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Foot Reflexology and 4-7-8 Breathing Exercise as Supporting Therapy to Reduce Anxiety and Maintain Vital Signs of ICU Patients

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Abstract: *Noising of the Intensive Care Unit (ICU) machine, high mortality rate, instability of other patients' conditions, and limited information may increase anxiety for ICU patients. Anxiety has an impact on declining health. Anxiety detains patients from sleeping, increases blood pressure, and slows healing. To manage patients' anxiety, pharmacological and non-pharmacological techniques were widely used. Using combined pharmacological and non-pharmacological therapy is more effective. This study aimed to describe the implementation of non-pharmacological therapy: foot reflexology, and 4-7-8 breathing as a substitution for pharmacological interventions for ICU patients. The method used was a nursing practice based on evidence-based nursing. The interventions were selected from three evidence-based references found in PubMed. The participant was three ICU patients who were 26-55 years old, SBP ≥ 140 mmHg, DBP ≥ 90 mmHg, HR≥60 bpm, RR 12-26 bpm, SpO2 95-100%, first time admitted to ICU, maximum nasal cannula installed, >4 hours admission to ICU, and GCS E4V5M6. The evaluation was carried out through the HADS and vital signs. The combination of foot reflexology and 4-7-8 breathing reduce anxiety and improve the patient's vital signs and oxygen saturation. These interventions may be beneficial to other ICU patients facing anxiety. Further investigations are needed.*

Keywords*: anxiety, foot reflexology, 4-7-8 breathing exercise, physiological indicators, case study report*

INTRODUCTION

The high mortality rate and the use of equipment in the Intensive Care Unit (ICU) increased anxiety in ICU patients (Choi, Tate, Rogers, Donahoe, & Hoffman, 2016). Ten different patients experienced anxiety caused by noise from bedside monitors, syringes, or infusion pumps (Konkani & Oakley, 2012). In addition, using sound alarms and the intensity of room light brightness increased patient anxiety in the ICU (Darbyshire, Müller-Trapet, Cheer, Fazi, & Young, 2019). At the same time, the deterioration of other patients in the ICU caused psychological anxiety for other ICU patients (Miranda-Ackerman et al., 2020). Limited information regarding the development of the disease also caused anxiety and worsened the patient's condition (Inoue et al., 2019). Anxiety impacts decreasing physical health (Inoue et al., 2019), causes difficulty for patients to sleep, increases blood pressure, and slows the healing process (Johnson, 2019). Anxiety also increases the hormone cortisol, which causes a decrease in the fight-or-flight process of the immune system (Won & Kim, 2020). The hormone cortisol affects the decrease in the availability of white blood cells and decreases the inflammatory process in the body (Won & Kim, 2020). Anxiety can also affect all holistic aspects of human needs, from biology, psychology, social, and spiritual (Khajian, Gelogahi, Aghebati, Mazloum, & Mohajer, 2018). Therefore, controlling the anxiety of ICU patients is essential and can also impact improving physical health (Inoue et al., 2019).

One of the indicators increasing in physical health is the standard physiological indicators that appear on the patient's vital signs (Pour-Ghaz et al., 2019). Criteria for patients who are admitted to the

ICU are unstable vital signs and require dynamic physiological observation (Pour-Ghaz et al., 2019). ICU patients can move to the regular ward if their physiological indicators are stable. ICU patients are closely related to measuring physiological indicators (Rahman et al., 2021). Physiological indicators can change drastically or stay stagnant in the ICU (Rahman et al., 2021). Besides the fact that ICU patients have unstable physiological indicators, anxiety is one of the factors that cause stagnate physiological indicators or even worse (Inoue et al., 2019). Anxiety causes an increase in heart rate, pulse rate, and respiration rate (Tarazona-Alvarez, 2019). Anxiety is difficult to deal with; it needs comprehensive and gradual intervention to reduce its effects (Götze et al., 2020). For this reason, the optimum step is to avoid anxiety factors and add non-pharmacological combination therapy (Leutualy et al., 2022; Sabeti, Mohammadpour, Pouraboli, Tahmasebi, & Hasanpour, 2021).

