Effect of Abdominal Massage on Clinical Outcomes of Enterally Fed Mechanically Ventilated Patients

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Abstract

Background: Ventilator-associated pneumonia was a severe healthcare associated infectionin intensive care units. Abdominal massage is non-pharmacological nursing intervention for decreasing elevated gastric residual, vomiting frequency and abdominal distension. Gastric distension and increased gastric residual are important risks for developing ventilator-associated pneumonia. Mechanically ventilated patients who are enterally fed, abdominal massage decreases the duration of the nutrition passage through the gastrointestinal tract, induces peristaltic movement, and thus lowers intra-abdominal pressure and the risk of aspiration. **Aim*:*** Was to assess the effect of abdominal massage on Clinical Outcomes of Enterally Fed Mechanically Ventilated Patients. **Method:** a quasi-experimental study, purposive sample of 60 adult's patient will be enrolled sequentially into two groups, each group consists of (30) patients. Four tools were used to conduct the study. Tool I: Patient Assessment Tool, Tool II: Glasgow coma scale, Tool III: Enteral nutrition Assessment Tools which include five parts and Tool IV: Clinical Pulmonary Infection Score (CPIS) to assess Ventilator-Associated Pneumonia (VAP). **Results:** The present study showed that there was a significant differences found among the intervention group throughout 1st, 3rd and 7th day of follow up regarding gastric residual volume assessments score pre and one hour post abdominal massage since p= 0.000*, 0.003*, 0.000* respectively. In addition; the study showed that 6.7% of the control group had≤6 Negative VAP compared to majority 86.7% of the study group have≤6 Negative VAP in the 7thday of follow up. **Conclusion:** Based on the results of the current research, it can be argued that abdominal massage is beneficial on decreasing abdominal distension; nasogastric tube feeds side effects, gastric residual volume (GRV) and reducing Ventilator-Associated Pneumonia (VAP) in the study than control group. Moreover, the results established that minority of the control group have ≤6 Negative VAP compared to majority of the study group have ≤6 Negative VAP in the 7th day of follow up. **Recommendations:** Abdominal massage for mechanically ventilated patients with enteral nutrition should be performed as routine nursing care if not contraindicated to lower the aspiration risk and consequently Ventilator Associated Pneumonia (VAP).

Key Wards: Clinical Outcomes, Abdominal Massage, Enteral Feeding, Mechanically Ventilated Patient.

Introduction

Mechanically ventilated patients need nutritional support because they are seriously ill and unable to take oral feeding. A catabolic condition with an elevated level of metabolic stress is frequent in ventilated patients as a result of a systemic inflammatory response. They're more likely to experience complications including ventilator-associated pneumonia or urinary tract infection, as well as organ failure, prolonged hospitalization, and death. Enteral feeding is also considered a treatment option for people who are unable to consume oral nutrition. Enteral feeding is believed to preserve gut health and thereby modulate the stress response to critical illness andreduce the disease severity. [(1)]

Mechanical ventilator (MV) should help in exchange of gases without inducing pulmonary trauma. Unfortunately, it can also cause pulmonary effects such as strain and stress. High pressure and volume can result in pulmonary trauma, which can lead to biotrauma and atelectasis. Also, ventilator-associated pneumonia is another complication that may occur.[(2)]

More than half of the patients in the critical care unit have irregular gastric motility, which causes sluggish gastric emptying. Delayed gastric emptying can cause a number of problems,

including insufficient caloric intake and infrequent use of enteral nutrition in the intensive care unit (ICU). The risk of ventilator-associated pneumonia is increased by nausea, regurgitation, and aspiration .[(3-4)]

As a result, assessing the gastric residual volume (GRV) is recommended to reduce the frequency of these complications. consequently, in cases of high GRV, it is important to reduce the amount of enteral feeding or the osmolality of the formula. The monitoring of gastric residual volume in critically ill patients undergoing mechanical ventilation has been the subject of many studies. Previous studies that found a correlation between GRV and VAP were not well designed to demonstrate GRV as a reliable marker of increased VAP risk, and they concluded that monitoring GRV in mechanically ventilated patients is unnecessary and provides no additional benefits. [(5-7)]..

Ventilator-associated pneumonia is a form of nosocomial bacterial infection that affects patients who have had invasive ventilation for at least 48 hours before being diagnosed. It's a common form of

pneumonia acquired in hospitals (HAP).

When a chest X-ray reveals new infiltration and at least one of the following criteria is present: fever, leukocytosis, and purulent tracheobronchial secretions, it may be diagnosed. The second most common hospital-acquired infection is pneumonia caused by a ventilator. The average or crude mortality rate associated with VAP varies from 40% to 70%, depending on the underlying disease, the etiologic pathogen of lung infection, the associated bacteremia, and the sufficiency of prophylactic antibiotic treatment.[8,9].

Abdominal massage, was a nursing intervention for minimizing elevated gastric residual, vomiting frequency, and abdominal distension, has been indicated in numerous studies. Abdominal massage shortens the time it takes for food to pass through the digestive tract, stimulates and preserves peristaltic activity, and decreases intra-abdominal pressure. Furthermore, it was a nonpharmacological, noninvasive, and safe approach with no side effects.[10.]

Moreover, abdominal massage often changes intra-abdominal pressure and increases vagal stimulation. This boosts gastric motility and improves gastric emptying. The favored nursing intervention for treating and decreasing gastrointestinal complications is the abdominal massage, because it has many benefits, including the simplicity of which nurses may apply it individually and the absence of side effects.[11,12].

Significance of the study

Ventilator-associated pneumonia was defined as nosocomial pneumonia that occurs at least 48 hours after the initiation of mechanical ventilation and affects from 6 % to 52% of total cases of nosocomial infection in critical care units. Also, it accounts 9–13% of the total deaths in patients with ventilator support devices . There have been several risk factors reported for the incidence of ventilator-associated pneumonia. It is possible to count factors relevant to the patient such as age and health condition, medication and care procedures such as enteral feeding, antacid prophylactic therapy, and infection control related factors. [13-15]

Enteral feeding was shown to be a three-fold increase in the development of ventilator-associated pneumonia in patients on mechanical ventilation. Reflux, aspiration, diarrhea, abdominal distention, constipation, and intestinal ischemia are also potential side effects. Patients who received enteral nutrition documented them in 62% of cases. [16-18]

Increased gastric residual volume was observed in 32 % to 39 percent of enterally fed patients, as well as feeding intolerance in 60 percent. Increased gastric residual

volume due to enteral feeding can cause pulmonary aspiration, which is one of the most dangerous mechanical problems and one of the major causes of Ventilator-associated pneumonia VAP. Aspiration was seen at a rate of 8 percent to 95 percent in intensive care units. The true incidence remains unclear due to the lack of standardized diagnostic criteria and silent aspiration.[19-25]

Gastric distention, high residual volume can be reduced by abdominal massage and this lowers the rate of ventilator-associated pneumonia. Several researches have shown that abdominal massage can affect constipation, gastric residual volume, and abdominal distention [26-29,30-34.] There hasn't been any research conducted on the influence of abdominal massage on the growth of Ventilator-associated pneumonia VAP. As a result, the aim of this study was to evaluate how abdominal massage affected the enterally fed patient's clinical outcomes who are mechanically ventilated.

