Evaluating the Impact of Sound Therapy on Pain and Agitation during Endotracheal Suctioning in Critically Ill Patients

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Abstract

Background: *Sound therapy can successfully relieve a variety of painful symptoms and is one of the most popular non-pharmacological treatments utilized by clinical personnel. Through pitch and rhythm, it activates the limbic system, which in turn triggers the pituitary gland to release endorphins, which results in a feeling of wellbeing* ***Aim of study*** *to evaluate the impact of sound therapy on pain and agitation during endotracheal suctioning in critically ill patients* ***Research design****: A* ***Quasi-experimental*** *study design was used.* ***Setting****: the study was conducted in General intensive care unit at Sohag main University Hospital.* ***Subjects:*** *Convenient sample of 79 patients were included in the study and they were assigned randomly to a control group and an intervention group.* ***Five tools*** *were utilized in this study:* ***I:*** *sheet for patient assessment,* ***II****: Critical-Care Pain Observation Tool (CPOT),* ***III****: Richmond Agitation-Sedation Scale (RASS),* ***IV:*** *Glasgow coma scale (GCS),* ***V****: Clinical outcomes assessment sheet.* ***Results:*** *revealed that Patient in the intervention group had significant relief of pain 5 min, and 15 min after intervention in comparison with control group patients, as indicated with P=0.04*&0.001**. According to the results, the study group's agitation levels were significantly lower than those of the control group five, three, and five minutes after the intervention (p-values of 0.005**, 0.005**, and 0.04*, respectively).* ***Conclusion****: Sound therapy was effective in the reduction of pain and agitation level among critically ill patients.* ***Recommendations:*** *Provide in-service education about the importance of sound therapy inside the intensive care unit.*

Key words: Agitation, Pain, Sound therapy

Introduction

Mechanical ventilation (MV) is an essential, life-saving treatment for critically sick patients with potentially deadly illnesses and respiratory conditions. In circumstances where breathing is difficult, in the critical care unit (ICU), it is among the most often utilized technical interventions to enhance gas exchange to the lung. Using an endotracheal tube (ETT) for mechanical ventilation is one of the most critical therapies administered to patients in the intensive care unit. **Elmaghraby et al. (2023)** claim that ETTs are linked to the development of biofilms. which raises the risk of ventilator-associated pneumonia in patients.

For managing airways and a fundamental competency for medical professionals tasked with maintaining airway patency is artificial airway suctioning. Every day, people all across the world undertake the standard process of suctioning the artificial airway. Therefore, it is essential that medical professionals understand the best and most efficient ways to carry out the process. Effective gas exchange, particularly in patients with artificial methods of airways, depends on secretion regulation. Providing safe and efficient secretion clearance for patients with artificial airways is the responsibility of the healthcare team. Around the world, artificial airway suctioning is a routine treatment carried out on a daily basis across the care continuum. Patient preparation, suction application using the inserted catheter, and post-operation care are all included in this technique **(Blakeman et al., 2022).**

In the intensive care unit (ICU), pain is a typical complaint that can happen both at rest and during standard ICU procedures like rotating, endotracheal suctioning, and removing a chest tube or drain. One multimodal analgesic approach is advised by clinical practice guidelines to reduce the quantity of opioids that are given; this should involve non-pharmacological interventions like music and massage. Prior systematic reviews conducted in critical care units for adults have documented the impact of music on inflammatory markers, stress, anxiety, and vital signs**(Lalonde, 2020).**

The International Association for Study of Pain (IASP) defines pain as an unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage," and that the accompanying notes be updated to a bulleted list that included the etymology. People often experience pain for psychological reasons when there is no tissue damage or other likely pathophysiological explanation. If we consider the subjective account, we cannot tell their experience apart from that caused by tissue injury **(Raja et al,2020).**

One of the most popular non-pharmacological therapies employed by clinical staff is music-based intervention, which successfully reduces a variety of unpleasant symptoms. Music therapy, according to the American Music Therapy Association, is the use of customized music listening by medical professionals as a therapeutic tool. This includes making music, singing, dancing to it, and/or listening to it in order to balance physical, emotional, cognitive, and socialization needs. This helps to improve communication barriers, let go of emotions, and encourage physical recovery. Through pitch, rhythm, and melody, music-based interventions activate the limbic system, which in turn triggers the pituitary gland to generate endorphins, which promote feelings of wellbeing. Physiological reactions such variations in blood pressure (BP), body temperature, heart rate (HR), respiration, and muscle tension are subsequently impacted by this **(Chen et al., 2021).**