The advantage of non-pharmacological therapy is the low risk of side effects (Brito et al., 2020). In addition, non-pharmacological therapy only requires a few tools and practice easily by the patients (Jayanthi & Hudiyawati, 2019; Sandvik, 2020). Initial anxiety management includes meditation, mindfulness, progressive muscle relaxation, breathing techniques, physical exercise, cognitive therapy, and spiritual therapy (Brito et al., 2020; Dewi, 2022; Mutiah & Dewi, 2022). Other non-pharmacological interventions are reflexology foot massage therapy (Alinia-najjar, 2020; Rezaei, 2022) and 4-7-8 breathing (Eskici İlgin & Yayla, 2023). The reflexology and 4-7-8 breathing reduce anxiety and maintain stable vital signs (Rezaei et al., 2022). Therefore, this study aimed to describe implementing the combination of foot reflexology and 4-7-8 breathing to reduce anxiety and stabilize ICU patients' vital signs and oxygen saturation (SpO2).

PATIENT'S INFORMATION

The patients (Pt) who were given the interventions of foot reflexology and 4-7-8 breathing were the ICU patients at a private hospital in the Sukoharjo district. Not only receive this combination therapy, but the patients also received other pharmacological therapies and were not stopped for the duration of the interventions. Three patients met the inclusion criteria for the intervention, with the identification of each patient listed in Table 1. Most patients were male (66.7%), had first-time ICU admission, had a history of surgery, and had a duration in the ICU of more than 8 hours. Most patients have medical diagnoses related to cardiology problems, and most of them get hypertensive medication like ranitidine, metoprolol, and captopril and digestive medication to avoid nausea like ondansetron.

Table 1. Respondent Characteristic

Patient	Medical Diagnosed	Gender/ Age	ICU Duration	GCS
Pt 1	Stroke non-hemorrhagic (Redundant)	Male 48	10 hour	15
Pt 2	Hypertensive urgency	Female 46	8 hour	15
Pt 3	Stroke hemorrhagic	Male 50	24 hour	15

CLINICAL FINDINGS

The initial patient's vital signs were unstable. The HADS score shows that the patient has moderate anxiety and depression. Pt 1, on several occasions, was found in an uncomfortable position and sweating cold. Pt 2 sleeps more peacefully, but his gaze strains when a nurse approaches. Pt 2 and 3 also asked why he could not be transferred to the regular ward and had a decreased appetite. Findings regarding the patient's HADS score and vital signs assessment can be seen in Table 2.

Table 2. Assessment Results

Patient	Score		Vital Sign			
	Depression	Anxiety	BP (mm Hg)	HR (x/mnt)	RR (x/mnt)	SpO2 (%)
Pt 1	18	16	156/92	62	26	98
Pt 2	16	19	182/117	101	26	97
Pt 3	14	15	141/90	72	23	98

TIMELINE

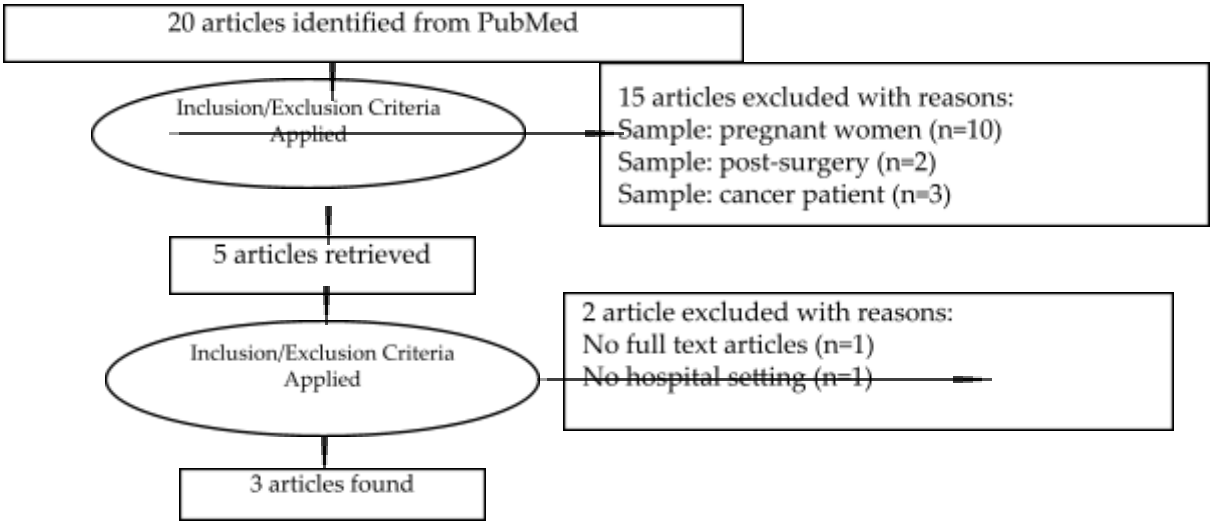
This study takes about two weeks. The patients who met the criteria were measured using HADS one day before the intervention. The procedure begins with preparing and measuring vital signs, followed by giving 4-7-8 breathing exercise interventions for 2 minutes and reflexology foot massage intervention for 5 minutes. Patients were evaluated based on HADS, vital signs, and SpO2. Two days after the intervention, the patient's anxiety was measured by HADS again as an evaluation phase of the intervention results.

