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Effectiveness of progressive mobilization level I on hemodynamic status of stroke patients in the ICU

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ABSTRACT

Introduction: *Most stroke patients in the ICU to experience very long immobilization and are only able to rest in bed due to decreased consciousness and physical weakness. However, prolonged bed rest in the ICU can have negative impacts on patients, one of which is changes in the patient's hemodynamics. Progressive mobilization has the potential to affect hemodynamic status and has received significant attention in the critical care setting.* ***Objectives:*** *This study aims to determine the effect of progressive mobilization level I on the hemodynamic status of stroke patients in ICU at Bintan Regional Hospital.* ***Methods:*** *The research design was a non-equivalent control group design. The sample size was 32 stroke patient respondents consisting of 16 intervention groups and 16 control groups, with a purposive sampling technique. Measurements were made using observation sheets to assess hemodynamic status before and after progressive mobilization.* ***Results:*** *The results of the bivariate analysis using the Paired T-Test showed that there was a difference in the average heart rate (p=0.000), systolic blood pressure (p=0.003), diastolic blood pressure (p=0.000), respiratory rate (p=0.000), and oxygen saturation (SaO2) (p= 0.001) between before and after progressive mobilization level I. The results of the Independent-T-Test showed that there was an effect of progressive mobilization level I on the hemodynamic status of ICU patients (p= 0.000 for each hemodynamic). There was an increase in hemodynamic status within the normal range after progressive mobilization.* ***Conclusions:*** *The results of this study can be a recommendation for nurses to carry out progressive mobilization level I by paying attention to the hemodynamic status of critical patients, especially for stroke patients to improve quality of life.*

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1. Introduction

Critical patients in the ICU are those who suffer from life-threatening diseases, and experience dysfunction in one or more organs and their lives depend on special equipment. Critical patients are at risk of experiencing unstable conditions and physiological changes that can deteriorate rapidly, requiring special care and close monitoring in the ICU (Das et al., 2021). One of the diseases that requires treatment in the ICU for monitoring is stroke. The main reasons for stroke patients being admitted to the ICU were neurological failure (87%) and hemodynamic instability (28.2%)(*American Association of Critical Care Nurses*, 2016).

Stroke is a clinical manifestation of impaired brain function, either focal or global (comprehensive), which occurs quickly, lasts more than 24 hours or causes death, without any other cause than vascular disorders. The prevalence of stroke in the world in 2016 was 33 million, with 16.9 million people having a first stroke attack. From data from the South East Asian Medical Information Center (SEAMIC), it is known that the highest stroke mortality rate in Southeast Asia occurs in Indonesia, followed in sequence by the Philippines, Singapore, Brunei, Malaysia and Thailand. In Indonesia, the prevalence of stroke increased from 8.3 per 1000 in 2013 to 12.1 per

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1000 in 2017. The number of deaths caused by stroke ranks second in those aged over 60 years and fifth in those aged 15-59 years. Currently, the Riau Islands Province ranks 4th highest in stroke incidence in Indonesia (Riskesdas, 2018).

Most stroke patients in the ICU to experience very long immobilization and are only able to rest in bed due to decreased consciousness and physical weakness. However, prolonged bed rest in the ICU can have negative impacts on patients such as ineffective airways and circulatory disorders, which have an impact on changes in patient hemodynamics. In addition, long-term immobilization can cause decreased muscle mass and bone mineral density, impaired body systems, impaired physical function, and neurocognitive and psychiatric disorders that are seen in the first week (Parry & Puthucheary, 2015). This will certainly have an impact on morbidity, mortality, and prolong the treatment time for stroke patients.

