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Effect of Foot Massage Therapy on Patient's Non-Invasive Hemodynamic Status in The Intensive Care Unit

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ABSTRACT

Intensive care is a care service for critical, acute, and life-threatening patients with hemodynamic instability. The use of a ventilator can make discomfort to the patients and then affect the patient's hemodynamics. Foot massage can be applied to intensive patients. This study aims to determine the effect of foot massage on non-invasive hemodynamic status patients in the ICU of the Sanglah General Public Hospital. The quasi-experimental design with a time series approach used, involve 12 patients using a purposive sampling technique. A foot massage was carried out for 30 minutes and hemodynamic measurements were taken 30 minutes later. The research data were analyzed using the Friedman test then continued with the post-hoc Wilcoxon Sign Rank test analysis. Foot massage therapy was given a significant effect on non-invasive hemodynamic status in patients in ICU, including decreasing respiratory frequency (p=0.002), decreasing MAP (p=0.002), decreasing heart rate (p=0.002), and increasing oxygen saturation (p=0.002). It provides a relaxation response that stimulates the sympathetic nervous system to decrease its activity and increase the work of the parasympathetic nerves which influence decreasing heart rate and blood pressure so that there is a balance between oxygen and carbon dioxide in the tissues then reduce the respiratory rate to become normal.

Keywords: foot massage; non-invasive hemodynamic status; ICU

INTRODUCTION

Intensive care is a care service that provide comprehensive and continuous services in 24 hours a day for critically ill patients, or patients who have a high risk of developing an emergency condition, occurs suddenly, potential and life-threatening disease (Kementrian Kesehatan Republik Indonesia, 2011). It is estimated that about 13 to 20 million people per year need life support in intensive care units (Yusuf and Rahman, 2019). The number of critically ill patients in hospital intensively increasing every year. Approximately 9.8–24.6% per 100,000 population who was critically ill and was admitted to the ICU. Almost 1,285 patients with a ventilator admitted in the ICU in several hospitals in Asian countries including Indonesia, and 575 of them died. Moreover, data on deaths caused by critical to chronic illnesses showed a significant limit reaching 7.4 million people in the world (WHO 2018 in Yusuf and Rahman, 2019).

A ventilator is a device that is used to replace and assist ventilation function of the lungs so that the lungs can deliver the oxygen demand in the body, reduce the work of breathing, increase oxygenation to tissues and managing patients with respiratory distress. The use of a ventilator in patients in ICU, often causes discomfort that will affect the status of the patient's hemodynamics (Daud and Sari, 2020). The patient in ICU also presents in a situation that is surrounded by a condition of a life-threatening patient, various medical procedures, and limited communication due to the use of breathing support, which affects the patient's emotional control, which impacts the patient's psychology. This situation causes an activation response of the hypothalamus, adrenal glands, pituitary gland, and sympathetic nervous system, influencing the patient's hemodynamic status and increasing the pulse and blood pressure. Uneasy conditions in patients can stimulate sympathetic nerve activation, increased norepinephrine production, and peripheral resistance then it requires intensive monitoring (Kurniawan, Kristinawati, and Widayati, 2019).

Hemodynamics is the dynamics of blood flow in the body's circulatory system. either through large blood circulation or lung circulation. Hemodynamics will always be maintained in a physiological condition in normal body conditions. However, in critically ill patients, the control mechanism cannot perform functions and duties normally, so the picture of the hemodynamic status becomes fluctuating (Daud and Sari, 2020). Multiple organ failure is a progressive

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disorder that occurs in two or more organ systems following an acute disturbance of systemic homeostasis, life-threatening and potentially reversible (Potter, 2011). WHO mentions that multi-organ failure is currently the main cause of ICU death. The patient mortality rate is one indicator of the quality of nursing services in the ICU (Megawati, 2019).

Situation analysis of Kurniawan, Kristinawati, and Widayati in 2019 in the ICU of RSUP dr. Soeradji Tirtonegoro Klaten, conducted on 11-13 June 2019, identified from 8 patients who were treated, 6 patients (75%) were hemodynamically unstable. The hemodynamic monitoring consists of blood pressure, mean arterial pressure, pulse frequency, and oxygen saturation have a state of ebb and flow to the limit indicator normal hemodynamic status (Kurniawan, Kristinawati and Widayati, 2019).