Table 3. Timeline of Study

No	Procedure	Duration
1	Work Phase (twice repetition)	4 days
	Preparation, vital signs monitoring	10 minutes
	4-7-8 breathing exercise intervention	2 minutes
	Foot reflexology massage intervention	5 minutes
	Vital signs evaluation	5 minutes
2	Evaluation Phase	2 days

THERAPEUTIC INTERVENTION

This study was a nursing practice based on evidence-based nursing implementation. The evidence-based reference used has been found from the search engine PubMed with advanced filters (1) foot reflexology massage and (2) anxiety, and (3) breathing technique (picture 1). The 20 articles that appeared were filtered again using patient criteria, place settings, and completeness of the article. Finally, three valid articles were obtained regarding foot reflexology intervention and 4-7-8 breathing techniques to decrease anxiety and physiological indicators in the ICU.



Picture 1. Diagram of Study Extraction

This study implemented the combination of foot reflexology and 4-7-8 for three ICU patients selected through inclusion and exclusion criteria (picture 2). Patients who received this combination intervention also received medical therapy as prescribed by the doctor in charge. Therapy from nutritionists and other medical personnel was not stopped during the intervention. After explaining the interventions' purposes, benefits, procedures, and indications, the patients signed informed consent. The flow of the initial stages, work, and final stages are shown at Figure 2.