One of the efforts that ICU nurses can make to avoid complications due to long bed rest is to carry out progressive mobilization (Musliha, 2019). Progressive mobilization is a technique that aims to stimulate blood circulation, maintain muscle strength, and stimulate the heart and breathing, especially for patients who are bedridden, have impaired movement, or are unable to mobilize due to muscle weakness. Patients who are on bedrest can be mobilized earlier since 24-48 hours of treatment (Parry & Puthucheary, 2019). Progressive mobilization can shorten patient care time and provide very positive effects, especially for patients with cardiovascular, neurological, musculoskeletal, metabolic, and other traumatic diseases (Tanijiarso & Lestari, 2020). Progressive mobilization has received significant attention in critical care settings, especially in the ICU, because of its potential to affect hemodynamic status (Hidayat & Julianti, 2022).

Several previous studies have shown that progressive mobilization interventions can improve functional status and improve patient hemodynamic status (Ningtyas, 2017). Based on research by Rahmanti dan Kartika Putri (2016), Progressive mobilization level I given to patients with decreased consciousness in the ICU showed evidence of an increase in the patient's blood pressure. This finding is also supported by researchers Suyanti, Iswari, and Ginanjar (2019) in which there was an increase in systolic and diastolic blood pressure from before to after receiving progressive mobilization intervention.

Data obtained from the medical records Bintan Regional Hospital showed that in 2023 there were 115 cases of stroke and 80 of them died. The results of interviews with several nurses stated that ICU nurses only provided interventions such as changing the fowler position and changing the right to left tilt position to patients undergoing bed rest. Nurses did not pay attention to the hemodynamic status of patients before and after being given the right and left tilt positions. Although this is part of the progressive mobilization stages, it shows that the progressive mobilization intervention carried out is still limited. Seeing this, the researcher was interested in examining the effect of progressive mobilization level I on hemodynamic status in critical ICU patients at Bintan Regency Hospital.

2. Methods

This research was a quantitative study with a Quasi Experiment research design and the research design approach used was a non-equivalent control group design. The study was conducted for 3 months (from February 15, 2024 to May, 27 2024) in the ICU room of the Bintan Regional Hospital. The study population was all stroke patients in the ICU of the Bintan Regional Hospital. The number of samples was obtained based on the Dahlan sample formula using the mean and SD of the previous study, as standard and calculated by the statistical formula obtained the results of 32 respondents. The group was divided into two groups, 16 experiment groups and 16 control groups. The sample collection technique in this study used purposive sampling with inclusion criteria: Patient with a medical diagnosis of stroke, Respondent age >25 years and <75 years, HR 60-120x/minute, systolic pressure ranging from 90-180 mmHg, oxygen saturation >90%, PaO2:FiO2 >250, PEEP value <10, temperature <38oC, RR <30x/minute, patient's level of consciousness with good eye response (RASS -5 to -3). Exclusion criteria for patients with:

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increased intracranial pressure and unstable hemodynamic status, patients who use mechanical ventilators for more than 7 days or experience postoperative relapse, patients with fractures were not consolidated, and patients who died during the study.

In this study, respondents in the experiment group were given progressive mobilization level I for 2 times a day (morning and evening) during 1 day for each respondents, including adjusting the head of bed position at a 30°, performing passive ROM every two hours, and performing continuous lateral rotation therapy (CLRT) every two hours by providing a right and left tilt position according to the patient's ability. Mobilization was carried out by researchers and research assistants who had been selected and met the requirements. The control group received routine mobilization intervention in the ICU, namely mobilization with the head of bed at a 30° and continuous lateral rotation therapy (CLRT) every 4 hours. The data collection instrument was an observation sheet to record the patient's hemodynamic status (blood pressure, heart rate, respiratory rate, and oxygen saturation). Researchers measured respondents' hemodynamics using several instruments in the form of calibrated sphygmomanometers and oximetry. Pre-test measurement before progressive mobilization level 1 (at morning) and post-test measurements were carried out after all positions in progressive mobilization level 1 had been carried out (at evening). Other data collection tools were calibrated sphygmomanometers and oximetry. Research analysis using the Paired-T-test and Independent T-test with a significance level of 5%.