The results of this study were the same as a preliminary study conducted by Izma Daud and Revina Nurul Saridi in the adult Intensive Care Unit of Ulin Hospital, Banjarmasin, in August 2019 which showed as many as 187 patients who used ventilators from the total patients who were admitted to the ICU. Nearly 100% of patients on ventilators present an unstable hemodynamics (Daud and Sari, 2020). A preliminary study in Sanglah General Public Hospital from 13 until 26 September 2021 showed that of the 32 patients treated, 24 (75%) had a hemodynamic compromise. Almost 90% of patients with unstable hemodynamics in ICU are on a ventilator, as the drugs administered aim to maintain hemodynamic status and hemodynamics within normal limits.

According to Virginia Henderson's theory, Henderson also developed a nursing model known as "The Activities of Living." The model explains that the nurse's job is to help individuals by increasing their independence as soon as possible (Kurdi et al., 2021). The nurse's self-intervention was carried out on a patient with unstable hemodynamics, such as monitoring vital signs every 15 minutes, fluid intake and output, giving Trendelenburg position in hypotension (lowering blood pressure) or semi-fowler in consciousness, and providing a conducive environment. Meanwhile, complementary therapy, especially foot massage, has never been applied as a complementary therapy in hemodynamically unstable patients.

Relaxation therapy is needed in unstable hemodynamic patients to relax blood vessels; then vasodilation causes blood pressure to return to normal (Kurdi et al., 2021). Relaxing a body can be done in several ways, such as through classical music therapy, yoga, deep breathing techniques, and massage therapy (Ni Luh Seri Astuti, Dharma Wisnawa and Satria Astawa, 2022). Foot massage is a massage therapy that can be given to patients with vascular disorders and life-threatening diseases due to having a positive effect on blood pressure, pulse rate, and respiratory. Foot massage can be done by providing manipulation of the soft tissue soles of the feet and does not emphasize certain points (Setyawati, Ibrahim, and Mulyati, 2016). Foot massage provides benefits to improve blood circulation so; that it increases blood circulation and relaxes muscles by using massage techniques, rubbing, squeezing, and twisting the patient's feet (Daud and Sari, 2020). Foot massage provides a physiological relaxation response. long massage movements, and slow gliding associated with decreased heart rate and frequency breathing (Azami et al., 2015).

Arditya Kurniawan, in his research in the ICU of Soeradji Tirtonegoro Hospital Klaten in 2019, applied foot massage to critically ill patients with hemodynamically unstable. The study results show that foot massage provides hemodynamic stabilizing benefits on heart rate, respiration, and mean pressure arteries, making patient care time in the ICU more effective. In 2021, a study by Nyayu Nina Putri C, Bhakti Permana, and Linlin Lindayani proved that foot massage was beneficial for maintaining hemodynamic status. When the patient is given a foot massage, the patient feels a touch on the body, which causes a feeling of pleasure, and calm, and physiologically reduces hemodynamic indicators within normal limits (Putri C, Permana and Lindayani, 2021).

Foot massage is a complementary therapy that can be applied easily in patients in the ICU because it can stimulate circulation so that it can stabilize hemodynamics, reduce edema, provide passive joint exercises, and provide comfort for the patient. Considering the benefits, the costs affordable, the possibility of side effects are few, and the procedure is simple, foot massage can be an alternative to complementary therapy recommended for intensive patients (Daud and Sari, 2020). Based on this background, the researchers are interested to know and analyzing the effect of foot massage therapy on non-invasive hemodynamic status in patients of the Intensive Care Unit at Sanglah Hospital, Denpasar.

METHOD

This study used a quasi-experimental research design with a time series approach. The time series approach is a series of time consisting of three observations, first hemodynamic observations on the measurement of the pretest, hemodynamic observations on the second measurement (posttest I), and hemodynamic observations on the third measurement (posttest II). This research was carried out in the ICU of Sanglah Hospital Denpasar in December 2021 until January 2022 using the population of all patients admitted to the ICU. Sample selection involves non-probability sampling using the purposive sampling technique. Purposive sampling is a sample selection technique research based

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on the aims and purposes of the researcher so that it is adjusted to the criteria determined by the researcher's self, with the purpose that the sample can represent the role of population characteristics (Nursalam, 2020).