Previous studies conducted in adult intensive care units shows that music can enhance a

number of outcomes in the intensive care unit, such as lowering agitation, discomfort, anxiety, and sedative use while also enhancing the quality of sleep. However, clinical practice recommendations do not include music interventions, and they are only occasionally employed in the intensive care unit. Furthermore, studies of the evidence have not addressed a specific set of interventions that involve auditory stimulation through recitation, auditory messages, or listening to nonmusical sounds. Whether nonmusical sounds in the intensive care unit can have the same positive effects as music is still unknown **(Papathanassoglou et al., 2025)** . Hence, the of this study is important to stand out results that not explained by previous studies.

Aims of the Study

Study aims to evaluate the impact of sound therapy on pain and agitation during endotracheal suctioning in critically ill Patients. In order to achieve this, the research hypotheses listed below have been developed.

Hypotheses of the Research

- **Pain** induced by endotracheal suctioning is expected to be lower in the study group compared to the control group.
- **Agitation** from endotracheal suctioning is anticipated to be lower in the study group compared to the control group.

Significance of the study

Due to the presence of artificial airways, reduced cilia clearance, and a cough reflex deficiency, most patients who are admitted to critical care units have more secretions in their airways and have difficulty getting rid of them. Suctioning, the most common invasive technique used on patients with artificial airways, is therefore necessary for these patients in order to eliminate accumulated secretions. When a suctioning operation is performed, there is a danger of hemodynamic, respiratory, and neurological compromises because the procedure causes discomfort and agitation **(Dilie et al., 2021).**

In the past year, the majority of the roughly 1100 patients admitted to Sohag Main University Hospital's general intensive care unit often needed intubation and mechanical ventilation. (Sohage main university Hospital ICU records) and hence the probability of need to intubation may be considered to be increased.

There are numerous potential advantages to this study. First, it will provide data-base that can be utilized by health team members to raise stuff awareness about importance of assessing pain and agitation during endotracheal suctioning. Second, medical practitioners can use these techniques to better control agitation and discomfort through using the sound therapy during suctioning procedure. It is also hoped that this effort will generate attention and motivation for further researches into this area.

Patients and methods

Design

A Quasi-experimental research design was used to conduct this study. This design was used to evaluate the impact of sound therapy on pain and agitation during endotracheal suctioning

Variables:

- Independent variable: The impact of sound therapy
- Dependent variable: Pain and agitation induced by endotracheal suctioning

Setting

The study was carried out in general ICU of anesthesia department at Sohag main university hospital. General ICU contains 2 large rooms (each of them contained 6 beds) and 1 small room (contains 2 patients)

Patients:

A convenient sample included critically ill adult female and male patients aged from (18-60 years old) who admitted to general ICU and intubated with mechanical ventilator for more than 48 hours divided into two

groups at random (control group and research group). Intervention using sound therapy was excluded if it was co-administered with interventions as massage, aroma therapy, or meditation.

The sample size was calculated using the Epi Info software statistical package.

Sample size calculation:

$$n = \frac{np\,(1-P)}{n-1(d^2 \div z^2) + p\,(1-p)}$$

n= sample size

P= proportion of population that meet the characteristics (when unknown=0.5)

z= level of confidence according to the standard normal distribution

d= tolerated margin of error

- An examination of statistics data from the records of Sohag Main University Hospital indicates that 1100 patients were admitted to these units in 2022–2023. With a 95% confidence coefficient, an accepted error of 5%, and an expected frequency of 50%, the confidence level is 99.9%. 79 patients were the approved sample size.

Study Tools:

- **Five tools** were used in this study for gathering data after reviewing the related literature.

Tool I: Critically ill patient assessment sheet:

This tool was developed by the researcher after reviewing the current literature **(Peng et al., 2022).** It was used to assess personal and clinical data of patient; it consists of three parts:

- **Part I**: Personal characteristics which include age and sex
- **Part II**: Clinical data such as the patient's vital signs, APACHE II, medical diagnosis, length of stay, arterial blood gases (PH, PaO2 in mmHg, Paco2 in mmHg, and fraction of inspired oxygen (Fio_2%), and weaning outcome (success or failure).

Tool II: **Glasgow coma scale (GCS)**, it was adopted from **(Tobias A. Mattei & Graham M. Teasdale.2020)**, this tool aims to assess level of consciousness LOC. It includes visual, verbal, and motor responses. **Scoring system**: Out of 15 points is the total score. Severe is equal to GCS < 8, Moderate is equal to GCS 9–12, and Mild is equal to GCS ≥ 13.

