

Impact of Foot Reflexology on Patients' Post-Craniotomy Weaning from Mechanical Ventilation and Time to Full Consciousness Recovery

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Abstract

Background: After craniotomy, patients with brain tumors face several problems, such as delayed endotracheal tube extubation and diminished consciousness. **The present study** aimed to evaluate the effects of foot reflexology on the impact of foot reflexology on patients' post-craniotomy weaning from mechanical ventilation and time to full consciousness recovery. **Design:** A quasi-experimental research design was used to conduct this study. **Setting:** The study was carried out at the neurosurgery intensive care unit at Beni-Suef University Hospital. **Subjects:** A purposive sample of 60 patients post-craniotomy was recruited in this study; the studied patients were assigned into two groups, with 30 patients in each group (the intervention and control groups). In the intervention group, foot reflexology was done twice a day, in the morning and the evening, for 30 minutes (15 minutes for each foot), in addition to the patient's regular care. This was done for a week. The control group just received standard post-craniotomy treatment. **Tools:** Four tools were used to collect data: **Tool (I):** Patients personal data. **Tool (II):** Glasgow Coma Scale (GCS), **Tool (III):** Time of full consciousness, and **Tool (IV):** Withdrawal from the ventilator. **Results:** The findings indicated that there was no statistically significant variation in the demographic attributes of the two groups ($p > 0.05$). The findings showed that, in comparison to the control group, the intervention group's mean scores for the amount of time required to regain consciousness and wean off of mechanical ventilation were significantly lower. **Conclusion:** The results showed that foot reflexology on the impact of foot reflexology have a positive effect on patients' post-craniotomy weaning from mechanical ventilation and time to full consciousness recovery. **Recommendation:** Foot reflexology is recommended to be applied as a non-pharmacological strategy and complementary therapy along with routine care to reduce weaning from mechanical ventilation and time to full consciousness recovery.

Keywords: Foot reflexology, Patients' post-craniotomy, Time to full consciousness recovery, Weaning from mechanical ventilation.

Introduction:

Every year, over 80,000 persons in the US are given a primary brain tumor (PBT) diagnosis. The average survival rate for individuals suffering from a malignant brain tumor is 35%. In adulthood, glioblastoma multiforme is the most prevalent type of primary malignant brain tumor. The five-year survival rate for individuals with glioblastoma multiforme is 5.6% (Ostrom et al., 2019). In Iran, the incidence of primary brain tumors is higher in men than in women (2-1). Glioblastoma is the most prevalent primary

brain cancer (15.1%) in this nation (Araghi et al., 2020).

For individuals with brain tumors, craniotomy is the usual course of treatment. To temporarily access the brain, a craniotomy involves removing a bone flap from the skull. Based on the nature of the brain ailment, a craniotomy may entail the partial or complete removal of a bone flap. Tumors, hematomas, aneurysms, traumatic injuries, foreign objects, inflammation, and infection are among the medical conditions that can be treated by craniotomy (Bui et al., 2021). Once the surgery is complete, the removed bone flap is usually put back. Reduced awareness, cerebral

vasospasms, refractory seizures, hemiparesis, and hematomas are the most frequent problems related to this technique in the postoperative phase. Intracerebral hypertension, seizures, and other sequelae are frequently encountered in non-elective surgical procedures (**Lepänluoma et al., 2023**).

Mechanical breathing is frequently required for patients having craniotomies. Important components of the care plan that can enhance the patients' post-operative recovery are the weaning off of the ventilator and the endotracheal tube for patients on it. According to Chanif et al., preventing sensory deprivation and accelerating the healing process can be achieved by implementing sensory stimulation measures during the first week following surgery. Acupuncture, reflexology, massage, and relaxation techniques can all be used to give sensory stimuli, which include aural, visual, olfactory, taste, and tactile (**Chanif et al., 2021**).