3. Results and Discussion

3.1 Result

a. Respondent Characteristics

Table 1. Frequency Distribution of Characteristics of Stroke Patient Respondents in the ICU at Bintan Regional Hospital (N=32)

Characteristics	Experiment Group (n=16)		Control Group (n=16)	
	f	%	f	%
Age				
– <45 Years	3	18.75	5	31.25
– 45-60 Years	8	50	6	37.5
– ≥60 Years	5	31.25	5	31.25
Gender				
– Man	10	62.5	9	56.25
– Woman	6	37.5	7	43.75
Educational Background				
– Elementary School	6	37.5	2	12.5
– Junior High School	3	18.75	4	25
– Senior High School	2	12.5	6	37.5
– Diploma	4	25	2	12.5
– Bachelor	1	6.25	2	12.5
Profession				
– Not working	2	12.5	3	18.75
– Fisherman	3	18.75	5	31.25
– Laborer	4	25	3	18.75
– Private employees	1	6.25	2	12.5
– Self-employed	3	18.75	1	6.25
– Government employees	3	18.75	2	12.5
Medical Diagnosis				
– Surgery	4	25	3	18.75
– Non-Surgical	11	68.75	13	81.25
Level of Awareness (GCS)				
– 13-15	14	87.5	13	81.25

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– 9-12	2	12.5	3	18.75
– 3-7	0	0	0	0
Level of Severity		0		0
– Mortality 6.4%	14	87.5	13	81.25
– Mortality 20.2%	2	12.5	3	18.75
– Mortality 21.5%	0	0	0	0
– Mortality 33.3%	0	0	0	0
Ventilator				
– Yes	2	12.5	3	18.75
– No	14	87.5	13	81.25
Total	16	100	16	100

Table 1 shows the results of the study of respondent characteristics. Based on age, most of the respondents were in the 45-60 year age category, there were 8 (50%) in the experiment group and 6 (37.5%) in the control group. Based on gender, the majority of respondents were man, there were 10 (62.5 %) in the experiment group and 9 (56.2%) in the control group. In terms of education, most of the experiment group respondents had an elementary school educational background (37.5 %), while the control group had a senior high school educational background (37.5 %). In terms of type of work, 4 (25%) in the experiment group the majority worked as laborers while 5 (31.25 %) in the control group the majority worked as fishermen. Based on medical diagnosis, most respondents were non-surgical disease criteria, 11 (68.75%) for the experiment group and 13 (81.25%) for the control group. Regarding the level of awareness of respondents during the research, it was found that the majority of both groups, 14 (87.5%) experiment group and 13 (81.25%) control group had a level of awareness with GCS 13-15. The disease severity level was the majority respondents, 14 (87.5%) in the experiment group and 13 (81.25%) in the control group with a mortality of 6.4%. The majority were not using a ventilator, there were 14 (87.5 %) in the experiment group and 13 (81.25%) in the control group.

b. Hemodynamic Status Before Progressive Mobilization Level I

Table 2. The Average Hemodynamic Status Before Progressive Mobilization Level I of Stroke Patients in the ICU at Bintan Regional Hospital (N=32)

Variable	Experiment Group (n=16)				Control Group (n=16)			
	Mean	SD	Min	Max	Mean	SD	Min	Max
Heart Rate (HR)	78	4.3	74	80	79	4.4	75	88
Blood Pressure (BP)-Systolic	102	12.2	95	112	99.5	12.7	90	110
Blood Pressure (BP)-Diastolic	83.5	7.5	70	95	81.7	7.3	70	90
Respiratory Rate (RR)	17.5	3.4	14	25	18	3.7	15	26
Oxygen Saturation (SaO_2)	96.5	0.8	96	99	97	0.8	95	98