Determination of the number of samples is selected based on the type of research. The researchers approached the patient's family in the ICU who underwent weaning the ventilator in patients who met the inclusion criteria and explained the intent and purpose of the researcher to the family for the willingness that the sample would be respondents in the study by signing the informed consent. The inclusion criteria in this study were the families who gave consent, patients who had mean arterial pressure of 90-110 mmHg, heart rate 90-110 x/min, respiration rate 20-30 x/min, and oxygen saturation ≤ 96%, patients without sedation, and aged 21-60 years. While the exclusion criteria were fracture patients, restless patients, and symptoms of deep vein thrombosis.

The number of members of the research sample in a research-type experiment or simple treatment is between 10 to 20 (Sugiyono, 2017). According to Arikunto (2015), some ways can be used to anticipate samples that drop out, namely by revising the number of samples assuming the number of samples that drop out (L) is 10%. So, the sample size is taken in this study as many as 12 people. Criteria for patients who were entered into the dropout criteria such as patients who experienced worsening hemodynamic status, found swelling and bruising on the legs, and complained of pain when given foot massage treatment.

First, the researcher observed the hemodynamic status of the sample before the foot massage was performed and documented it on the observation sheet. The second observation was carried out 30 minutes after the first observation. After the second observation, the researchers conducted a foot massage therapy intervention on the sample for 15 minutes on each leg. The third observation was performed after 30 minutes of the intervention was completed. During the research process, no samples experienced a dropout, meaning that no samples experienced deterioration in hemodynamics. In the study, the researcher was assisted by a research team with a Good Clinical Practice (GCP) certificate and was declared ethically fit.

RESULT

Participant's Characteristic

Table 1. Frequency Distribution of Research Subjects Characteristics

Characteristics	Frequency	Percentage
Age		
21-30 years old	2	16.7
31-40 years old	0	0
41-50 years old	4	33.3
51-60 years old	6	50.0
Gender		
Man	9	75.0
Woman	3	25.0
Total	12	100.00

Based on table above, it can be concluded that from 12 samples, 6 respondents (50%) from the age 51-60 years, 4 people (33.3%) from 41-50 of age and as many as 2 people (16.7%) of respondents who came from the ages of 21-30. It also was obtained from 12 samples taken based on inclusion and exclusion criteria, the number of respondents who are male is 9 people (75%) and respondents who are female, which are 3 people (25%).

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Table 1. Differences in Non-Invasive Hemodynamic Status in the Pretest and Posttest-I Groups, and in the Posttest-I and Posttest-II Groups (n=12)

Hemodynamic Status	Monitoring	Mean	p-value
Respiration Rate (RR)	Pretest	24.75	0.234
	Posttest I	24.75	
	Posttest I	24.75	0.002
	Posttest II	18.75	
Oxygen Saturation	Pretest	95.58	1.000
	Posttest I	95.58	
	Posttest I	95.58	0.002
	Posttest II	98.83	
Mean Arterial Pressure (MAP)	Pretest	97.08	0.798
	Posttest I	96.92	
	Posttest I	96.92	0.002
	Posttest II	85.75	
Heart Rate (HR)	Pretest	100.83	0.264
	Posttest I	99.92	
	Posttest I	99.92	0.002
	Posttest II	84.08	

Table 2. showed that the Wilcoxon Sign Rank Test analysis showed no significant difference in the mean respiratory rate between pretest and posttest I (p=0.234), while the mean respiratory frequency in posttest I and posttest II showed a significant difference p=0.002). Second, there was a significant difference in oxygen saturation measurement in posttest I and posttest II (p=0.002). However, there was no significant difference in mean oxygen saturation between the pretest and posttest I (p=1.000). It indicates an increase in the average oxygen saturation in posttest I and II. Third, there is no significant difference in MAP between the pretest and posttest I (p=0.078), but the mean MAP shows a significant difference between posttest I and posttest II (p=0.002). It showed a slight decrease in the mean MAP from posttest I to posttest II and a significant decrease from posttest I to posttest II monitoring. Last, on heartbeat measurement, there was a small decrease in mean HR in posttest I to posttest II, but there was no difference in mean HR significantly between pretest and posttest I (p=0.798). Thus, it can be identified that there was an effect of foot massage on the non-invasive hemodynamics status of patients in the ICU Sanglah Hospital Denpasar significantly decreased respiratory rate (p=0.002), increased oxygen saturation (p=0.002), decreased MAP (p=0.002), and decreased heart rate (p=0.002).