In intensive care units (ICUs), sensory deprivations—particularly touch deprivation—are frequent. The sense of touch can be stimulated and consciousness level raised by tactile stimuli and reflexology. Reflexology has been described as an age-old and widely used method for treating psychological issues in several different nations (**Hatefi et al., 2019**). In reflexology, pressure is applied to the reflex spots on the hands and feet of patients, which can stimulate the neurological system, blood circulation, and particular bodily parts and organs. This stimulation can lessen pain or discomfort in those particular bodily areas. Additionally, it's been noted that reflexology works well to ease tension and reduce stress while also improving blood circulation overall (**Mahdavi pour et al., 2019**).

Foot reflexology during open heart surgery has been shown to improve awareness and shorten the time it takes for the patient to be extubated and weaned off the ventilator (**Elsayed et al., 2019; Kandemir and Oztaki, 2019**). According to Lee, reflexology can improve the body's ability to recover by increasing the flow of energy throughout the body (**Lee, 2020**). Additionally, they showed that pressing on the reflex spots on the feet activates the central and peripheral nerve

systems that control the secretory glands and visceral organs. As a result, energy can be released and circulated all over the body. In addition to the other impacts of this intervention, there is evidence that it can have considerable therapeutic effects on patients in the form of placebo-like effects (**Quattrin et al., 2016**).

Furthermore, hypotheses addressing the body's energy balance, such as those about gate control, neural impulse, lactic acid, and endorphins, has been used to explain these effects (**Tiran & Chummun, 2021**). Reflexology, according to **Quattrin et al. (2016)**, is useful for preserving bodily equilibrium since it stimulates normally dormant body areas and relaxes overactive ones. Foot reflexology was discovered by **Ebadi et al., (2019)** to be useful in reducing the amount of time patients needed to wean after open heart surgery. Reflexology's application in the treatment of medical disorders, however, was not supported by a comprehensive evaluation of the pertinent research (**Ebadi et al., 2019**) Furthermore, research revealed that the reflexology approach had no discernible impact on patients with various medical disorders. Systematic reviews noted the need for more research to confirm the benefits of reflexology intervention on various patient groups, taking into account the inconsistent findings of pertinent studies (**Lee et al., 2021**).

Reflexology restores balance and improves comfort by applying pressure to responsive spots on the foot that correspond to every part of the body. Reflexologists think that pressing specific reflex points on the sole during illness may release calcium and uric acid crystals that have built up in nerve endings, clear obstructions in nerve pathways, and enhance blood flow all over the body (**Ballard et al., 2019**). Several studies have validated the advantages of reflexology, including decreased anxiety and pain following surgery (**Oztürk et al., 2018**), less pain and exhaustion, and better patient sleep quality (**Rambod 2019**). In addition to providing regular treatment in the intensive care unit, nurses can also use foot reflexology to lower anxiety and stabilize physiological parameters in patients undergoing coronary artery bypass graft

surgery (Abbaszadeh et al., 2018).

Significance of the study:

Foot reflexology is one of the most important complementary therapies for pain reduction (Singh & Chaturvedi, 2019). For example, research by Amer et al. (2022) found that individuals having coronary angiography found that foot reflexology were a useful technique for reducing anxiety. Furthermore, foot reflexology reduces the need for analgesics and postoperative pain, according to Koras et al. (2019). Furthermore, there hasn't been much research done on the efficaciousness and structuring of foot reflexology therapy for craniotomy patients. Further research is required to validate the efficaciousness of foot reflexology and the optimal designs of this therapeutic approach in patients with varying medical conditions.

Additionally, more research is required to enhance evidence-based practice about reflexology to examine the effects of this intervention on the state of awareness following surgery, as there are currently few studies that address this topic. So, this study was conducted to evaluate the effects of foot reflexology on the impact of foot reflexology on patients' post-craniotomy weaning from mechanical ventilation and time to full consciousness recovery.

Operational definitions:

Weaning from mechanical ventilation: refers to the patient's spontaneous breathing at the moment the endotracheal tube was removed.

The time of full consciousness or full consciousness recovery: According to the Glasgow Coma Scale (GCS=15), it is defined as the moment the patient regains their maximal level of consciousness.

