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The Correlation Between the Type of Fluid Administration and the Incidence of Hypotension in Patients Undergoing Spinal Anesthesia at RS Wijayakusuma Purwokerto

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ABSTRACT

Background: Spinal anesthesia is a type of regional anesthesia that involves injecting a local anesthetic into the subarachnoid area. The effect of sympathetic blockade in spinal anesthesia can cause dilation of blood vessels, suppress systemic vascular resistance and result in hypotension [1]. The effects of hypotension are pulmonary aspiration, cardiac arrest, respiratory depression, and loss of consciousness. A sudden drop in blood pressure can also cause a heart attack, a complication of spinal anesthesia. Method: A quantitative approach using a correlational observational design with research variables, namely the administration of fluid types with the incidence of hypotension in patients undergoing spinal anesthesia. The research was conducted in the IBS room at Wijayakusuma Hospital, Purwokerto, with samples was calculated obtained 53 respondents who were selected using a purposive sampling technique. The relationship between the two variables tested was carried out using the non-parametric chi square statistical test with the Fisher exact test Results: Among the respondents, the type of fluid administered was crystalloids in 98.1% of cases, with 70.2% of respondents not experiencing hypotension. The chi-square test yielded a p-value of 1.000, indicating no significant correlation between the type of fluid administered and the incidence of hypotension in patients undergoing spinal anesthesia. Conclusion: There is no significant correlation between the administration of crystalloid or colloid fluids and the incidence of hypotension in patients undergoing spinal anesthesia at RST Wijayakusuma Purwokerto.

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1. INTRODUCTION

Medical practices that are performed invasively on the part of the body that is to be opened are called surgeries. In most cases, incisions are used to open this area of the body [1] . Anesthesia is a medication that prevents a patient from feeling pain during a medical procedure. The two most common types of anesthesia are spinal anesthesia (regional anesthesia) and general anesthesia[2]. Spinal anesthesia is a type of regional anesthesia that involves injecting a local anesthetic into the subarachnoid space. Spinal anesthesia is known as an intradural spinal block or an intrathecal block. Spinal anesthesia involves injecting a local analgesic medication into the subarachnoid space between lumbar 2 and lumbar 3, lumbar 3 and lumbar 4, or lumbar 4 and lumbar 5. The

cardiovascular effects of spinal anesthesia are related to the degree of sympathetic blockade affecting thoracic 1 to lumbar 2 (T1–L2) nerves. The effects of sympathetic blockade in spinal anesthesia can cause vasodilation, depress systemic vascular resistance, and result in hypotension [3].

Blood pressure less than 90/60 mmHg or quite low is usually called hypotension[4]. The causes of intraoperative hypotension are varied, vasodilation (anesthetic drugs and systemic inflammation), intravascular hypovolemia due to bleeding, low cardiac output (bradycardia or low stroke volume), high intrathoracic pressure (mechanical ventilation), and sympathetic nervous system disorders are potential causes of intraoperative hypotension, the baroreflex system or regulation is disturbed[5]. Hypotension is the most common complication of spinal anesthesia, with a frequency of more than 80%. According to research[3] The incidence of hypotension after spinal anesthesia is around 15-33% in cases that usually occur in surgery, with the majority of cases occurring in obstetrics (11.8% (9.6% in general surgery), and hypotension due to trauma blood pressure is 4.8%. The incidence of hypotension in caesarean section with spinal anesthesia is 83.6%, but only 16.4% with epidural anesthesia.

The effects of hypotension include pulmonary aspiration, cardiac arrest, respiratory depression, and loss of consciousnessa sudden drop in blood pressure can also cause a heart attack, a complication of spinal anesthesia[6]. Actions to reduce and prevent hypotension after spinal anesthesia include prehydration using crystalloid or colloid fluids. Hypotension can be treated with intravenous fluids, vasopressors, Trendelenburg position, and oxygen therapy[3]. About 50 to 70% of the human body is body fluid. Body fluids are divided into two main fluids, namely intracellular fluid and extracellular fluid, which are separated by cell membranes. Intracellular fluid is the fluid inside the cells. Intracellular fluid accounts for approximately 40% of body weight. Intracellular fluid contains large amounts of potassium and phosphate ions, moderate amounts of magnesium and sulfate ions, small amounts of chloride and sodium ions, but almost no calcium ions[7].