DISCUSSION

The results of this study indicate that 50% of the respondents came from age 51-60 years old and at least come from the age 21-30 (16.7%). Koutsoukou et al. in Ricky (2017) explain with increasing age a person the higher the tendency of the body's physiological abilities both at the cellular level and organ level to decrease. The increasing of age causes the ability of the lungs to exchange gases in the alveoli decrease, decreased alveolar surface, decreased function of lung ventilation and contracted heart and decreased physiological reserves of the body.

Physiological reserve plays a role which is important in maintaining one's balance when the body is weak or even sick so that at old age the body loses the ability to maintain homeostasis.This study were the same as research result of Putra (2018) which showed that the characteristics of respondents who are treated in the ICU are dominated by age 47-57 years old as 24.45% and 57-67 years old as 43.9% (Putra, 2018). In the opinion of researchers, the aging process is a dynamic process. along with increasing age, the degeneration process will cause changes in anatomy and physiology of the body so that it affects the body's ability to cope decreased organ function and body resistance. This process explains that with age all body systems age as well. Therefore, the elderly will be more susceptible to developing a disease.

Based on research of Kurniawan, Kristinawati, and Widayati (2019) on 10 intensive patients in RSUP dr. Soeradji Tirtonegoro Klaten found that there were 70% men respondents while women were only 30%. As Daud and Sari (2020) stated that of 31 respondents in the ICU, as many as 21 people (68%) of the respondents were male and 10 people (32%) of respondents are female. Men have a higher level of activity and more diverse than women, men have higher

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levels of mobility higher, so the risk of accidents is also higher (Daud and Sari, 2020). In addition, most of the men work as a breadwinner whose activities are more often outside, so that more at risk of injury and falling ill (Yuswandi, Wardi Warongan, and Rayasari, 2020).

Comparison of male respondents more than female respondents in this study may be because, during the study period, the admitted to the ICU were dominated by men. In the opinion of researchers, men have higher rates of morbidity than women because women and men have different lifestyle tendencies, like men who have habits of smoking and drinking alcoholic beverages. In addition, compared to women, men are more dominant in using means of transportation and carrying out extreme activities, so the possibility of accidents, injuries, and illness is higher.

The result of post hoc analysis of the Wilcoxon Sign Rank test showed that there was the effect of foot massage on non-invasive hemodynamic status in 12 patients in the ICU Sanglah Hospital Denpasar significantly decreased respiratory frequency (p=0.002), increased oxygen saturation (p=0.002), decreased MAP (p=0.002) and decrease in heart rate (p=0.002) thus Ha is accepted. As Putri C, Permana, and Lindayani (2021) result, research showed a significant decrease in all hemodynamic indicators, such as decreased RR, MAP, and HR, and a significant increase in oxygen saturation with p-value < 0.05.

Daud and Sari (2020 in their research of 31 patients in the ICU room at Ulin Hospital Banjarmasin, showed that there was the effect of foot massage significantly on MAP (p=0.001), heart rate (p=0.035), and respiratory frequency (0.001) but does not affect saturation oxygen (p=0.317). Similarly, the results of research by Kurniawan, Kristinawati, and Widayati (2019) explained that after foot massage, the hemodynamic status was non-invasive patients showed p=0.001 (<0.05) on RR; p=0.000 (<0.05) on HR; and p=0.004 (<0.05) on MAP, while in oxygen saturation the value of p=0.591 (p>0.05) which means that the effect of foot massage is significant on non-invasive hemodynamic status in patients on HR, RR, and MAP but no significant change in saturation oxygen. These two studies showed different results on oxygen saturation. This study showed a significant effect on decreasing saturation because of selecting the sample that the researcher used in the saturation criteria under the criteria of the two previous researchers (≤ 96%). It made the results of posttest I and posttest II already at the same value from the range normal value of oxygen saturation (95-100%) so that there was no significant increase in the mean significance after foot massage.

The results of this study indicate that the average respiratory frequency in the posttest I-posttest II was more significant (p=0.002) compared to the pretest-posttest I (p=0.234). The average RR in posttest I was 24.75 x/min decreased to 18.75 x/min on posttest II. As for the respiration rate, the average oxygen saturation posttest I-II was more significant (p=0.002) compared to the pretest and posttest I. The mean oxygen saturation in posttest I was 95.58%, while in posttest II, it was 98.83%.

