



Research paper

The effects of foot reflexology on anxiety and physiological parameters among candidates for bronchoscopy: A randomized controlled trial

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ABSTRACT

Introduction: Patients who are about to undergo invasive diagnostic procedures are usually anxious and worried. High levels of anxiety can interfere with the successful implementation of procedures and threaten patient well-being. Foot reflexology has been shown to be effective in alleviating anxiety and stabilizing physiologic status among different patient populations. Nonetheless, there is inadequate evidence regarding the effects of the technique on patients who are candidates for bronchoscopy. The aim of this study was to assess the effects of foot reflexology on anxiety and physiological parameters among the candidates for bronchoscopy.

Methods: This study was a randomized controlled trial on 80 candidates about to undergo a bronchoscopy. Subjects' anxiety, heart rate, respiratory rate, diastolic and systolic blood pressures, and arterial oxygen saturation were measured thrice, i.e. before foot reflexology, immediately after reflexology, and immediately before bronchoscopy.

Results: Contrary to the control group, variations of anxiety, heart rate, respiratory rate, diastolic and systolic blood pressures, and arterial oxygen saturation were statistically significant in the reflexology group ($P < 0.05$).

Conclusion: Foot reflexology alleviates anxiety and improves physiological parameters among the candidates for bronchoscopy. Consequently, it may be used as a non-invasive non-pharmacological remedy for subjects who are on the waiting lists for invasive diagnostic procedures such as bronchoscopy.

1. Introduction

As a diagnostic and therapeutic technique, fiberoptic bronchoscopy is widely used to assess patients with pulmonary diseases [1]. It is the direct observation and examination of the larynx, trachea, and bronchi by using a flexible fiberoptic bronchoscope. Fiberoptic bronchoscopy is the best method for examining the respiratory system [2].

Endoscopic procedures, including bronchoscopy, always cause anxiety, stress, and discomfort for patients [3]. Procedural anxiety happens due to factors such as fear from the unknown, prediction of pain and discomfort, concerns over the diagnosis or prognosis of the underlying conditions, and lack of control during the procedure [4]. Bernasconi et al., reported that 51% of patients who undergo bronchoscopy are anxious [5].

Pre- and intra-procedural anxiety can increase myocardial oxygen demand and cause different physiological complications such as tachycardia and tachypnea, reduce patients' tolerance, and prolong recovery time [6,7]. Due to the serious complications of anxiety,

developing and using medical and nursing anxiety-management strategies seem essential [8]. According to Andrychiewicz et al., relieving anxiety of patients particularly who have not undergone bronchoscopy previously is one of important responsibilities of the medical staff [9].

There are different pharmacological and non-pharmacological treatments for anxiety. Due to the short-term effects and the different side effects of pharmacological treatments, the use of non-pharmacological remedies for anxiety is increasing progressively. Reflexology, particularly foot reflexology (FR), is one of the non-pharmacological remedies which is widely used for pain and anxiety management [10]. Not only FR reduces stress and tension, improves tissue perfusion, and promotes homeostasis, but also it is considered as a strategy to strengthen nurse-patient relationship [11]. In FR, a healer uses his/her fingers to press reflex points on the feet in order to restore patients' health and promote homeostasis [12].

Many studies have so far investigated the effects of reflexology—as a non-invasive nursing intervention—in different situations. These studies reported the effectiveness of reflexology in alleviating pain and

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anxiety among cancer patients [13,14], improving the sleep quality and reducing the fatigue [15] shortening the length of mechanical ventilation weaning time [16] decreasing vasomotor problems and increasing quality of life [17] reducing blood pressure, triglyceride, and blood sugar [18], alleviating depression, promoting immune function [19], boosting mood, and reducing systolic and diastolic blood pressures (SBP and DBP), heart rate (HR), and general fatigue [20]. However, Gunnarsdottir and Jonsdottir found reflexology ineffective in alleviating pre- and post-operative anxiety among the candidates for coronary artery bypass graft surgery [21].

