



Experimental Study

The effect of foot reflexology on pain and anxiety of male patients with chest trauma: A randomized clinical trial

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Abstract

Objectives: This study ascertained how foot reflexology affected pain and anxiety in male chest trauma patients.

Methods: In Saveh, Iran, from November 2019 to January 2020, 49 chest trauma patients with blunt and penetrating chest injuries underwent this two-arm, double-blinded, and randomized controlled experiment. Patients were enrolled and randomly assigned to either the foot reflexology group (FRG) (n=25) or the control group (CG) (n=24), which received no treatment. The Visual Analog Scale and Spielberger state anxiety inventory, respectively, were used to assess each patient's pain intensity and anxiety before and after the intervention. After 25 min of reflexology on the reflection point in the right foot in the FRG, all treatments were carried out in the left foot. Apart from the intervention, patients in both groups were given routine care.

Results: Before the intervention, there was no significant difference between foot reflexology and CG in regards to pain severity (69.17±21.53 vs. 70.28±19.61, p=0.53) and anxiety (56.35±18.30 vs. 54.91±17.25, p=0.46). While after the intervention, pain severity and anxiety for the FRG (24.63±14.18, 23.71±10.25) were significantly less than the CG (63.46±20.17, 48.58±15.61) (p<0.001).

Conclusion: Foot reflexology in male patients with chest trauma reduces pain and anxiety without increasing side effects.

Keywords: Anxiety; chest trauma; complementary medicine; pain; reflexology.

Despite the increasing progress of science, technology, and industrialization of societies in recent decades, trauma is the leading cause of mortality and disabling conditions in individuals up to the age of 40.^[1,2] Traffic accidents are the most frequent cause of trauma-related mortality, accounting for around 90% of all fatalities in less developed countries.^[3] According to an Iranian study, 71.7% of patients admitted to the emergency room had head, neck, and chest trauma.^[4] Given the potential for harm to essential organs such as the heart, lungs, major arteries, and trachea, attention to chest trauma

is crucial. About 58.4% of cases of chest trauma are associated with complications to the pneumothorax, hemothorax, sternum, scapula, fracture of the clavicle and ribs, lung contusion, and heart damage.^[5,6] The leading cause of death or disability among young workers worldwide is trauma.^[3,7,8] In the United States, trauma kills 110,000 people annually and costs society \$117 billion.^[9]

In addition, 6000 out of every 100,000 disabilities per year are due to chest trauma.^[5] The most common complications of

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trauma include future disability, decreased sense of independence, stress, sadness, feelings of distress, mental disorders, maladaptation, and low self-esteem, which leads to severe anxiety and depression.^[10] Post-trauma hospitalization anxiety slows down the recovery and healing process. Patients with anxiety disorders experience a negative impact on their quality of life, which can be quite crippling in severe situations.^[9,11,12]

Pain is another typical ailment experienced by patients with chest injuries. According to Bijani et al.,^[5] 87.4% of patients with chest trauma complained of pain. Actual or potential tissue injuries bring on pain, which can be a distressing and emotional experience.^[13,14] Despite improvements in pain management methods, half of patients admitted to clinical settings still report moderate-to-severe pain.^[15,16] Health-care providers' knowledge of the physiology of pain and anxiety is critical.^[17] Opioids and non-steroidal anti-inflammatory medications, respectively, are used to lessen mild-to-moderate and severe traumatic acute pain. Although such drugs lessen severe pain, they are expensive and have several negative effects.^[18] Some side effects in the upper gastrointestinal system include ulcers, perforation and bleeding, constipation, nausea, or vomiting. Other adverse effects include dry mouth, increased tolerance or reliance, dizziness and sleepiness, pruritus, somnolence or cognitive impairment, and urine retention.^[19] Complementary and alternative medicine (CAM) is a new, low-cost, and safe method widely used to treat and control complications of various diseases in developed and developing countries.^[20,21]