Table 2 shows that before progressive mobilization level I in the experiment group, the mean heart rate was 78 times/minute (SD=4.3), mean systolic blood pressure was 102 mmHg (SD=12.2), mean diastolic blood pressure was 83.5 mmHg (SD=7.5), mean

respiratory rate was 17.5 times/minute (3.4), and mean oxygen saturation (SaO2) was 96.5% (SD=0.8). While in the control group, the mean heart rate was 79 times/minute (SD=4.4), mean systolic blood pressure was 99.5 mmHg (12.7), mean diastolic blood pressure was 81.7 mmHg (7.3), mean respiratory rate was 18 times/minute (SD=3.7), and mean oxygen saturation (SaO2) was 97% (SD=0.8).

c. Hemodynamic Status After Progressive Mobilization Level I

Table 3. The Average Hemodynamic Status After Progressive Mobilization Level I of Stroke Patients in the ICU at Bintan Regional Hospital (N=32)

Variable	Experiment Group (n=16)				Control Group (n=16)			
	Mean	SD	Min	Max	Mean	SD	Min	Max
Heart Rate (HR)	92	4.3	80	100	80	4.5	74	97
Blood Pressure (BP)-Systolic	117	10.9	105	120	100	12.8	97	110
Blood Pressure (BP)-Diastolic	90.3	8.3	85	117	83	7.7	67	99
Respiratory Rate (RR)	22	3.8	16	26	19	3.5	15	24
Oxygen Saturation (SaO2)	98.5	0.9	97	99	96.5	0.8	95	97

Table 3 shows that after progressive mobilization level I in the experiment group, the mean heart rate was 92 times/minute (SD=4.3), mean systolic blood pressure was 117 mmHg (SD=10.9), mean diastolic blood pressure was 90.3 mmHg (SD=8.3), mean respiratory rate was 22 times/minute (SD=3.8), and mean oxygen saturation (SaO2) was 98.5% (SD=0.9). While in the control group, the mean heart rate was 80 times/minute (SD=4.5), mean systolic blood pressure was 100 mmHg (SD=12.8), mean diastolic blood pressure was 83 mmHg (SD=7.7), mean respiratory rate was 19 times/minute (SD=3.5), and mean oxygen saturation (SaO2) was 96.5% (SD=0.8).

d. Difference in Hemodynamic Status Before and After Progressive Mobilization Level I

Table 4. Analysis of Differences in Hemodynamic Status Before and After Progressive Mobilization Level I of Stroke Patients in ICU at Bintan Regional Hospital (N=32)

Variable	Experiment Group (n=16)		Control Group (n=16)	
	t	*p-value*	*t*	*p-value*
Heart Rate (HR) – Pre-test – Post-test	-5,578	0,000	-7,491	0.060
Blood Pressure (BP)-Systolic – Pre-test – Post-test	-3,546	0.003	-6,572	0.058
Blood Pressure (BP)-Diastolic – Pre-test – Post-test	-7,578	0.000	-4,978	0.702
Respiratory Rate (RR) – Pre-test – Post-test	-6,490	0.000	-4,205	0.065
Oxygen Saturation (SaO2) – Pre-test	-7,306	0.001	-7,447	0.081

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– Post-test

Table 4 shows the results of the Paired T-Test for the hemodynamic status of the experiment group and the control group before and after progressive mobilization. The results shows that there was a significant difference in hemodynamic status in heart rate (p=0.000), systolic blood pressure (p=0.003), diastolic blood pressure (p=0.000), respiratory frequency (p=0.000), and oxygen saturation (SaO2) (p=0.001) between before and after progressive mobilization level I in experiment group. Meanwhile, in the control group shows that there was no significant difference in the hemodynamic status of heart rate (p=0.060), systolic blood pressure (p=0.058), diastolic blood pressure (p=0.702), respiratory frequency (p=0.065), and oxygen saturation (SaO2) (p=0.081) between *pre-test* and *post-test.* These results indicate that there is an influence of progressive mobilization level I in the patient's hemodynamic status.