The results of our brief literature review showed that no study had yet investigated the effects of FR on anxiety among the candidates for bronchoscopy even though some studies evaluated the effects of other non-pharmacological remedies such as relaxation [22], multimedia education [23], verbal empathy and touch [18] and intra-procedural music therapy [24] on state anxiety and patients' tolerance during bronchoscopy. Some of these studies reported that these remedies had no considerable effect on patients [23,25]. Consequently, the present study was done to provide further evidence concerning the effectiveness of reflexology. The aim of the study was to assess the effects of FR on anxiety and physiological parameters among the candidates for bronchoscopy.

2. Materials and methods

2.1. Design

This was a randomized controlled trial.

2.2. Participants

Eighty patients who were candidates for bronchoscopy were recruited conveniently from Shariati teaching hospital that is affiliated to Tehran University of Medical Sciences, Tehran, Iran. During sampling, totally, 163 patients were assessed for eligibility, among them 83 patients were excluded because of not meeting the inclusion criteria ($n = 66$) and refusal of participation ($n = 17$). The enrolled patients were randomly allocated to two 40-person groups, i.e. the control and the reflexology groups. Random allocation was performed by using the drawing method. Accordingly, for each two patients who were recruited, a coin was tossed to determine their group allocation. All patients had a fifty-fifty chance for being allocated to either group. Sampling was done sequentially from throughout 2015 and was continued until adequate numbers of patients were recruited into the study. There was no loss to follow up in the study.

Eligibility criteria were; aged between 18–60, able to communicate verbally, full consciousness, no lesion or disorder on the feet and other conditions affecting the feet (such as diabetes mellitus, neurological disorder), no previous history of bronchoscopy or participation in similar studies, no necessity to undergo emergency bronchoscopy, no history of psychological or anxiety disorders (based on patients medical records or on a self-report basis), no acute pain, no dependence on opioids, alcohol, or strong tranquilizers, no use of such substances in the last week before recruitment to the study, no vision disorder interfering with patients' ability to show the level of their anxiety on a visual analogue scale, and no active bleeding disorder. Those patients who voluntarily withdrew from the study or their bronchoscopy was cancelled were excluded.

2.3. Measurement tools

Study data were gathered by using the following three tools:

1. A demographic characteristics and clinical history questionnaire which was filled out by the second author through doing personal interviews with the participants one day before undergoing the

procedure.

2. The Visual Analogue Scale for anxiety measurement (VAS 0–10): The VAS 0–10 is a scalar self-report scale on which people can rate the level of their anxiety from 0 to 10. Higher scores stand for higher levels of anxiety. The VAS 0–10 is a standard tool which has been frequently used in previous studies and has been reported to have satisfactory validity and reliability (24 and 25).
3. A data sheet for documenting patients' physiological parameters including DBP, SBP, HR, respiratory rate (RR), and arterial oxygen saturation (SaO_2): HR was measured by counting the number of radial pulse while RR was measured by counting the number of respirations in one whole minute. Moreover, DBP, SBP, and SaO_2 were measured by using a vital signs monitoring device. The device was calibrated before data collection. Besides, as the time interval between the reflexology intervention and bronchoscopy procedure was not equal for all patients, we measured and documented this time interval for the patients of both groups.

2.4. Intervention

All foot reflexology interventions were done by the second author who is the qualified therapist (trained and certified in an accredited educational institution in Iran, and with 3 years of experience).

On the morning of their bronchoscopy, the therapist implemented FR for each of the patients in the reflexology group after measuring their baseline anxiety and physiological parameters. Accordingly, the intended patient was placed on a bed in supine position in a private room and the therapist stood at the bottom of the bed so that the patient and the therapist were face to face. Then, the therapist rubbed the palmar surfaces of her hands against each other in order to warm her hands. After that, the dorsal and the plantar surfaces of one foot were lubricated (by sesame oil) and massaged to be warmed for five minutes while the other foot was covered with a piece of towel. Thereafter, the pituitary, solar plexus, heart, and lung reflex points of the lubricated foot were massaged for ten minutes. Finally, the same intervention was implemented on the other foot. In total, reflexology massage of both feet lasted for 30 min. Anxiety and physiological parameters assessment for the patients in the reflexology group was performed at three measurement time points namely before FR (T1), immediately after FR (T2), and immediately before bronchoscopy (T3). Assessments at T3 were performed in the bronchoscopy room while the patient was placed on a bronchoscopy bed and was going to undergo the procedure.