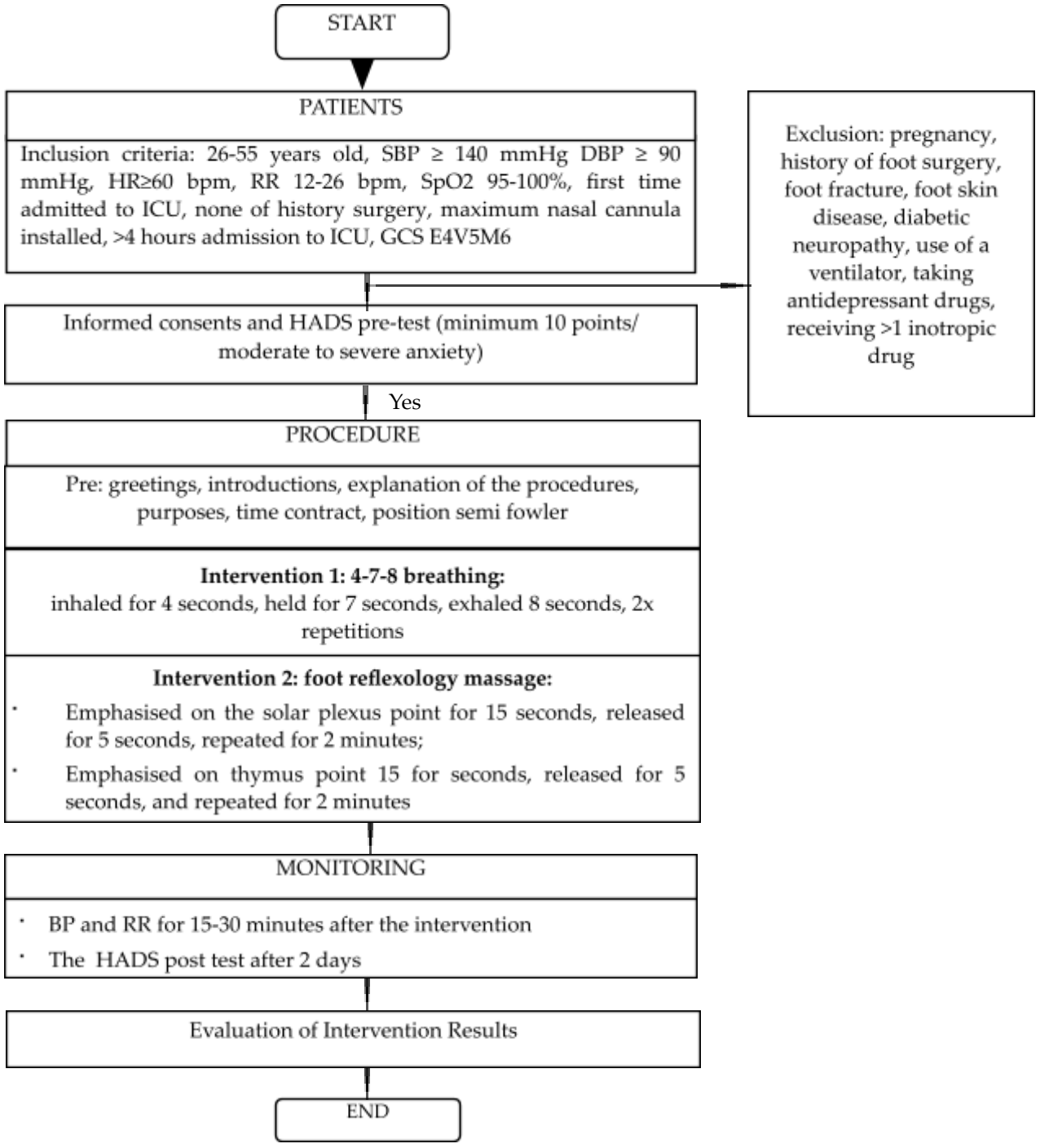


Figure 2. Intervention Flowchart

Foot reflexology massage is a non-pharmacological therapy method by placing pressure on specific points on the feet (Alinia-najjar et al., 2020). Points on the feet are connected to all body organs, including glands, muscles, and bones (Ariganjoye, Gibson, Mossad, Posey, & Sharley, 2023). Foot reflexes are performed for approximately 30 minutes with repeated pressure for 15 seconds (Ariganjoye et al., 2023). The 4-7-8 breathing is breathing with counting techniques, inhaling for 4 seconds, holding for 7 seconds, and exhaling for 8 seconds (Eskici İlgin & Yayla, 2023).

The intervention was evaluated through the patient's anxiety score, BP and RR. Anxiety scores were evaluated after two days of intervention using the HADS (Hospital Anxiety Depression Scale). The HADS instrument consists of seven questions about anxiety and seven about depression in the hospital (Shdaifat & Al Qadire, 2022). The HADS is valid with a correlation coefficient of 0.44-0.68 and reliable with *Cronbach's alpha* range of 0.85 (Cassiani-Miranda, Scoppetta, & Cabanzo-Arenas, 2022). The HADS has the highest score at three and the lowest at zero. The classification of total HADS is 0-7 stands for normal, 8-10 for borderline abnormal, and 11-21 for abnormal. Meanwhile, the BP and RR were monitored before and 15-30 minutes after each intervention package.

FOLLOW UP AND OUTCOMES

The Patient's Anxiety

The evaluation results after the intervention showed that the patient's HADS score had decreased (Table 4).

Table 4. Patient Anxiety Evaluation

Patient	Pre-intervention		Post-intervention	
	Depression	Anxiety	Depression	Anxiety
Pt 1	18	16	10	12
Pt 2	16	19	11	11
Pt 3	14	15	9	11

Pt 1 and Pt 3 experienced a decrease in depression levels from abnormal to borderline. However, Pt 2 remains in the abnormal category yet decreased the score from 16 to 11 within two days of intervention. In contrast, the patient's anxiety scores decreased around 4-8 but were still considered abnormal.

The Patient's Physiological Indicators

Physiological indicators measured in this study were the patient's vital signs consisting of blood pressure (BP), heart rate (HR), respiratory rate (RR), and oxygen saturation (SpO2). Overall, the evaluation results after the intervention showed a decrease in BP and stabilized HR, but RR and SpO2 did not show significant changes after the interventions. However, it was still considered in the normal range (Table 5).

Pt 1 showed alteration in BP to less than 140/91, HR ranged from 65 to 81, RR ranged from 20 to 24, and SpO2 ranged from 98 to 99. Pt 2 showed a significant decrease in BP from 182/117 to 144/98 after the intervention on the first day but decreased slightly from 152/93 to 150/91 on the second day. It also occurred in HR and RR. The HR altered from 101-104 to 81-99 from day 1 to day 2. The RR remained at 26 on the first day but decreased from 25 to 22 on the second. Pt 3 also experienced decreased BP and RR, increased HR yet remained in the normal range, and increased SpO2 to 99%.