The study aimed to:

To evaluate the impact of foot reflexology on patients' post-craniotomy weaning from mechanical ventilation and time to full consciousness recovery through:

-Assessing weaning from mechanical ventilation in the intervention group compared to the control group.

-Assessing time to full consciousness recovery in the intervention group compared to the control group.

Subjects and methods:

Research hypothesis:

Diabetic children who receive foot reflexology are expected to experience less pain and anxiety regarding insulin injection than those who do not.

Design:

A quasi-experimental research design was used to conduct this study

Setting:

The study was carried out at the neurosurgery intensive care unit at Beni-Suef University Hospital.

Subjects:

A purposive sample of 60 patients post-craniotomy was recruited in this study; the studied patients were assigned into two groups, with 30 patients in each group (the intervention and control groups). In the intervention group, foot reflexology was done twice a day, in the morning and the evening, for 30 minutes (15 minutes for each foot), in addition to the patient's regular care. This was done for a week. The control group just received routine post-craniotomy treatment

Sample size calculation:

Based on the following assumptions, the sample size for each group was determined: $\alpha = 0.05$, $\beta = 0.2$, and d (mean difference between the two groups) = 0.7. With a 10% attrition rate in mind, 30 participants in each group were determined to be the ideal sample size.

Inclusion criteria included:

Patients aged 21-65 years

From both sexes

Agree to participate in this study

The level of consciousness from 5 to 7 according to the Glasgow Coma Scale (GCS)

After surgery stable vital signs.

Exclusion criteria included:

Patients are suffering from any mental disease.

Feet problems

- Local infection of the feet or recent lower limb surgery
- Impaired skin integrity in the lower extremities
- Decreased level of consciousness during the study
- Receiving narcotics and sedatives during the study

Tools for data collection:

Three tools were used to collect data for the current study as follows:

Tool (I): patients' data: Including age, gender, educational level, and residence

Tool (II): Glasgow Coma Scale (GCS): Three parts of the GCS are used to determine a patient's level of consciousness. Eye-opening, verbal answers and muscular reactions to orders or painful stimuli are among the components. A total GCS score of 3 indicates significant neurological abnormalities, whereas a score of 15 indicates complete consciousness (Schnakers et al., 2009). With a 94% correlation coefficient and a 96% Cronbach's alpha, Enriquez et al. (2019) verified the validity and reliability of this measure.

Tool (III): Time of full consciousness assessment sheet: It was developed by researchers in the study after reviewing the recent related literature and research studies (Kandemir & Oztekin, 2019; Allahbakhhsian et al., 2020) used to assess time to reach full consciousness.

Tool (V): Withdrawal from the ventilator assessment sheet: It was developed by researchers in the study after reviewing the recent related literature and research studies (Kandemir & Oztekin, 2019; Allahbakhhsian et al., 2020) to assess the time required to withdraw from the ventilator.

Procedure:

Validity of Tools:

The tools were evaluated for content validity by five professors from Beni-Suef University who have over ten years of experience in critical care nursing, neurosurgery, and critical care medicine. The experts did not make any changes to the tools based on their assessment of the tools' sentence structure, content appropriateness, or item order.

Reliability of the tools:

Cronbach's alpha was used to assess the dependability of the instruments. The instruments were deemed dependable as tool II's dependability coefficient was (0.85), tool I's was (0.89), and tool V's was (0.83).

Pilot Study:

To determine the most practical and thorough method of gathering the required data, a pilot study was conducted on five patients, or 10% of the sample, to examine the applicability and feasibility of the tool's many elements. The overall study sample comprised the pilot study participants.

Ethical and administrative considerations:

The study was approved to be conducted before it began by the Sohag Faculty of Nursing's Ethical Research Committee. To get their permission and to explain the goal of the study, the researchers met with the two directors of the chosen setting. Patients were asked for their oral consent to gain their cooperation. Data collection was private and voluntary. Researchers gave patients an explanation of the study's purpose and methods. The freedom to decline to take part in the study has been verified.