The patients in the control group were placed in the same environment and solely received the care services routinely provided to all patients in the study setting without any FR. Anxiety and physical parameters assessment in this group was also performed at the same place and time points as the reflexology group, i.e. on the morning of bronchoscopy (T1), half an hour after T1 (T2), and immediately before bronchoscopy (T3). It is worthy of note that neither medication therapy nor local anesthesia was administered to the patients before data collection. Moreover, none of the patients in the reflexology and the control groups met each other during the intervention. See Fig. 1 for a Consolidated Standards of Reporting Trials (CONSORT) flow diagram.

2.5. Statistical analysis

Analysis of the data was done via the SPSS software (version 16.0). Those variable which had been measured at ratio or interval levels were described by using mean and standard error of mean (SE) while nominal and categorical variables were presented by using raw and relative frequencies. The groups were compared with each other through running the independent-sample t , the Chi-square, and the Fisher's exact tests. Moreover, the repeated measures analysis of variance (RM ANOVA) and the Bonferroni's post hoc test were carried out in order to compare the variations of anxiety, DBP, SDP, HR, RR, and SaO_2 across the three measurement time points. The level of significance was

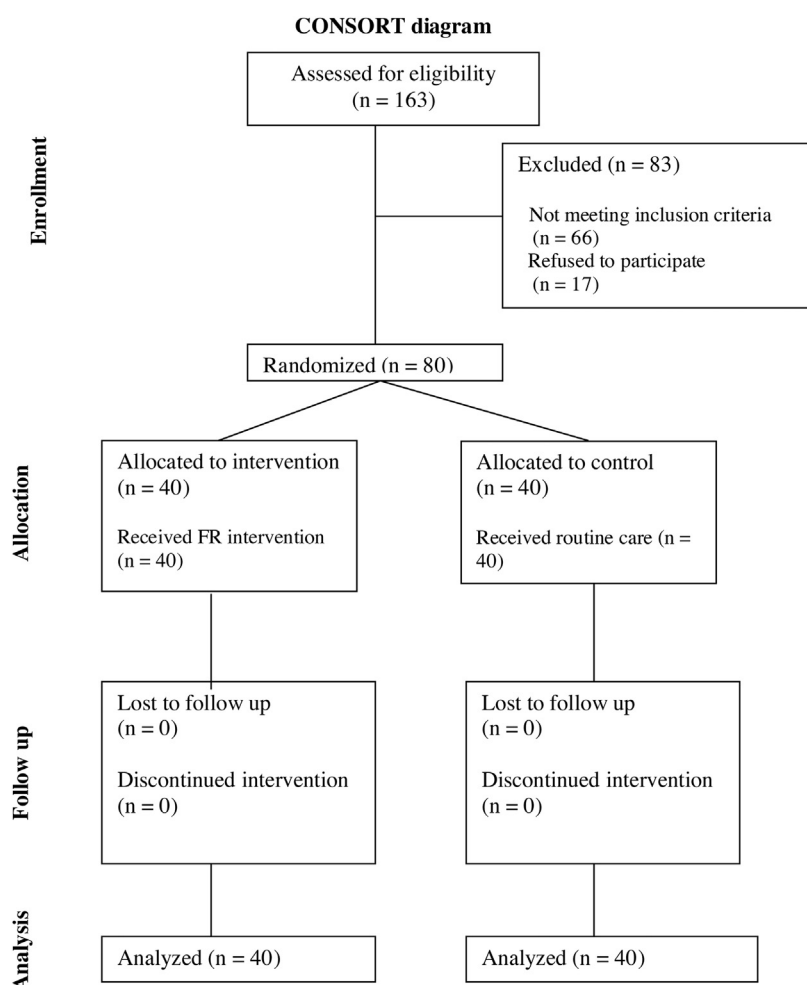


Fig. 1. Consolidated Standards of Reporting Trials (CONSORT) flow diagram.

considered to be less than 0.05.

