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The Impact of Foot Reflexology on Suctioning-Induced Anxiety Among Mechanically Ventilated Patients in ICUs

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Abstract

Background: Suctioning has been to date documented as one of the most painful and anxiety-inducing experiences among mechanically ventilated patients admitted to intensive care units.

Aim: The present study was conducted with aim to investigate the impact of foot reflexology, as a non-pharmacological method, on suctioning-induced anxiety in ICU patients receiving mechanical ventilation.

Method: This randomized controlled trial study was conducted on 36 mechanically ventilated patients in the ICU of a military hospital in Tehran, Iran, in 2021. The subjects were randomized into either the intervention group (foot reflexology) or the control group (routine care). After the completion of the suctioning procedure, the foot reflexology technique was applied for 20 minutes on reflex points of the heart and lungs (the anterior third of the sole of the foot) in the intervention group patients. Levels of anxiety were assessed using the Faces Anxiety Scale (FAS) before and after the intervention.

Results: No statistically significant difference was found between the two groups in demographic characteristics and anxiety levels at the pre-intervention stage. However, anxiety was significantly reduced after foot reflexology treatment in the intervention group compared to the controls (p<0.001). Additionally, anxiety levels significantly decreased in the intervention group after the intervention compared to before the intervention (p<0.001), while increased in the control group (p=0.001).

Implications for Practice: The results of the present study showed that foot reflexology is effective in reducing suctioning-induced in ICU patients receiving mechanical ventilation. Therefore, it is recommended to use this non-pharmacological approach at the patient's bedside.

Keywords: Anxiety, Foot Reflexology, ICU, Mechanical Ventilation, Suctioning

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Introduction

Intensive care units (ICUs) are among the specialist wards of healthcare facilities, providing care services for patients with life-threatening and serious conditions (1). Approximately 80-90% of such cases are in the dire need of respiratory support by mechanical ventilation (MV) devices (2), to the extent that about 800,000 inpatients in the United States have to be mechanically ventilated each year (2). In general, MV is carried out using two modalities, namely invasive and non-invasive. During the invasive procedure, intubation and suctioning are always performed when interruptions occur in the cleaning ability of the ciliated cells and protective reflexes, along with the patient's inability to clear lung secretions (3,4). Patients undergoing MV commonly require 3-24 suctioning practices within 24 hours (5). This procedure helps drain the lung secretions, prevent airway obstruction and atelectasis, provide proper ventilation and oxygen supply, and minimize respiratory efforts (6).

ICU patients often find suctioning as a traumatic experience, which is associated with complications such as hypoxemia, significant changes in heart rate (HR) and blood pressure (BP), cardiorespiratory arrest (CRA), tracheal or bronchial rupture, bronchospasm, lung infection and pulmonary bleeding, and increased intracranial pressure (ICP) (7, 8). Overall, mechanically ventilated patients experience high levels of anxiety, ranging from 46 to 87% (9). In fact, MV patients cannot verbally express their feelings or communicate, leading to anxiety, frustration, and fear of losing control over their treatment decisions (10,11). Excessive noise, light, and other stimuli in ICUs can increase the risk of anxiety (12). Painful procedures like suctioning can intensify this anxiety as patients feel disconnected from the MV device and struggle to breathe (8). Anxiety can also lead to bronchoconstriction, increased airway resistance, higher work of breathing (WoB), and prolonged MV device use (13). Respiratory symptoms may occur which include shortness of breath, rapid breathing, oxygen saturation changes, hyperventilation, coughing, and feelings of suffocation (14,15). Untreated anxiety may result in cognitive issues such as delirium, psychosis, and dementia (16,17). Therefore, it is crucial to reduce suctioning-induced anxiety (SIA) in ICU patients.

Nurses, as frontline healthcare providers, play a key role in managing suctioning through pharmacological and non-pharmacological interventions in order to minimize patients' anxiety (18). While anti-anxiety medications may cause drowsiness, shallow breathing, reduced patient cooperation, delay weaning and prolonged hospital stays, non-pharmacological approaches can effectively reduce anxiety without the side effects and costs associated with medications (19). Complementary and alternative medicine (CAM) has been introduced as a non-pharmacological strategy, including aromatherapy, acupuncture, music therapy, biofeedback techniques, massage therapy, relaxation techniques, and foot reflexology (FR) (20-23). During the foot reflexology, deep pressure is applied on certain points of the feet with the thumb and the forefinger (24), based on the idea that each body organ has a reflex point on the soles of the feet, the hands, and the ears (25).