Table 5. Evaluation of Patient's Physiological Indicators

Patient	Pre-Intervention				Post-Intervention			
	BP (mm Hg)	HR (x/mnt)	RR (x/mnt)	SpO2 (%)	BP (mm Hg)	HR (x/mnt)	RR (x/mnt)	SpO2 (%)
				Day 1				
Pt 1	156/92	62	26	98	135/91	65	24	99
Pt 2	182/117	101	26	97	144/98	99	26	97
Pt 3	141/90	72	23	98	127/85	84	20	98
				Day 2				
Pt 1	138/90	77	24	99	133/89	81	20	99
Pt 2	152/93	104	25	96	150/91	97	22	98
Pt 3	140/89	67	20	97	136/78	81	20	99

DISCUSSION

Anxiety points on the feet are the solar plexus and thymus points (Alinia-najjar et al., 2020). The solar plexus is a point that is connected to the bottom of the rib cage; where this section will tighten if someone is anxious, thus making the diaphragm also narrow (Göral Türkcü & Özkan, 2021). Meanwhile, the thymus point is related to the immune system and a sense of well-being (Göral Türkcü & Özkan, 2021). The thymus point is the central organ of the immune system that regulates T-cell response; in a state of anxiety, the T-cell production response will decrease (Thapa & Farber, 2019). Meanwhile, according to Ren & Crowley (2019) decreased T-cell response results in vascular dysfunction and, in many cases, leads to high blood pressure.

For this reason, pressure on the point of anxiety helps to activate and maximize the work of the glands and related organs. Pressure on the solar and thymus points helps repair the immune system so that T-cell and vascular dysfunction does not occur. In another case, pressure on the solar plexus point for one minute in patients with breast cancer has a comforting effect, reduces anxiety, and improves sleep quality (Rezaei et al., 2022). According to Dwivedi (2022), solar plexus points and thymus are reflex points that improve sleep quality and patient comfort.

Counting breathing techniques train the brain's hippocampus to remember and focus on breathing techniques (Rusch et al., 2019). Rusch et al (2019) stated that the breathing technique with counting, called mindfulness counting, could increase the comfort level and reduce stress. Breathing exercises stimulate relaxation by involving the rest-digest system in the parasympathetic nervous system (Gál, Ștefan, & Cristea, 2021). Breathing exercises can activate the parasympathetic system, lowering blood pressure and widening blood vessels (Yau & Loke, 2021). However, improvement in vital signs and anxiety cannot be separated from the role of pharmacological therapy. Inotropic drugs which patients consumed also contributed to improving the patient's vital signs. Pharmacological therapy, such as metoprolol, captopril, and hydralazine, was the first line in reducing HR, BP, and cardiac workload (Brathwaite & Reif, 2019). Combining pharmacological and non-pharmacological therapy was more optimum for achieving the therapy goal than alone therapy (Rios et al., 2019). While pharmacological works in the biological system of the body's organs, non-pharmacological focuses on the patient's sense of control (Khan, Amatya, Bensmail, & Yelnik, 2019). The combination of foot reflexology and 4-7-8 breathing as an additional therapy helps decrease the patient's depression and anxiety, as well as stabilize the vital signs and oxygen saturation

PATIENT PERSPECTIVE

The patient's response varied after receiving the intervention package for four days. Pt 2 said that the intervention package had a good impact on the patient, like becoming relaxed, sleeping easily at night, and relaxing tense muscles. Pt 2 has also self-demonstrated breathing exercises in the intervention package. Meanwhile, Pt 1 did not inform detail about the patient's feelings after the intervention package. Still, the patient answered the nurse's question about whether this exercise package made the patient relatively calm, and the patient answered with a nod of "Yes, calm down." In addition, Pt 3 also provided a positive perspective when he said that this intervention package had a good impact on him and relaxed him. Most patients agree with a yes response and nod if this intervention package is calming enough other than the pharmacological therapy received.

INFORMED CONSENT

The patient has explained the intervention package to be carried out. The information includes the time, purposes, benefits, side effects, and details procedure. The patient is given a paper containing consent if they agree/disagree with the intervention. The patient signs at the end of the informed consent paper for the decision that has been made. The limitations of this study come from the need for optimal risk prevention, strict and continuous monitoring from other duty nurses. Nevertheless, in the beginning, the patient has been educated about the response that will be felt and must report if imperfect senses are felt. Besides, the patient's response immediately after the intervention, up to seven hours of shifting time, is monitored closely.

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