arterial pressure was maintained with an infusion of metaraminol,

colloid preload improved hemodynamic stability and reduced maternal nausea and vomiting but had no effect on neonatal outcome.[6]

The purpose of this study is to examinethe effect of preload in maintaining cardiovascular stability in patients undergoing C.s under spinal anesthesia and assess the hemodynamic changes in patients undergoing C.s with preload, comparison with another patient without preload in HR , BP (SBP ,DBP ,MAP) .

2. Methodology

This is a cross sectional case control hospital – based study; performed during the period (sep.2014 – dec.2015) in Khartoum north teaching hospital and academy teaching hospitalon 30 obstetric women undergoing cesarean section by spinal anesthesia - 15 without preload (control) and 15 with preload (cases) with normal saline 500 ml.Patients diagnosed with heart failure, renal failure or multi organ failure are excluded from the study.30 cases wereincluded, and a designed questionnaire used to collect data from patients after they signed a written consent form.HR, BP,MABP,PSO2 were recorded. Data gather was analyze using statistical package of social science SPSS 15 , computer statistical analysis software (SPSS: statistical program for the social sciences).

Ethical Consideration

Ethical clearance and approval for conducting this research was obtained from the hospitals. Permission and written consent was obtained from thepatients.

3. Results

Table 1: Shows mean age in patients give preload and those whom are not

	Number	Minimum	Maximum	Mean	Std. Deviation
No Preload	15	23	42	29.87	5.489
Normal saline	15	20	36	28.6	5.591

Table 2: Shows mean HR in patients give preload and those whom are not

	Number	Minimum	Maximum	Mean	Std. Deviation	P value	Comment
No Preload	15	70	131	101.33	16.749	0.449	Insignificant
Normal saline	15	70	170	107.33	25.207		

Table 3: Shows mean SPo2in patients give preload and those whom are not

	Number	Minimum	Maximum	Mean	Std. Deviation	P value	Comment
No Preload	15	86	100	96.2	4.491	0.042	Significant
Normal saline	15	95	100	98.87	1.807		

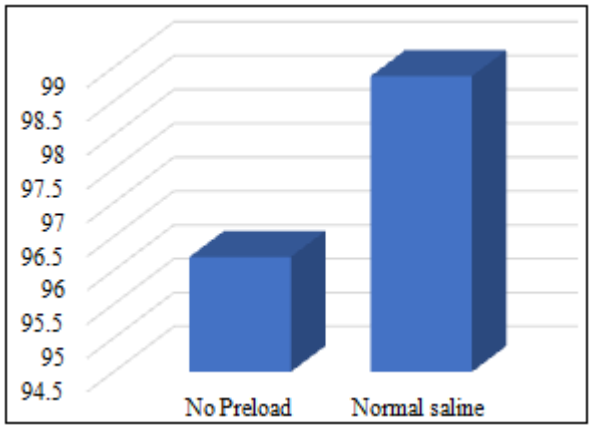

Figure 1: Shows mean SPo2in patients give preload and those whom are not

Table 4: Shows difference in Systolic BP Between patients give preload and those whom are not

	No Preload		Normal saline		P value	Comment
	Mean	Std. Deviation	Mean	Std. Deviation		
Pre Systolic BP	128.07	17.094	115.73	6.112	0.014	Significant
first min systolic BP	123.87	16.852	149.73	14.235	0.000	Significant
after 4 min systolic BP	124.47	16.318	147.07	16.007	0.001	Significant
after 9 min systolic BP	115	17.481	114.67	22.544	0.964	Insignificant
after 19 min systolic BP	125.53	15.459	133.87	16.548	0.165	Insignificant
after 29 min systolic BP	127.33	17.381	135.2	17.737	0.230	Insignificant

Table 5: Shows difference in diastolic BP Between patients give preload and those whom are not