e. Effect of Progressive Mobilization Level I on Hemodynamic Status

Table 5. Analysis Effect of Progressive Mobilization Level I on the Hemodynamic Status of Stroke Patients in the ICU at Bintan Regional Hospital (N=32)

Variable	After Progressive Mobilization Level I	
	t	***p-value***
Heart Rate (HR)		
– Experiment Group	-3,287	0.000
– Control Group		
Blood Pressure (BP)-Systolic		
– Experiment Group	-3,763	0.000
– Control Group		
Blood Pressure (BP)-Diastolic		
– Experiment Group	-4,865	0.000
– Control Group		
Respiratory Rate (RR)		
– Experiment Group	-6,345	0.000
– Control Group		
Oxygen Saturation (SaO2)		
– Experiment Group	-7,071	0.000
– Control Group		

Based on Table 5, the results of the Independent T-Test shows that there was an statistically significant effect of progressive mobilization level I on the hemodynamic status of stroke patients in the ICU, namely heart rate, blood pressure (systolic and diastolic), respiratory rate and oxygen saturation (p=0.000 for each variable).

3.2 Discussion

The results of this study report that there is a statistically significant effect of progressive mobilization level I for 1 day (2 times a day: morning and evening) on stabilizing the hemodynamic status of stroke patients in the ICU. Various hemodynamic variables that can be influenced by progressive mobilization include heart rate, blood pressure, respiratory frequency and oxygen saturation. This was proven by the results of the analysis of the average hemodynamic status of the experiment group using the Paired T-Test, which obtained a p-value <0.005 (heart rate p=0.000, systolic blood pressure p=0.003, diastolic blood pressure p=0.000, respiratory frequency p=0.000 and oxygen saturation p=0.001). Then, it was further proven by the results of Independent T-Test which shows p=0.000 for each hemodynamic variable.

The results of this study support previous research which revealed the influence of progressive mobilization on hemodynamic status in critical patients in the ICU such as heart rate,

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blood pressure, respiratory frequency and oxygen saturation (Hartoyo, 2017; Agustin, 2020; Nugroho, 2019; Suyanti, 2019; Yundari et al., 2022; Yen, 2024). Several studies have been conducted to explore the relationship between progressive mobilization and hemodynamics of critically ill patients in the ICU. Yundari et al. (2022) in their research provided progressive mobilization treatment to ICU patients 2 times a day (morning and evening) for 3 days for each patient. The results of the study showed that there was an effect of progressive mobilization on the hemodynamic status of patients in the ICU (pulse rate p=0.000, respiratory rate p=0.000, systolic blood pressure p=0.000, diastolic blood pressure p=0.004, MAP p=0.000, and SaO2 p =0.000). Research by Ningtyas et al. (2017) reported a similar thing, where level I and II progressive mobilization interventions for 7 days were effective in stabilizing systolic pressure, MAP, heart rate, and effectively reducing the risk of pressure ulcers in critical patients in the ICU. Progressive mobilization of levels I and II in critical patients can stabilize systolic pressure (52.46 %), stabilize MAP (58.43%), stabilize heart rate (68.99%) and reduce the risk of pressure ulcers (55.03%) for 7 repeated intervention days.

In terms of heart rate, the results of this study showed that the mean heart rate of patients in the experiment group at pre-test was 78 times/minute and at the post-test was 92 times/minute. While in the control group, the mean heart rate at the pre-test was 79 times/minute and at the post-test was 80 times/minute. There was an increase in mean heart rate in the experiment group that was given progressive mobilization level I intervention with a difference of 14 points, while in the control group that only received routine intervention according to the ICU SOP, there was no significant increase in mean heart rate (an increase of only 1 point). Based on the results of the Paired T-Test analysis in the experiment group, p=0.000 ($p \leq 0.05$) was obtained, which means that there was an effect of progressive mobilization on the mean heart rate of stroke patients in the ICU. Furthermore, based on the Independent T Test, p=0.000 ($p \leq 0.05$) was obtained, which means there is a difference in the mean heart rate between the group given progressive mobilization and those not given progressive mobilization. Stroke patients in ICU who underwent progressive mobilization level I showed a more significant increase in heart rate compared to the control group.

