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EFFECT OF PASSIVE ROM ON HEMODYNAMICS POST OPERATIVE GENERAL ANESTHESIA PATIENTS IN RECOVERY ROOM

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Abstract

General anesthesia can reduce cardiac contractility, which results in reduced cardiac output and blood pressure, which can slow the release of anesthetic drugs in the body, which will result in prolonged hemodynamic recovery. This study aims to determine the effect of passive ROM administration on changes in the hemodynamic status of patients after general anesthesia surgery in the recovery room at Lavalette Hospital, Malang. The research design used was a "quasi-experimental" with a "pre-test and post-test design with control group" approach. The sampling method used was "purposive sampling" with a total of 60 respondents divided into 2 groups of treatment and control. The results of the statistical test obtained a p-value of 0.000 ($p < 0.05$), which means H1 is accepted. Therefore, there is a significant difference between hemodynamic status including blood pressure, MAP, pulse rate, RR and Spo2 after passive ROM is administered. Therefore, the results obtained indicate that there is an effect of passive ROM administration on improving the hemodynamics of patients after general anesthesia surgery at Lavalette Hospital, Malang.

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Introduction

General anesthesia is often referred to as induction and maintenance, which refers to a procedure to initiate and maintain the depth of anesthesia by utilizing a combination of intravenous agents and inhalation (Rehatta et al., 2019). The surgical process under general anesthesia can affect the functioning of the cardiovascular and respiratory systems (Mutaqqin, 2009).

Disorders of the cardiovascular system when general anesthesia is administered can be risky resulting in a decrease in cardiac contractility which has an impact on reduced heart volume and blood pressure. So that it can slow down the release of anesthetic drugs in the body which will result in the length of hemodynamic recovery (Sirait, 2020).

A total of 1.2 million patients in Indonesia undergo surgery under anesthesia, and are in 11th place out of the first 50 disease management in hospitals throughout Indonesia with surgical patients (Ministry of Health, 2019). The percentage of Indonesian patients undergoing surgery under general anesthesia is estimated to be around 70–80% of the total surgical patients (Herlianingsih et al., 2025). Postoperative hemodynamic instability (in PACU) is experienced by half to more than half of patients—ranging from 54–60% (Wolde et al., 2024). These conditions include hypotension, hypertension, tachycardia, and bradycardia. Intraoperatively, especially during GA induction with propofol, approximately 13–23 % of patients experience abnormal hemodynamic changes (Kawasaki, 2018).

The central nervous system and respiratory are two very important physiological systems of the body and can be affected by general anesthesia (Purwadi, 2021). Patients who receive sedatives after surgery may experience changes in consciousness, which can reduce their ability to act effectively as well as affect blood circulation and heart function (Khasanah & Yulistiani, 2020).

Hemodynamic disorders that are not treated quickly and appropriately can lead to organ dysfunction, which if left untreated can develop into multiple organ failure (Agustin, 2020). As part of the medical team, nurses play an important role in caring for critical patients and have a great responsibility in monitoring the patient's hemodynamic condition.

Efforts that can be taken to accelerate the recovery of hemodynamic status in postoperative patients with general anesthesia in the recovery room include teaching physical exercise or early mobilization. One of the actions that can be done is to carry out motion exercises or Range of Motion (ROM) (Purwandi, 2021). When passive ROM is applied to the upper and lower extremities, the blood vessels become more elastic, undergoing a dilation phase, which results in smoother blood flow to the heart.

This optimizes the performance of the heart, allowing it to pump blood more efficiently, which ultimately increases blood pressure. Through passive ROM, cardiovascular function can be improved. It helps improve peripheral venous circulation, improves blood flow, and ultimately affects blood pressure (Hidayat & Julianti, 2022).

Research Diana & Yachin, (2019) Said the main task of nurses in the recovery room is to observe blood pressure, respiratory status, oxygen saturation, and consciousness levels. In addition, nurses should apply passive range of motion exercises to postoperative patients to speed up the patient's recovery from the effects of anesthesia. In research Khasanah & Yulistiani, (2020) The administration of passive ROM was effective in increasing the client's systolic and diastolic blood pressure postoperatively, there was an increase in blood pressure at systolic pressure of 15.84 mmHg and diastolic pressure of 9.63.