	No Preload		Normal saline		P value	Comment
	Mean	Std. Deviation	Mean	Std. Deviation		
Pre diastolic BP	79.53	13.309	69.93	10.173	0.035	Significant

first min diastolic BP	74.8	12.924	90.8	12.214	0.002	Significant
after 4 min diastolic BP	73.93	15.636	89	13.077	0.008	Significant
after 9 min diastolic BP	69.67	17.919	64.27	12.458	0.346	Insignificant
after 19 min diastolic BP	73.6	15.436	75.33	11.812	0.732	Insignificant
after 29 min diastolic BP	73.27	13.682	77.27	8.964	0.352	Insignificant

Table 6: Shows difference in MAP Between patients give preload and those whom are not

	No Preload		Normal saline		P value	Comment
	Mean	Std. Deviation	Mean	Std. Deviation		
Pre MAP	96.8	15.74	85.07	8.04	0.016	Significant
first min MAP	91	13.717	110.6	11.873	0.000	Significant
after 4 min MAP	90.6	14.846	108.4	12.866	0.002	Significant
after 9 min MAP	84.67	16.723	81	15.497	0.538	Insignificant
after 19 min MAP	91	14.716	94.87	12.705	0.448	Insignificant
after 29 min MAP	91.47	14.111	96.53	11.294	0.287	Insignificant

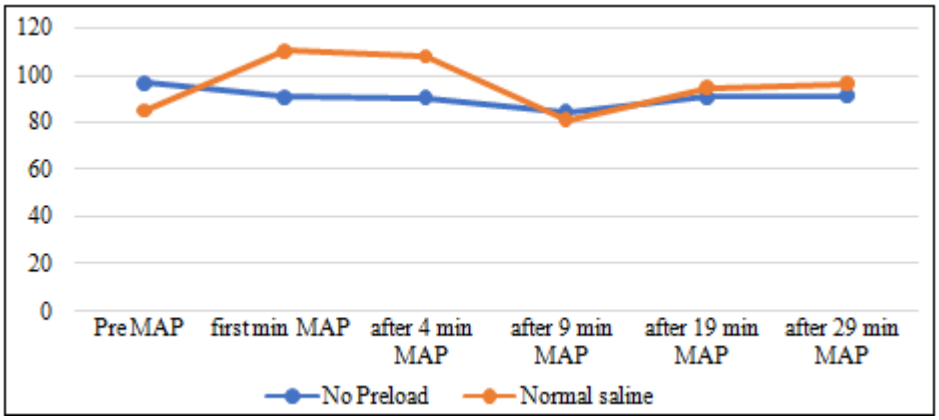

Figure 2: Shows difference in MAP Between patients give preload and those whom are not

4. Discussion

This study conducted on a total of 30 patients, aimed at comparing the effect of preload in maintaining cardiovascular stability in patients undergoing C.s in 15 patients used preload and in others 15 patients without preload .

In the patients without preload the minimum age is 23 , maximum age 42 , mean age 29.87 and the standard deviation is 5.489. In the patients with preload ,the minimum age is 20 , maximum age is 36 , mean age 28.6 and the standard deviation is 5.591 .

It was obvious that the mean HRfor patients with preload (107.33) is better than in patients without preload (101.33)

The mean SPo2 in patients with preloadis (98.87) higher than those withoutpreload 96).

The MABP in patients withpreload is higher than in patients with preload.

The finding of this study is disagree with the study of Siddik-Sayyid et al [5] whom they found a little effect of preload with colloid or crystalloids fluids administration to prevent hypotension that is occur after spinal anesthesia in cesarean section, and agree with NganKee et al [6]whom they found the infusion of metaraminol, colloid preload improved the maternal hemodynamic stability[6]

The important findings of this study there is a positive role in theeffect of preload with crystalloid (normal saline) in hemodynamic improvement.

5. Conclusion

There is obvious effect to reduce the incidence of hypotension and nausea following spinal anesthesia in Cs with preload with crystalloid solution following by usingvasopressor and ondansetron.We recommendto give patients undergoing Cs at least500 ml preload fluids to minimize incidence of hypotension .

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