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The Effect of Gelatine Colloid Preloading on Hypotension Prevention in Cesarean Section with Spinal Anesthesia at The Central Surgery Installationof Banyumas Regional Hospital

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ABSTRACT

Background:Hypotension in cesarean-section patients occurs due to peripheral vasodilation. It was the result of a sympathetic blockade caused by spinal anesthesia medication. Several methods can be employed to manage hypotension during cesarean section surgery, including fluid loading and vasopressors. Preloading with colloid fluids like hydroxyethyl starch (HES) before initiating spinal anesthesia has been deemed effective in reducing the incidence and severity of hypotension. A preliminary study revealed a decrease in blood pressure (up to 20%) in the first 15 minutes after spinal anesthesia was given to 30 cesarean section patients.Method: In this research, a Quasi-Experimental method was employed with a Pretest-Posttest Control Group Design. A total of 94 respondents were selected as the research sample using a purposive sampling technique. The respondents were divided into two groups: the ephedrine group and the preloading group. The data obtained were then analyzed using Independent Sample T-Test. Results:There is a significant effect on systolic and diastolic blood pressure between the ephedrine and preloading group, with respective significance values of p 0.010 and p 0.001. Conclusion:Preloading gelatine colloid is effective in maintaining blood pressure (systolic and diastolic) in cesarean section patients with spinal anesthesia.

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1. INTRODUCTION

Hypotension in cesarean section with spinal anesthesia according to[1][2][3] occurs due to vasodilation of peripheral blood vessels as a result of sympathetic blockade due to spinal anesthetic drugs. then according to [4] this clinical problem arises due to abnormalities due to the occurrence of peripheral vascular vasodilation caused by sympathetic blockade due to spinal anesthesia. During late pregnancy, the supine position causes the gravid uterus to compress the inferior vena cava and results in drastic hemodynamic changes. Prolonged hypotension leads to organ ischemia and cardiovascular collapse in the laboring mother. Furthermore, decreased blood flow to the uterine vascular bed leads to hypoxia, acidosis, fetal distress, decreased Apgar score, and infant health risks.

Several methods are used in handling hypotension during cesarean section surgery, namely using fluid loading and with vasopressors[5][6]. According to[7][8][9], preloading fluids before initiation of spinal anesthesia with colloids such as hydroxyethyl starch is considered effective in reducing the incidence and

severity of hypotension. The same thing was also stated by[10][11][12], the administration of colloid fluids is more effective than crystalloids because it can fill a longer intravascular space and a larger molecular weight, so it will have an effect on greater intravascular volume expansion.

Based on the results of observations made by researchers in the central surgical installation of Banyumas Regional Hospital in September 2022 on 30 cesarean section patients, it was found that the incidence of a decrease in blood pressure to > 20% in the first 15 minutes after spinal anesthesia. In connection with this situation, the researcher felt the need to further examine the effect of preloading, especially gelatine, on the prevention of hypotension in cesarean section with spinal anesthesia at the Central Surgical Installation of Banyumas Hospital.

2. RESEARCH METHOD

The research method used was quantitative method with quasy experimental research design with pretest-post test design with control group design. Measurement of research variables was carried out by measuring blood pressure before and after the intervention of preloading gelatinecolloid fluid in the presence of control variables. The study was conducted to determine the effect of gelatinecolloid fluid preloading on the prevention of hypotension in cesarean section with spinal anesthesia.

This study was conducted from April 18 to June 1, 2023 in the Central Surgical Installation Room of Banyumas Hospital by taking samples of cesarean section patients with spinal anesthesia. The sampling technique used was accidental sampling, where patients who were scheduled for elective surgery on that day were taken as research samples according to the sample criteria that had been carried out.The samples collected in this study amounted to 94 cesarean section patients with spinal anesthesia, the number was divided into two research groups, namely the control group which was given a certain dose of vasopressors before surgery began and the intervention group with the administration of colloid preloading. Data collection was done through assessment of patients and obtained data on age, history of surgery, weight, height, parity, spinal anesthesia dosage, as well as blood pressure, heart rate, mean aerterial pressure before and after treatment.

