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RELATIONSHIP BETWEEN PRELOADING FLUID ADMINISTRATION AND INTRAOPERATIVE HYPOTENSION INCIDENTS IN MAJOR SURGERY PATIENTS WITH SPINAL ANESTHESIA

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Abstract
Surgery using spinal anesthesia or Subarachnoid Block (SAB) can cause acute vasodilation due to the blockade of the sympathetic nervous system, which increases the capacity of peripheral blood vessels, thereby reducing venous return and causing acute hypotension. This study aims to determine the relationship between preloading fluids administration and intraoperative hypotension incidence in major surgical patients with spinal anesthesia. This is a non-experimental quantitative study with a cross-sectional correlation approach. The sampling method used is non-probability sampling with a purposive sampling technique. The instruments used observation sheets, a watch, and a tensimeter/NIBP. The study uses the Chi-square test (a=0.05). The results of this study show that the majority of respondents who were given preloading fluids amounted to 26 respondents (65.4%) from 43 respondents. Meanwhile, those who experienced intraoperative hypotension amounted to 23 respondents (53.3%) from 43 respondents. The Chi-square test results showed a p-value of 0.004, indicating a significant relationship between preloading fluids administration and intraoperative hypotension incidence in major surgical patients with spinal anesthesia at Lavalette Hospital. It is hoped that health practitioners, especially anesthesia nurses, will pay attention to preloading fluid needs according to the condition of major surgical patients with spinal anesthesia in preventing intraoperative hypotension.
Keywords: *Preloading Fluids; Intraoperative Hypotension; Major Surgery; Spinal Anesthesia*

INTRODUCTION

Spinal anesthesia or *Subarachnoid block* (SAB) is a type of regional anesthesia used as analgesia because it can relieve pain so that patients remain relaxed and conscious during surgery (Djari et al., 2021) . According to Ramdan et al., 2022) , administering spinal anesthesia can cause certain side effects and complications. One of the side effects of administering spinal anesthesia is hypotension which is characterized by hemodynamic changes in the form of decreased systolic blood pressure, diastolic pressure, and decreased mean arterial pressure, as well as an increase or decrease in pulse rate.

Hypotension that occurs after spinal anesthesia if not properly managed can cause tissue and organ hypoxia. In addition to hypotension caused by side effects from spinal anesthesia, in cases of major surgery that require a longer duration of surgery, it will cause several other complications. A study conducted by (Krisiyanto et al., 2022) stated that hypotension that occurs in major surgery and a duration of surgery of more than 2 hours is one of the factors causing cardiovascular complications in the form of hypotension, hypertension,

bradycardia, and shock while in the PACU. This is in line with research by Abebe *et al.* , 2022 which states that a duration of surgery of more than 4 hours and intraoperative complications can cause patients to experience slow recovery while in the recovery room. A more severe complication of intraoperative hypotension after spinal anesthesia is the occurrence of hypovolemic shock which can cause death (Hafiduddin *et al* ., 2023)

Surgical procedures in Indonesia rank 11th out of 50 types of treatment in first aid efforts in hospitals and as many as 32% of them are major surgical procedures (Alfarisi, 2021) . In cases of hypotension during surgery with spinal anesthesia, the highest cases were found in obstetric surgery at 11.8%, followed by cases of hypotension in general surgery at 9.6%, and hypotension in surgery with trauma at 4.8%, (Mustaqim & Mardalena, 2021)

Based on data from Lavalette Hospital, Malang City, the number of major surgical cases in the period September - December 2023 was 225 patients. The types of operations that are classified as major operations or major surgeries that are most often performed at Lavalette Hospital, Malang City are obstetrics and gynecology, oncology, digestive, and orthopedic surgery. The most major surgical cases using spinal anesthesia techniques are in cases of *orthopedic surgery* on the lower extremities and in cases of obstetrics and gynecology. Of all major surgical patients who experienced intraoperative hypotension after spinal anesthesia, 10% of the total major surgical cases with spinal anesthesia techniques.

Surgery performed using spinal anesthesia or *Subarachnoib block* (SAB) will cause acute vasodilation due to blockade of the sympathetic nervous system which can increase the capacity of peripheral blood vessels, thereby reducing venous return and causing acute hypotension (Hafiduddin *et al* ., 2023) . The main cause of hypotension in spinal anesthesia is sympathetic tone blockade caused by decreased systemic vascular resistance and cardiac output (Ramdan et al., 2022) . Spinal anesthesia causes sympathetic inhibition, causing arterial dilation and venous congestion. This will cause decreased return from the veins to the heart, decreased cardiac output and ending in decreased blood pressure or hypotension.