Reflexology as a complementary medicine modulates blood pressure, reduces stress levels, improves gastrointestinal function, and relieves nervous tension.^[12,14,22] Reflexology is the science of stimulating points (usually on the soles of the feet or palms) associated with internal organs and is one of the six most widely used CAM methods in European countries.^[23] One of the reflexology techniques is Rwo Shur, which is used in many parts of Asia. Joseph Eugster developed this approach in Taiwan. The Rwo Shur method combines the thumb-sliding and pressure techniques. A session usually lasts about 30 min.^[24,25] Using special techniques, massaging particular points on the soles of the feet improves body homeostasis, boosts the immune system, and increases blood circulation to the organs at each point of the foot.^[15,20] Several ideas outlined the mechanisms of reflexology. One is the pain relief gate control theory, which contends that massage has analgesic properties.^[26] The second idea is that massage can calm the patient and lessen pain by enhancing endorphin release, stimulating the parasympathetic nervous system, and lowering the levels of stress and anxiety hormones.^[26,27] Anxiety stimulates the secretion of epinephrine and norepinephrine, which increases myocardial oxygen demand, heart rate, blood pressure, and respiratory rate. Increased heart workload leads to a higher risk of dysrhythmia and ischemia.^[28,29]

Reflexology as a non-invasive and low-cost intervention can

What is presently known on this subject?

- Trauma is the leading cause of mortality and disabling conditions in humans. Pain and anxiety are common discomforts experienced by patients with chest trauma.

What does this article add to the existing knowledge?

- This article focuses on the use of complementary treatments, such as foot reflexology, as one of the non-pharmacological ways to alleviate pain. Specifically, it reveals that foot reflexology reduces pain and anxiety in male patients with chest trauma without any side effects.

What are the implications for practice?

- The use of complementary treatments like foot reflexology presents an effective and safe approach to managing post-trauma pain and anxiety. These findings support a trend towards the adoption of non-pharmacological methods in health practices and encourage a broader acceptance of such treatments.

be performed while maintaining patient privacy^[22,30,31] and can always be a way to increase communication between nurse and patient.^[32] Modern nursing is based on comprehensive care, including treating the patient's body and overall wellness. Reflexology, a well-known CAM branch, can be included in nursing care.^[33] Researchers determined the impact of FR on pain and anxiety in male patients with chest trauma due to the paucity of research on the benefits of complementary medicine interventions in nursing on the reduction of trauma-related physical effects, such as pain and anxiety. Due to cultural and religious considerations, this study was conducted only on male patients. The study hypotheses were:

1. Foot Reflexology reduces the pain severity of male patients with chest trauma
2. Foot Reflexology reduces the anxiety of male patients with chest trauma.

Materials and Method

Design and Setting

This two-arm, double-blinded, randomized, and controlled trial was conducted in the surgical ward at the Shahid Modarres Hospital in Saveh, Iran. The study was registered on the Iranian Registry of Clinical Trials (No. IRCT20161223031522N12, date: November 02, 2019). Patients hospitalized between November 2019 and January 2020 with chest trauma were eligible.

Participants

The sample size was determined at 27 patients for each group based on prior research,^[24] with a power of 80% and α of 0.05, using G-Power software version 3.0.10. Sixty-eight male patients) 45.21 ± 14.17 years (with blunt and penetrated chest trauma were assessed for the study, and the final sample included 56 patients. Patients were recruited by convenience sampling method and were randomly assigned to either the foot reflexology group (FRG) ($n=28$) or the control group (CG) ($n=28$). Three FRG patients and four CG patients were excluded from the study (Fig. 1).

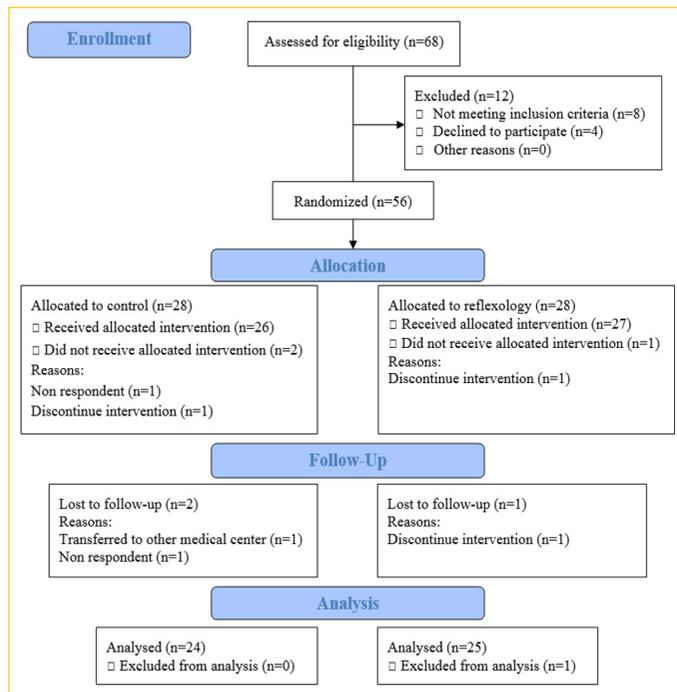


Figure 1. The process of study.

