

The Effect of Acupressure on Pain Associated with Chest Tube Removal in Patients with Chest Trauma

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ARTICLE INFO

Article history:

Received 11 February 2024

Revised 01 March 2024

Accepted 16 March 2024

Keywords:

Acupressure;

Pain;

Chest tube

ABSTRACT

Background: Inserting a chest tube is a life-saving procedure for patients with chest trauma, but it is often associated with significant pain. To alleviate this discomfort, non-pharmacological methods such as acupressure can be employed. Therefore, this study aimed to determine the effect of acupressure on pain during chest tube removal in patients with thoracic trauma.

Methods: This quasi-experimental study involved the selection of 204 patients with chest tubes following chest trauma in Zahedan in 2022. The through patients were selected purposefully and Non-random allocation divided into two intervention and control groups of 102 people. The intervention group received acupressure treatment, while the control group did not. Pain levels of the patients were measured using a pain intensity scale on both the day of chest tube insertion and the day of removal. The data were analyzed using statistical test such as independent-t, paired-t and chi-square statistical tests within the SPSS 26 software.

Results: The normality of the main variable was assessed using the Kolmogorov-Smirnov (KS) test. The significance level for the pain variable was found to be less than 0.05 ($P < 0.001$), indicating a non-normal distribution. Therefore, the Mann-Whitney U test was utilized for data analysis. The results of the Mann-Whitney test revealed that before the intervention, the mean pain scores were 9.46 ± 0.69 in the intervention group and 9.47 ± 0.65 in the control group. After the intervention, the mean pain scores were 7.11 ± 0.98 in the intervention group and 9.39 ± 0.90 in the control group. Based on the Mann-Whitney U value obtained from the comparison of the two groups before and after the intervention, it can be concluded that the intervention had a significant effect on reducing pain (Table 2).

Conclusion: The insertion and removal of chest tube after trauma can be an extremely painful experiences for individuals. Considering the crucial role of nurses, non-pharmacological methods such as acupressure can be used to alleviate their pain. Acupressure is a cost-effective, accessible, and readily available approach that can be utilized in this context.

Introduction

Trauma encompasses various pathological and psychological conditions [1]. Medically, it is defined as any form of intentional or unintentional injury or damage inflicted upon the human body by external factors, resulting in penetrating or non-

penetrating wounds [2]. Traumatized patients often present with life-threatening conditions such as severe respiratory and cardiac disorders, cardiac and respiratory arrest, severe poisoning, open chest wounds, and significant internal and external bleeding [2].

Statistics indicate that trauma is a major contributor to disability in modern societies [3]. It is the leading cause of death among individuals under the age of 45 in both the United States and worldwide, with approximately 5.8

The authors declare no conflicts of interest.

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million annual fatalities attributed to trauma [4]. Trauma accounts for 10% of all deaths globally, surpassing the combined mortality rates of malaria, tuberculosis, and HIV/AIDS [4]. Alarming, the World Health Organization predicted a 40% increase in trauma-related fatalities by 2023 [3]. Iran also faces a significant burden of trauma cases, ranking among the highest in the world [5]. With a death rate of 58 cases per 100,000 people, Iran ranks second in terms of trauma-related mortality [6].

In addition to the risk of mortality, trauma can result in various consequences, particularly in the case of chest trauma, which may lead to injuries such as rib fractures, pneumothorax, tension pneumothorax, lung compression, and hemopneumothorax with lung compression [7]. In approximately 17.6% of cases, surgical intervention and the insertion of a chest tube are necessary. According to several studies, palliative treatments and chest tube insertion have been the primary methods of managing these cases, accounting for around 90% of treatments [7]. Chest drains are employed in a wide range of situations, including post-heart surgery, trauma, post-operative complications, and other medical conditions. They serve to evacuate air, pus, or fluid from the lungs [8], and their utilization contributes to the treatment of approximately 85% of patients with chest trauma [9].

While the presence of a chest tube is crucial for patient care [10], it often leads to pain at the surgical site [11] and generates significant fear and anxiety in patients [12]. The insertion of a chest tube brings forth consequences such as pain and anxiety [13] due to the invasive nature of the procedure.

On the other hand, chest tubes are typically removed within 24 to 48 hours after surgery or when excess air, blood, or fluid has been adequately drained [8]. However, the removal of a chest tube has been reported as a painful and distressing procedure for patients [14]. This pain can further contribute to feelings of anxiety, creating a cycle where pain and anxiety intensify one another [15]. Therefore, by effectively managing pain and anxiety, both aspects can be mitigated.