2.6. Ethical considerations

The first author visited eligible patients one day before bronchoscopy and briefly explained the aims and the flow of the study to them, ensured them about the confidentiality of the data and the safety of the study intervention, and obtained their written informed consent. The study was approved by the Ethics and Research Committee of Tehran University of Medical Sciences, Tehran, Iran. Moreover, Iranian Registry of Clinical Trials registered the study. The ethical approval and the registry codes were 130.16229 and IRCT2014091319141N1, respectively.

3. Results

The independent-sample *t*, the Chi-square, and the Fisher's exact tests showed no significant between-group differences regarding the patients' demographic characteristics (including age, gender, place of residence, and marital, employment, and educational status), underlying conditions, chief complaints, the necessity to perform bronchoscopy from their own perspectives, and their attitudes towards massage therapy as a palliative and therapeutic measure. Therefore, the groups were homogenous regarding the above-mentioned characteristics (Table 1). Moreover, the independent-sample *t*-test revealed that between-group differences in terms of the mean scores of baseline anxiety, DBP, SBP, HR, RR, and SaO₂ were not statistically significant (Table 2). Furthermore, the means of the time intervals between T2 and T3 in the reflexology and the control groups were 28.02 ± 2.83 and

Table 1
Participants' demographic characteristics at baseline by study group.

Variables		Intervention group N = 40	Control group N = 40	P value
Age (Years) (Mean \pm SE)		45.55 \pm 1.78	48.23 \pm 1.72	0.28
Gender	Male	21 (52.5%)	20 (50%)	0.82
	Female	19 (47.5%)	20 (50%)	
Marital status	Married	32 (80%)	33 (82.5%)	0.77
	Unmarried	8 (20%)	7 (17.5%)	
Educational status	Illiterate	6 (15%)	7 (17.5%)	0.79
	Below diploma	20 (50%)	18 (45%)	
	Diploma	7 (17.5%)	10 (25%)	
	University	7 (17.5%)	5 (12.5%)	

Table 2
Baseline values of patients' anxiety and physiological parameters by study group.

Variables	Reflexology group N = 40	Control group N = 40	P value (The independent-sample <i>t</i> test)
	Mean \pm SE	Mean \pm SE	
Anxiety	4.35 \pm 33.0	3.78 \pm 29/0	0.2
SBP (mm Hg)	125.65 \pm 78/2	122.25 \pm 63/2	0.37
DBP (mm Hg)	82.2 \pm 80/1	79.95 \pm 95/1	0.4
HR	95.8 \pm 03/3	90 \pm 83/2	0.16
RR	23.35 \pm 93/0	22.55 \pm 72/0	0.49
SaO ₂ (%)	94.6 \pm 49/0	94.85 \pm 42/0	0.7

Table 3

Comparisons of the groups at different measurement time points with regard to the variations of anxiety and physiological parameters.