Searching for the literature, researchers have not found studies that raise this topic. Previous research focused on the effect of passive ROM on the aldrette score of general anesthesia patients and patients in the room with >2 hours postoperatively. Based on this problem, the researcher wanted to conduct a study on the effect of passive ROM administration on changes in the hemodynamic status of postoperative patients under general anesthesia in the recovery room of Lavalette Hospital Malang. Therefore, the researcher is interested in conducting a study on "The Effect of Passive Range of Motion (ROM) Giving on Changes in Hemodynamic Status of Postoperative Patients with General Anesthesia in the Recovery Room of Lavalette Hospital Malang".

Method

This study uses quantitative research with a *quasi-experimental* approach model with *a pre test approach and post test design with control group*. The passive ROM procedure is carried out about 8 times in each movement for 15 minutes including extension flexion on the wrists and feet, elbows, knees, toes, adduction abduction on the arm and groin, supination pronation on the forearm is carried out by researchers and research assistants in accordance with the existing passive ROM SOPs. Meanwhile, the purpose of applying this method is to answer the hypothesis that has been determined regarding the effect of ROM on changes in the hemodynamic status of patients after *general* anesthesia.

This research was carried out at Lavalette Hospital Malang. This research was carried out with an estimated time of 1 month in the months of April 20 – May 20, 2025. This research has obtained ethical approval with No. DP.04.03/F.XXI.30/00372/2025 from the Research Ethics Committee of the Ministry of Health of the Ministry of Health.

The population in this study was all postoperative patients with general anesthesia in the recovery room of IHC Lavalette Hospital Malang amounting to 139 patients. The sample used was 60 with calculation using the Slovin formula which was divided into 30 control groups and 30 treatment groups, respectively. In the treatment group, passive ROM intervention was given and in the control group, passive ROM booklets and gifts in the form of neck pillows were given.

This study uses a non-probability technique with *purposive sampling*. The inclusion and exclusion criteria used in this study are as follows:

1. Inclusion criteria
   a) Patients who are willing to be respondents
   b) Patients with ASA physical status I - II
   c) Post-operative patients under general anesthesia as soon as they enter the recovery room
   d) Patients in the age range of 26 – 60 years
2. Exclusion criteria
   a) Patients with musculoskeletal disorders
   b) Patients who have a history of heart disease and respiratory disorders
   c) Patients with obesity (BMI > 30)
   d) Postoperative patients with general anesthesia indicated to be admitted to the ICU

The instruments used in this study were observation sheets of patient hemodynamic measurements containing data *on respiratory rate* (RR), SpO2, *heart rate* (pulse), blood pressure, and

mean arterial pressure (MAP). The tools and materials used are monitors to observe TTV, sphygmomanometers, pulse oximeters, and watches.

Univariate analysis is a descriptive statistical analysis of research variables. In descriptive analysis, it is used to describe and summarize data scientifically in the form of tables or graphs (Nursalam, 2015). Bivariate analysis was used against two variables that were suspected to have a relationship or influence (Setiadi, 2013). In this study, a difference in score will be analyzed in the control group and the general anesthesia postoperative treatment group before and after the administration of passive ROM. The research methods used by the researcher are *Pre-test* and *Post test*.

This study used the Kolmogorov-Smirnov normality test (K-S) with a large sample number (n > 50). If normal distributed data is obtained, then the tests used use a parmetric test, namely a *paired t-test and an* independent t-test. However, if the data produced is abnormally distributed, then the tests used use non-parametric tests, namely the Wilcoxon test and the Mann-Whitney test.

Results

General Data of Research

Respondent characteristic data are described in general by gender, age, and type of surgery.

Table 1. Distribution of Characteristics of Postoperative Patient Respondents with General Anesthesia in the Recovery Room of Lavalette Hospital Malang

Characteristics	Treatment Groups		Control Group	
	(F)	(%)	(F)	(%)
Gender				
Male	11	47.82	12	52.18
Women	19	51.36	18	48.64
Total	**30**	**50**	**30**	**50**
Age				
26-35 years old	8	66.67	4	33.33
36-45 years old	6	40	9	60
46-55 years old	10	45.46	12	54.54
56-60 years old	6	54.56	5	45.45
Total	**30**	**50**	**30**	**50**
Types of Operations				
Obgyn surgery	6	50	6	50
Orthopedic surgery	4	40	6	60
Digestive surgery	10	58	8	42
Oncology surgery	6	56	5	44
General surgery	4	46	5	54
Total	**30**	**50**	**30**	**50**

Source: Research data

In table 1 related to the characteristics of respondents in the treatment and control group based on gender, data was obtained that as many as 37 out of 60 or (61.66%). Based on age characteristics, data was obtained that 22 out of 60 respondents were in the age range of 46 – 55 years or (36.66%). Based on the characteristics of the type of surgery, data was obtained as many as 18 out of 60 respondents were in the type of digestive surgery with a percentage of (30%).