Operational Definition of Clinical Outcomes: the clinical outcomes involved in this study include; *tolerance of enteral nutrition* as indicated by decreased occurrence of abdominal distension, constipation, diarrhea, vomiting, and low gastric residuals and decreased incidence of ***ventilator-associated*** **pneumonia (VAP).**

Aim of the study

The Aim of the study was to assess the effect of abdominal massage on Clinical Outcomes of Enterally Fed Mechanically Ventilated Patients.

Research hypothesis

H1: There would be a relationship between the Abdominal Massage and the Clinical Outcomes.

H2: The abdominal massage would decrease abdominal distension; episodes of vomiting, gastric residual volume in the intervention group compared to control group.

H3: The abdominal massage would decrease occurrence of Ventilator-Associated Pneumonia in the intervention group than those in the control group.

II. Materials and method

Design

A quasi-experimental design was used in this research

Study settings

This study was conducted in Anesthesia Intensive Care Unit of the Emergency Hospital affiliated to Tanta University Hospitals, Tanta City, Egypt.The hospital has one floor for Anesthesia Intensive Care Unit which consist of 4 wards, each ward contains 6 beds (The capacity of the unit includes24 beds).

Subjects

A purposive sample of 60 critically ill adults' patients and meeting the inclusion criteria. they would be enrolled sequentially into two groups; each group consisted of (30) patients. The sample size estimated by Power analysis of independent t tests [One tail, Effect size = 0.55; The significance level (α) at 0.05; Power (1-β) = 0.85]

The two groups were as following:

Group (I): was the control group and not received the abdominal massage

Group (II): was the study group, they would receive the intervention measure which was the abdominal massage

The subjects were selected according to the following Criteria;

- Their age ranged from 18 to less than 60 years,
- The Sequential Organ Failure Assessment Score (SOFA) lower than 14,
- The patients used only H2 receptor antagonists as gastric prophylaxis,
- Mechanically ventilated for at least 48 h,
- Absence of infection manifestations and infiltration on chest X-ray for 48hours post intubation,
- on nasogastric enteral feeding.

Exclusion criteria were:

-The patients with tracheostomy, abdominal wound, surgery gastrostomy and jejunostomy tubes, radiotherapy, ileus, diarrhea,

-The patients used pro-kinetic agents,

-The patients were hemodynamically unstable, HIV infection, or cytotoxic drugs-induced neutropenia.

Tools of the study

The data was collected using four tools as following:

Tool I:bio Socio-demographic characteristics of the patient

The tool was designed by the researcher after researching the literature[(35)]to collect the data. It involved three parts

Part (A): Socio-demographic characteristics of the patients:

Socio-demographic data involves, gender, marital status, age, educational level, working and residence

Part (B): Patients' clinical data

It was formulated by the researcher after reviewing of the relevant literatures [(35)] which include data such as admission diagnosis, length of ICU stays, mechanical ventilation related clinical data, past medical history and current medications.

Part (C): The Sequential Organ Failure Assessment Score (SOFA) [(36-37)]

The tool was used to estimate the morbidity and mortality for critically ill patients according to the level of organ dysfunction based on the clinical data. It

was designed by **Lambden et al., (2019**) and adopted by the researcher.

The Sequential Organ Failure Assessment Score **(**SOFA) included six organ system, respiratory, cardiovascular, hepatic, coagulation, renal and neurological systems every organ system is assigned scored from 0 (normal) to 4 (high degree of organ malfunction). It was used to assess patients on intensive care unit admission. It was calculated using online software on **ClinCalc.com**. The SOFA score ranges from 0 to 24. The SOFA score ranged from 0-6 ,7-9,10-12, 13-14,15-24, correlated to less than10%,15-20% ,40-50%, 50-60%, and more than 80% mortality respectively.

Tool II: Glasgow Coma Scale;[(38)]

It was used to assess the level of consciousness. The scale assesses patients' responsiveness through eye-opening, motor, and verbal responses. It was used on the first, second, and seventh days of the study, and the scores ranging from 3 (worst) to 15 (best).

Tool III: Enteral Nutrition Assessment Tools:

It was designed by the researcher after extensive search of the literature to evaluate the effect of abdominal massage on the enteral feeding related gastrointestinal complications. It included five parts as following;

Part(A): Enteral feeding follows up sheet

This was included data about the rate, type and amount of feeding/ml, feeding regimens and type of feeding tube used.

Part (B): Gastric residual volume assessment sheet:

It was used to assess the amount of gastric residual before the abdominal massage and the second time one hour after the second massage. It was done three times; on the first, second and 7th day of the study [39-40]

Part (C): Abdominal circumference assessment sheet:[21]

It was done before the abdominal massage and one hour after the second massage on the first, second and 7th day of the study**.**

Part(D): Vomiting assessment sheet

It was done on the first, second and 7th day of the study.

Part (E): Defecation assessment sheet;

which include assessment of frequency and consistency of defecation on the first, second and 7th day of the study.

Tool IV:Clinical Pulmonary Infection Score (CPIS) for Ventilator-Associated Pneumonia(VAP) [(41-42)]

It was designated and used by (**Mohamed, E. E., &AbdAlla, A. E. D. A.,2013)** and **(Fernando, et al., 2020))** and adopted by the researcher to assess ventilator associated pneumonia (VAP) on the first, second and 7th day of the study. It was

calculated using on line software on **mdcalc.com**.[43] It includes assessment of six parameter: **Patient temperature, Leukocytic count, Tracheal secretions**, **oxygenation , Chest x-ray, andQuantitative growth of pathogenic bacteria in tracheal aspirate culture**. every parameter had score according to its result. The total score ranges from 0 to 12. The patients with CPIS more than 6 were evaluated as VAP positive while others with CPIS less than or equal 6 were evaluated VAP negative.

The following table show the scoring system of Clinical Pulmonary Infection Score (CPIS)[44]

parameter	point
Patient temperature	
≥36.5 ° C and ≤38.4 ° C	(0 points)
≥38.5 ° C and ≤38.9 ° C	(1 point)
≥39 ° C	(2 points)
≤36 ° C	(2 points
Leukocytes	
≥4000 / mm $^{-3}$ and ≤11000 / mm $^{-3}$	(0 points)
<4,000 / mm $^{-3}$ or> 11,000 / mm $^{-3}$	(1 point)
<4,000 / mm $^{-3}$ or> 11,000 / mm $^{-3}$ with ≥500 bands	(2 points)
Tracheal secretions (0-4 + counts summed over hours)	(0 points)
<14+	(1 point)
≥14 +	(2 points)
≥14 + and purulent	
PaO2 (mmHg) / FIO2	
> 240 or presence of ARDS	(0 points)
≤240 or no presence of ARDS	(2 points)
Chest x-ray	
Without infiltrator	(0 points)
Patchy or diffuse infiltrate	(1 point)
Localized infiltrators	(2 points)
Quantitative growth of pathogenic bacteria in tracheal aspirate culture	(0 points)
≤1 + or no growth	(1 point)
> 1+	(2 points)
> 1+ and the same bacteria on Gram stain	

Method of data collection:

The study was accomplished through the following steps:

1-An official hospital permission was received from the responsible authority in the selected Intensive Care Unit, Tanta University Hospitals before conducting the study.