Non-pharmacological methods are employed to manage pain and anxiety, and one such intervention is acupressure [16]. Unlike acupuncture, which uses special needles to apply pressure, acupressure involves the application of pressure using hands or wooden/plastic objects [17]. Acupressure is a treatment technique that targets specific acupoints on the skin's surface, aiming to stimulate the body's natural healing process. It is believed that these points are closely connected to vital organs [18], and by stimulating them, the flow of energy is regulated, blood circulation is improved, blood congestion is relieved, and overall organ function is revitalized, leading to enhanced well-being [19].

Through the application of pressure using fingers or plastic beads, acupressure works to regulate the

sympathetic and parasympathetic nervous systems, thereby maintaining body function and promoting comfort. However, the exact underlying mechanism of acupressure is still not fully understood. The rationale behind acupuncture is the stimulation of the body's self-regulation process, which involves the release of neurochemicals such as serotonin, known to regulate mood and reduce pain and emotional distress, including anxiety [20].

Acupressure is an accessible and non-invasive intervention that offers a cost-effective alternative to acupuncture. Unlike acupuncture, acupressure carries a lower risk of side effects. Nurses can easily acquire the skills of acupressure and incorporate it into their clinical practice to enhance patient comfort and alleviate discomfort [19]. In the context of acupressure, nurses play a vital role in facilitating, supporting, and delivering optimal patient care. They have an obligation to take appropriate action when the safety and well-being of the patient are at risk, including communicating concerns to healthcare provider and collaborating with the healthcare team. Nurses are also responsible for advocating for policies and procedures that promote patient safety in relation to complementary medicines [21]. However, there is limited evidence on the effectiveness of acupressure in addressing psychosocial aspects of health [19].

Given the limited resources available in this area, the present study was conducted in 2023 to investigate the impact of acupressure on pain associated with chest tube removal in patients with chest trauma.

Methods

The current quasi-experimental study was conducted in Zahedan in 2023 and focused on patients with chest tubes following thoracic trauma. Based on Bastani et al. 's study (2013) [22], the sample size for each group was determined to be 102 individuals, with a 95% confidence interval and 95% test power. The study included a total of 204 participants, who were selected purposefully and Non-random allocation divided into two intervention and control groups of 102 people.

The research was conducted in the inpatient and surgical departments of Khatam and Imam Ali hospitals in Zahedan. The study included participants aged 18-56 years who met specific criteria. The inclusion criteria encompassed individuals who currently had a chest tube, demonstrated a clear understanding of their surroundings and the current time, had no prior experience with chest tube connection, and had no history of opium or cigarette use. Additionally, participants were required to exhibit a level of anxiety that did not warrant immediate medical intervention. The exclusion criteria consisted of unwillingness to participate in the study and transfer to intensive care units (ICU).

The data collection tools used in this study included a demographic information questionnaire and the pain intensity scale. Before the intervention, both the intervention and control groups completed a demographic information questionnaire that included questions about age, sex, education level, and marital status.

The intensity of patients' pain was assessed using a numerical pain measurement scale. This scale is a horizontal line ranging from 0 to 10, with corresponding scores indicating different levels of pain intensity. The scoring system is as follows: 0 represents no pain, 1-3 indicates mild pain, 4-6 signifies moderate pain, 7-9 represents severe pain, and 10 represents the most severe imaginable pain. The validity and reliability of the numerical pain measurement scale have been investigated in multiple studies. For instance, in Rambad's study on the effect of shiatsu massage on pain intensity during venipuncture for hemodialysis, the questionnaire's validity was reported with a Cronbach's alpha of 0.95, and its reliability was supported by a test-retest reliability of 0.90. Many other studies have also demonstrated the validity and reliability of this tool [22]. The participants were provided with instructions on how to use this scale during the study [23].

After receiving approval from the ethics committee of Zahedan University of Medical Sciences (IR.ZAUMS.REC.1402.182) and obtaining the necessary permissions, the researchers provided a detailed explanation of the study to the potential participants. Those who wanted to participate were asked to provide written consent and also complete the demographic information questionnaire. Following the participants' chest tube surgery and subsequent transfer to the ward, their levels of anxiety were measured using the pain intensity Scale.

The researcher, in collaboration with a general surgery specialist, applied acupressure to specific points on patients who underwent chest tube insertion. Before the intervention, the patients' pain levels were measured. During the intervention, acupressure was performed on both the intervention group and the control group. In the intervention group, the researcher placed a plastic bead on the Shenmen point of the non-dominant ear and applied pressure using their fingers for a duration of 10 minutes. Additionally, circular pressure was applied to the third eye point using the researcher's thumb, with an average of 20-25 circular movements per minute, for another 10 minutes (Figure 1). This intervention was conducted on the first and second days following the chest tube insertion as the typical duration for the tube to remain in place ranges from 24 to 48 hours. The patients were also educated on how to perform acupressure on the designated points. Lastly, before removing the chest tube, acupressure was administered, and the patients' pain levels were measured once again.