In unstable hemodynamic conditions, the body's compensation is to regulate the sympathetic nerves to increase cardiac output and peripheral vasoconstriction so that blood pressure will return to normal. However, in conditions of spinal anesthesia, there is a blockade of the sympathetic nerves which causes vasodilation so that the body is unable to regulate to increase cardiac output and carry out peripheral vasoconstriction (Krisiyanto *et al* ., 2022) . Blockade of the sympathetic nerves due to spinal anesthesia can reduce systemic blood vessel resistance which will cause hypotension (Wicaksono *et al* ., 2022) .

Hypotension that occurs in major surgical cases will cause various cardiovascular complications such as hypotension, hypertension, tachycardia and shock during post-operatively (Krisiyanto *et al* ., 2022) . In cases of major surgery that require a longer operating time and complications such as hypotension during intraoperatively will have an impact on slowing down recovery when the patient

is in the recovery room (Abebe et al., 2022) . In addition to complications that occur during post-operatively, there are more severe complications as a result of intraoperative hypotension after spinal anesthesia, namely hypovolemic shock which can cause death (Hafiduddin *et al* ., 2023)

Actions taken to prevent hypotension include administering *vasopressors* in the form of metaraminol, phenylephrine, or norepinephrine, selecting the type of anesthetic drug used such as levobupivacaine or bupivacaine, fluid therapy using crystalloid or colloid fluids, along with the method of administering fluids by *preloading* or *coloading* . In addition, non-invasive actions to prevent hypotension are carried out using the leg wrapping method using elastic bandages, adjusting the left tilt position and adjusting the *Trendelenburg position* (Djari et al., 2021; Fitzgerald et al., 2020) . According to research by Djari et al., 2021 regarding "Prevention of Post-Spinal Anesthesia Hypotension in Cesarean Section Surgery" states that of the various interventions used to prevent hypotension, such as fluid therapy and vasopressors, it is considered more effective, practical and can be used in all types of surgery.

In cases of major surgery, it will require a longer duration of surgery and risk greater blood loss, which will increase the incidence of intraoperative hypotension (Nurbudiman, 2020) . Physiologically, when bleeding occurs, it will be accompanied by a decrease *in cardiac output* and in the condition of spinal anesthesia, there is a blockade of the sympathetic nerves which causes vasodilation so that the body is unable to regulate to increase cardiac output and carry out peripheral vasoconstriction (Nurbudiman, 2020) . If the condition of decreased *cardiac output* is not immediately treated by administering fluids, vasodilation will occur and as a result hypotension will occur. This is because intravenous fluids can increase blood volume and improve blood circulation to compensate for the decrease in vascular pressure in the periphery (Sari et al., 2022) . So it can be said that intravenous fluid administration is more effective than other therapies used to prevent hypotension after spinal anesthesia.

Perioperative intravenous fluid management can be given by preloading or *coloading* . *Preloading* is the administration of fluids that is carried out before the patient is given spinal anesthesia, while *coloading* is the act of administering fluids after the patient is given spinal anesthesia (Sari et al., 2022) . Based on research conducted by (Sukmaningtyas & Utami, 2022) found that *preloading* causes a decrease in the incidence of hypotension in a short time after spinal anesthesia and is able to replace fluids lost before spinal anesthesia compared to patients who do not receive *preloading* .

Intravenous *preloading* fluid therapy can offset the effects of sympathectomy vasodilation caused by spinal anesthetic drug agents, so that hypotension can be prevented. *Preloading* will increase the amount of fluid in the intravenous up to 10% with crystalloid fluids (Visantino & Muhaji, 2022) . Monitoring the fluid needs and adequacy of major surgical patients before undergoing spinal anesthesia is something that must be considered by nurses and doctors who are members of the surgical team. Thus, the incidence of intraoperative hypotension

can be minimized and complications that will be obtained from the hypotension do not occur.

Based on this background, the researcher is interested in conducting a study on the relationship between preloading fluid administration given before spinal anesthesia and the incidence of intraoperative hypotension in patients undergoing major surgery at Lavalette Hospital. In this case, the author focuses on the incidence of hypotension that occurs in major surgery patients during the intraoperative phase, especially in the first 15 minutes after spinal anesthesia induction because previous studies have focused more on cases of major surgery patients with general anesthesia and complications due to hypotension that occur in the postoperative phase.