2- Tool development:

The study involved four tools. Tools (I, and III) were formulated by the researcher after searching the relevant literature. While Tools (II, and VI) were adopted and used by researcher, this included Glasgow Coma Scale and Clinical Pulmonary Infection Score (CPIS).

3- Validity of the tools

The tools were tested for content validity by experts in the field of the study and accordingly the needed modifications were done.Content validity index = 98.8%.

4. Reliability of the tools.

Alpha Cronbach's test was used, and reliability factor was =0.896, Cronbach's Alpha for Tool I was 0.856, Tool II was 0.873. Tool III was 0.855, and Tool IV Was 0.866.

5. A pilot study: -

It was conducted on 10% of the patients (six critically ill patients). The needed modifications were done before the main study. Data obtained were excluded from the present study.

6. The data was collected in duration of time approximately 8 months from **April 2019 to November 2019**

and include **the following three phases:**

A- Assessment phase: Was carried out for both study and control groups to collect baseline data from patients or their families in both control and intervention groups by using all tools(Tool I,II,III,IV).Data was collected first from control group to prevent contamination of data, over a period of 3 months. then data collection from the intervention group started and lasted 5 months to be completed.

B- Implementation phase:

Control group;The patients in this group did not receive the abdominal massage , they received only routine hospital care for enterally feed patients on mechanical ventilation. Prior to enteral feeding, Gastric residual volume was assessed **(**GRV) and abdominal circumference were measured for all patients in the control group.

Study group;the subjects received the abdominal massage as a suggested nursing intervention for enterally feed patients on mechanical ventilation plus the routine hospital care.

All patients in the study group received abdominal massage. The massage was performed in the privacy of the patient.

The massage patient was lying in a supine position with his or her legs slightly bent through placing the patient's legs on a pillow. The bed's head was raised 30 to 45 degrees. The upper anterior iliac projection under the chest ribs was exposed, while the rest of the body was covered. The researcher took a position to the right of the patient's pelvis.

The abdominal massage was done to the abdominal wall in the direction of the bowel. It was performed twice daily for 20 minutes in a clockwise direction over the intestines on the abdominal wall. The massage was performed half an hour before enteral feeding to minimize the risk of aspiration, with a 6-hour period between massages. lubricant gel was used to make the massage easier. During the study, the head of the bed elevated to angle 30 to 45 degrees and was maintained 24 hours a day, with a 30-degree angle for performing the massage.

Five stages of abdominal massage were used: **the first stage** started with a gentle relaxing stroke up the abdominal wall, followed by motions likes brushing the skin in the abdominal region. **The second stage**, elastic deformation movement of the thoracic lumbar fascia, was performed by putting the dominant hand on the abdominal skin, the other hand on it, and applying pressure then squeezing the skin under pressure. **The third stage**; the abdominal skin is picked and kneaded by the fingers as if it was dough. **The fourth stage** includes shock motions from top to bottom and conversely around the armpit. The muscles in the intercostal spaces of false ribs moved during the **final stage**.[40,45]

The gastric residual volume (GRV) and abdominal circumference were measured before **the** Abdominalmassage and 1 hour after second massage**.**

Gastric residual volume was measured by aspirating the gastric contents using a 60-ml syringe before each feeding. Extra syringes were used if the amount exceeds one syringe. the evaluation of gastric emptying of patients on continuous enteral feeding, enteral feeding was stopped for 30 minutes before aspirating the gastric residual and abdominal circumference measurements. Patients in the intervention group had their measurements taken just before receiving an abdominal massage.

Abdominal circumference measurements were done using soft flexible, plastic tape. The starting point for the measurement was umbilicus. During expiration, the subject's waist was labelled with a marker pencil, and measurements were taken at the same point each time

The light and deep palpation were used to assess abdominal distension. Applying

pressure adequate to form a 1 to 2cm depression for light palpation and 2.5- to 7.5-cm depression for deep palpation. It was assumed that there was no distension if the abdomen was soft and not tense. The distension was considered when the abdomen was tense and hard.**(40)**

C- Evaluation phase: This phase was carried out for both control and intervention group using tool II: (Glasgow coma scale),tool III:(Enteral nutrition Assessment Tools)Part A-E and tool IV(Clinical Pulmonary Infection Score (CPIS) for Ventilator Associated Pneumonia three times; 1st, 3rd and 7th day of study period .Comparison will be done among the studied groups to define the effect of abdominal massage on tolerance of enteral nutrition **as indicated by absence of abdominal distension, constipation, diarrhea, vomiting, and low gastric residuals; and *ventilator-associated* pneumonia (VAP) risk** as a clinical Outcomes of enterally fed mechanically ventilated patients.

7. **Ethical consideration:**

The researcher clarified the aim of the study to the relatives of the all eligible patients.

- The researcher assured maintenance of anonymity and confidentiality of the subject data using code number.
- the patients' families were informed that they could withdraw at any time of the study
- Patients' guardian informed about their rights to agree for their patient to participate or withdraw from the study at any time.

  Informed and written consent was obtained from the patient's family before their patients enrolling in the study.
- The researcher was start with control group then study group to prevent contamination of data
- Privacy of the studied patients will be maintained

Statistical analysis:

SPSS software statistical computer package version 25 was used to organize, tabulate, and statistically analyze the collected data. The range, mean, and standard deviation were calculated for quantitative data. For qualitative data, comparison was done using Chi-square test ($\chi 2$). For comparison between means of variables for two groups, independent samples T-test was used. The paired samples T-test was used to compare the means of variables before and after intervention in a group. The F-value of analysis of variance (ANOVA) was calculated to compare means for variables over three periods of intervention in a group, or for more than two variables.

Pearson and Spearman's correlation coefficient **r** were used to assess the correlation between variables. For the purposes of interpreting the results of significance tests (*), a significance level of P<0.05 was chosen. In addition, for the interpretation of the results of the significance tests (**), a highly significant value of P<0.01 was used[(46)] .

Result

Table (1): Showed percent distribution of the studied patients according to their socio–demographic characteristics among the studied groups. The results of the present study illustrated that; more than third 36.7%, majority (80%)and more than half (53.3%) of the control group were in the age group 30-<40years, males and lived in rural area respectively; in addition same percent of them 30% are singles and have university education. For study group; same percent 23.3% in the age group 30-<40years and car read and write as level of education; in addition, more than three quarter of them 76.7% and more than half60% and 63.3% of them males, married and doing work respectively.

Table (2) Showed percent distribution of the studied groups according to their past and current health relevant data. The results revealed that ; half percent 50% of control and study group patients had past history of hypertension and diabetes respectively, while more than half 60% and 46% of them had past history of respiratory disorders and hypertension respectively, in addition more than half 60% compared to half 53.3% of control and study were smoker.

Regarding current medication, the majority (73.3%) and (83.3%) of control and study group patients respectively recently undergoing antibiotic medication. Additionally the same percentage (60%) and (56.7 %) of the control group patients respectively undergoing antihypertensive, sedatives, calcium channel blockers and narcotics medication respectively; while; less than half and same percent of(43.3%) of the studied group undergoing sedatives, narcotics and muscle relaxant medication.