Tool III: Critical-Care Pain Observation Tool (CPOT): French was the primary language used in the creation of the Critical Care Pain Observation Tool (CPOT). Later, it underwent numerous translations into different languages. The purpose of the Critical Care Pain Observation Tool (CPOT) is to accurately measure the degree of pain experienced by critically ill patients, both aware and unconscious, and to distinguish between operations that cause pain and those that do not. This approach is divided into four main categories: facial expressions, body movements, muscle tension, and compliance with a ventilator (for intubated patients) or verbalization (for extubated patients).

Scoring system: this tool assess presence or absence of pain but, doesn't measure the severity of pain, so score of >2 indicate the occurrence of pain **(Alves, 2023).**

Tool IV: Richmond Agitation-Sedation Scale (RASS) Scale:

Richmond Agitation-Sedation Scale (RASS) is a widely used scale that assesses the degree of agitation and sedation and gauges how severe these conditions are. This tool was adopted from **(Sessler.etal, 2002)**

Scoring system of RASS: a score between +4 and −5: +4: combative, +3: very agitated, +2: agitated, +1: restless, 0: alert and calm, −1: drowsy, −2: light sedation, −3: moderate sedation, −4: deep sedation, and −5 **(Rashidi et al., 2020)**.

+4	Combative; overtly violent; immediate danger to staff
+3	Very agitated; pulls or removes tubes/catheters; aggressive
+2	Agitated; frequent non-purposeful movements; fights ventilator
+1	Restless; anxious but not aggressive/vigorous
0	Alert and calm
-1	Drowsy; not fully alert but sustained awakening; eye contact to voice >10 secs
-2	Light sedation; briefly awakens to voice with eye contact <10 secs
-3	Moderate sedation; movement or eye opening to voice but no eye contact
-4	Deep sedation; no response to voice; movement or eye opening to physical st
-5	Unrousable; no response to voice or physical stimulation

Tool V: Clinical outcomes evaluation form:

A tool used to evaluate patient outcomes that was created by the researcher following a review of recent related literature, it consists of Pain intensity, agitation level, duration of stay in ICU, discharge type as improvement or death, and number of times of re-intubation occurrence

Methods: -

Three primary phases comprised the study.

l- preparation phase

After outlining the study's purpose, the head of general ICI, the hospital's responsible authority, granted formal permission to carry out the study. The local ethical committee of the nursing faculty linked with Sohag Main University Hospital granted approval, highlighting the fact that there was no risk to study participants and that the project complied with clinical research ethics (the ethical code was 207). **Development of tools:** The study instrument was created by the researchers based on an analysis of recent and pertinent literature. **Content validity**: A panel of five experts, two medical staff members, and three critical care nurses connected to Sohag University assessed the study tool's content validity. There were no changes, and the validity index was 0.87. No modifications were reported. The Cronbach's Alpha test was used to evaluate the study **tool's reliability**; the results showed that the tools were consistent and stable, with a reliability score of 0.969. A preliminary investigation: In order to evaluate the tools' applicability and clarity, a pilot research was conducted prior to data collection on 10% (7 patients) of the sample size who was admitted to the aforementioned units at Sohag Main University Hospital and who satisfied the established selection criteria. The study did not include the seven patients from the pilot study.

Ethical considerations:

Each patient/patient relative was informed about the aim of the study before starting, and was informed that participation in the study is voluntary and that they had the right to withdraw from the study at any time with no consequences, without giving any reason and that their responses would be held confidentially. The Anonymity of the collected data has been ensured for the participants.

II- Implementation phase

The researcher presents an introduction to the patients and staff and described the technique. Data such as age and sex, diagnosis, past history of diseases, length of stay, type of ICU, collected and recorded in the sheet. Adult patients with endotracheal tube were considered for the enrollment. Patients randomly assigned to a control group receiving conventional treatment and an intervention group receiving sound therapy plus conventional treatment. **Study group** patients listened to light music with slow rhythm via earpieces connected to the researcher phone during period of suctioning procedure (duration of listening to music is equal to the standard duration of suctioning procedure), 3times daily at the nursing shift of afternoon or evening. The intervention was performed at afternoon or evening to reduce the possibility of interfering with patient's routine care. Earpieces cleaned with antiseptic spray in between patient's uses. **Control group:** Patients didn't listen anything while the suctioning was being done. Before, during, and right after the endotracheal suctioning was finished, as well as five and fifteen minutes later, the patients' degrees of agitation and pain were assessed. The Critical-Care Pain Observation Tool (CPOT) was used to measure the severity of the pain, and the Richmond Agitation-Sedation Scale (RASS) was used to measure agitation.