The procedure of Data collection:

The study's conduct was approved by the Beni-Suef Faculty of Nursing's Ethical Research Committee before its commencement. To get their agreement and to understand the study's goal, the researchers met with both of the setting's directors. To get the patients' cooperation, oral consent was requested. The gathering of data was optional and private. Researchers described the purpose and approach of the study to patients. The option to decline to take part in the study has been verified.

Preparation for the study:

Constructing data-gathering tools has involved a thorough examination of relevant contemporary national and international research. Additionally, the relevant authorities granted formal approval to carry out the study.

- The basis for the foot reflexology approach was provided and used on the subjects by the researcher who holds a certificate of reflexology training.

- To complete, participants' personal information was collected. Additionally, the subjects' written informed consent was collected. The subjects received post-operative treatment in the neurosurgery intensive care unit after the procedure. The foot reflexology intervention was given to the intervention group participants in the ICU trial, on top of the standard care provided to these patients, which included changing dressings, keeping an eye on vital signs, assessing GCS, and giving antibiotics. For a maximum of one week, the participants in the intervention group underwent a 30-minute foot reflexology treatment, which involved 15 minutes for each foot, twice a day in the morning and evening. An hour following the patient's admittance to the intensive care unit, the foot reflexology intervention was started. It lasted until the participant received a GCS score of 15, or it ended automatically if the patient exceeded the allotted one week.

- Additionally, the ICU nurses recorded the time of weaning or withdrawal from mechanical ventilator support in hours for the participants in the control group, who received routine care relating to craniotomy patients. Every day, the researchers reported to the intensive care unit (ICU) to complete study checklists based on the medical records of the subjects.

Assessment:

- After the researcher gave a brief introduction to the patients being researched and the rationale behind the study, the subjects were split into two groups: thirty patients made up the intervention group and thirty patients comprised the control group.

Implementation:

In the intensive care unit, the intervention was carried out beside the participant's bedside, with a privacy curtain draped around the mattress. Basic foot hygiene, such as cleaning and drying their feet and, if needed, trimming their nails, was carried out before the intervention. The subjects' feet were

not treated with lotion or cream. The subjects were positioned in a supine position. To minimize tiredness and tension on the participants' muscles, the feet were gently raised, and a tiny pillow was placed beneath the knees. For fifteen minutes, each foot underwent a three-stage foot reflexology.

By **Bahonar et al., (2019)** the feet's pressure points were chosen. Three steps are involved in foot reflexology, according to **Bahonar et al., (2019)**: (1) A generic foot massage. This exercise involves rotating your feet, extending your feet, and stretching your Achilles tendon for a minute on each foot. The left hand was used to hold the bottom of the heel of the right foot, while the other hand was used to hold the metatarsal arch of the same foot. The foot was then turned three times in each direction, clockwise and counterclockwise. The left foot was treated using the same method.

Stimulation of the solar plexus, the relaxation point, on each foot, this stimulation was delivered for 12 minutes. This point can be stimulated to promote balance, relaxation, calmness, fewer panic attacks, and a decrease in stress and despair. To activate the solar plexus, rotated pressure was delivered using the thumb. The reflex point is stimulated. The hypothalamus, pituitary, heart, lung, and adrenal glands can all be stimulated by applying pressure to the reflex point. Hormone secretion and autonomic nervous system homeostasis are two aspects of the hypothalamus gland's activity. In addition to regulating hormone secretion and fostering emotional and physical equilibrium, the pituitary gland also regulates other endocrine glands.

The heart and lungs control breathing and oxygen saturation. Adrenaline and hydrocortisone release from the adrenal glands is linked to improved balance, decreased stress, and depression. In this stage, the reflex point was stimulated by exerting circular pressure with the thumb for two minutes. Biting motions from above the diaphragm area of the sole towards the toes with the thumbs were used to stimulate the areas associated with the heart and lungs. Each foot's pressure points correspond to the body's organs on the same

side. To activate the heart, for instance, pressure was placed on the relevant location on the left foot. Based on Figure 1, the pressure point locations in this study were chosen.

Evaluation:

The effect of foot reflexology on patients' post-craniotomy weaning from mechanical ventilation and recovery time to full consciousness was finally reevaluated by comparing the means of the data between the intervention and control groups.