The amount of extracellular fluid decreases with age, up to one third (30%) of the total volume in adults. In general, intravenous fluids are divided into two categories, namely crystalloid fluids that contain electrolytes (such as potassium, sodium, calcium, chloride) and colloid fluids that have a high molecular weight and osmotic activity that causes the fluid to have a tendency to remain in the intravascular space for a fairly long time[8]. Returning fluids lost in surgical wounds, replacing blood and replenishing fluid losses from excretory organs are the goals of administering fluids during surgery. The aim of administering fluids throughout the operation is to repair fluid loss from the surgical wound, compensate for bleeding, and replenish fluid loss from the excretory organs[7]. In a study conducted at Hasan Sadikin Hospital Bandung, administration of colloid fluids was an option to avoid hypotension after spinal anesthesia.

This fluid remains in the blood vessels longer than crystalloids. Meanwhile, in a study conducted in the operating room of A.Yani Metro Hospital, there was no difference in the effectiveness of pre-loading and coloading of lactated ringer crystalloid fluids to avoid hypotension in spinal anesthesia[9]. The results of a preliminary study conducted by researchers at RST Wijayakusuma Purwokerto obtained the number of patients who received surgery from January to November 2023 with spinal anesthesia 1,243 patients. Approximately 113 patients per month with spinal anesthesia at RST Wijayakusuma Purwokerto were performed and experienced changes in blood pressure after spinal anesthesia. And management to prevent hypotension at the Wijayakusuma Purwokerto Army Hospital is by administering crystalloid fluids and colloid fluids, the crystalloid fluid used is ringer lactate fluid, and the colloid fluid used is hes fluid.

If changes in blood pressure are not addressed, especially a decrease in blood pressure, hypotension will occur and if hypotension occurs and action is not taken immediately to prevent hypotension, this will cause a number of conditions, including vomiting, loss of consciousness, cardiac arrest, fetal compromise, and nausea[10]. Considering the changes in blood pressure in patients undergoing surgery with spinal anesthesia, researchers are interested in conducting research To knowing the types of fluids given to intra-anesthesia patients spinal, to determine the incidence of hypotension in patients with spinal anesthesia in intraoperative patients, and then to knowing the relationship between the type of fluid given and the event hypotension in patients under spinal anesthesia with spinal anesthesia at RST Wijayakusuma Purwokerto.

2. RESEARCH METHOD

Researchers used this type of research using a quantitative type of research, with a crosssectional design with research variables, namely the administration of fluid types with the incidence of hypotension in patients undergoing spinal anesthesia. The research was conducted in the IBS room at Wijayakusuma Hospital, Purwokerto, with a population of 113 respondents. The number of samples was calculated using the Slovin formula and obtained 53 respondents who were selected using a purposive sampling technique for respondents with the criteria of being mature and willing to become respondents. The data collection technique uses direct observation techniques with instruments in the form of observation sheets containing the respondent's identity, age, gender, type of fluid and infusion, blood pressure monitoring equipment using a bedside monitor. The results of the research were carried out using two types of data analysis, univariate data was carried out for respondent

characteristics and presented with frequency distribution. For bivariate data, the relationship between the two variables tested was carried out using the non-parametric chi square statistical test with the Fisher exact test.

3. RESULT AND DISCUSSIONS

This study is a quantitative study with correlational observation and cross-sectional design. The study was conducted from April to May 2024 at RST Wijayakusuma Purwokerto. Sampling was carried out using purposive sampling of 53 respondents. Observation sheets were used by researchers in this study to collect research samples, researchers provided informed consent before sampling and explained the purpose of the study.

3.1. Univariat

A total of 53 respondents participated in this study with distribution based on fluid type and incidence of hypotension as follows:

Table 1 shows the results of the characteristics of respondents with the type of fluid, the majority of whom used crystalloid fluids with a total of 52 respondents (98.1%). Based on the results of the study, it was found that the majority of respondents were given crystalloid fluids but there was one respondent who was given colloid fluids, and the respondent did not show hypotension compared to crystalloids where some crystalloids experienced hypotension, that colloids are more efficient than crystalloids in preventing hypotension after spinal anesthesia, but the decision to use depends on the doctor's assessment of the benefits when compared to the disadvantages of colloids, namely cost, effects on coagulation and hypersensitivity reactions. Several studies have shown that the incidence of hypotension remains significant regardless of the type or time of fluid administration after spinal anesthesia and doctors must wisely use the right vasopressor.