III-Evaluation phase

Patients in both study group and control group were evaluated for Pain,

agitation level, vital signs, arterial blood gases five consecutive days, three times daily to compare between both groups. Additionally, the other outcome was assessed, including length of stay in the ICU, and mortality rate.

Statistical analysis:

Data entry and analysis were conducted using version 26 of the statistical software for the social sciences (SPSS). The data was presented using numbers, standard deviation, and percentage means. To demonstrate a relationship between variables, the researcher used the chi-squared test. A T-test was used to compare the means. When p is less than 0.05, the P-value is deemed statistically significant.

Results

Table (1) shows individual traits in both the intervention group and control groups. About forty percent of the intervention group and 45% of the control groups were between the ages of fifty-one and sixty. There was no statistically significant difference in either sex or age (P=0.91, P=0.28, respectively).

Table (2): Shows clinical data clinical data from both the control and study groups. Concerning to body mass index BMI, Conscious level and APACHEII score there was no statistical significance difference between both groups P=0.54 &P=0.73, &0.095 respectively. Concerning to medical diagnoses, 35% and 25.6% of intervention group and control group respectively had respiratory diseases, 65% and 74.4% of both groups respectively had a non-respiratory diagnosis. The majority of the research and control groups had no prior health records. 45.5% and 65.4% respectively.

Table (3): demonstrates a highly statistically significant difference in respiratory rate between the study group and the control group on the third day during and five minutes after the intervention (P=0.000 and P=0.001, respectively). Concerning to the 5th day, there was highly statistically significant difference between both groups 5min after intervention, P=0.003. The two groups do not differ statistically significantly in terms of body temperature or MAP.

Table (4): Shows that there is a statistically significant difference between both groups in relation to oxygen saturation (SaO2) parameters in the 1st, 3rd, and 5th day (P=0.05). Regarding the 5th day as well, the study group and control group differ statistically significantly within the usual range after intervention in relation to PH, & PCo2, P=0.01& P=0.03 respectively and no statistically significant difference between both groups in relation to PO2, SaO2 and PF ratio.

Table (5): Shows that **in the first day**, there is a statistically significant difference between the two groups regarding the mean score of pain during and 5min after intervention P=0.003, &P=0.005 respectively

On the third day, the mean pain score during and five minutes after the intervention differed statistically significantly between the two groups (P=0.005, P=0.04, correspondingly).

On the 5th day there is a statistically significant difference between two groups in relation to the mean pain score during, & 5min after intervention P=0.006, &P=0.04 respectively

Table (6): Reveals that **in the first, third, and 5th days**, there is a statistically significant difference between the two groups concerning to the mean agitation score, during and 5min after intervention (all P<0.05)

Table (7) demonstrates that the study group and control group had highly significant statistical differences in their mean agitation scores (2.5±0.96) and 2.02±1.01, respectively (P=0.04), and that their mean pain scores were (1.4±0.9) and (3.8±1.7), respectively (P=0.001). The mean length of mechanical ventilator use was 8.8±3 for the study group and 11.4±5.3 for the control group, with a statistically significant difference (P=0.01). There was a highly significant statistical

difference (P=0.004) in the study and control groups' mean lengths of stay in the critical care unit, which were 14.9±12 and 20±2.3, respectively. The mortality rates for the study group and control group were 32% and 58%, respectively, with a highly significant statistical difference. Re-intubation rates were high (57.5%) for the control group and 35 percent for the study group, with a highly significant statistical difference between the two groups (P=0.03).

Figure (1) presented that there was significant positive correlation between critical pain observation score and length of stay in study group and control group after intervention (P=0.003*), r=0.72.