3. RESULT AND DISCUSSIONS

1. Characteristics of respondents based on age, height, surgery history and parity

Table 1. Sample distribution based on age, height, surgery history and parity

characteristics	Control group		Intervention group	
	n	%	*n*	%
Age				
Early adulthood	33	70,2	35	74,5
Late adulthood	14	29,8	12	25,5
Total	47	100	47	100
Height				
< 150	11	23,4	3	6,4
≥ 150	36	76,6	44	93,6
Total	47	100	47	100
Surgery history				
yes	26	55,3	10	21,3
No	21	44,7	37	78,7
Total	47	100	47	100
Parity				
Primigravida	14	29,8	17	36,2
Multigravida	33	70,2	30	63,8
Total	47	100	47	100

2. The distribution of research samples based on body weight

Table 2. Sample distribution based on body weight

Group	*Mean*	*SD*	*Min-Max*	(95% CI)	
				Lower	*Upper*
Control	70,98	15,808	51-60	66,34	75,62
Intervention	70,32	7,559	48-97	68,10	72.54

3. The distribution of research samples based on bupivacaine dosage

Table 3. Sample distribution based on bupivacaine dosage

Dosage	Control group		Intervention group	
	n	%	*n*	%
12,5 mg	14	29,8	3	6,4
15 mg	33	70,2	44	93,6
Total	47	100	47	100

4. Distribution of research samples based on heart rate

Table 4. Sample distribution based on heart rate

Time	HR	Control group		Intervention group	
		n	%	*n*	%
pre	≤ 100	33	70,2	46	97,9
	> 100	14	29,8	1	2,1
post	≤ 100	33	70,2	46	97,9
	> 100	14	29,8	1	2,1
Total		47	100	47	100

5. Distribution of study samples based on mean arterial pressure

Table 5. Sample distribution based on mean arterial pressure

Time	MAP	Control group		Intervention group	
		n	%	*n*	%
Pre	< 60	0	0	0	97,9
	≥ 60	47	100	47	100
Post	< 60	3	6,4	0	0
	≥ 60	44	93,6	47	100
Total		47	100	47	100

6. Blood Pressure in Cesarean section Patients with Spinal Anesthesia in the Ephedrine Group

Univariate analysis of the blood pressure of the study sample in cesarean section surgery patients with spinal anesthesia in the ephedrine group.

Table 6. Blood Pressure in the Ephedrine Group

Time	Blood Pressure	*n*	*Minimum*	*Maximum*	*Mean*	SD
Pre	Systolic	47	101	167	128,98	15,709
	Diastolic	47	40	110	75,68	15,559
Post	Systolic	47	73	142	114,26	15,613
	Diastolic	47	37	98	65,13	13,429

7. Blood Pressure in Cesarean section Patients with Spinal Anesthesia in the Colloid Gelatine Preloading Group

Univariate analysis of blood pressure in research samples from cesarean section patients with spinal anesthesia in the intervention group.

Table 7. Blood Pressure in the Colloid Gelatine Preloading Group

Time	Blood Pressure	*n*	*Minimum*	*Maximum*	*Mean*	SD
Pre	Systolic	47	110	138	128,17	6,445
	Diastolic	47	55	87	73,83	8,273
Post	Systolic	47	108	135	121	7,489
	Diastolic	47	57	85	72,66	7,355

8. Normality Test

The normality test used in this study was the Kolmogorov-Smirnov Test because the sample size for each group was > 30 based on the determination of the large sample size[13].

Table 8. Normality *Kolmogorov smirnov test*

Group	Time	Blood Pressure	*Z*		
			□□□□□	*n*	□□□□□
Control	Pre	Systolic	0,080	47	0,200
		Diastolic	0,114	47	0,160
	Post	Systolic	0,077	47	0,200
		Diastolic	0,063	47	0,200
Intervention	Pre	Systolic	0,122	47	0,075
		Diastolic	0,109	47	0,200
	Post	Systolic	0,138	47	0,053
		Diastolic	0,096	47	0,200

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Homogeneity Test

The results of the homogeneity test

Table 9. Homogenity Levene Test

Blood Pressure Post Control – Intervention	*Based on Mean*	
	Levene Statistic	□□□□□
Systolic	13,506	0,000
Diastolic	9,482	0,000

9. The Effect of Ephedrine Administration on Blood Pressure in Cesarean sectionn Patients at the Central Surgery Installation of Banyumas Hospital

The results of the paired sample t-test on samples before and after being given ephedrine.

Table 10. Blood Pressure in the Ephedrine Group Before and After Ephedrine Administration

Blood Pressure	Time	*n*	*Mean±SD*	Difference *Mean±SD*	□□□□□	□□□□□
Systolic	Pre	47	128,98±15,709	14,723±19,421	5,197	0,000
	Post	47	114,26±15,613			
Diastolic	Pre	47	75,68±15,559	10,553±14,971	4,833	0,000
	Post	47	65,13±13,429			

10. The Effect of Preloading ColloidGelatine on Blood Pressure in Patients with Cesarean section at the Central Surgery Installation of Banyumas Hospital

The results of the paired sample t-test on samples before and after being given preloading.