According to admission diagnosis; the table shows that small and same percent (6.7%), (13.3%), (6.7%), (3.3%) ,(23.3) and(3.3%)of the control and study group patients admitted to ICU with acute respiratory distress syndrome, drug intoxication, respiratory acidosis ,shock, traumatic brain injury and pulmonary edema respectively, while none of control group compared to small percentage (3.3%)of study group patients admitted with cardiac arrhythmias.

Regarding to length of ICU stay , the mean value of control and study group was (11.20±2.04)and (9.57±2.05)respectively

with significant difference between the two groups in which p= 0.003*****.There was no significance differences between control and study group in relation to past medical history, current medication and admission diagnosis.

Table (3): Revealed Percent distribution of the studied groups according to their mechanical ventilation related clinical data**.** It was revealed that less than half 40% and 36.7% %of control and study group patients respectively undergoing SIMV as a mode of ventilation. Also; the mean value of extubation time for control group was (8.57±3.01) compared to (6.07±3.11) for the study group with a significant difference since p= 0.002.

Regarding duration of mechanical ventilation, it was observed that the mean value of control and study group was (7.00±2.56) and (4.97±2.83) respectively and there was a significant difference among the studied groups since p= 0.005*****.

Concerning the patients' status on discharge, more than half (53.3%) of control group were transferred to other wards compared to the same percentage of study group were completely recovered. while (10%) compared to none of control and study group respectively were died.

Table (4): Showed Percent distribution of the studied groups according to their enteral feeding data. It was shown that more than half (56.7%) compared to third (33.3%) of control and study group respectively were receiving intermittent feeding. **In relation to the size of the tube feeding used**; it was found that; more than half (63.3%) and (66.7%) of control and study group respectively used large diameter tube.

Table (5). Demonstrated percent distribution of the studied groups according to enteral feeding data throughout the periods of study. It was revealed that a significant difference among the studied groups throughout the study periods (at **At 1st day,3rd day** and **At 7th day**) **regarding** type, amount and rate of feeding since p=0.000*. In addition; there were a significant difference among the study versus control group in relation to type, amount and rate of feeding throughout the study period since p =<0.05 except amount and rate of feeding in the 1st day of follow up.

Table (6): Demonstrated Percent distribution of the studied groups according to their **(SOFA)** score on admission to intensive care unit. It was shown that near half (43.3%) of control and study group undergoing score from (7-9). In addition, tenth (10%) compared to (3.3%)of control and study group respectively scored 13-14.Also, this table showed that the mean value of control and

study group regarding SOFA level on ICU admission was (9.13±2.32) and (9.03±1.99) respectively and there was no significant differences were found among the studied patients since p= (0.858) .

Table (7): Presented the Mean scores of Glasgow Coma Scale among the studied groups throughout study periods; it demonstrated that Glasgow Coma Scale mean value of control group was(7.70±2.003, 8.03±2.076 and11.43±2.285) in the 1st, 3rd and 7thday of the study period respectively compared to(6.40±1.429, 7.30±1.705, 11.60±1.404) for the study group in the same study period. Moreover, this table illustrated that there was a significant difference for the study and control throughout the study period where p= (0.000) *.

in addition; there was a significant difference between the control versus study group regarding first day of study periods where P value = 0.005*.

Table (8): Demonstrated the Mean scores of Gastric Residual Volume and Abdominal Circumference Assessments Score among the studied groups throughout the periods of the study. There were proven that no significant difference was found among the control group related to gastric residual volume and abdominal circumference assessments score throughout the study period since p => 0.05.On contrary side, a statistical significant differences among the study group throughout 1st, 3rd and 7thday of follow up regarding gastric residual volume assessments pre and one hour post abdominal massage since p= 0.000*, 0.003*, 0.000* respectively. In addition, there was a statistically significant differences found among the study group only in the 7thday of follow up regarding abdominal circumference assessments pre and one hour post massage since p=0.047*.

Table (9): Showed Percent distribution of the studied groups according to vomiting episodes and defecation frequency throughout the periods of the study. According to frequency of vomiting episodes; it was shown that a statistically significant differences among study and control group throughout the periods of follow up since p= 0.000* and 0.015* respectively. In addition, there were a significant difference between control versus study group throughout the study period in relation to frequency of vomiting episodes since (P= 0.044*, 0.000*) and (0.000*) in the 1st, 3rd and 7th day of follow up respectively.

Regarding to frequency of defecation, there was a statistically significant differences among the study and control group throughout the periods of follow up since p=0.000 *and 0.008 *respectively.

Moreover, there was a high significant difference between control versus study group in the 3rd and 7th day of follow up related to frequency of defecation since (P= 0.000 *).

Table (10): Presented Percent distribution of the studied groups according to their Clinical Pulmonary Infection Score parameters (CPIS) and risk of Ventilator-Associated Pneumonia (VAP) throughout the periods of the study

According to Total CPIS level; this table revealed that small percent 6.7% of control group compared to majority 86.7% of the study group have≤6 Negative VAP in the 7thday of follow up. Also, there was a statistically significant differences among the control group related to; white blood cell count, tracheal secretion, pulmonary radiology and culture of tracheal aspirate throughout the study period where (P=<0.05*)

In addition; there was significant differences among the study group related to tracheal secretion, oxygenation, and pulmonary radiology where P=<0.05. Also, there was a high statistically significant difference between study versus control group throughout the study period where P = 0.000 each.

Table (11): Revealed the correlations between Patient Clinical outcomes and Clinical Pulmonary Infection Score (CPIS) among the studied groups throughout the periods of the study. **Concerning the correlation between different clinical outcomes and Clinical Pulmonary Infection Score (CPIS),** this table showed that there was a significant negative correlation between Glasgow Coma Score and Clinical Pulmonary Infection Score for control group in the 7th day of follow up since r = - 0.431 and p= 0.017 while ; there was a significant positive correlation between SOFA score and Clinical Pulmonary Infection Score in the same group in the 1st day of follow up since r = 0.380 and p= 0.038. Furthermore; this table reveals that there was a significant negative correlation between abdominal circumference assessment and Clinical Pulmonary Infection Score in the study group in the 3rd day of follow up since (r = - 0.461) and (p= 0.010).

Table (1): Percent distribution of the studied groups according to their socio–demographic characteristics.

Characteristics	The studied patients (n=60)				χ^2 P
	Control group (n=30)		Study group (n=30)		
	N	%	N	%	
Age (in years)					
▪ (20-<30)	6	20.0	3	10.0	
▪ (30-<40)	11	36.7	12	40.0	2.627
▪ (40-<50)	9	30.0	7	23.3	0.453
▪ ≥50	4	13.3	8	26.7	
Range	**(22-56)**		**(23-59)**		t=0.875
Mean ± SD	**39.20±9.38**		**41.53±11.20**		P=0.385
Gender					
▪ Male	24	80.0	23	76.7	FE
▪ Female	6	20.0	7	23.3	1.00
▪ Marital status					
▪ Single	9	30.0	4	13.3	
▪ Married	13	43.3	18	60.0	3.796
▪ Widow	6	20.0	4	13.3	0.284
▪ Divorced	2	6.7	4	13.3	
Level of education					
▪ Illiterate	4	13.3	4	13.3	
▪ Read and write	6	20.0	7	23.3	
▪ Basic primary education	4	13.3	3	10.0	0.803
▪ Diploma	5	16.7	7	23.3	0.977
▪ Secondary education	2	6.7	2	6.7	
▪ University education	9	30.0	7	23.3	
Occupation before disease					
▪ Work	20	66.7	19	63.3	FE
▪ Not work	10	33.3	11	36.7	1.00
Place of residence					
▪ Rural	16	53.3	16	53.3	FE
▪ Urban	14	46.7	14	46.7	1.00

FE: Fisher' Exact test

Table (2): Distribution of the studied groups according to their past and current health relevant data.