RESEARCH METHODS

This study is a quantitative study with *a Cross Sectional research design* . The population in this study were major surgical patients with spinal anesthesia at Lavalette Hospital Malang. Determination of the sample in this study used the Slovin formula. Based on calculations with the Slovin formula, the number of samples in this study was 43.

Sampling using *non-probability sampling technique* with *purposive sampling* and each member of the population has an equal opportunity to be a sample. In addition, for data collection in this study using research instruments in the form of observation sheets, watches, tensiometers connected to the patient monitor screen/NIBP.

This research was conducted at Lavalette Hospital Malang which was implemented on July 1-14, 2024. After going through data processing including *editing, coding, tabulating, data entry, and cleaning* , the data was then analyzed univariately for each variable, while bivariate analysis was carried out using the *Chi Square statistical test* using SPSS.

RESEARCH RESULTS AND DISCUSSION

1. Respondent Characteristics

Table 1Characteristics of Respondents in the Lavalette Hospital Operating Room

Characteristics	Frequency (n)	Percentage (%)
Gender		
Man	12	27.9
Woman	31	72.1
Total	43	100
Age		
18-25 Years	8	18.6
26-35 Years	17	39.5
36-45 Years	14	32.6

Characteristics	Frequency (n)	Percentage (%)
46-55 Years	4	9.3
Total	43	100
Medical Diagnosis		
Carcinoma *ovary*	6	14.0
Ovarian cystoma	14	32.6
Lower extremity fracture	14	32.6
Cervical carcinoma	4	9.3
Cephalopelvic Disproportion	2	4.7
Long labor	3	7.0
Total	43	100
Surgical Procedures		
BSO TAH	17	39.5
ORIF	14	32.6
SC	5	11.6
SVH BSO	4	9.3
Radical Hysterectomy	3	7.0
Total	43	100

Based on table 1, it is known that most of the respondents are female, namely 31 respondents (72.1%) of the total 43 respondents. In terms of age characteristics, almost half of the respondents are in the age range of 26-35 years, namely 17 respondents (39.5%) of the total 43 respondents. Characteristics based on medical diagnosis are known to be *ovarian cystoma* and lower extremity fractures with the same number of respondents, namely 14 respondents (32.6%) of the total 43 respondents. In terms of characteristics based on surgical procedures, it is known that most of the operations performed are TAH BSO, namely 17 respondents (39.5%) of the total 43 respondents.

2. Preloading Fluid Administration Data

Table 2*Preloading* Fluid Administration in Major Surgery Patients in the Operating Room of Lavalette Hospital

Variables	Given		Not given	
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)
Preloading	26	60.5	17	39.5

Based on table 4.2, it is known that the preloading score of 43 respondents at the 15th minute after SAB was given *preloading* , with a number of respondents given *preloading* as many as 26 (60.5%) respondents.

3. Intraoperative Hypotension Incident Data

Table 3Major Surgery Patients in the Lavalette Hospital Operating Room

Variables	Blood Pressure Hypotension		Blood Pressure Not Hypotension	
Intraoperative Hypotension	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)
	23	53.5	20	46.5

Based on the table above, it is shown that the incidence of intraoperative hypotension was known to occur in 23 (53.5%) of 43 respondents.

4. *Preloading* Fluid Administration and Intraoperative Hypotension in Major Surgery Patients with Spinal Anesthesia at Lavalette Hospital

Table 4. Relationship between Preloading Fluid Administration and Intraoperative Hypotension Incidents

		Intraoperative Hypotension				p-value
		Hypotension		No Hypotension		
		F	%	F	%	
Preloading	**Not given**	14	82.4	3	17.6	**0.004**
	Given	9	36.4	17	65.4	
	Total	**23**	**53.5**	**20**	**46.5**	

Based on table 4, the *Chi-Square statistical test* has been performed and obtained *p-value* = 0.004 <0.05. So it can be concluded that H0 is rejected and H1 is accepted with the existence of a relationship between the administration of preloading fluids and the occurrence of intraoperative hypotension.

DISCUSSION

Preloading Fluid Administration and Intraoperative Hypotension in Major Surgery Patients with Spinal Anesthesia at Lavalette Hospital

The results of the study obtained a p-value of 0.004 (<0.05) indicating a significant relationship between *preloading fluid administration* and the incidence of intraoperative hypotension in major surgical patients with spinal anesthesia. In a statistical context, *the p-value* in the statistical results of the study showed a value that was smaller than the significance level used, namely 0.05. In this case, it can be interpreted that the null hypothesis (H0) is rejected and the alternative hypothesis (H1) is accepted.