The results of this study support previous studies that have highlighted the effects of progressive mobilization on hemodynamic status, especially heart rate in critically ill patients. Sitepu & Sipayung (2022) emphasize the benefits of early mobilization on the hemodynamics of critically ill patients with congestive heart failure. The findings of this study further highlight the relevance of mobilization interventions in influencing vital signs, including heart rate. Likewise, Hidayat & Julianti (2022) in their study showed that progressive mobilization level I can improve hemodynamic stability, namely blood pressure and oxygen saturation which are closely related to heart rate regulation in critically ill patients with decreased consciousness. Furthermore, Zhou et al. (2022) highlighted the positive effects of early progressive mobilization which not only increased muscle strength but also improved functional status, which could indirectly affect heart rate regulation. Muscle strengthening through mobilization can contribute to better cardiovascular function, which has the potential to affect heart rate in critically ill patients. During mobilization, heart rate increases in response to physical activity and heart rate decreases in response to rest.

Another hemodynamic parameter that can be affected by progressive mobilization in ICU patients is blood pressure (systolic and diastolic). The results of this study showed an increase in mean systolic blood pressure from 102 mmHg (at pre-test) to 117 mmHg (at post-test) and in mean diastolic blood pressure from 83.5 mmHg (at pre-test) to 90.3 mmHg (at post-test) in stroke patients who were given progressive mobilization. There was an increase in mean systolic blood pressure of 15 mmHg and diastolic blood pressure of 6.8 mmHg in the experiment group given progressive mobilization intervention. Meanwhile, in the control group, it was known that mean systolic blood pressure at pre-test was 99.5 mmHg and at post-test was 100 mmHg, and in mean diastolic blood pressure at pre-test it was 81.7 mmHg and at post-test it was 83 mmHg. In the control group, there was no significant changes in blood pressure. ICU patients who underwent

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progressive mobilization showed a more significant increase in blood pressure than the control group.

In the experiment group, the results of the Paired T-Test for systolic blood pressure were found p=0.003 and diastolic blood pressure were found p=0.000 (p≤0.05), which means that there is an effect of progressive mobilization on the systolic blood pressure and diastolic blood pressure of stroke patients in the ICU. However, the control group showed the opposite results, where no significant difference was found in systolic blood pressure (p=0.058) and diastolic blood pressure (p=0.702). Furthermore, based on the Independent T Test, it was found that p=0.000 (p≤0.05), which means there was a difference in mean blood pressure (systolic and diastolic) between the groups given progressive mobilization and those not given progressive mobilization. The difference in systolic blood pressure values between the group that received progressive mobilization and those that did not receive progressive mobilization was 17 mmHg, then the difference in diastolic blood pressure values was 7,3 mmHg.

The results of this study are also in line with research by Syarbaini & Girianda (2023) where implementing progressive mobilization for 3 days was proven to have an effect on muscle strength, patient functional status, hemodynamic status and duration of ventilator use. In progressive mobilization levels 1 and 2, the patient's hemodynamic status was affected, as evidenced by changes in blood pressure from 165/81 mmHg to 120/85 mmHg. Likewise, research by Aryanti et al. (2022) , after carrying out progressive mobilization twice a day for 5 days, ICU patients saw a significant increase in systolic and diastolic blood pressure. The increase in blood pressure was seen to increase on the 3rd day, 5th day and 7th day of observation. Similar findings were also conveyed by Hidayat & Julianti (2022), Suyanti (2019) & Hartoyo et al. (2017), which shows that in critical patients with decreased consciousness in the ICU, progressive mobilization level I measures can increase blood pressure and oxygen saturation.