History	The studied patients (n=60)				χ^2 P
	ontrol group (n=30)		Study group (n=30)		
	N	%	N	%	
Past medical history					
▪ Hypertension	15	50.0	17	50.0	
▪ Cardiac diseases	7	23.3	13	43.3	
▪ Malignancy diseases	6	20.0	5	16.7	1.071
▪ Respiratory disorders	18	60.0	14	46.7	0.796
▪ Liver diseases	14	46.7	11	36.7	
▪ Diabetes	15	50.0	15	50.0	
Smoking Habits					
▪ Yes	18	60.0	16	53.3	
▪ No	12	40.0	14	47.7	
Current medications					
1. Antibiotics					
▪ Ongoing for ≥ 72 hours	8	26.7	5	16.7	FE
▪ Recently (< 72 hours) introduce	22	73.3	25	83.3	0.532
2. Antihypertensive drugs	18	60.0	17	56.7	
3. Hypoglycemic drugs	16	53.3	15	50.0	
4. Calcium channel blockers	17	56.7	13	43.3	4.80
5. Beta blockers	6	20.0	14	46.7	0.054
6. Sedatives	18	60.0	13	43.3	
7. Narcotics	17	56.7	13	43.3	
8. Muscle relaxant	15	50.0	13	43.3	
Admission diagnoses					
▪ Acute respiratory distress syndrome	2	6.7	2	6.7	
▪ Drug intoxication	4	13.3	4	13.3	
▪ Respiratory acidosis	2	6.7	2	6.7	
▪ Guillain–Barré syndrome	2	6.7	1	3.3	
▪ Myasthenia gravis	2	6.7	1	3.3	
▪ Spinal cord injury	3	10.0	2	6.7	3.343
▪ Shock	1	3.3	1	3.3	0.993
▪ traumatic brain injury	7	23.3	7	23.3	
▪ Stroke	1	3.3	3	10.0	
▪ Chest trauma	4	13.3	3	10.0	
▪ Cardiac arrhythmias	0	0.0	1	3.3	
▪ Pulmonary edema	1	3.3	1	3.3	
▪ Respiratory failure	1	3.3	2	6.7	
Length of ICU stay **Range** **Mean ± SD**	(8-15) 11.20±2.04		(7-14) 9.57±2.05		**t=3.096** **P=0.003***

* Significant at level P<0.05

Table (3): Percent distribution of the studied groups according to their mechanical ventilation related clinical data

Mechanical ventilation related clinical data	The studied patients (n=60)				χ^2 P
	Control group (n=30)		Study group (n=30)		
	N	%	N	%	
Mode of ventilation					
▪ Control	11	36.7	13	43.3	0.287
▪ SIMV	12	40.0	11	36.7	0.866
▪ Assist mode	7	23.3	6	20.0	
Time of extubation					
Range	(3-14)		(1-13)		**t=3.170**
Mean ± SD	8.57±3.01		6.07±3.11		**P=0.002***
Duration of MV					
Range	(2-12)		(1-12)		**t=2.916**
Mean ± SD	7.00±2.56		4.97±2.83		**P=0.005***
Status on discharge					
▪ Transferred to other wards	16	53.3	14	46.7	4.059
▪ Complete recovery	11	36.7	16	53.3	0.131
▪ Died	3	10.0	0	0.0	

* Significant at level P<0.05.

Table (4): Percent distribution of the studied groups according to their enteral feeding data

Enteral feeding data	The studied patients (n=60)				χ^2 P
	Control group (n=30)		Study group (n=30)		
	N	%	N	%	
Feeding regimen					
▪ Intermittent	17	56.7	10	33.3	4.344
▪ Continuous	13	43.3	20	66.7	0.114
Type of feeding tube used					
▪ Small diameter tube	11	36.7	10	33.3	FE
▪ Large diameter tube	19	63.3	20	66.7	1.00

FE: Fisher' Exact test

Table (5): Percent distribution of the studied groups according to enteral feeding data throughoutthe periods of study.

Enteral feeding data	The studied patients (n=60)													
	Control group (n=30)						χ^2 P	Study group (n=30)						χ^2 P
	At 1st day		At 3rd day		At 7th day			At 1st day		At 3rd day		At 7th day		
	N	%	N	%	N	%		N	%	N	%	N	%	
1.Type of feeding														
▪ Blended	0	0.0	4	13.3	9	30.0	35.937	0	0.0	14	46.7	16	53.3	51.131
▪ Commercial	0	0.0	11	36.7	13	43.3	0.000*	8	26.7	13	43.3	14	46.7	0.000*
▪ Milk and juice	30	100.0	15	50.0	8	26.7		22	73.3	3	10.0	0	0.0	
Control group Vs Study group														
χ^2	FE		13.722		9.997									
P	0.005*		0.001*		0.007*									
2.Amount of feeding/ml/2 Hours														
▪ 200	30	100.0	30	100.0	0	0.0	90.00	25	83.3	0	0.0	0	0.0	82.905
▪ 300	0	0.0	0	0.0	26	86.7	0.000*	5	16.7	17	56.7	6	20.0	0.000*
▪ 400	0	0.0	0	0.0	4	13.3		0	0.0	13	43.3	24	80.0	
Control group Vs Study group														
χ^2	FE		60.00		FE									
P	0.052		0.000*		0.000*									
3.Rate of feeding (ml /hour)														
▪ 80		100.0	21	70.0	0	0.0	66.176	30	100.0	0	0.0	0	0.0	115.714
▪ 100		0.0	9	30.0	25	83.3	0.000*	0	0.0	22	73.3	6	20.0	0.000*
▪ 150		0.0	0	0.0	5	16.7		0	0.0	8	26.7	24	80.0	
Control group Vs Study group														
χ^2	-		34.452		FE									
P			0.000*		0.000*									

* Significant at level P<0.05

Table (6): Percent distribution of the studied groups according to their Sequential Organ Failure Assessment Score (SOFA) on admission to intensive care unit.

The Sequential Organ Failure Assessment Score (SOFA)	**The studied patients (n=60)**				χ^2 **P**
	Control group (n=30)		**Study group (n=30)**		
	N	**%**	**N**	**%**	
SOFA level on ICU admission					
▪ (0-6)	5	16.7	4	13.3	
▪ (7-9)	13	43.3	13	43.3	1.540
▪ (10-12)	9	30.0	12	40.0	0.673
▪ (13-14)	3	10.0	1	3.3	
Range	**(6-13)**		**(6-13)**		t=0.179
Mean ± SD	**9.13±2.32**		**9.03±1.99**		P=0.858

* Significant at level P<0.05

Table (7): Mean scores of Glasgow Coma Scale among the studied groups throughout study periods.