Data Distribution

Table 2. Distribution of Systolic and Diastolic Blood Pressure, Mean Arterial Pressure (MAP), Pulse, *Respiratory Rate* (RR), and SpO2.

Groups	Variable	N	Red		Mean Difference
			Pre-test	Post test	
Treatment Groups	Systolic	30	111.93	124.87	12.94
	Diastolic	30	76.23	82.3	6.07
	MAP	30	86.2	94.93	8.73
	Pulse	30	75.9	85.67	9.77
	RR	30	16.83	19.33	2.95
	SpO2	30	97.57	98.57	1.0
Control Group	Systolic	30	110.33	119.37	9.04
	Diastolic	30	72.43	76.1	3.67
	MAP	30	86.77	90.5	3.73
	Pulse	30	71.9	77.7	5.8
	RR	30	16.37	18.37	2.0
	SpO2	30	97.3	98.27	0.97

Source: Research data

In table 2, the pre-test in the treatment and control group on systolic blood pressure found a difference between the mean of 12.94 mmHg and 9.04 mmHg. For diastolic blood pressure, the difference between the mean was 6.07 mmHg and 3.67 mmHg. MAP found a difference between the mean of 8.73 mmHg and 3.73 mmHg. For Nadi, the difference between the mean was 9.77 x/minute and 5.8 x/minute. For *Respiratory rate* (RR), the difference between the mean was 2.95 x/minute and 2.0 x/minute. For SpO2, the difference between the mean was 1.0% and 0.97%.

Normality Test

The normality test was carried out to show whether the distribution of research data was normally distributed. In this study, the normality test used the Kolmogorov-Smirnov test for pre-test blood pressure data in the treatment group and control group.

Table 3. Normality Test Results

Kolmogorov-Smirnov		Treatment	Controls
Pre-test	Systolic	0.200	0.200
	Diastolic	0.200	0.200
	MAP	0.200	0.133
	Pulse	0.200	0.200
	RR	0.000	0.021
	Spo2	0.001	0.042

Source : Research data

Based on table 3, systolic, diastolic, MAP and pulse pressure showed a value of > 0.05 so that the data was distributed normally. As for RR and Spo2, it showed a value of < 0.05 so that the distributed data was abnormal. Therefore, it can be concluded that the systolic, diastolic and mean arterial pressure (MAP) pre test data for the control and treatment groups are normally distributed. As for *the respiratory rate* (RR) and SpO2, the control and treatment groups were abnormally distributed.

Paired T-Test and Wilcoxon Test

Paired t-test is a statistical method used to analyze the difference or influence between two paired samples. Wilcoxon is a statistical method used for a non-parametric test to find out the average difference of objects that have abnormally distributed data.

Table 4. Paired T-Test and Wilcoxon Test Results

Paired T-Test				
Groups	**Variable**		**N**	**P value**
Treatment	Systolic	Pre	30	0.000
		Post	30	
	Diastolic	Pre	30	0.000
		Post	30	
	MAP	Pre	30	0.000
		Post	30	
	Pulse	Pre	30	0.000
		Post	30	
Controls	Systolic	Pre	30	0.000
		Post	30	
	Diastolic	Pre	30	0.000
		Post	30	
	MAP	Pre	30	0.000
		Post	30	
	Pulse	Pre	30	0.000
		Post	30	
Wilcoxon				
Groups	**Variable**		**N**	**P value**
Treatment	Systolic	Pre	30	0.000
		Post	30	
	Diastolic	Pre	30	0.000
		Post	30	
Controls	MAP	Pre	30	0.000
		Post	30	
	Pulse	Pre	30	0.000
		Post	30	

Source: Research data

The results of the paired t-test and Wilcoxon were obtained with a p-value of 0.000. The alpha in the study was 5% or 0.05. The p-value obtained from the test results is smaller than the alpha value (0.000 < 0.05). So it can be interpreted that H1 is accepted, where there is a difference between the pre test and post test data of the treatment group and the control group.

Test the effect of passive ROM administration on changes in the hemodynamic status of patients postoperative general anesthesia in recovery *room*

The test results were used to see the average difference between the data of the hemodynamics variables of the post test group and the passive ROM treatment group.