Critical patients spend a long time in the hospital. Prolonged bed rest in patients can affect the cardiovascular system. The supine position causes 11% of blood volume to disappear from the legs, most of which would otherwise go to the chest. In the first 3 days of bed rest, plasma volume will decrease by 8% to 10%. This loss becomes 15% to 20% by the fourth week. These changes cause an increase in cardiac workload, an increase in resting heart rate periods, and changes in stroke volume, causing a decrease in cardiac output.

Blood pressure can be influenced by several factors, namely cardiac output, preload and peripheral resistance. Besides that, changes in blood pressure, both in a state of decreased consciousness and a conscious state, are greatly influenced by the presence of a stimulus. Stimulus can come from within as a manifestation of changes in the body's physiology due to the disease suffered. In addition, stimuli can come from outside the individual, both physical and social (Watanabe et al., 2022). Central blood pressure can change with changes in body position. Participating in physical activities such as progressive mobilization can increase cardiac output by improving cardiac function and venous return, which can ultimately have a positive impact on the patient's hemodynamic status.

In progressive mobilization level 1 with the head of bed position, the return of blood from the lower part of the body to the right atrium improves. Blood vessel resistance and right atrial pressure that are not too high allow the volume of blood entering the right atrium (venous return) to be optimal, so that the right ventricular filling pressure (preload) increases, which can cause an increase in heart volume and cardiac output (volume of blood pumped left ventricle to aorta every minute). When passive ROM is given to the upper and lower extremities, the blood vessels become more elastic and dilated, so that blood flow to the heart becomes smoother, increasing the work of the heart and the heart's ability to pump blood, which in turn increases blood pressure. Changes in lateral or oblique position also affect the return flow of blood to the heart, increasing heart volume and the heart's ability to pump blood (Watanabe et al., 2022; Suyanti, 2019).

Another hemodynamic that is affected by progressive mobilization is respiratory frequency. Related respiratory frequency, the results of this study showed an increase in the mean respiratory frequency of the experiment group from before progressive mobilization, namely 17.5 times /minute to 22 times/minute after progressive mobilization. Meanwhile, in the control

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group, the mean respiratory frequency at pre-test was 18 times/minute and at post-test was 19 times/minute. This value shows that there is an increase in mean respiratory frequency in stroke patients in ICU who receive progressive mobilization measures. It was proven from the Paired-T-Test analysis that there was an effect of progressive mobilization on respiratory frequency (p=0.000). When compared between the two groups, there was a significant difference between the experiment group which received progressive mobilization intervention and the control group (p=0.000). The mean difference between the two groups is 3 respiratory frequencies.

The impact of early progressive mobilization on the respiratory rate of patients in the ICU is a critical area of research that has received significant attention in recent years. Progressive mobilization is a combination of exercises with head elevation, passive ROM and active ROM as well as tilting left and right, sitting, moving and walking. These exercises can improve functional status in bed rest patients. Respiratory benefits refer to increased oxygen transport, increased tidal volume, increased thoracic expansion, and improved drainage of respiratory secretions (Zorowti et al., 2016). Progressive mobilization given to the patient is expected to cause a good hemodynamic response. In an upright sitting position, lung performance, both in the distribution of ventilation and perfusion, will increase during mobilization. The rate and depth of breathing increases alveolar ventilation, reduces the work of breathing and increases diaphragm expansion (Castagna O., et al., 2023).