Figure (2) presented that there was significant positive correlation between Richmond agitation sedation score and length of stay in study group and control group after intervention (P=0.001*), r=0.59

Discussion:

In addition to sensory processes, pain is a multifaceted, subjective experience that also incorporates cognitive and psychological processes. Thus, the goal of music therapy is to treat a wide range of issues that may contribute to the transition from acute to chronic pain or worsen the pain experience. Individualized, active music engagement is part of music therapy for pain treatment, which goes beyond simply listening to pre-recorded music to divert attention or unwind **(Hanser, 2020).**

In the critical care unit (ICU), agitation is typical. Pain, underlying illness, withdrawal symptoms, delirium, and certain medications are some of the many contributing variables. Agitation can lengthen hospital stays, increase the risk of complications, and expose patient safety by causing tubes and catheters to be unintentionally removed **(Aubanel et al., 2020).**

Therefore, the study was conducted to evaluate the Impact of sound therapy on Pain and agitation during endotracheal suctioning in critically ill Patients.

According to the current study, the age and sex of the participants in the study and control groups did not differ statistically significantly. This is in the line with the finding of (**Rashidi et al., 2020),** who found that there was no discernible difference in terms of hospitalization, age, or gender between the two study groups. I see that is important to have no differentiation between both groups as regard personal data to achieve homogeneity.

According to the current study's clinical data, respiratory disorders affected almost one-third of the patients in both groups. This is consistent with the results of **(Çalışkan et al., 2024),** who reported that Chronic obstructive pulmonary disease was the most prevalent condition, accounting for 12.5% of cases.

According to a recent study, the study group and the control group differed in respiratory rate on the third and fifth days during and five minutes after the intervention with highly statistically significant. This was consistent with the findings of **(Çalışkan et al., 2024) ,** who found that when mechanically ventilated patients received music therapy and sound isolation therapies, their hemodynamic parameters improved, their reported pain level decreased, and they required less sedation. Also In the line with **(Dong et al., 2023),** who found that over time, the experimental group showed a statistically significant drop in heart rate, respiration rate, systolic blood pressure, discomfort, and anxiety when compared to the control group (all P<0.001).

According to the mean pain score during and five minutes after the intervention, the two groups in the current study differed statistically significantly (P=0.003 and P=0.005, respectively). This is in line with the findings of **Salsabila et al., 2024,** who found that offering patients natural sound interventions can lessen their pain. By the way, **Rashidi (2020)** found that music considerably reduced pain scores when compared to noise reduction and normal treatment. Additionally, this is consistent

with the results of **(Brazoloto & Fujarra, 2024)** who reported that Although the impact on pain reduction can be low to moderate, music therapy and music-based interventions can significantly improve the satisfaction of patients experiencing pain during medical procedures. I think the positive effect of music on pain return to the relaxation effect of music which primarily on brain.

According to **Chen et al. (2021)**, who noted that the benefits of music-based therapies included reduced agitation, anxiety, and discomfort, the study group's agitation levels were significantly lower than those of the control group five minutes after the session. Also in agreement with **(Widiastuti et al., 2023),** Who stated that**;** Participants who listened to music while receiving intensive care unit therapy did not experience any instances of agitation.

The results of the current study showed a positive correlation between length of stay in the intensive care unit (ICU) and pain level as measured by the critical pain observation score. This finding is in the line with **(Papathanassoglou et al., 2025)**, who stated that length of ICU stay decreased with music therapy. In contrast to **(Brazoloto & Fujarra, 2024),** who reported that music did not reduced length of hospital stay. Also in contrast to **Alotni et al. (2024),** who found that a no relation between length of ICU stay and pain. In my opinion our research finding reflect internal patient suffering which require more days inside ICU for recurring.

The current study demonstrated a positive relationship between length of stay in the intensive care unit and agitation, which was measured using the Richmond agitation sedation scale. The result is consistent with **(Aubanel et al., 2020)**, who found that an agitated patient is at risk for potentially fatal outcomes such as device removal, prolonged ICU stay, ongoing sedative use, and extended mechanical ventilation.

The current study found a very significant statistical difference between the study group and control group in relation to mean durations on mechanical ventilators; 8.8±3 and 11.4±5.3 respectively (P=0.01). This was in line with the results of **(Aubanel et al., 2020)**, who reported that the agitated patient is at risk for life-threatening consequences such as unintentional device removal, prolonged sedative usage, extended mechanical ventilation, prolonged ICU admission, and associated comorbidities. This finding disagree with **(Dong et al., 2023),** who found that there was no statistical significant difference between control group and the experimental group in relation to time of ICU stay. In my point of view this result due to the strong effect of study intervention that affected positively on duration of patient on mechanical ventilators.