In the control group, participants received acupressure on Sham points, which are known to be ineffective in the philosophy of acupressure, and do not have any relaxing

or therapeutic effects. The specific Sham points utilized in this study were the outer corner of the left eyebrow and the entrance to the ear cavity, both on the non-dominant side. The control group did not receive any specific acupressure treatment. Instead, they received routine care, including assessing secretion levels, caring for the surgical site and dressing, and being provided with a spirometer. The participants were instructed on how to use the spirometer but were not supervised during its usage. Pain levels were measured and recorded for the control group at two different stages. The first measurement was taken at the time of chest tube removal, and pain was assessed using the pain intensity scale.

The data were analyzed using several statistical tests in SPSS 21, including paired t-test (to compare pain within each group before and after the intervention), independent t-test (to compare the intensity of pain between the two groups), and chi-square test.

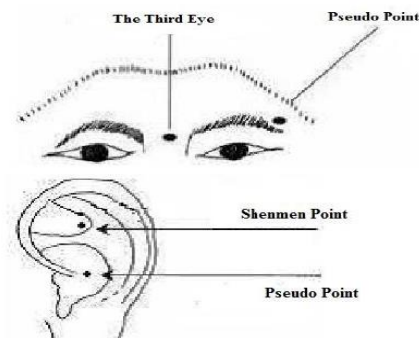


Figure 1- Shenmen point used for intervention

Results

The mean ages of participants in the intervention and control groups were 35.36 ± 11.3 and 37.57 ± 12.03 years, respectively. (Table 1) provides demographic information of the participants. The results indicated no statistically significant difference in variables such as sex, age, education level, and marital status between the intervention and control groups before the intervention.

The normality of the main variable, pain, was assessed using the Kolmogorov-Smirnov (KS) test. The significance level for the pain variable was found to be less than 0.05 ($P < 0.001$), indicating a non-normal distribution. Therefore, the Mann-Whitney test was employed for data analysis.

The results of the Mann-Whitney test revealed that before the intervention, the mean pain scores were 9.46 ± 0.69 in the intervention group and 9.47 ± 0.65 in the control group. After the intervention, the mean pain scores were 7.11 ± 0.98 in the intervention group and 9.39 ± 0.90 in the control group. Based on the Mann-Whitney U value obtained from the comparison of the two groups before and after the intervention, it can be concluded that the intervention had a significant effect (Table 2).

Table 1- Individual characteristics of the participants

Variable	Group	Intervention Number (percentage)	Control Number (percentage)	Total	P value
Gender	Men	62(30/4)	53(26/0)	115(56/4)	0/2
	Female	40(19/6)	49(24/0)	89(43/6)	
Level of education	Illiterate	11(5/4)	10(4/9)	21(10/3)	0/96
	Elementary	34(16/7)	39(19/1)	73(35/8)	
	Diploma	33(16/2)	32(15/7)	65(31/9)	
	Bachelor's degree	18(8/8)	16(7/8)	34(16/7)	
	Master's degree	6(2/9)	5(2/5)	11(5/4)	
Marital status	Single	60(29/4)	55(27/0)	115(56/4)	
	Married	42(20/6)	47(23/0)	89(43/6)	
Average age (years)		11/3 ± 35/36	12/03 ± 37/57	11/70 ± 36/47	

Table 2- Comparison of the mean total pain score before and after the intervention in patients of two groups

Variable	Group	Intervention Mean ± SD	Control Mean ± SD	P value	Mann-whitney u
Pain	Before	9/46± 0/69	9/47± 0/65	0/958	5182/500
	After	7/11± 0/98	9/39± 0/90	0/000	469/00

Discussion

This research investigated the impact of acupressure on pain levels in trauma patients who underwent chest tube insertion and subsequent removal. It was observed that patients experienced severe pain following chest tube insertion.

Chest tube removal (CTR) is universally recognized as a distressing and highly painful experience for patients [24]. CTR pain can range from moderate to severe, mainly attributed to the separation of the chest tube from adhered and attached tissues. Unmanaged CTR pain can have detrimental effects on pulmonary function, including weakened respiratory muscles, reduced chest expansion, decreased lung volumes, and impaired cough effectiveness. These effects can lead to hypoxemia, increased susceptibility to lung infections, tachycardia, elevated cardiac output, and vasoconstriction. Consequently, these complications contribute to poor prognosis, increased morbidity, and high mortality rates [25].