The exact mechanism of thereflexology is not fully understood, but theories suggest its effects through the Gate Control Theory of Pain and the Classical Theory of function in the nervous system and nerve impulses, increased endorphin and enkephalin release, pain control, improved immune system function, and removal of toxins from the body (26). Reflexology helps prevent the transmission of pain signals by inhibiting the afferent messages and closing the nerve valves in the posterior ramus (27). It also affects the parasympathetic nervous system, stimulating the hypothalamus and decreasing metabolism, heart rate, blood pressure, respiration rate, and oxygen consumption, leading to relaxation and pain relief (28). FR is an undemanding, economical, and non-invasive technique to reduce anxiety levels (29) and can be a part of nursing care in the specialist wards (30,31).

Numerous studies have investigated the impact of FR on anxiety, yielding varied results. The uncertainties in the medical community necessitate further research on reflexology to establish strong evidence. Anxiety has often been overlooked in the nursing care for unconscious patients and there is limited research on the impact of FR on SIA in ICU patients undergoing MV. Considering the importance of reducing anxiety in this context and the existing research gap, this study was conducted with aim to explore the effects of FR on SIA in mechanically ventilated patients in ICUs.

Methods

This randomized controlled trial study was completed on all the MV patients in the dire need of suctioning, admitted to the eight-bed ICU of a selected military hospital in Tehran, Iran, from May to

August 2021. The inclusion criteria were being in the ICU for a minimum of 24 hours, being connected to an MV device, having a hemodynamically stable status (BP: 100-140 mmHg; HR: 60-100; respiration rate: 12-20; and oxygen saturation [SPO_2]: 90% or higher) (32), age over 18 years old, obtaining the Glasgow Coma Scale (GCS) score of 8, having healthy soles in terms of the absence of corns, fungal skin problems, and previous scars, as well as receiving confirmed neuropathy. The exclusion criteria included need to perform other therapeutic interventions, such as taking venous access, taking arterial blood gas tests, etc. during the intervention program, becoming conscious, removing the endotracheal tube at the onset of FR, as well as the patient's fighting with the ventilator during the intervention. The study was fulfilled after obtaining written informed consent, informing the patients' companions regarding the research objectives, and participating in the study on a voluntary basis. In addition, observing the principles of confidentiality and the patient's right to withdraw from the study, acquiring the necessary permits from the relevant authorities, adhering to the provisions of the Declaration of Helsinki, and the publication principles were also met.

The sample size was further calculated based on the instructions in the study of Abbaszadeh et al. (2018) (33). Using the G*Power software package (version 3.0.10) and taking into account the type-I error of 0.05 and the test power of 80%, 16 people were thus placed in each group. Considering the possibility of a 10% attrition rate, the sample size of 18 patients was determined in each group, and in total 36 cases were studied (Figure 1). The samples were included using convenience sampling and based on specific inclusion criteria. Then, the samples were divided into two groups of test and control using a simple random method involving flipping a coin.