According to a recent study, over two-thirds of the study group extubated successfully, compared to roughly one-fourth of the control group, this was in line with **(Çalışkan et al., 2024)**, who reported that the mean duration of mechanical ventilation support was 18.79±20.64 days for study group; and for control group was 18.87±20.57 days. In contrast to **(Golino et al., 2019),** who discovered that music listening had no effect on the length of weaning trials for patients on mechanical ventilation. I think the current study results was because music therapy has a palliative effect on patients' anxiety, vital signs, and oxygenation, which quickly improves their condition.

Sound therapy has significantly shown great effect of reducing pain and agitation levels, so it should be considered to be a part of routine nursing care during suctioning

Conclusion:

Patients in the study group and the control group showed a statistically significant improvement in their levels of agitation and pain following the intervention, with the use of sound therapy during the suctioning operation demonstrating the greatest improvement when using sound therapy during suctioning procedure.

Recommendations

In line with the findings of the study, the following recommendations are made:

Sound therapy should be a part of routine nursing care during suctioning. Additionally, the best frequency, duration, and time for sound therapy use also require more multicenter and randomized controlled research.

Limitations

The study has limitation as it wasn't conducted on large sample size, which might limit the generalization of the result.

Table (1): Percentage distribution of the studied patients in both groups according to their demographic data (Total number of Patients=79)

Variables	Study Group (40)		Control Group (39)		P. value
	No.	%	No.	%	
Age					0.28
18-35 year	13	25%	19	25%	
36-50 year	11	35%	7	30%	
51-60 year	16	40%	13	45%	
Age M ±SD	37.9± 15		42±16.5		0.18
Patients gender					
Male	20	50%	20	51.3	0.91
Female	20	50%	19	48.7	

Chi-square test,
*** Statistically significant difference (p<0.05), ** highly statistically significant difference (p<0.01).**

Table (2): Percentage distribution of the studied patients in both groups according to their Clinical data (no =79)

Items	No (n=79) %				
	Study Group (40)		Control Group (39)		
	N	%	N	%	P value
Normal weight	16	40%	15	38.5%	0.54
Underweight	2	5%	5	12.8%	
Overweight	4	10%	5	12.8%	
Obese class I	5	12.5%	5	12.8%	
Obese class II	13	32.5%	9	23.1%	
BMI	19±2		19.5±3		0.7
APACHE II Score on admission	15.1±6.8		18.2±9.6		.095
Consciousness level Conscious	19	47.5%	7	17.9%	0.73
Unconscious	21	52.5%	32	82.1 %	
Total	40	50.6%	39	49.4%	
Medical diagnoses					
Respiratory causes	14	35%	10	25.6 %	0.96
Cardiovascular causes	6	15%	4	10.2 %	
Traumatic causes	9	22.5%	12	30.7 %	

Miscellaneous	11	27.5%	13	33.3%	
Past history of diseases Hypertension (HTN)	4	10%	6	15.5%	0.48
Diabetes (DM)	3	7.5%	2	5.1%	
Congestive heart failure	2	5%	-	-	
Hypertension+ Diabetes	4	10%	2	5.1%	
Hypertension+ Diabetes+ heart failure	1	2.5%	2	5.1%	
COPD	5	12.5%	3	7.7%	
Stroke	1	5%	-	-	
COPD+HTN	2	5%	-	-	
Non	18	45.5%	22	56.4%	

* Significant at (P<0.05) -BMI: body mass index-COPD: chronic obstructive pulmonary disease - APACHEII: cute physiologic assessment and chronic health evaluation II score

Table (3): Comparison between study group and control group in relation to their Vital signs before and after intervention or routine care (n=79)

Vital signs	**1st day**			**3rd day**			**5th day**		
	Study group	**Control group**	**p-value**	**Study group**	**Control group**	**p-value**	**Study group**	**Control group**	**p-value**
Temperature									
Before	38.1±0.7	37.5	0.57	37.8±	37.6±	0.06	37.9±0.5	38.6±5.7	0.41
During	37.8± 0.68	37.8± 0.68	0.77	38.2±	38.1±	0.37	38.1±0.67	37.95±0.65	0.43
5min after	37.6± 0.41	37.6± 0.45	0.88	37.6±0.5	37.6±0.6	0.28	38.67±6.7	37.3±1.6	0.23
15 min after	37.3± 0.74	37.6± 1.6	0.08	37.9±0.68	37.6±1.6	0.06	38.1±0.72	38±0.68	0.88
Respiration									
Before	33.7±10.1	35.3±8.9	0.44	31±7.8	34.4±7.1	0.07	30.8±8.3	33.6±8	0.11
During	22.2±4.5	26.3±7.1	0.01*	19.5±4.5	24.4±6.2	0.000***	33.5±8.9	34.5±7.3	0.5
5min after	26±6.8	22.6±4	0.072	20.4±5.6	24.4±5.7	0.001**	20.8±5.5	25±7.3	0.003**
15 min after	19.4±4.5	22.6±6.5	0.08	21.7±5.8	24.9±6.5	0.07	19.9±5.5	22.2±6.7	0.08
Mean									