Louise Keet. (2008): The Reflexology Bible: The Definitive Guide to Pressure Point Healing. 1st ed. Octopus Publishing Group Ltd 2008. Pp 96-174.

Statistical analysis:

SPSS software version 22 (SPSS, Inc. Chicago, Illinois, USA) was used to analyze the data. To determine normality, the Kolmogorov-Smirnov test was employed. Normal numeric variables were analyzed with the t-test, while qualitative factors were analyzed with the Chi-square test. The two groups' mean scores for the periods of full consciousness and weaning or withdrawal from mechanical breathing assistance were compared using the independent t-test. A significance level of <0.05 was chosen.

Results:

Table (1) indicates that 48% of the control group and 52% of the intervention group were men. 52% of the control group and 50% of the intervention group had secondary education as their highest level of education. In terms of housing, 80% of the control group and 78% of the intervention group lived in cities.

Age, gender, education, occupation, and length of surgery were among the personal data that did not reveal a statistically significant difference between the two groups ($p>0.05$).

The mean Glasgow Coma Scale score for the intervention group and control group is displayed in **Table (2)**, where no statistically significant differences were found between the two groups.

In **Table (3)** findings revealed that the intervention group's period between ICU admission and full consciousness was 93.67 ± 35.06 hours, while the control group's was 216.05 ± 64.27 hours. Additionally, demonstrates how foot reflexology helped participants in the intervention group shorten the period between being admitted to the intensive care unit and regaining consciousness, with highly statistically significant differences between the two groups found.

Table (4) presents the time intervals for the intervention group (92.02 ± 35.24 h)

and the control group (208.82 ± 64.85 h) between the ICU admission and weaning or withdrawal from mechanical ventilator support. Additionally, it demonstrates that there were

very significant variances and improvements noted in the patients' withdrawal from breathing support between the intervention and control groups.

Table 1: Personal data in both intervention and control groups

Variable	Groups				P value
	Intervention group (n=30)		Control group (n=30)		
	Mean \pm SD	N (%)	Mean \pm SD	N (%)	
Age (year)	31.66 \pm 6.17		27.44 \pm 5.67		0.067
Sex	Female		26 (52.0%)		0.78
	Male		24 (48.0%)		
Education	Elementary education		27 (54.0%)		0.47
	Secondary education		10 (52%)		
	University education		2 (4%)		
Length of surgery (hours)	4.82 \pm 2.76		3.35 \pm 2.20		0.901
Residence	Urban		40 80%		0.43
	Rural		10 20%		

Independent samples t-test; Chi-square test

Table 2: Differences in Glasgow Coma Scale (GCS) in both intervention and control groups

Variable	Intervention group (n=30)	Control group (n=30)	P value
	Mean \pm Sd	Mean \pm Sd	
Glasgow Coma Scale (GCS)	8.05 \pm 2.02	8.06 \pm 3.2	0.063

Independent samples t-test

Table 3: Differences in the time to reach full consciousness mean score in both intervention and control groups

Variable	Intervention group (n=30)	Control group (n=30)	P value
	Mean \pm Sd	Mean \pm Sd	
Time to reach full consciousness (hours)	93.67 \pm 35.06	216.05 \pm 64.27	P=0.001

Independent samples t-test

Table 4: Differences in the time to wean from the ventilator in the intervention group and control group

Variable	Intervention group (n=30)	Control group (n=30)	P value
	Mean \pm Sd	Mean \pm Sd	
Time weaning from the ventilator (hours)	92.02 \pm 35.24	208.82 \pm 64.85	P=0.001

Independent samples t-test

Discussion:

Weaning off of mechanical ventilation is a multi-step process that involves removing the ventilator and allowing the patient to breathe on their own (Ebadi et al., 2019). Sufficient spontaneous breathing without MV

for 48 hours following extubation is considered successful weaning. This duration of time is debatable; some authors recommend extending it to seven days or even 72 hours following extubation (Zein et al., 2020). In the present study, we evaluate the effect of foot reflexology on the time of full consciousness

recovery and ventilation support withdrawal in patients with brain tumors after craniotomy.