GCS score	The studied patients (n=60) Range Mean ± SD							
	Control group(n=30)			F P	Study group(n=30)			F P
	At 1st day	At 3rd day	At 7th day		At 1st day	At 3rd day	At 7th day	
Glasgow Coma Score	(5-13) 7.70±2.003	(5-12) 8.03±2.076	(5-14) 11.43±2.285	**28.372** **0.000***	(4-9) 6.40±1.429	(4-10) 7.30±1.705	(8-14) 11.60±1.404	**100.438** **0.000***
Control Vs Study **t** **P**	**2.894** **0.005***	1.495 0.140	0.340 0.735					

* Significant at level P<0.05

Table (8): Mean scores of Gastric Residual Volume and Abdominal Circumference Assessments Score among the studied groups throughout the periods of the study

Assessment parameters	The studied patients (n=60) Range Mean ± SD								
	Control group (n=30)			Study group (n=30)					
				At 1st day		At 3rd day		At 7th day	
	At 1st day	At 3rd day	At 7th day	Before massage	1 Hour after massage	Before massage	1 Hour after massage	Before massage	1 Hour after massage
Gastric residual volume Assessment	(120-250) 70.33±33.16	(120-250) 69.00±33.15	(120-300) 83.00±38.25	(150-250) 80.67±32.68	(70-200) 15.00±26.49	(50-250) 39.33±55.08	(50-200) 9.33±44.09	(50-120) 3.33±21.389	(30-60) 46.67±9.94
F P	1.467 0.236			46.93 0.000*	42.02 0.000*				
Study group only t P				8.549 0.000*		3.105 0.003*		8.515 0.000*	
Abdominal circumference Assessment	(86-125) 03.77±10.28	(90-128) 07.13±9.76	(90-129) 07.73±9.85	(86-117) 01.50±8.24	(84-115) 98.90±8.21	(90-128) 07.13±9.76	(86-125) 03.77±10.28	(86-125) 03.77±10.28	(84-115) 98.90±8.21
F P	1.380 0.257			2.688 0.074	2.953 0.057				
Study group only t P				1.224 0.226		1.30 0.199		2.026 0.047*	

* Significant at level P<0.05.

Table (9): Percent distribution of the studied groups according to vomiting episodes and defecation frequency throughout the periods of the study.

Assessment	The studied patients (n=60)													
	Control group (n=30)						χ^2 P	Study group (n=30)						χ^2 P
	At 1st day		At 3rd day		At 7th day			At 1st day		At 3rd day		At 7th day		
	N	%	N	%	N	%		N	%	N	%	N	%	
Frequency of vomiting episodes														
▪ None	13	43.3	3	10.0	4	13.3	12.348	12	40.0	21	70.0	28	93.3	25.217
▪ Once/day	12	40.0	17	56.7	15	50.0	0.015*	18	60.0	7	23.3	2	6.7	0.000*
▪ **Twice/day	5	16.7	10	33.3	11	36.7		0	0.0	2	6.7	0	0.0	
Control group Vs Study group														
χ2	6.240		23.00		38.941									
P	0.044*		0.000*		0.000*									
Frequency of defecation														
▪ None	28	93.3	24	80.0	18	60.0	9.771	25	83.3	2	6.7	0	0.0	61.27
▪ Once/day	2	6.7	6	20.0	12	40.0	0.008*	5	16.7	28	93.3	30	100.0	0.000*
Control group Vs Study group														
χ2	FE		FE		FE									
P	0.424		0.000*		0.000*									

* Significant at level P<0.05
**Twice/day equal zero for frequency

Table (10): Percent distribution of the studied groups according to their Clinical Pulmonary Infection Scoreparameters (CPIS) and risk of Ventilator-Associated Pneumonia (VAP) throughout the periods of the study

CPIS items	The studied patients (n=60)													
	Control group(n=30)						χ^2 P	Study group(n=30)						χ^2 P
	At 1st day		At 3rd day		At 7th day			At 1st day		At 3rd day		At 7th day		
	N	%	N	%	N	%		N	%	N	%	N	%	
1.Temperature (°C)														
▪ (36.5-38.4)	1	3.3	0	0.0	1	3.3	**5.079**	3	10.0	5	16.7	5	16.7	3.070
▪ (38.5-38.9)	25	83.3	19	63.3	21	70.0	**0.279**	21	70.0	22	73.3	23	76.7	0.546
▪ ≥39.0 or ≤36.0	4	13.3	11	36.7	8	26.7		6	20.0	3	10.0	2	6.7	
2.White Blood Cell Count														
▪ (4-11)	21	70.0	6	20.0	5	16.7		0	0.0	2	6.7	1	3.3	
▪ <4 or >11	6	20.0	11	36.7	11	36.7	**24.248**	22	73.3	21	70.0	26	86.7	**4.942**
▪ Either <4 or >11 plus band forms ≥500	3	10.0	13	43.3	14	46.7	**0.000***	8	26.7	7	23.3	3	10.0	**0.293**
3.Tracheal Secretions														
▪ <14+ Small	0	0.0	0	0.0	0	0.0		2	6.7	9	30.0	12	40.0	
▪ ≥14+ moderate/large	24	80.0	15	50.0	22	73.3	**6.817**	25	83.3	20	66.7	17	56.7	**10.05**
▪ ≥14+ plus purulent secretions	6	20.0	15	50.0	8	26.7	**0.033***	3	10.0	1	3.3	1	3.3	**0.040***
4.Oxygenation														
▪ >240 or ARDS	5	16.7	4	13.3	6	20.0	**0.480**	21	70.0	5	16.7	3	10.0	**29.712**
▪ ≤240 and no ARDS	25	83.3	26	86.7	24	80.0	**0.787**	9	30.0	25	83.3	27	90.0	**0.000***
5.Pulmonary Radiography														
▪ No infiltrate	0	0.0	0	0.0	0	0.0		10	33.3	21	70.0	22	73.3	
▪ Diffuse or patchy infiltrate	23	76.7	13	43.3	21	70.0	**8.038**	12	40.0	8	26.7	8	26.7	**18.828**
▪ Localized infiltrate	7	23.3	17	56.7	9	30.0	**0.018***	8	26.7	1	3.3	0	0.0	**0.001***

Continued …

le (10): Percent distribution of the studied groups according to their Clinical Pulmonary Infection Score parameters (CPIS) and risk of Ventilator-Associated Pneumonia (VAP) throughout the periods of the study