Agitation, Pain, Sound therapy

Blood pressure									
Before	80.1±15	82.4	0.58	74.8±17	76.5±6	0.69	78.0±16	78.4	0.4
During	76.4±18	75.5±29	0.85	77.1±15	78±21	0.78	73.7±18	77.0±24	0.3
5min after	79.6±14	80.2±19	0.86	73.1±17	73.2±28	0.70	77.5±20	77.5±15	0.6
15 min after	78.9±16	83.4±19	0.27	77.7±14	78.3±20	0.51	76.5±16	80.6±20	0.8

*Statistically significant difference (P≤ 0.05) - T-test -
-MAP: mean arterial pressure - -Temp:body temperature

Table (4): Comparison between study group and control group in relation to Arterial blood gases parameters' (ABG) one hour before and after intervention

ABG parametrs	**1st day**			**3rd day**			**5th day**		
	Study group	**Control group**	**p-value**	**Study group**	**Control group**	**p-value**	**Study group**	**Control group**	**p-value**
PH									
Before	7.40±0.1	7.41±0.4	0.78	7.39±0.09	7.36±0.1	0.44	7.40±1.09	7.36±0.08	0.07
After	7.39±0.9	7.35±0.1	0.09	7.39±0.09	7.36±0.1	0.2	7.39±0.1	7.38±0.1	0.01*
PCo2									
Before	40.2±17	43.9±20	0.39	46.1±16	45.5±17	0.90	47.8±20	41.6±11	0.1
After	48.2±17	42.1±14	0.09	47.25±17	41.8±11	0.1	51±21	41±17	0.03*
PO2									
Before	88.6±29	90.1±34	0.06	91±38	96±34	0.5	89.6±30	96±40	0.38
After	95 ±37	91.2±48	0.28	117.3±41	101.4±45	0.56	109.42±30	116±43	0.42
SaO2									
Before	94.4±4.4	95.5±24	0.85	96.4±18	93.6±18	0.4	94.4±4.4	95.5±24	0.77
After	97.1±4.5	93.9±5.5	0.05*	96.37±3.7	92.7±9.1	0.05*	98.2±3	92±8.9	0.05*
PF ratio									
Before	177±71	202.15±78	0.14	218.3±93	198±79	0.19	208.6±86	201±98	0.7
After	199.55±70	176 ±70	0.16	236.87±90	206.4±111	0.3	218.2±93.6	198±79.5	0.44

*Statistical significant difference (P≤ 0.05) - T-test
PH: acidity or power of hydrogen -PaO_2: partial pressure of oxygen -$PaCO_2$ partial pressure of carbon Dioxide -SaO_2: oxygen saturation – PF ratio: $PO2/FIO_2$ FIO_2: fraction of inspired oxygen.

Table (5) Mean distribution of pain score among study group and control group of patients before and after intervention. (total N of all Pts=79)

CPOT	1st day			3rd day			5th day		
	Study group	**Control group**	**p-value**	**Study group**	**Control group**	**p-value**	**Study group**	**Control group**	**p-value**
Before	6.5±1.9	6.9±1.4	0.21	6.6±1.2	6.7±0.66	0.76	3.5±0.56	3.4±0.48	0.69
During	5.8±1	6.7±1.5	0.003**	4.9±0.8	5.4±0.75	0.005**	5.5±1	5.6±1	0.006**
5min after	3.6±0.8	3.4±0.77	0.23	4.4±0.92	5±1.4	0.04*	4.1±1.2	4.9±1.3	0.04*
15 min after	2.3±1	3.5±1	0.06	3.5±0.55	3.4±0.49	0.44	2.9±0.9	3.1±1.7	0.07

*Statistically significant difference (P≤ 0.05) T-test
CPOT: critical care pain observation tool

Table (6) Mean distribution of agitation score for both Study group and Control group of patients before and after intervention. (Total N of all Pts=79)