Table 5. Independent T-Test and Mann Whitney Test Results

Independent T-Test		
Variable		**P value**
Systolic blood pressure post test	Treatment	0.000
	Controls	
Diastolic blood pressure post test	Treatment	0.000
	Controls	
Mean Arterial Presure (MAP) post test	Treatment	0.000
	Controls	
Nadi post test	Treatment	0.000
	Controls	
Mann-Whitney		
Respiratory rate (RR) post test	Treatment	0.000
	Controls	
SpO2 post test	Treatment	0.000
	Controls	

Source : Research data

The results of the treatment and control group post test for systolic and diastolic blood pressure, MAP, pulse, RR and SpO2 were obtained with a p-value of 0.000 where 0.000 < 0.05 which means H1 is accepted. These results can be concluded that there is a significant difference between the hemodynamics of post-test patients in the treatment group and the post-test control group.

Discussion

Hemodynamics of Post General Anesthesia Patients Before Intervention in the Treatment and Control Group

General anesthesia, both inhaled and intravenous, can physiologically decrease the activity of the sympathetic nervous system, causing peripheral vasodilation, decreased vascular tone, and decreased cardiac contractility. This has the potential to cause hypotension and heart rate changes during and after surgery (Sucitaria, 2022). Post-general anesthesia patients usually experience changes in blood pressure, pulse, and mean arterial pressure (MAP) (Paulina, 2022).

Changes in patient hemodynamics after general anesthesia surgery are related to gender, which is more common in female respondents. This is in accordance with the theory Astuti, (2024), that female patients tend to be more susceptible to hemodynamic changes than male patients. This is attributed to the influence of the hormone estrogen which plays a role in the regulation of the cardiovascular system. Estrogen has protective effects, such as increasing HDL levels and preventing atherosclerosis, but changes in hormone levels, especially at menopause, can trigger post-anesthesia hemodynamic instability.

Changes in the hemodynamics of patients after general anesthesia surgery are related to age, which is more common in the age group of 46-55 years) early elderly. This is in accordance with the theory (Widiginaastuti, 2022), that in elderly patients more often experience prolonged recovery time after general anesthesia, which is associated with slowed drug metabolism and an increased risk of hemodynamic complications. In elderly patients, there is an increase in sensitivity to anesthetic drugs due to a decrease in the body's metabolic ability, especially decreased liver and kidney function. This causes the effects of anesthetic drugs to last longer and affect hemodynamic stability, such as blood pressure and heart rate (Tumbey et al., 2024).

Changes in the hemodynamics of patients after general anesthesia surgery are related to the type of surgery, which is more common in digestive surgery. This is in accordance with the theory Ekawati, (2015), that large and complex types of surgery such as major abdominal surgery tend to have a higher risk of hemodynamic instability than minor surgery. Abdominal surgery, especially digestive surgery, is at risk of causing hemodynamic instability due to fluid loss through the gastrointestinal tract, fasting before surgery, as well as potential intraoperative bleeding. This fluid imbalance disorder can lead to hypotension, hypovolemia, and tissue perfusion disorders.

Hemodynamics of Post General Anesthesia Patients After Intervention in the Treatment and Control Groups

Based on opinion Khasanah & Yulistiani, (2020) Non-pharmacological interventions with passive ROM administration have been shown to help stabilize the hemodynamics of postoperative patients under general anesthesia. In passive ROMs, it can increase the activity of the sympathetic nervous system, which stimulates the release of norepinephrine thereby increasing heart rate (chronotropy), cardiac conduction (dromotropy), and ventricular contractility (inotropy), which overall improves hemodynamic conditions. Physiologically, the stability of post-anesthesia hemodynamics is highly dependent on the balance between vascular resistance, cardiac output, and effective blood volume. Non-pharmacological interventions support this process by increasing perfusion and reducing complications due to the effects of anesthesia (Handoyo et al., 2024).

Hemodynamic stability in postoperative general anesthesia patients is related to gender. According to Pomegranate, (2019) showed that male patients tended to experience hemodynamic stabilization faster after being given passive ROM than women. This is in accordance with the opinion of Zhou et al. (2020) who explain that muscle mass and blood circulation volume in men are generally larger, which can accelerate the cardiovascular system's response to mobilization interventions, including ROM exercises. In contrast, in female patients, stabilization of blood pressure and pulse rate took place a little slower. This is supported by a study from Kim & Lee (2017) which states that differences in estrogen hormones and vascular tone between men and women can affect the speed of recovery of the hemodynamic system, including after anesthesia.