However, there is currently a lack of standard procedures or guidelines for managing CTR-related pain. Non-pharmacological methods, such as cold therapy, have been proposed as a potential treatment to alleviate pain resulting from these distressing procedures [24].

The need for effective pain management has highlighted the importance of incorporating complementary therapies into pharmacological interventions to enhance pain relief and minimize the use of narcotics.

Traditionally, analgesics have been the recommended approach for reducing CTR pain. However, patients often exhibit variable responses and may not achieve complete relaxation. Non-pharmacological physical therapies,

including cryotherapy (cold therapy), have been previously suggested as alternative options [25-26]. The use of non-pharmacological alternatives such as acupressure, which have fewer side effects has shown promise in pain management [27]. In light of the findings from this study, the application of acupressure immediately after chest tube removal can effectively reduce pain due to the increased production of endorphins in the body.

Similarly, another study has concluded that interventions such as acupressure may involve processes such as stimulating A delta fibers in the skin, which transmit signals to the brain's grey matter and inhibit pain stimulation, ultimately reducing pain perception. Additionally, acupressure can activate enkephalins in brain neurons, inhibiting the transmission of pain signals to the brain. It can also trigger the release of endorphins and meta-enkephalins in the brain, activate the pain relief system in the midbrain, and impact the central pain network in the hypothalamus and limbic system [27].

These findings align with the results of a study conducted by Baluchi Bidakhti et al. (2021), which examined the effect of acupressure on the SP6 and ST36 points to reduce pain caused by fistula needle insertion in patients undergoing hemodialysis [23]. Although the population studied in Baluchi Bidakhti's study differed, these patients also experienced an invasive procedure (fistula needle insertion) that can be similarly painful to chest tube insertion. The study demonstrated that non-pharmacological methods such as acupressure effectively managed pain, thereby supporting the findings of the present study.

Moreover, Islam Sabri Abd et al. (2022) examined the impact of acupressure on pain intensity and anxiety levels of patients after coronary artery bypass surgery and showed that acupressure reduced pain intensity and

anxiety levels post-surgery, positively influencing coronary artery transplantation outcomes [21]. These results are consistent with the findings of the present study. Consequently, it can be concluded that non-pharmacological interventions such as acupressure can effectively manage pain in patients with chest tubes.

The study conducted by Bastani et al. (2016) aimed to compare the effects of acupressure and cold therapy on pain experienced during the removal of chest tubes in older patients who underwent open-heart surgery. The findings of this study demonstrated that acupressure effectively reduced pain intensity during chest tube removal in older patients [26]. These results align with the findings of the present study. Despite the differences in the target population, both studies indicated that acupressure was effective in managing pain [26].

The results from these studies highlight the potential benefits of employing acupressure by trained individuals who accurately select acupoints and apply appropriate pressure. This non-pharmacological technique can prove valuable in managing pain for patients with chest tubes. Therefore, nurses, who play a crucial role in pain management, should acquire the necessary skills in this non-pharmacological approach and utilize it for the benefit of their patients.

Darabi et al. (2013) investigated the effect of acupressure on pain and fatigue in individuals with chronic heart failure. The findings of this study demonstrated that acupressure could effectively improve pain in these patients [28]. Although the population studied in this research differed from the present study, both studies highlight the efficacy of acupressure in pain management, regardless of the acute or chronic nature of the condition.

Considering the results of the present study and the aforementioned similar studies, it can be concluded that acupressure has the potential to reduce overall healthcare costs by minimizing associated complications [29]. It is an effective non-pharmacological approach for managing pain in trauma patients. Therefore, its utilization in acute situations, such as when a person experiences trauma and requires painful procedures like chest tube insertion, can be beneficial in pain management. This highlights the importance of nurses receiving training and applying acupressure techniques to effectively control pain in these individuals.

Limitations

This study had several limitations that should be acknowledged. One limitation was the use of a subjective pain scale to assess patients, which could be influenced by individual differences, cultural factors, and mental and psychological aspects. The subjective nature of pain assessment introduces variability that can be challenging for researchers to control effectively. To mitigate this

limitation, future studies should explore more objective methods for measuring patient pain.

Conclusion

The results of the present study highlight the effectiveness of acupressure intervention in reducing pain associated with chest tube removal in trauma patients. This study is important in countries such as Austria and Iran, where the prescription of pain-relieving drugs is restricted to medical doctors, leading to limited access to pharmacological pain relief options. Acupressure, on the other hand, is a readily easy-to-learn technique that can be administered by paramedics [27]. It is both a low-cost alternative and proves to be a valuable approach in reducing patients' pain.

Acknowledgement

We would like to thank the respected officials of Zahedan, the officials and all participating patients for their valuable cooperation throughout this research. Without their support, this study would not have been possible.

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