Regarding personal information such as age, gender, education, occupation, place of residence, and duration of operation, the results did not reveal a statistically significant difference between the two groups. According to the researchers, it validated the shared characteristics between the patients in the control group and the intervention group.

The findings indicated that, in terms of the Glasgow Coma Scale mean score, no statistically significant differences were found between the two groups. It represented the homogeneity between patients in the intervention group and the control group, according to the researchers.

The findings demonstrated that foot reflexology was useful in shortening the participants' stay in the intensive care unit (ICU) before they regained full consciousness. It also increased the intervention group's level of consciousness, with highly statistically significant differences between the two groups observed. **Vahedian-Azimi et al., (2022)** showed that giving general body massages to ICU patients was an effective way to raise their level of consciousness one to four hours after the intervention, which is in line with our findings. Research has demonstrated that massage therapy can enhance patients' health outcomes, including their state of awareness, by activating the skin's tactile and pressure receptors as well as the nerve fibers (**Allahbakhhsian et al., 2020**).

Early stimulation with arousal therapy has been shown by **Mandep (2022)** to significantly raise awareness in coma patients with catastrophic brain injuries. Toxins can be eliminated from the body by massage, according to **Kurt & Can, (2018)** who also mentioned that massage can enhance renal and general blood flow. Better oxygen delivery to the brain and arterial blood oxygenation levels can also be linked to an elevated state of awareness. According to **Elsayed et al., (2019)**, patients having open heart surgery who are admitted to the intensive care unit (ICU) may have an increase in consciousness after a single 60-minute reflexology session (30 minutes in each foot). Foot reflexology (30 minutes in each foot) was also demonstrated by **Kandemir & Oztekin (2019)**, to be an efficient way to increase the level of

consciousness in open-heart surgery patients in the ICU.

The current study's results showed that there were improvements and highly statistically significant differences between the patients in the intervention and control groups when it came to their removal from ventilation assistance. A 60-minute reflexology session (30 minutes in each foot) used once could cut down on the amount of time patients following open heart surgery spent in the intensive care unit (ICU) on artificial breathing. This was demonstrated by **Elsayed et al. (2019)**. Additionally, it was demonstrated by **Kandemir & Oztekin (2019)** that foot reflexology (30 minutes in each foot) was useful in shortening the time it took for patients undergoing open heart surgery to wean off the ventilator in the intensive care unit.

According to **Allahbakhhsian et al., (2020)**, patients with open heart surgery who were brought to the ICU had a shorter weaning period from the ventilator after a single 30-minute foot reflexology session (15 minutes in each foot). Nevertheless, research on the effects of foot reflexology has yielded inconsistent findings. According to **Ebadi et al., (2019)**, there was no discernible reduction in the duration of weaning time for patients following open heart surgery with foot reflexology.

Moreover, **Kavei et al., (2019)** discovered that foot reflexology did not successfully lessen post-open-heart surgery patient agitation. Moreover, reflexology's efficacy for patients with various medical disorders was not supported by a systematic examination of the pertinent literature (**Ernst et al., 2021**). Numerous health difficulties associated with their disease and therapies affect patients with chronic disorders. Patients with chronic disorders may experience further difficulties from traditional therapies such as surgery and long-term pharmaceutical therapy (**Candy et al., 2020**). It's critical to develop original and creative solutions based on the demands and situations of the patients (**Rahimi et al., 2018**).

Conclusion:

Based on the results of this study, it can be concluded that foot reflexology on the impact of foot reflexology has a positive effect

on patients' post-craniotomy weaning from mechanical ventilation and time to full consciousness recovery.

Recommendation:

Based on the current study findings, it can be recommended that:

- Foot reflexology is recommended to be applied as a non-pharmacological strategy and complementary therapy along with routine care to reduce weaning from mechanical ventilation and time to full consciousness recovery.
- Replication of the current study on a larger probability sample and in other settings to generalized results.
- Future research is advised to look at how well reflexology affects the outcomes of other patients, including the length of hospital stays and patient acceptance and satisfaction.

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