RASS	1st day			3rd day			5th day		
	Study group	**Control group**	**p-value**	**Study group**	**Control group**	**p-value**	**Study group**	**Control group**	**p-value**
Before	3.77±0.42	3.76±0.42	0.95	3.7±0.45	3.6±0.49	0.30	3.2±0.77	3.5±0.68	0.11
During	2.8±0.74	3.2±0.55	0.005**	2.4±0.74	2.5±0.96	0.005**	2.5±0.96	2.02±1.01	0.04*
5min after	3.4±0.49	3.2±0.40	0.05*	2.4±0.49	3.2±0.40	0.005**	2.7±1.01	3.1±0.89	0.05*
15 min after	3.82±0.38	3.38±0.36	0.80	3.8±0.40	3.7±056	0.33	2.7±1.18	2.7±1.02	0.97

T-test *Statistical significant difference (P≤ 0.05) RASS:Richmond agitation sedation scale

Agitation, Pain, Sound therapy

Table (7): Patient's Outcomes among study group and control group:

Items	Study Group (n=40) 50.6%	Control group (n=39) 49.4%	P value
	M±SD	M±SD	
Mean agitation score	2.5±0.96	2.02±1.01	0.04*
Mean pain score	1.4±0.9	3.8±1.7	0.001**
Duration on MV	8.3±3	11.4±5.3	0.01*
Length of stay in ICU	14.9±12	20±2.3	.004**
Mortality rate N (%)	13(32%)	23(58%)	.014*
Extubation outcomes			
Reintubation	14(35%)	23(57.5%)	0.03*
Extubation success	26(65%)	17(42.5%)	

*Statistically significant difference (P≤ 0.05) -independent sample t-test

MV:mechanical ventilator -ICU : intensive care unit - APACHE : acute physiology and chronic health evaluation.

Figure (1): Correlation critical pain observation scale and length of stay

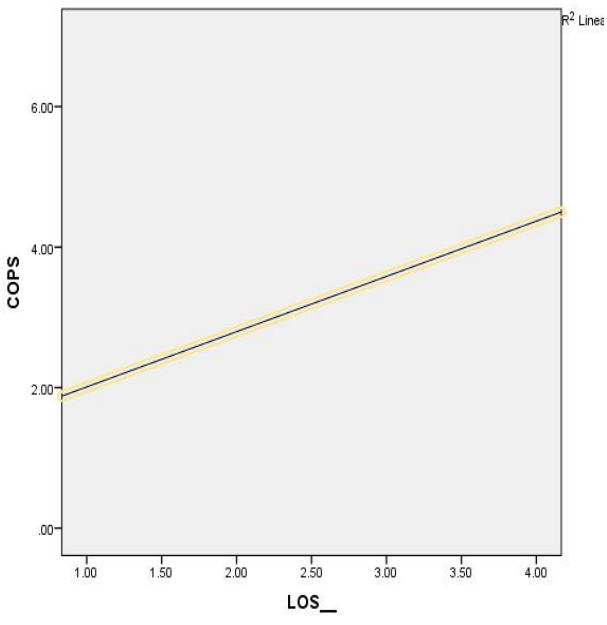
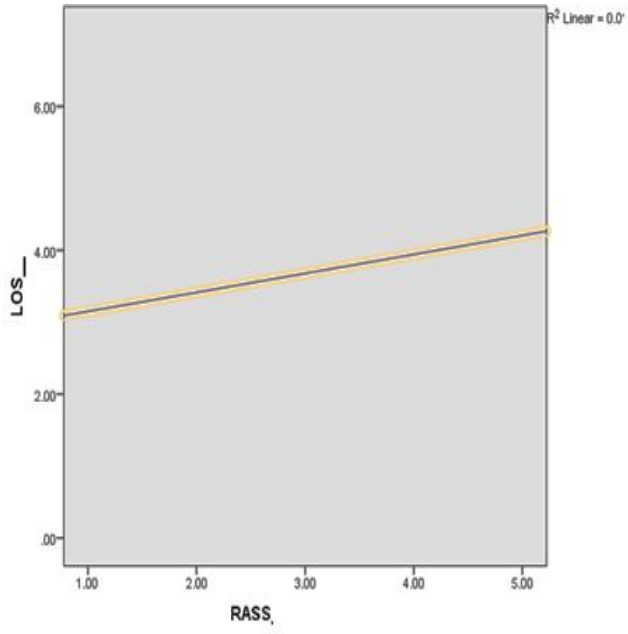


Figure (2): Correlation between Richmond agitation sedation score and length of stay in study group and control group



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