Variable		Before the intervention (T1) Mean \pm SE	After the intervention (T2) Mean \pm SE	Before bronchoscopy (T3) Mean \pm SE	P value (RM ANOVA) P-value
Anxiety	Intervention	4.35 \pm 0.33	2.70 \pm 0.22 ^c	2.83 \pm 0.23 ^d	> 0.001
	Control	3.78 \pm 0.29	3.85 \pm 0.30	4.88 \pm 0.34	
SBP (mm Hg)	Intervention	125.65 \pm 2.78	116.37 \pm 2.38 ^c	119.87 \pm 2.43 ^d	> 0.001
	Control	122.25 \pm 2.63	120.87 \pm 2.70	130.98 \pm 2.98	
DBP (mm Hg)	Intervention	82.2 \pm 2.63	76.55 \pm 1.69 ^c	80.65 \pm 1.97 ^{d,*}	> 0.001
	Control	79.95 \pm 1.95	79.73 \pm 2.11	86.88 \pm 2.23	
HR	Intervention	95.8 \pm 3.03	83.72 \pm 2.52 ^c	89.23 \pm 2.76 ^{d,*}	> 0.001
	Control	90 \pm 2.83	91.40 \pm 2.83	101.70 \pm 2.88	
RR	Intervention	23.35 \pm 0.93	21.78 \pm 0.76 ^c	22.37 \pm 0.88 ^{d,*}	> 0.001
	Control	22.55 \pm 0.72	22.53 \pm 0.69	24.58 \pm 0.37	
SaO ₂ (%)	Intervention	94.6 \pm 0.49	95.45 \pm 0.36 ^c	95.97 \pm 0.37 ^{d,*}	0.004 ^{c,d,*}
	Control	94.85 \pm 0.42	94.75 \pm 0.40	95.23 \pm 0.32	

^c The Bonferroni's test showed significant difference between T1 and T2 (P < 0.05).^d The Bonferroni's test showed significant difference between T2 and T3 (P < 0.05).^{*} The Bonferroni's test showed significant difference between T1 and T3 (P < 0.05).

27.7 \pm 2.74 min, respectively. There was no significant difference between the groups regarding this time interval (P = 0.93).

The results of the RM ANOVA illustrated a significant difference between the groups regarding the variations of anxiety mean scores across the three measurement time points (P < 0.001). The Bonferroni's post hoc test revealed that in the reflexology group, there were significant differences between T1 and T2 and also between T2 and T3 regarding the mean scores of anxiety (P < 0.001), denoting a significant decrease in the mean score of anxiety between these time points in this group. However, the difference between T1 and T3 was not statistically significant (P = 0.46; Table 3).

The results of RM ANOVA also showed significant differences between the groups regarding the variations of DBP, SBP, HR, and RR across the three measurement time points (P < 0.001). The trends of these variations in the reflexology group were mainly downward. Moreover, the level of SaO₂ in the reflexology group increased significantly across the measurement time points (P < 0.001) and the between-group difference in terms of the variations of SaO₂ was statistically significant (Table 3).

The results of the Bonferroni's post hoc test also showed significant differences between T1 and T2, T1 and T3, and T2 and T3 regarding the levels of DBP, HR, and SaO₂ in the reflexology group, denoting significant decreases in the levels of DBP and HR and a significant increase in the level of SaO₂ in this group (P < 0.05). Moreover, in this group, the differences between T1 and T2 as well as T2 and T3 regarding the levels of SBP were statistically significant while the difference between T1 and T3 was not significant (P = 0.59). The results of the same test illustrated that none of the differences between the measurement time points were statistically significant in the control group (P > 0.05; Table 3).

4. Discussion

The results of the present study showed that FR was effective in alleviating anxiety among the candidates for bronchoscopy. The level of anxiety among patients in the reflexology group decreased but in the control group increased from T1 to T2 and the difference between two groups was significant (P < 0.001). Moreover, compared with T2, the level of anxiety in both groups increased slightly at T3. The amount of this increase in the reflexology group (from 2.70 \pm 0.22 to 2.83 \pm 0.23) was so small that it might be clinically insignificant. These increases in the levels of anxiety in both groups at T3 can be attributed to fear of the unknown and procedural fear.

The study findings also revealed significant decreases in the levels of DBP, SBP, HR, and RR and a significant improvement in the level of SaO₂ at T3 in the reflexology group. Although the changes in the levels

of RR and SaO₂ were statistically significant, they were so marginal that could not be considered clinically significant. However, changes in the levels of DBP, SBP, and HR not only were statistically significant, but it may be considered clinically significant. Measurements at T3 were performed immediately before bronchoscopy while the patients were placed on a bronchoscopy bed in the bronchoscopy unit. At this time, they received oxygen therapy at a rate of 3–5 liters per minute. Accordingly, the level of SaO₂ increased in both groups at T3 as compared with T1 even though the increases were small and clinically insignificant (Table 3).