CPIS items	The studied patients (n=60)												
	Control group(n=30)						χ^2 P	Study group(n=30)						χ^2 P
	At 1st day		At 3rd day		At 7th day			At 1st day		At 3rd day		At 7th day		
	N	%	N	%	N	%		N	%	N	%	N	%	
6.Culture of tracheal aspirate specimen														
▪ Pathogenic bacteria cultured ≤1 or no growth	6	20.0	23	76.7	7	23.3		30	100.0	29	0.0	30	100.0	
▪ Pathogenic bacteria cultured >1+	20	66.7	3	10.0	20	66.7	**28.79 0.000***	0	0.0	0	96.7	0	0.0	-
▪ Pathogenic bacteria cultured >1+ plus same pathogenic bacteria on gram stain >1+	4	13.3	4	13.3	3	10.0		0	00	0	0.0	0	0.0	
Total CPIS level														
▪ ≤6 Negative VAP	5	16.7	0	0.0	2	6.7	**5.886**	25	83.3	27	90.0	26	86.7	**0.577**
▪ >6 Positive VAP	25	83.3	30	100.0	28	93.3	**0.053**	5	16.7	3	10.0	4	13.3	**0.749**
Range Mean ± SD	(5-9) 6.57±1.17		(6-11) 7.70±1.44		(5-11) 7.40±1.48		**t=3.348 P=0.001***	(4-6) 4.93±0.640		(4-7) 4.70±0.750		(4-7) 4.70±0.877		**t=1.297 p=0.200**
Control Vs Study t P	**6.731 0.000***		**10.110 0.000***		**8.613 0.000***									

Table (11): Correlationsbetween Patient Clinicaloutcomes and Clinical Pulmonary Infection Score (CPIS)among the studied groups throughout the periods of the study.

Patient's Clinical Outcome	Clinical Pulmonary Infection Score (CPIS)											
	Control group						Study group1 hour after massage					
	At 1st day		At 3rd day		At 7th day		At 1st day		At 3rd day		At 7th day	
	r	P	r	P	r	P	r	P	r	P	r	P
Length of ICU stay	-0.137	0.469	-0.152	0.423	-0.009	0.963	0.027	0.886	0.094	0.623	0.240	0.201
Mechanical ventilation related clinical data												
▪ Time of extubation	-0.184	0.331	-0.143	0.452	-0.037	0.845	-0.223	0.236	0.009	0.963	0.248	0.186
▪ Duration of MV	-0.197	0.298	-0.103	0.589	-0.082	0.666	-0.191	0.311	0.028	0.885	0.259	0.166
SOFA score	0.380	0.038*	0.012	0.948	0.216	0.252	-0.188	0.321	0.169	0.373	0.243	0.196
Glasgow coma score	-0.043	0.822	-0.285	0.128	-0.431	0.017*	-0.309	0.096	0.100	0.600	-0.101	0.596
Gastric residual volume assessment	0.147	0.439	0.325	0.079	0.149	0.432	-0.122	0.520	0.244	0.194	0.000	1.000
Abdominal circumference assessment	0.063	0.740	-0.129	0.496	0.313	0.092	-0.080	0.674	-0.461	0.010*	-0.100	0.599
Frequency of vomiting episodes	0.134	0.482	-0.151	0.427	0.172	0.364	0.341	0.065	0.216	0.251	-0.255	0.174
Frequency of defecation	0.016	0.933	-0.148	0.435	-0.185	0.328	0.183	0.334	0.060	0.754	-	-

* Significant at level P<0.05

Discussion

Ventilator associated pneumonia (VAP) in intensive care units was the most common hospital acquired infection developed within 48 hours of intubation. Ventilator associated pneumonia affected nearly a percentage of 6% to 52% of patients in intensive care units. Among predisposing factors for VAP was the enteral feeding. Moreover, the incidence of VAP in mechanically ventilated patients was increased by enteral feeding. It increased the development of VAP three-fold. The enterally fed patients were developed increased gastric residual volume in 32% and feeding intolerance in 46% of them. Increased gastric volume was found to be a sign of feeding intolerance, and an association between gastric volume and nosocomial pneumonia was detected. Enteral feeding causes an increase in gastric residual volume, which leads to pulmonary aspiration, that is one of the most severe mechanical complications.**(10)**

Aspiration is one of the essential factors causing the VAP whichresult from elevated gastric residual and delayed gastric emptying. Hence, prevention and treatment of feeding intolerance in critically ill patients receiving enteral nutrition were a significant nursing consideration. These necessitate the use of techniques that increase the rate of gastric emptying, thus increasing tolerance to feeding.**(47,31)**

Currently, the abdominal massage was considered a non-pharmaceutical method that knew to be effective in reducing aspiration. which has been proved to decrease various enteral feeding-related gastrointestinal complication via its direct impact on gastric residual which is a significant predictor of enteral feeding tolerance**.** **(47,26-27,12).**

The present study was conducted in order to know how effective abdominal massage was on ventilator-associated pneumonia and gastric residual volume among patients with enteral feeding. The result of the present study illustrated that the mean age and SD of control and study group was (**39.20±9.38**) and **(41.53±11.20**) respectively were in the age group from 20-50 years; in relation to sex majority of control and study group were males. Regarding place of residence near half of the control group and more than half of the study group lived in urban and rural areas equally; **this finding was contradicted with Elpasionyet.al (2017)** **[48]**who mentioned that a total 60 patients were participated in the study with mean age and SD (60 ± 19.70) years for study and

(55.07 ± 20.16) years for control group and noted that (60%) in the study group and (53.3%) in the control group were males. The current study revealed that there were no statistically significant differences between both groups regarding socio–demographic characteristics. These results are **in the same line with Aysal et al., (2012),** who reported that there were no statistical significant differences between groups in term of age and sex.**(12)**

Regarding to admission diagnoses; the present study revealed that near than quarter of the control and study group admitted to ICU with a diagnosis of traumatic brain injury and minority of them had drug intoxication. Regarding to length of ICU stay; the current study showed that the mean value of control group was 9.40±2.11 compared to 9.00±1.97 of study group and there was a statistically significant differences among the studied patients regarding to length of hospital stay. This can be explained that the SOFA score for the studied group was the same for nearly half of admitted patient to intensive care unit. The score was designed to describe a sequence of complications of critical illness and among this complication was the longer hospital stay due to their morbidity **(49)**

This finding was **in line with Elpasiony et.al (2017)**(48)**,** who noted that neurological problems were the most common cause of ICU admission in both groups and there was no statistical significance difference between the two groups in relation to past medical history.

Regarding to mechanical ventilation related clinical data; the current study showed that about half of control group undergoing Synchronized intermittent mandatory ventilation (SIMV) compared to about half of study group who were undergoing control mode of ventilation. Also, the result presented that there was a significant difference among the studied groups **regarding duration of mechanical ventilation.concerning the patients' status on discharge**, more than half of the control group were transferred to other wards compared to the same percent of study group who were completely recovered.

In relation to the distribution of the studied groups according to their SOFA score on ICU admission, the present study showed that near half of control and study group undergoing score from (7-9), also this result presented that the mean value of control and study group regarding SOFA level on ICU admission was 9.13±2.32 and 9.03±1.99 respectively and there was no significant difference among the studied groups .**This finding was in agreement with Elbilgahy et al. (2015) (50),** who

found that there was strong association between increased days on mechanical ventilation **MV**& long duration of length of ICU stay in both groups. As the length of stay at the hospital is prolonged, the patients have more chances to get hospital-acquired infections.

The findings of the present study revealed that there was a significant difference of the study group in the 1st, 3rd and 7thday of follow up and there was a significant difference between control and study group throughout periods of study related to Glasgow coma scale. **This finding was in contradicted with Elpasiony et.al (2017)[48],** who noted that there was no statistical significance difference between the two groups related to Glasgow coma scale.