A coin toss was used by the research assistant to randomly place patients in the FRG or CG. The research assistant then assigned participants to the FRG and CG. The patients' group membership was hidden from the participants and the researcher performing the analysis. These criteria were required for inclusion: Willingness to participate in the study, absence of any foot skin disorders (such as fungus, psoriasis, freckles, any ulcers including diabetic foot ulcer), age between 18 and 65 years, full consciousness after hospitalization, no history of anxiety disorders, and no use of anti-anxiety drugs based on patient statements and medical records. The exclusion criteria were: Chronic pain (such as back pain caused by lumbar disc, migraine headaches, pain caused by sciatica, rheumatic diseases, osteoarthritis, etc.), history of sedatives consumption in the past 3 months, use of other complementary therapies during the study, participation in an exercise program at the last 6 months, withdrawal to continue study participation and transfer to another hospital.

Data Collection Tools

Demographic and medical history data were collected from the patient's medical record. Demographic characteristics included age, marital status, level of education, location, and type of trauma, cause of trauma, and duration of hospitalization. Demographic information and medical history were obtained from the patients' medical records. Age, marital status, level of education, trauma site and type, trauma cause, and medical history were some of the demographic factors.

The visual analog scale (VAS), a subjective, validated tool to quantify acute and chronic pain with excellent reliability, was used to measure pain.^[18,34] A 10-cm line was provided to the

participants, and they were instructed to make a handwritten mark down it. With values ranging from 0 to 10, this scale illustrates a continuum of pain. Based on a Likert scale with four categories for pain: no pain (0–4 mm), mild pain (5–44 mm), moderate pain (74–45 mm), and severe pain (75–100 mm), the data obtained.

The Spielberger state anxiety inventory (SAI) was used to measure anxiety. This tool consists of 20 items to assess a person's manifest anxiety. The four options on the Likert scale, which range from extremely low to very high, were used for the items' design. Scores of 20–31 indicate mild anxiety; 32–42, moderate to low; 43–53, moderate to high; 54–64, moderate; 65–75, severe; and 76 and above, very severe anxiety. Iranian studies confirmed SAI's validity and reliability.^[29,35] The Cronbach alpha coefficient was calculated as 0.89 for the SAI, which confirms its internal consistency.

Procedure

Due to cultural and religious considerations in performing reflexology for the male patient by the male nurse, all interventions in the FRG were performed by the male researcher, a qualified reflexologist and a master of medical-surgical nursing with seven years of experience in critical care. However, including only male candidates helped us remove the effects of confounders such as gender. The Rwo Shur method of reflexology was used in FRG. Liquid paraffin without essence was used to facilitate massage. After full consciousness, in a private room, the patient was positioned in a comfortable position, and a small pillow (with no movement restriction) was placed under his knees. The intervention was then performed on the right leg. The foot was massaged for five min to warm up and increase blood flow, and reflexology started. Reflexology was implemented on the reflection point of the brain (the pituitary gland in the big toe, the pineal gland above the pituitary gland of the big toe, to the middle of the base of the big toe) for three min, the solar plexus (central nervous system reflection point) for two min, diaphragm reflection point for three min, thyroid reflection point for three min, adrenal gland reflection point for three min, gastric re-

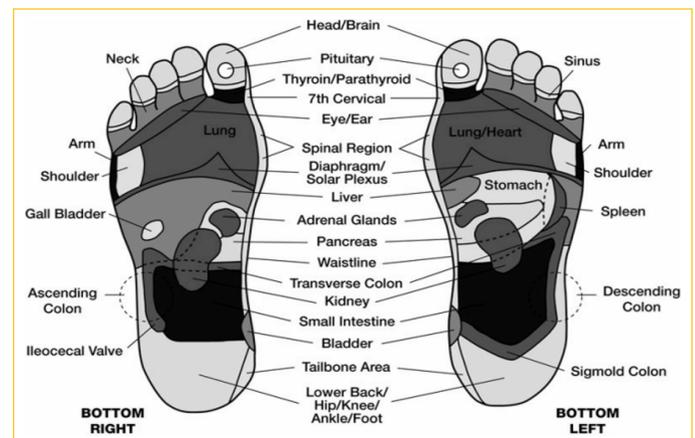


Figure 2. The foot reflexology points.^[45]

flexion point for three min, and trapezius muscle reflection point for three min (25 min)^[36] (Fig. 2). Then, the same protocols were performed on the left foot. Reflexology was performed for three consecutive days, with slow speed, regular rhythm, and depths of 1–3 mm.^[24,37] Besides the reflexology intervention, patients in the CG received the standard care provided in the study setting.