Hemodynamic stability in postoperative general anesthesia patients is related to age. According to Umaroh, (2024) Patients in the age range of 46–55 years began to show a decrease in physiological function, especially in the cardiovascular system. Decreased elasticity of blood vessels, decreased baroreceptor response to changes in blood pressure, and reduced efficiency of heart work are factors that cause the hemodynamic stabilization process to take place slower than the younger age group. Nevertheless, passive ROM interventions remain effective in helping to improve hemodynamics in this age group. After the intervention is performed, blood pressure becomes more stable, the pulse rate improves to normal values, and the patient's comfort and physiological readiness for further recovery is improved.

The stability of hemodynamics in postoperative patients under general anesthesia is related to the type of surgery. In patients undergoing major surgery, such as abdominal surgery or orthopedics, it was found that postoperative hemodynamic responses tended to be unstable due to high physiological stress, longer duration of anesthesia, and greater intraoperative bleeding. This condition is in line with the results of a study by Kim (2019), who stated that this type of invasive and long-duration surgery increases the risk of fluctuations in blood pressure and pulse rate, especially in the early phases after general anesthesia.

Effect of Passive ROM on Hemodynamics of Post General Anesthesia Patients in the Recovery Room of Lavalette Hospital Malang

In a study conducted by Khasanah & Yulistiani, (2020) Passive ROM administration triggers a response to sympathetic nerve activity which is the extrinsic control of stroke volume (SV), resulting in increased heart rate, ventricular contraction, and the amount of blood pumped by the heart. The stimulus received from the nerve impulses will cause the sympathetic nervous system to trigger the activity of the various organs and smooth muscles that are under its control. The sympathetic nerve will give a signal to the adrenal medulla to release the hormone adrenaline into the blood. Activation of sympathetic nerves will cause blood vessels to experience vasoconstriction, where the workload of the heart in pumping blood will increase. It will increase stroke volume and increase blood pressure (Subramaniam, 2015).

Other research conducted by Asiah, (2022) showed that although the average respiratory rate of patients after general anesthesia after passive ROM was within the normal range (about 18-19 times/minute), some patients experienced increased respiratory rates that helped improve respiratory function and oxygenation. Passive ROM helps stimulate muscle activity and blood circulation, which increases the tissue's oxygen needs. In response, the body increases the respiratory rate to meet higher oxygen needs, resulting in a significant increase in the value of the respiratory rate in the recovery chamber (Nopitasari & Sulistyowati, 2017).

Based on the opinion of researchers, the administration *of passive Range of Motion* (ROM) has a significant influence on hemodynamics, especially on the hemodynamics of patients after general anesthesia. By performing passive ROM, there is a change in the position of the body due to the movements caused. These movements cause contractions in the muscles and trigger a response to sympathetic nerve activity which plays a role in regulating the tone of blood vessels. Activation of sympathetic nerves will make blood vessels undergo vasoconstriction. When vasconstriction, the blood vessels will narrow so that the heart will work harder to pump blood. This will facilitate the process of perfusion, diffusion, and redistribution of blood flow from more active parts of the body to less active parts of the body. The presence of motion stimulation will stimulate the heart to increase the afterload or workload in pumping blood because it is triggered by an increase in energy needs in the limbs, so that blood pressure will increase.

This increase in blood flow increases the perfusion of tissues, including lung tissue and respiratory muscles, so that the oxygen supply to the tissues is more optimal. With smoother blood circulation, the oxygen transported by hemoglobin in the blood can be distributed more effectively throughout the body's tissues. The process of diffusion of oxygen from the capillaries to the tissue cells becomes more efficient, which helps to increase oxygen saturation in the blood and supports the function of vital organs.

The researchers also assessed that passive ROM training is a simple, safe, and effective form of non-pharmacological intervention, especially in patients who are not yet able to move actively. This intervention has a dual benefit, namely helping to prevent complications due to immobilization (such as deep vein thrombosis or venous stasis) and at the same time accelerating the recovery of vital parameters, in particular systolic, diastolic, and pulse rate blood pressure. The positive response to this intervention can be seen from the results of pre-test and post-test measurements which showed a significant decrease in hemodynamic fluctuations. In addition, patients also look more clinically stable and better prepared to proceed to the next phase of active mobilization.

Conclusion

From the results of this study, it can be concluded that there is an effect of passive ROM administration on improving the hemodynamics of patients after general anesthesia in *the recovery room* of Lavalette Hospital Malang. With stable hemodynamics, the recovery process of patients in the room is faster.

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