Table 2 shows the results of the characteristics of respondents with hypotension, most of whom did not experience hypotension with a total of 42 respondents (70.2%) with an average systolic blood pressure of 119.95 mmHg and an average diastolic pressure of 70.30 mmHg and respondents who experienced hypotension were 11 respondents (20.8%) with an average systolic blood pressure of 85.8 and an average diastolic blood pressure of 56 mmHg.Based on the results of this study, the incidence of hypotension in respondents with crystalloid fluid administration was 11 respondents (20.9%). In line with the research of Fikran et al., (2016) Spinal anesthesia causes peripheral vasodilation and also causes a decrease in systemic vascular resistance which is often accompanied by hypotension. Hypotension after spinal anesthesia can cause significant morbidity and mortality. The clinical diagnosis of hypotension is when systolic blood pressure decreases by 20 to 30% from the initial systolic blood pressure or when systolic blood pressure is less than 100 mmHg.

Hypotension that occurs after spinal anesthesia is caused by paralysis of preganglionic sympathetic fibers which causes venous and arterial vasodilation resulting in decreased systemic vascular resistance. This can also be accompanied by decreased venous return, resulting in decreased cardiac output.

Table 1. Frequency Distribution Based on Fluid Type (n = 53)

No	Characteristics Respondent	f	%
1	**Liquid of infussion Type**		
	Crystalloid	52	98,1
	Colloid	1	1,9

Table 2. Frequency Distribution Based on Hypotension Occurrence (n = 53)

No				lood Pressure	
		f	%	Mean Systolic	Mean Diastolic
1	**The incidence of hypotension**	11	20,8	85,8	56
	Hypotension	42	70,2	111,95	70,3
	Not hypotension				

3.2. Bivariat

Based on **Table 3**, it shows the relationship between crystalloid fluid administration and the incidence of hypotension, it was found that there were as many as (20.9%) respondents who were given crystalloid fluids experienced hypotension, and as many as 41 respondents (77.9%) did not experience hypotension. While the relationship between the administration of colloid fluid types and the incidence of hypotension was zero, and there was no hypotension of 1 respondent (1.9%). After conducting a non-parametric chi square statistical test with the

Fisher exact test, a p-value of 1,000 (p> 0.05) was obtained, so there was no significant relationship between the administration of fluid types and the incidence of hypotension in patients with spinal anesthesia at RST Wijayakusuma Purwokerto.Based on the results of the hypothesis test using the non-parametric chi square statistical test between fluid administration and the incidence of hypotension, it has a p-value of 1,000 (>0.05), so it can be concluded that there is no significant relationship between the administration of fluid types and the incidence of hypotension.

Table 3. Relationship between Type of Fluid Given and Hypotension Incidents (n = 53)

Liquid of infussion Type	Blood Pressure Hypotention		Not hypotention		*p- value*
	n	**%**	**n**	**%**	
Crystalloid	11	20,9	41	77,9	1,000
Colloid	0	0	1	1,2	

Colloid fluids maintain blood pressure stability better than crystalloids. Colloids are often used in fluid therapy, such as for bleeding or fluid preload in regional anesthesia patients. One use of colloids is in caesarean sections with spinal anesthesia. Spinal anesthesia has complications such as hypotension, whereas Crystalloid has a shorter half-life in the intravascular compartment and generally exits the intravascular space within 1 hour resulting in its ability to expand intravascular volume making it less successful in maintaining intravascular volume during the formation of dynamic spinal anesthetic effects and vasodilation. as a result Compared with crystalloids, the volume effect of colloids is also about 2-5 times greater. In addition, there is a difference in colloid osmotic pressure between colloids and crystalloids [11]. Spinal anesthesia causes peripheral vasodilation and also causes a decrease in systemic vascular resistance which is often accompanied by hypotension. Hypotension after spinal anesthesia can cause significant morbidity and mortality.