The VAS, which was made as a ruler, was marked by the patients themselves immediately after the intervention. The SAI was then completed by the patients, aided by the patients' relatives on the day after the intervention. Researchers were not involved in completing the questionnaires. A trained researcher assistant gathered the data.

Statistical Analysis

The normality of data distribution was examined using the Kolmogorov–Smirnov test. Frequency, percentage, mean, and standard deviation were used to analyze the individual characteristics of the patients. Using the independent sample t-test and Chi-square test, the homogeneity of groups for demographic and clinical characteristics of the patients was evaluated. The difference between the anxiety and pain severity scores in the two study groups at baseline and after intervention was compared using the independent t-test. The researchers used a paired t-test to evaluate the mean changes in the outcome variables after intervention compared to the baseline. The significance level for the data analysis was set at <0.05 using SPSS software ($p < 0.05$).

Ethical Considerations

The Baqiyatallah University of Medical Sciences Ethics Committee approved this study (IR.BMSU.REC.1398.206). This study considered the Helsinki Declaration, the Tehran Declaration of Ethics in Medical Research, and the guidelines of the Committee on Publishing Ethics. The study was voluntary for all participants. All participants gave their consent verbally and in writing. The patients, their families, hospital nurses, and managers explained the study's goal and methodology. Forms and inventories were filled out anonymously without participant names or identification. The patients paid no money while participating in the trial. They could leave the study whenever they wanted without loss of benefits.

Results

The mean age was 45.21 ± 14.17 . Most participants were married, had a high school education, and had a history of car accidents. Table 1 shows that the individual characteristics of the two groups were homogeneous ($p > 0.05$). Before the intervention, there was no significant difference between the two groups in terms of anxiety or pain severity ($p = 0.46$ and 0.53 , respectively). However, after the intervention, the pain severity ($p < 0.001$) and anxiety ($p < 0.001$) in the FRG were significantly less than the CG, as demonstrated in Tables 2 and 3.

Table 1. Individual characteristics in the foot reflexology and control groups

Variables	Groups		P-value
	Foot reflexology n (%)	Control n (%)	
Marital status			
Single	8 (10.49)	9 (11.85)	0.29 ^a
Married	14 (18.36)	12 (15.80)	
Widowed	2 (2.62)	3 (3.95)	
Divorced	1 (1.31)	0 (0)	
Level of education			
Primary education	9 (11.80)	10 (13.16)	0.43 ^a
High school degree	12 (15.74)	11 (14.48)	
Academic education	4 (5.24)	3 (3.95)	
Cause of trauma			
Car accident	12 (15.74)	15 (19.75)	0.56 ^a
Motorcycle accident	9 (11.80)	6 (7.90)	
Falling	3 (3.93)	1 (1.31)	
Quarrel	1 (1.31)	2 (2.62)	
	Mean±SD	Mean±SD	
Age (year)	45.65±11.45	49.12±12.65	0.42 ^b
Duration of hospitalization (day)	9.21±4.23	10.37±5.28	0.19 ^b

^aChi-square; ^bt-test. SD: Standard deviation.

Table 2. Comparison of patients' pain severity in the foot reflexology and control groups

Variables	Groups		P-value
	Foot reflexology Mean±SD	Control Mean±SD	
Pain			
Before intervention	69.17±21.53	70.28±19.61	0.53 ^b
After intervention	24.63±14.18	63.46±20.17	
p	0.001 ^a	0.38 ^a	

^apaired t-tests; ^bt-test. SD: Standard deviation.

Table 3. Comparison of patients' anxiety in the foot reflexology and control groups

Variables	Groups		P-value
	Foot reflexology Mean±SD	Control Mean±SD	
Anxiety			
Before intervention	56.35±18.30	54.91±17.25	0.46 ^b
After intervention	23.71±10.25	48.58±15.61	
p	0.001 ^a	0.36 ^a	

^apaired t-tests; ^bt-test. SD: Standard deviation.