Table 11. Blood Pressure in the Preloading Group Before and After Administration of Colloid Gelatine Preloading

Blood Pressure	Time	*n*	*Mean±SD*	*Difference Mean±SD*	□□□□□	□□□□□
Systolic	Pre	47	128,17±6,445	7,170±7,139	6,885	0,000
	Post	47	121±7,489			
Diastolic	Pre	47	73,83±8,273	1,170±3,053	2,628	0,012
	Post	47	72,66±7,355			

11. Differences in Blood Pressure in Cesarean section Patients with Spinal Anesthesia in the Ephedrine Group and the Colloid Gelatine Preloading Group

The results of the Independent Sample t Test hypothesis test.

Table12. Independent sample t-test in the Ephedrine and Gelatine Colloid Preloading groups

Blood Pressure	Group	*Mean±SD*	*Difference*		□□□□□	□□□□□
			Mean	*SD*		
Systolic	Control	114,26±15,613	-6,745	2,526	-2,670	0,010
	Intervention	121±7,489				
Diastolic	Control	65,13±13,429	-7,532	2,233	-3,372	0,001
	Intervention	72,66±66				

4. DISCUSSION

Based on preliminary studies conducted in the central surgical installation of the Banyumas Regional General Hospital in August there were 91 patients, in September there were 111 patients, and in October 124 patients. so that the average patient in 1 month was 109 patients. The sample size in this study was calculated using the Slovin formula.Due to the risk of respondents dropping out, it was necessary to add 10% to the total sample count.So, in the above calculation, the number of samples obtained was 94 samples which were divided into two groups, namely 47 samples in the colloid gelatine preloading group and 47 samples in the ephedrine group. And based on table 12, it is known that the significance value is 0.010 for systole and 0.001 for diastole ($p < 0.05$) (based on equal variances not assumed), then the independent sample t test hypothesis test which gives the result that H_0 is rejected and H_a is accepted, which means that there is a significant difference between the average posttest blood pressure results both systolic and diastolic in the ephedrine group and colloid gelatine preloading group.

Keeping the volume of body fluids relatively constant and the composition of electrolytes in them stable is important for homeostatis [14]. Gelatin colloid preloading which has a relatively low molecular weight of 30.35 kDa and a larger molecular size than hydroxyethyl starch can provide a sealing effect on the blood vessel wall so that it can last longer in the blood vessels than crystalloid fluids. When compared to other colloids, the immediate plasma expansion effect of gelatin is 80-100% of the volume introduced so that it can keep the blood volume relatively constant.

When there is vasodilation of peripheral blood vessels due to sympathetic blockade as an effect of spinal anesthesia, then blood will flow a lot to the vasodilated vascular. As per Pascal's law that liquid flows from high pressure to low pressure [15]. Where when vasodilation occurs peripheral resistance decreases. While the backflow of blood is inhibited in the inferior vena cava due to pressure by the uterus. Then the volume of blood in the upper vascular body becomes decreased pressure. Therefore, more pressure is needed to increase the blood rate where one of the factors that affect blood pressure is blood volume in addition to cardiac output and peripheral resistance [16]. Direct blood volume can fill the lumen of the blood vessels and exert pressure on the walls of blood vessels when vasodilation occurs so that hypotension does not occur or if there is a decrease in blood pressure, the percentage of decrease is minimal..The results of this study indicate that preloading colloidgelatine is very effective for preventing hypotension in cesarean section with spinal anesthesia. This study is in accordance with research[17][18][19][20] which states that there is an effect of fluid preloading on the prevention of hypotension. this is also supported by[4][7][18] which states that the administration of crystalloid and colloid fluids is effective in preventing hypotension. research from[9][19][21] also states fluid preloading (before initiation of spinal anesthesia) with colloids such as hydroxyethyl starch effectively reduces the incidence and severity of arterial hypotension, while crystalloid preloading is not indicated.because crystalloids easily move from intravascular to extravascular

5. CONCLUSION AND RECOMMENDATION

There is a slight difference in effectiveness between gelatine colloid preloading and ephedrine administration in preventing hypotension during cesarean section with spinal anesthesia. The average difference in blood pressure between the control and intervention groups was 6,745 mmHg in systolic pressure and 7,532 mmHg in diastolic pressure.This study can be used as a data source for further research related to the allergic effects ofgelatine colloid.

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