The clinical diagnosis of hypotension is if the systolic blood pressure decreases by 20 to 30% from the initial systolic blood pressure or if the systolic blood pressure is less than 100 mmHg. Hypotension that occurs after spinal anesthesia is caused by paralysis of preganglionic sympathetic fibers which causes venous and arterial vasodilation, resulting in a decrease in systemic vascular resistance. This may also be accompanied by decreased venous return, resulting in decreased cardiac output. The decrease in blood pressure after spinal anesthesia is primarily related to the degree of sympathetic blockade. Hypotension after spinal anesthesia usually occurs within the first 15 to 20 minutes. This is the amount of time required for the local anesthetic to cause a certain level of nerve block and to persist.[12], [13], [14]. The occurrence of hypotension during spinal anesthesia is caused by sympathetic blockade, causing peripheral vasodilation. In this condition, venous return and cardiac output decrease, resulting in hypotension. Hypotension is diagnosed when systolic blood pressure is less than 90 mmHg and diastolic blood pressure is less than 60 mmHg [15].

Loss of circulatory fluid can decrease venous return, reduce ventricular muscle stretch and result in decreased cardiac output leading to hypotension and poor perfusion. To prevent hypotension, two main types of intravenous solutions are used before surgery: crystalloids and colloids. The crystalloid solution spreads into the intravascular space and interstitial tissue, with one third of the solution remaining in the intravascular space and the remainder entering the tissue. Although available in isotonic, hypertonic, and hypotonic forms, excess use of crystalloids can cause peripheral and pulmonary edema due to decreased plasma colloid oncotic pressure. In contrast, colloids are more effective in expanding circulating volume and preventing hypotension after spinal anesthesia because their larger molecules hold in the intravascular space and increase osmotic pressure. However, colloids cause pulmonary edema and anaphylactic shock, although they have a longer half-life and blood circulation, making them efficient in stabilizing hemodynamic change [16], [17].

Giving colloid co-loading fluids is one way to prevent hypotension due to spinal anesthesia during caesarean section. Co-loading fluids are given to increase vascular volume which is expected to reduce the vasodilation effect caused by spinal anesthesia. Administration of co-loading colloid fluids increases venous return, leading to increased cardiac output. Administration of co-loading colloid fluids increases intravascular volume to maintain cardiac return to hemodynamic changes due to spinal anesthesia. Colloids also have a high molecular weight and osmotic activity so that the fluid stays longer in the intravascular space [18]A study examined the effect of administering colloid and crystalloid fluids on blood pressure in caesarean section patients with spinal anesthesia at Ulin Regional Hospital, Banjarmasin, 20 people were given RL and 20 people were given HES. From the statistical tests carried out it can be concluded that there is no significant difference in blood pressure with the administration of post-spinal crystalloid and colloid fluids [19]

Lactate light fluid is known as a mixture of balanced crystalloids or balanced electrolytes which has a composition that is closer to the composition of plasma, because lactate light fluid fills the extravascular space and after one hour only 20 to 25% is in the intravascular space after one hour. Prevention of hypotension consists

of increasing the volume of circulation to compensate for the decrease in peripheral resistance. Therefore, hypotension can be prevented by rapidly administering Ringer's lactate at 10-15 ml/kg BW. If hypotension persists after administering fluids, a vasopressor such as epedrine can be given 5 to 10 mg via intravenous bolus, because epedrine is an indirect vasopressor that increases heart muscle contractions (central effect) and a vasoconstrictor (peripheral effect) [20], [21]. Based on research conducted in April-May 2024 at RST Wijayakusuma Purwokerto, researchers realize that this research is far from perfect and further researchers can consider these shortcomings and limitations. Any limitations in this Researchers did not calculate the volume of fluid given to patient and to determiner blood pressure checks were carried out once every 15 minutes after spinal anesthesia.

4. CONCLUSIONS AND RECOMMENDATIONS

The results of this study can be concluded that: the highest distribution of fluid administration was the administration of fluids with crystalloid fluids as many as 52 respondents or 98.1%. In the results of this study, the highest distribution of hypotension events was not experiencing hypotension as many as 42 respondents or 70.2%. Based on the results of the non-parametric chi square test in this study, there was no relationship between the type of fluid and the incidence of hypotension in patients with spinal anesthesia at RST Wijayakusuma Purwokerto with a p-value of 1,000 (p-value> 0.05). So, in providing anesthesiology nursing care, the type of intravenous fluid given is not a factor that can cause hypotension, so the staff can provide fluids according to the patient's needs while paying attention to other causal factors.

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