Hypotension is defined if there is a decrease in arterial blood pressure > 20% below the normal value or if the systolic blood pressure is below 90 mmHg and the diastolic blood pressure is below 60 mmHg. The incidence of hypotension is also followed by a decrease in *Mean Arterial Pressure* (MAP) below 60 mmHg (Visantino & Muhaji, 2022) .

Preloading fluid administration is carried out with the aim of increasing blood volume and blood pressure before anesthesia is given. Administration of anesthesia, especially spinal or epidural types, can cause vasodilation or sudden

widening of blood vessels, which can result in a decrease in blood pressure. By administering *preloading fluids* , it will be able to help replenish blood volume and maintain blood pressure so that it remains within the normal range, thus preventing hypotension (Hafiduddin *et al* ., 2023)

This study is in line with research from Sari *et al.* , (2022) with the results that there was a significant difference in *Mean Arterial Pressure* (MAP) before and after administration of colloid fluids in patients with *Sectio Caesarea* with spinal anesthesia at RSD Dr. A. Dadi Tjokrodipo Bandar Lampung. Colloid fluids are given with the aim of increasing vascular volume which is expected to alleviate the effects of vasodilation due to spinal anesthesia. Administration of colloid fluids can increase venous return blood flow so that cardiac output increases and increases intravascular volume sufficient to maintain cardiac return blood flow so that hypotension can be prevented.

The results of the study showed that *the p-value* was 0.004. Based on the statistical results of the researcher, this provides strong evidence that there is a positive effect of preloading fluid administration in preventing intraoperative hypotension. This is important in clinical practice because intraoperative hypotension can cause serious complications, including decreased blood flow to vital organs, increasing the risk of organ damage, and can cause prolonged postoperative care which has an impact on the risk of increased morbidity of post-surgery patients. Therefore, one strategy to prevent intraoperative hypotension in patients with spinal anesthesia is the administration of *preloading fluids* .

In addition to further research, it is necessary to explore various factors that may affect the effectiveness of *preloading fluids* . In this study, major surgical patients were given *preloading fluids* by administering 1000cc of crystalloids before spinal anesthesia. In this case, attention is needed to calculate the right fluid requirements because each patient will certainly have different levels of fluid adequacy. In addition, the timing of *preloading fluid administration* must ensure that the patient has actually received preloading fluids before spinal anesthesia is given and also pay attention to the patient's clinical condition whether the patient has been adequate.

The results of this study underscore the importance of an evidence-based approach in medical practice, especially in meeting fluid needs for patients undergoing surgery. The use of accurate statistical data and proper interpretation of data from research results are key to improving the quality of patient care. However, it is also important to consider the practical aspects of care, considering that each patient has different needs and responses to medical interventions, especially in meeting fluid needs, each patient will have different needs.

Thus, although the results of this study indicate that there is a relationship between *preloading fluid administration* and the incidence of hypotension in major surgical patients with spinal anesthesia, the final clinical decision must consider the balance between scientific evidence showing that *preloading fluids* can provide a positive effect on preventing intraoperative hypotension for major surgical patients and by considering the individual clinical conditions of each patient

because the need for fluids varies in each patient according to the clinical conditions of each patient . This study can increase understanding of intraoperative hypotension management, especially in major surgical patients and provide a strong basis for better clinical practice in perioperative nursing.

CONCLUSION

Based on the results of the study and discussion of the relationship between the administration of preloading fluids and the incidence of intraoperative hypotension in major surgical patients with spinal anesthesia, it can be concluded that there is a significant relationship between the administration of preloading fluids and the incidence of intraoperative hypotension in major surgical patients with spinal anesthesia. In this study, there are several limitations for researchers, such as the standard operating procedure for administering preloading fluids and the amount of preloading fluids needed is decided by an anesthesiologist so that researchers are not authorized to make decisions regarding the administration of preloading fluids. The dosage and type of anesthetic drugs given by an anesthesiologist are not the domain of researchers to intervene even though they have an influence on the incidence of hypotension, and this study only focuses on short-term effects. With this research, for health practitioner institutions, especially nurse anesthetists, it is hoped that they can pay attention to the provision of nursing care, especially in the provision of preloading fluids for major surgical patients with spinal anesthesia and for further researchers it is hoped that they will pay more attention to the adequacy of fluids in each patient and ensure that preloading fluids are given according to the patient's needs and clinical conditions without influencing the decisions of other paramedics.

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