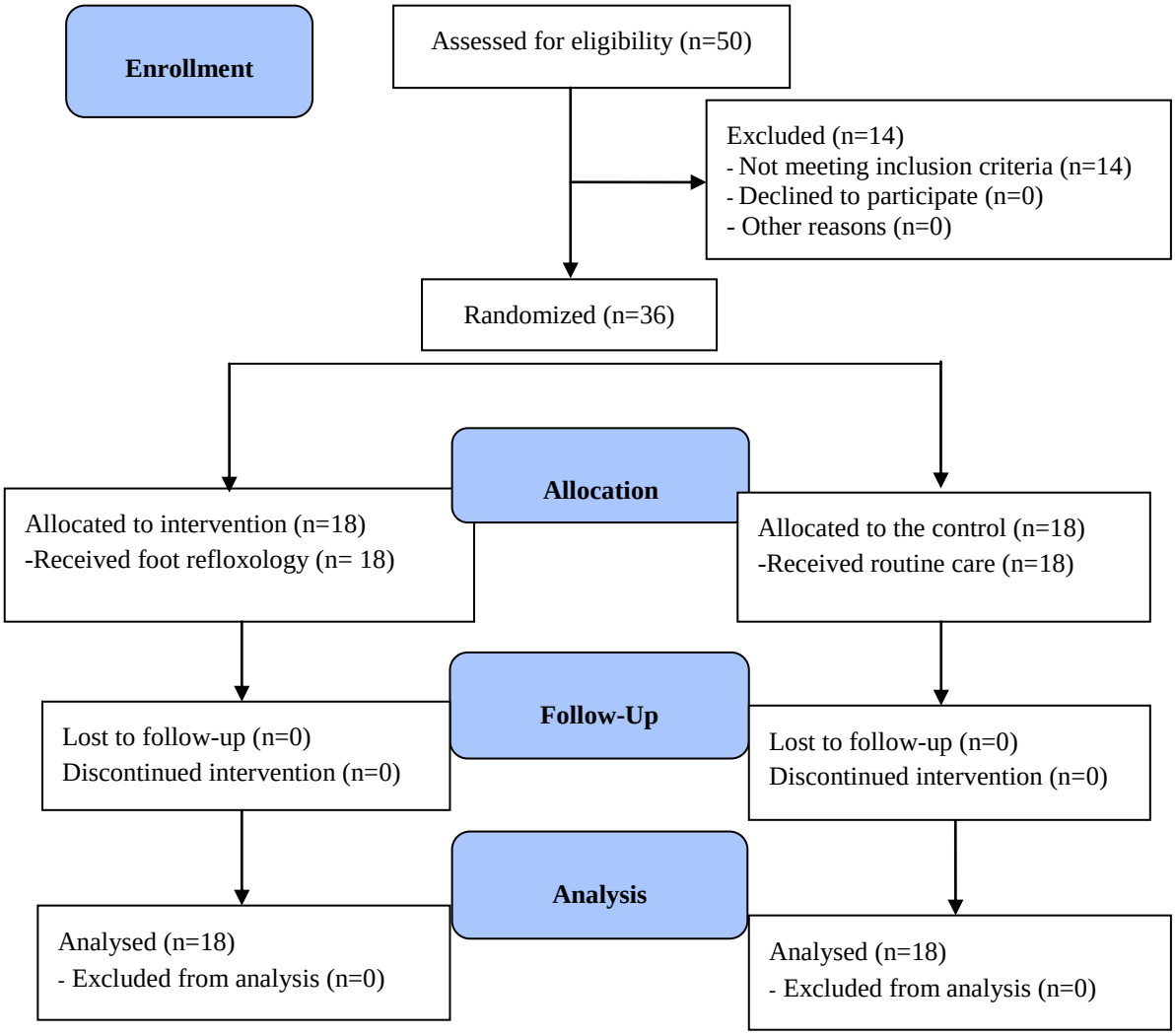

Figure 1. CONSORT 2010 flow diagram of the study

The data collection tools were the Demographic Characteristics Form (DCF) and the Faces Anxiety Scale (FAS). DCF contained the items regarding age, gender, underlying diseases, the type and dose of the taken sedatives, taking anti-anxiety medications, the type of anti-anxiety medications, the length of stay in the ICU, the number of days in the MV device, the type of artificial airway, and the type of the MV device, which was completed through interviews with the patients and checking their medical records.

The FAS (Figure 2), developed by Derogatis et al. (34), also consisted of five faces with score ranging from 1: no anxiety, 2: mild anxiety, 3: moderate anxiety, 4: severe anxiety, to 5: very severe anxiety. In this research instrument, the patient's anxiety could be scored from 1 to 5, by examining their mouth opening, eyebrow shape change, forehead wrinkles, and smile line. The FAS display five potential responses, spanning from a neutral expression to intense fear. The faces were drawn by a graphic designer referencing fearful expressions, depicting the changes in facial muscles during heightened fear. Fear and anxiety, while sharing physical symptoms, stem from different origins. Fear typically responds to present danger, whereas anxiety is a reaction based on past experiences (35). The validity and reliability of the FAS had been also reported with coefficients of 64% (36) and 90%, respectively (37).

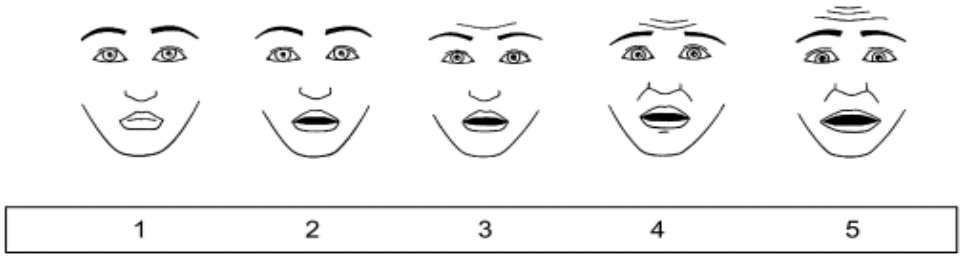

Figure 2: Faces Anxiety Scale (FAS) (Derogatis LR, Melisaratos N. The brief symptom inventory: an introductory report. Psychological medicine. 1983;13(3):595-605.)