The monitoring MAP and HR results showed that the mean posttest I-II was more significant (p=0.002) compared to the pretest-posttest group I. The mean MAP at posttest I was 96.92 mmHg and at posttest II was 85.75 mmHg. Meanwhile, the average HR at posttest I was 99.92 x/min, and at posttest II was 84.08 x/min. This shows that the difference between posttest I and posttest II is that the mean MAP and HR decrease.

In this study, there was an increase in the number of respondents with a frequency respiratory rate, oxygen saturation, MAP, and pulse rate within normal ranges before and after a foot massage. The number of respondents who had respiratory frequency normal before the foot massage was 8.3% increased to 58.3% after performing a foot massage. The number of respondents who had normal oxygen saturation before the foot massage was 83.3% and increased to 100% after the foot massage was performed massage. The number of respondents who had a normal MAP before the foot massage was 66.7% increased to 100% after the foot massage. While the amount respondents who had a normal heart rate before foot massage were 41.7% and increased to 100% after foot massage.

It were similar with the research results of Setyawati, Ibrahim, and Mulyati (2016) which identified that there was an increase in the number of respondents who have a frequency normal breathing before foot massage was 42.4% increased to 66.7% after a foot massage. Number of respondents who had a normal MAP before foot massage was 84.9% and increased to 93.9% after foot massage was performed massage. The number of respondents who had a normal heart rate from 66.7% of patients before foot massage to 70% of patients after foot massage. Meanwhile there was no change the number of patients who had normal oxygen saturation between before and after the procedure foot massage. It may be because in this study the researchers chose respondents with oxygen saturation criteria <96%. different to the research of Setyawati, Ibrahim, and Mulyati (2016) who showed that the average oxygen saturation on the pretest, posttest I, and posttest II were already at the same value both from the range normal value of oxygen saturation (95-100%) so that there was no significant increase in the mean significant after foot massage.

Salvo (2016) in Massage Therapy, Principles and Practice, explained that foot massage can provide physiological and psychological effects. Physiological effect of foot massage as changing body functions of lowering blood pressure and pulse, alter hormonal and neurotransmitter levels, and increase ROM (Range of motion). Foot massage can also affect blood flow to the bones, increasing tissue oxidation, nutrient exchange, and removal of metabolic waste.

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Psychological foot massage can reduce anxiety and stress levels and improve positive feelings. The concept of touch in the form of foot massage will be perceived as a stimulus relaxation so that it provides a relaxation response that stimulates the sympathetic nervous system to reduce activities that affect lowering blood pressure (Putri C, Permana, and Lindayani, 2021).

According to foot massage guidelines, the researcher massaged both respondents' feet in this study. Foot massage is done with 5 basic techniques and paying attention to comfort points such as points BL60, LV3, and Sp6. BL60 point is in the cavity between the outer ankle bone and the ankle Achilles tendon, useful for improving blood circulation. The point LV3 is the point that lies two fingers above the skin that joins the first and second toes on the foot. Emphasis on the LV3 point is useful for dealing with stress and reducing anxiety and pain in the legs. While the Sp6 point is located 3 fingers above the ankle on the depression under the tibia. Proper massage at this point creates a comfortable sensation because it stimulates the body to secrete endorphins.

Researchers believe a massage that passes through the points will help the body produce endorphins to provide comfort, relaxation, and serenity. The massage effect can provide relaxation of smooth muscle resulting in arterial vasodilation and decreased blood pressure mean arterial pressure. A foot massage stimulates the sympathetic nerves to reduce epinephrine and serum cortisol, resulting in vasodilation of peripheral blood vessels. Vasodilation of peripheral blood vessels causes a decrease in heart rate and an increase in cardiac output. In the end, with increased cardiac output, the alveoli diffusion process becomes optimal so that oxygen saturation increases and respiratory rate decreases. The balance of oxygen and carbon dioxide concentrations in tissues, interpreting Adequate oxygenation as indicated by oxygen saturation values within normal limits. The respiratory center will catch a positive stimulus when the saturation value increases, so that will respond to reduce the respiratory rate until it reaches a normal point. Thus, foot massage is very useful for maintaining the point physiological balance of the body within normal limits.

CONCLUSION

Foot massage therapy significantly affected the non-invasive hemodynamic status of 12 patients in the ICU room of Sanglah Hospital Denpasar. Foot massage is recommended to ICU nurses to add knowledge about hemodynamic management and hold foot massage training so they can later apply foot massage as a complementary therapy that is useful for maintaining the stability of the hemodynamics of patients in the ICU.

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