As a non-pharmacological intervention, FR has been used in different studies. For instance, Quattrin et al., and Stephenson et al., reported the effectiveness of reflexology in alleviating anxiety and pain among patients suffering from cancer receiving chemotherapy [13,14]. The results of the present study were also in line with the findings of Jirayingmongkol et al. regarding the effect of FR to promote blood flow, calms patients, and gives them a sense of well-being [26]. Kahnagi et al., also investigated the effects of reflexology on the level of anxiety among patients who were going to undergo a coronary artery bypass graft surgery. During their intervention, they massaged the pituitary, solar plexus, liver, and heart reflex points for 30 min and employed Spielberger's State Anxiety Inventory to measure the level of anxiety among their participants before and after their intervention and one day before the surgery. They finally concluded that their reflexology intervention significantly alleviated the level of anxiety (P < 0.001) [27].

Some studies also showed the effectiveness of other types of massage therapy on patient outcomes. For instance, Rho et al. found that aromatherapy massage significantly alleviated anxiety among Korean elderly women (P < 0.05). However, they did not differentiate whether alleviation of anxiety was due to their aromatherapy, massage therapy, or both interventions [28], while in the present study, we investigated the pure effects of FR. With regard to the mechanism of action of FR, previous studies have reported that stimulating the feet during reflexology activates the parasympathetic nervous system and inhibits the sympathetic nervous system and thus, alleviates the symptoms of stress and anxiety [29–31]. Besides, Kuhn reported that FR suppresses the hyperactive points and activates deactivated points in the body and thereby, promotes homeostasis and tranquility in the body [29].

The findings of the present study were also in agreement with the findings of the previous studies which reported the effectiveness of different reflexology techniques in alleviating physiological parameters among different patient populations and in different settings. For example, Kaur et al. found that reflexology significantly reduced HR and SBP and increased DBP and SaO₂ among critically-ill patients

hospitalized in intensive care units [30]. Hayes and Cox also implemented a five-minute foot massage on 25 patients who were hospitalized in intensive care units and found it effective in reducing HR, RR, and mean arterial pressure and calming patients [31]. Furthermore, Mackereth et al. reported that reflexology promoted muscular relaxation and reduced SBP among patients with multiple sclerosis [32]. However, contrary to our findings, Elisabet et al. found that three 40-min sessions of FR significantly increased HR and blood pressure among healthy people [33]. Similarly, the results of a study made by Somchock illustrated that FR significantly increased DBP among patients with hypertension [34]. Gunnarsdottir and Jonsdottir also found that reflexology had no significant effects on anxiety among patients who were to undergo coronary artery bypass graft surgery [21]. These contradictory findings may be due many factors such as the differences in the samples, eligibility criteria, patient populations, FR techniques, as well as the number and length of FR sessions in the studies.

4.1. Study limitations

The most significant limitation of the study was our use of a VAS for measuring anxiety despite the availability of valid and reliable measures such as Spielberger's State Anxiety Inventory. We preferred the VAS 0–10 over other measures due to the fact that we wanted to assess patients' anxiety for three times with short time intervals in between. Other measures for anxiety assessment are usually lengthy and hence, longer periods of time are needed for answering such measures. The other limitation of the study was lack of blinding. In other words, both the therapist and the study participants were not blind to the group they were allocated to but the statistician was blind to the group allocation.

5. Conclusion

The aim of our study was to assess the effects of foot reflexology on anxiety and physiological parameters among the candidates for bronchoscopy. It can be concluded from the findings of the present study that foot reflexology may be effective in alleviating procedural anxiety, reducing DBP, SBP, HR, and RR, and increasing SaO₂ among the candidates for bronchoscopy. Foot reflexology seems to have greater importance for patients who are going to undergo an invasive procedure and show considerable variations in their physiological parameters due to procedural anxiety. Consequently, it may be used as a simple complementary therapy to reduce anxiety, promote tranquility, and stabilize physiologic status among the candidates for invasive medical procedures.

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