The eligible patients who met the inclusion criteria were included in the study. To implement the intervention program following the suctioning procedure, the anxiety scores of the patients were promptly noted. Subsequently, the participants in the intervention group received FR. For this purpose, the patient was first positioned on the back, and then the head of the bed was elevated to 30 degrees. The patient's foot was positioned directly in front of the researcher's hand, while the researcher sat on a chair aligned with the patient's foot. Before beginning the intervention, the researcher warmed their hands and applied a lubricant. The FR technique was then practiced on the left foot followed by the right foot in four steps. The initial step involved holding the foot in the hands for one minute. In the second step, the spreading foot technique was carried out on each foot for one minute using slow and gentle pressure with the thumbs of both hands, moving from the heels to the toes. In the third step, four fingers of both hands were placed on the back surface of each foot, with the thumbs on the reflex point of the heart and lungs (i.e., the anterior third of the sole). Gentle pressure was applied in a rotating manner for 7-10 minutes. In the final step, the one-minute sliding top technique was applied with gentle movements from top to bottom on the entire back area and the legs' sides using the fingers of both hands and thumbs for support. Reflexology was performed for 10 minutes on each foot (totally twenty minutes). After the massage, the patient's anxiety level was measured and recorded. The control group did not receive any special intervention. and their anxiety was only checked and recorded right after the suctioning procedure and again 20 minutes later.

Data was analyzed using the SPSS software package (version 20)and descriptive and inferential statistics. First, the normal distribution of the data was checked by the Smirnov-Kolmogorov test. The distribution was not accordingly normal, except for age. Therefore, non-parametric tests, including Fisher's exact test, independent-samples t-test, Mann-Whitney U test, and Wilcoxon signed-rank test were utilized for data analysis. $P<0.05$ was considered as the significance level.

Results

The mean age of the study participants was 67.5±12.81 years old in the intervention group and 70.39±11.44 in the controls (age range of 25-75 years). Moreover, 55.6% of patients were female

and 44.4% were male. No statistically significant difference was observed between the two groups regarding demographic characteristics (p >0.05), implying their homogeneity before the intervention (Table 1).

Table 1: Characteristics of the participants in the intervention and control groups

Characteristic	Intervention	Control	*P*-value
Age(years) Mean±SD	67.5±12.81	70.39±11.44	0.603* t=-0.713
Gender, n (%)			
Female	10 (55.6)	10 (55.6)	1.000**
Male	8 (44.4)	8 (44.4)	
Underlying disease, n (%)			
Yes	15(83.8)	17(94.4)	0.603**
No	3 (16.7)	1(5.6)	
GCS, n (%)			
9	15(83.8)	12(66.7)	0.443**
10	3 (16.7)	6 (33.3)	
Receiving narcotic drugs, n (%)			
Yes	3 (16.7)	4(22.2)	1.000**
No	15(83.8)	14 (77.8)	
Airway type, n (%)			
Tracheal tube	16 (88.9)	17 (94.4)	1.000**
Tracheostomy	2 (11.1)	1 (5.6)	
Cause of hospitalization, n (%)			
Covid 19	15(83.8)	12(66.7)	0.553**
Pneumonia	2 (11.1)	3 (16.7)	
Stroke	1 (5.6)	3 (16.7)	
Contracting Covid 19, n (%)			
Yes	15(83.8)	12(66.7)	0.433**
No	3 (16.7)	6 (33.3)	
Smoking, n (%)			
Yes	1 (5.6)	1 (5.6)	1.000**
No	17 (94.4)	17 (94.4)	
Number of hospital days			
Mean Rank	17.69	19.31	0.650***
Number of intubation days			
Mean Rank	19.36	17.64	0.628***

*Independent sample t-test, **Fisher exact test, ***Mann-Whitney U

Table 2: Mean rank of anxiety caused by suction before and after intervention in the intervention and control groups

Time	Intervention	Control	Mann-Whitney U test
Before intervention (Mean rank)	16.94	20.06	Mann-Whitney U=134 p=0.389
After the intervention (Mean rank)	14.17	22.83	Mann-Whitney U=84 p=0.013
Wilcoxon test	p<0.001 Z=-3.83	p=0.001 Z=-3.57	