Regarding the mean values of gastric residual volume(GRV) **assessments score**, the present study showed that there was a statistical significant differences found among the study group throughout 1st, 3rd and 7thday of follow up regarding gastric residual volume assessments score before and one hour after the abdominal massage. **This is congruent with Yaghoubinia et.al (2017) [51]** who reported that when comparing changes in GRV measurements between the first and last day of the study, there was statistically significance difference between both groups as near to three quarter of patients in the study group had equal amount of GRV at the first and last day of the study in relation to near half of patients in the control group. Moreover; another randomized controlled study on adult patients receiving enteral nutrition, showed that abdominal massage was effective in decreasing excess GRV and abdominal distention .[10,52]

Abdominal massage can stimulate peristaltic movement mechanisms, alter intra-abdominal pressure, and cause mechanical and reflexive effects on the intestines, reducing food transition time in the intestines, increasing intestinal movements, and thus facilitating food flow through the digestive tract. Furthermore, according to **Momenfar et al (2018)**, abdominal massage will stimulate touch and pressure receptors, resulting in sympathetic nervous system stimulation, which enhances gastrin secretion and accelerates gastric peristalsis, reducing abdominal distention and consequently gastric residual volume (GRV).[53]

In addition, the current result presented that there was a statistically significant among study group only in the 7th day of follow up regarding **abdominal circumference assessments** score before and one hour after the abdominal massage. This finding was in line with **Fareed et.al**

(2017) [54] who reported that the intervention massage group had a statistically significant difference on the first and last day compared to the other group. When the results of abdominal circumference of both groups were measured on the first and last day, abdominal circumference was substantially higher in the control group, according to **Uysal et al., (2012)**[12].**Similarly, the study done by Dehghan et al. (2018)** [44] it was observed that the abdominal circumference of the massage group decreased significantly after the study, although it increased significantly in the control group, and there was a considerable difference between the two groups.

Moreover, the study done by **Wang, Huang, & Jin, (2019)**[55]revealed that the abdominal massage helps to relieve abdominal distension, gastric residual, and vomiting. Abdominal massage did not reduce abdominal circumference in ICU patients when the intervention was less than 7 days long., but it did reduce abdominal circumference in ICU patients when the intervention time was equal to 7 days.

Regarding to vomiting episodes and defecation assessment among the studied groups throughout periods of study; the current study showed that there was a statistically significant difference among study group throughout the periods of follow up regarding frequency of vomiting episodes. **This is supported with Fareed et.al (2017)** [55]**,** who reported that there were significant decreases of vomiting frequency among study than control group in all times of follow up. In addition, there are studies indicating that abdominal massage reduces vomiting. [12,56]

Also, there was a statistical significant difference among study group throughout the periods of follow up regarding frequency of defecation this agreed with the stud done by**Altun Ugras et al (2020)** [57] **who stated that**, the patients who underwent abdominal massage had earlier bowel evacuation than the control group. Also, this in the same line of a previous study that showed that the abdominal massage decreased defecation periods and reduced the incidence of constipation in patients who were admitted to a trauma ICU, were fed enterally, and were on mechanical ventilator assistance.[44]

Moreover,according to **Okuyan and Bilgili (2019)**a comparison of the post-intervention constipation status of individuals in the massage and control groups revealed that the massage group's constipation status decreased with a significant difference between the groups.

Similarly, **Cevik et al. (2018)** found that the mean scores for the number of defecations increased after abdominal massage than before and during it, in a sample of twenty-two elderly patients[58,59] This agreed with the study done by (**Turan et al 2016) [60] who revealed that the** abdominal massage in orthopedic patients, was found to alleviate constipation symptoms and reduce the time to defecation. Furthermore, abdominal massage has been shown to activate the parasympathetic nervous system by increasing muscle activity, releasing digestive enzymes, and relaxing sphincters in the GI tract. Furthermore, abdominal massage causes a mechanical and reflex influence in the intestines due to changes in intraabdominal pressure, which increases peristalsis. The movement of nutrients across the gastrointestinal tract is accelerated by increasing peristalsis. As a result, stool stays in the large intestine for less time, and bowel movements become more frequent.[44,60]

In relation to Clinical Pulmonary Infection Score (CPIS) and the risk of Ventilator-Associated Pneumonia (VAP) throughout the periods of the study, the current study showed that minority of the control group hade ≤ 6 Negative VAP compared to majority of the study group who have ≤ 6 Negative VAP in the 7thday of follow up. Finally, there was a statistically significant differences among the massage group throughout the study period in relation to; tracheal secretions, oxygenation and pulmonary radiography. **This results were in line with Elpasiony et.al (2017)[49],** who stated that the finding of the study revealed that at the last day of the study there was statistically significance difference between study and control group patients regarding development of VAP as one third of the study group had developed VAP compared to near two thirds of control group.

Concerning the correlation between different clinical outcomes and Clinical Pulmonary Infection Score (CPIS); the present finding raveled that there was a significant negative correlation between Glasgow coma score and Clinical Pulmonary Infection Score in the control group in the 7th day of follow up and there was a significant positive correlation between SOFA score and Clinical Pulmonary Infection Score in the same group in the 1st day of follow up .In addition there was negative correlation between Gastric residual volume assessment and Clinical Pulmonary Infection Score in the study group at the first and third day one hour after the abdominal massage.

Abdominal massage has been shown in the literature to induce parasympathetic activity, resulting in a gastrointestinal response. As a result, abdominal massage increases intestinal movements and gastric emptying, reducing the risk of reflux and aspiration by changing intra-abdominal pressure and producing a mechanical and reflexive impact on the intestines, decreasing abdominal distension**.**[29]

Aspiration may occur due to increased gastric content as a result of reflux and vomiting. Consequently, elevated gastric residual volume and vomiting are harmful in enteral feeding patients.[61]Furthermore, the present study showed that there was a significant negative correlation between abdominal circumference assessment and Clinical Pulmonary Infection Score in the study group in the **3rd day of follow up**. Therefore, it is important to perform abdominal massage for enteral feeding patient on mechanical ventilation to avoid complications like a high gastric **residual volume** (GRV), abdominal distension, vomiting and consequently ventilator associated pneumonia.

Conclusion

Based on the results of the current study, it can be argued that abdominal massage is more effective in decreasing abdominal distension; nasogastric tube feeds side effects, gastric residual volume (GRV) in the massage group than the control group. Also, the results concluded the beneficial effect of abdominal massage on decreasing of Ventilator Associated Pneumonia **VAP** in the intervention massage group than control group. Also, the minority of the control group have ≤ 6 Negative VAP compared to majority of the study group have≤6 Negative VAP in the 7th day of follow up.

Recommendations

- Intensive care units nursing staff must focus on early assessment of abdominal distension; nasogastric tube feeding side effects, and gastric residual volume (GRV) before every feeding.
- Involve the abdominal massage as a regular part of the routine care for enterally feed critically ill patients unless contraindicated to reduce gastric residual volume (GRV), risk of aspiration and consequently prevention of ventilator associated pneumonia.
- Further research with large probability sampling is needed.

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