The paired t-test showed a decreasing trend of pain ($p < 0.001$) and anxiety ($p < 0.001$) in the FRG after the trial, while the CG outcome variables had no significant difference ($p > 0.05$).

Discussion

This study ascertained how foot reflexology affected chest trauma patients' pain and anxiety. At the beginning of the study, pain severity was moderate to high in the two study groups, and there was no significant difference between them. However, the pain severity differed in the two study groups after the intervention. The pain severity in the FRG was significantly reduced compared to the CG. Pain is a stressor in the body system; any trauma to any part of the body has a negative effect on the whole system. Endorphins are natural sedative chemicals released by the body in response to reflexology.^[20] Reflexology releases endorphins and enkephalins, which are at least five times more analgesic than morphine, by opening the nerve pathways overloaded with sensory impulses.^[38] In another study of massage therapy's effect on pain severity in orthopedic patients, the difference in mean pain severity before the intervention was not statistically significant between the two study groups. However, the intervention group's pain intensity was significantly lower than the CG, indicating that massage therapy helped these patients feel less pain.^[39] The findings of another study that looked at how reflexology affected rheumatoid arthritis patients' pain and sleep deprivation revealed that while the mean pain severity and sleep quality score before the intervention were not significant, the severity of pain after reflexology in the intervention group was significantly lower than the CG.^[36] An investigation into the impact of reflexology on post-appendectomy pain intensity found that although there was no immediate difference between the reflexology, placebo, and CGs before and after the intervention, at 10 min and 24 h later, the reflexology group's pain intensity was significantly lower than that of the other two study groups.^[40]

The two groups did not significantly differ in anxiety severity in this study. However, when the trial ended, the two study groups' levels of anxiousness were different. The results indicated that the FRG experienced much less severe anxiety than the CG when compared to each group. Foot reflexology helps balance the energy throughout the physical structure and modulates the nervous system to relieve the psychological symptoms of stress by reducing anxiety and muscle tension, calming the mood, and facilitating the feeling of well-being.^[12] In another study on the effect of reflexology on pain severity and anxiety following hysterectomies, the mean pain and anxiety intensity in the intervention group were significantly less than in the CG 30 and 60 min after treatment.^[37] In another study conducted to investigate the effect of reflexology on the severity of anxiety in patients candidate for bronchoscopy, reflexology reduced anxiety, and improved physiological parameters of patients.^[41] However, in another study that investigated massage therapy's effect on anxiety

and pain in burn patients, the mean pain severity and level of anxiety before and after massage therapy had no significant difference.^[42] McCullough et al.^[43] conducted a systematic review investigating reflexology's physiological and biochemical outcomes. They demonstrated that 17 trials reported no adverse effects from reflexology, which is consistent with our findings, and reflexology reduced patients' anxiety and pain levels in those trials. Evidence suggested that FR was made to relax the body while coordinating biological functions. Such a concept is predicated on the idea that reflex areas in the feet and hands correspond to the glands, organs, and body parts.^[44] Up to now, we have found no study evaluating the impact of FR on pain and anxiety management in chest trauma patients. So, based on the present study and other mentioned evidence, it is suggested to use the FR to reduce pain and anxiety in patients with chest trauma due to low cost, easy usage, and lack of side effects. We recommend more studies comparing the analgesic effects of FR to those of other chemical drugs.

Limitations

The small sample size of this study was one of its limitations. In addition to the small sample size, the study was performed at a single clinical center. Therefore, the generalizability of the findings may be affected. Another limitation of this study was that it was performed only on male patients due to cultural considerations, so it could not be generalized to the whole community. For future studies, we recommend investigating reflexology's effect on female patients.

Conclusion

Overall, the results demonstrated that FR succeeded in lowering chest trauma patients' pain and level of anxiety. Therefore, both hypotheses of the research were confirmed. Given that any research leads to identifying new issues in the clinical setting, the researchers hope this research can provide a background for future studies. Considering the importance of independent nursing interventions in enhancing the quality of life in patients with chest trauma, training nursing students to explain the concepts of CAM and their application in patient care seems necessary. Clinical nurses can use the findings of this study to provide comprehensive and holistic care to manage the problems of patients with chest trauma.

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