As well, the Mann-Whitney U test results at the pre-intervention stage revealed no significant difference in the levels of anxiety between the intervention and control groups (p=0.389). However, after the intervention, the control group obtained significantly higher scores in the levels of anxiety than the intervention group (p=0.013). Moreover, the Wilcoxon signed-rank test showed a significant difference between the levels of anxiety in the intervention group before and after the

FR implementation, that is, anxiety diminished after the intervention (p<0.001). Additionally, there was a significant difference between the levels of anxiety before and after the intervention program in the control group (p=0.001), and the levels of anxiety increased in the control group after 20 minutes (Table 2).

Discussion

This study aimed to investigate the impact of FR on SIA in mechanically ventilated patients admitted to ICUs. The results of the current research indicated no significant difference between the intervention and control groups in terms of demographic characteristics. Therefore, the intervention's effect could be more generalizable. Moreover, the study found that FR effectively reduced SIA in mechanically ventilated patients in the intervention group.

Anxiety is commonly known to activate the hypothalamus-pituitary-adrenal axis, increase cortisol levels, affect vital signs, raise myocardial oxygen demand, and potentially lead to death. With seven thousand nerves in each foot, the FR technique, a non-pharmacological intervention, stimulates these nerves to reduce anxiety and promote a balanced state in the body. Limited studies have been conducted on patients' anxiety caused by suction. In this regard, in study of Akin Korhan et al. (2014), 30 minutes of reflexology on their foot, hands and ears for five days led to a reduction in anxiety symptoms and calming the mechanically ventilated patients (38). In another study by Abbaszadeh et al. (2018), FR reduced anxiety levels in patients undergoing coronary artery bypass grafting (CABG) (33). Similarly, Bahrami et al. observed a decrease in anxiety levels in women with acute coronary syndrome after FR (39). In the investigations by Hasavari et al. (40) and Kahangi et al. (41), reflexology had further led to a decrease in anxiety in the patients experiencing coronary angiogram.

In contrast to the results of the present study, a study similar to the current design was conducted by Sadeghi Niaraki et al. (2022), which utilized the four-hand suction method (two hands for suction and the other two for support and touch) for premature infant under ventilation. The study focused on infants' anxiety through behavioral observations and no effect was found on the infant's anxiety within two minutes post-suctioning (42). Also, in the study of Peyrovi et al, there was no difference between facilitated tucking position and routine care in coping with stress in preterm infants during endotracheal suctioning (43). The inconsistency in the results of these studies and the current research is likely due to differences in the intervention type and the study population. In addition, Razmjoo et al. (2013) investigated the impact of FR on the levels of anxiety after planned Cesarean section (C-section). In the intervention group, the FR technique was performed for 10 minutes, two hours after the surgery. The levels of anxiety were measured at the pre- and post-intervention stages using a numerical rating scale (NRS). The study results accordingly revealed no significant difference between the two groups in terms of anxiety (44). Moreover, Kavei et al. (2013) conducted a trial on post-CABG anxiety, showing no significant differences between the intervention (20 minutes FR on the heart and lung reflex points), placebo (heel surface contact technique), and control groups (routine care) (45). The reasons for the inconsistency of the results in previous investigations and the present study may be differences in statistical populations, different environments and wards, and the methods of anxiety measurement.

One of the strengths of this study was the implementation of an intervention that was uncomplicated and well-tolerated by patients to decrease the stress induced by suctioning. One of the limitations of the current study was its overlap with the onset of the COVID-19 outbreak, coupled with constraints on time and workforce, resulting in an extended sampling period. To solve this problem, the researcher selected a hospital where she was employed in this manner; she had greater authority to intervene, which aided in expediting the work process.

Implications for practice

Given the efficacy of the FR intervention program on the level of anxiety of the MV patients in ICU, it was proposed to educate FR to the ICU nurses and patient's companions because it is cost-effective and straightforward technique for providing care to MV patients during suctioning. Further research is recommended on the use of this non-pharmacological intervention and other CAM methods on psychological variables, hemodynamic indicators, and suctioning-induced hypoxemia in mechanically ventilated patients. Additionally, conducting studies in a qualitative way can have a better

understanding of the effectiveness of this method in reducing the stress of patients during suction by analyzing the experience of patients who received this intervention.

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Conflicts of interest
The authors declared no conflict of interest.

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