Suyanti et al. (2019) explained that progressive mobilization of level 1 in the Head of Bed position allows gravity to pull the diaphragm downwards, increasing lung expansion and oxygen delivery in the lungs, so that the level of oxygen bound to hemoglobin increases and the oxygen saturation value increases. In addition, changing body position and increasing physical activity can improve blood circulation, reduce respiratory muscle atrophy, and reduce the risk of ventilator-associated pneumonia, deep vein thrombosis, and pressure sores. This suggests that progressive mobilization of patients can positively influence their physiological parameters, potentially aiding patient recovery and management in the ICU. Several studies highlight the importance of early progressive mobility interventions in improving the RR improvement of critically ill patients. On research Nugroho et al. (2019) reported the influence of progressive mobilization level I on the respiratory frequency of critical patients in the ICU at Indriati Solo Baru Hospital with p= 0.000 < 0.05. The pre-test Respiration Rate (RR) is an average value of 16 times/minute while the post-test respiratory frequency is an average value of 17 times/minute.

The effect of early mobilization in patients using mechanical ventilators and independence in daily activities, as studied by Watanabe et al. (2023), demonstrating the broader benefits of implementing mobilization on functional outcomes and patient autonomy. Jolley et al. (2017) emphasized the safety and feasibility of early progressive mobility in patients on mechanical ventilators, suggesting that its implementation could improve functional outcomes in patients' breathing. Additionally, Schujmann et al. (2018) have investigated a progressive mobilization program to improve physical activity, respiratory and muscle function in ICU patients, demonstrating the potential benefits of a comprehensive mobilization strategy in the critical care setting. Progressive mobilization of level I will affect oxygen saturation which will increase the frequency and depth of breathing, increase alveolar ventilation, reduce respiratory workload, and increase diaphragm expansion (Agustin et al., 2020).

Another hemodynamic parameter affected by progressive mobilization is oxygen saturation. The results of this study showed that before progressive mobilization treatment, the oxygen saturation of ICU patients was 96.5% and increased to 98.5% after treatment. Meanwhile in the control group, oxygen saturation at pre-test was 97%, and at post-test was 96.5%. Paired-T-Test analysis showed that there was an effect of progressive mobilization on the oxygen saturation of ICU patients who received progressive mobilization (p=0.000), but not in the control group. When comparing the mean post-test oxygen saturation values between the two groups, there was a significant difference between the two groups (p=0.001).

Oxygen saturation is one of the hemodynamic parameters that can be affected when patients are given progressive mobilization. Several factors that can affect oxygen saturation are the amount of oxygen entering the lungs (ventilation) and the capacity of hemoglobin to transport

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oxygen. Physical activity can increase oxygen delivery to tissues by improving lung function and the efficiency of oxygen transport in the blood. When patients engage in progressive mobilization, their respiratory and cardiovascular systems adapt to the increased demands of exercise, their oxygen saturation levels may improve, indicating better tissue perfusion and overall hemodynamic stability. In addition, lateral rotation in progressive mobilization can increase pulmonary ventilation and perfusion to tissues and optimize gas exchange (Indriani et al., 2021).

Several studies have explored the benefits of progressive mobilization on improving oxygen saturation. One study published in the Journal "Endurance" (2022), emphasized the hemodynamic stabilization effect of progressive mobilization Level I on blood pressure and oxygen saturation in stroke patients. Martínez-Ballesté, P et al. (2019) also proved that progressive mobilization Level I was significantly proven to increase oxygen saturation significantly in critically ill patients using ventilators, in addition to preventing decubitus events.

In addition, Wahyudin (2024) explained that the 30° head up position increases oxygen saturation levels in ischemic stroke patients. Progressive mobilization patients placed in the head of bed position, then the force of gravity will pull the diaphragm down, resulting in better lung expansion (oxygen distribution in the lungs). Thus, the respiratory process will function more optimally when the patient is in the head of bed position. Perfusion, diffusion and distribution of blood flow and oxygen can flow throughout the body so that the oxygen saturation value increases (Watanabe et al., 2021).

4. Conclusion

The progressive mobilization level I was effective for stabilizing blood pressure, heart rate, respiratory rate and oxygen saturation of stroke patient in the ICU. Therefore, it is suggested that the implementation of progressive mobilization of level I for 2 time a day (morning and evening) can be used as an alternative nurse intervention.

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