The Effect of Abdominal Massage on Decreasing Ventilator-Associated Pneumonia in Enterally fed Patients

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Abstract

background ventilator associated pneumonia (VAP) is a very challenging infection as it continues to complicate the course of 8% to 28% of patients receiving mechanical ventilation. Abdominal massage is assumed to prevent enteral nutrition related causes of VAP as it decreases gastric residual volume (GRV). Aim of the study was to examine the effect of abdominal massage on decreasing VAP in enterally fed patients, determine the effect of abdominal massage on GRV seen in enterally fed patients. Design quasi- experimental design was used. Setting the study was conducted at ICU in Benha University Hospital. Study subjects: convenient sample of 60 adult male and female patients, divided into two equal groups, study and control, (30 each). Data collection tools: five tools were used: 1) Patient Assessment Tool, 2) Glasgow Coma Scale, 3) Enteral Feeding Assessment Tool, 4) Abdominal Massage Protocol and 5) VAP Assessment Tool. Results: It was found that VAP decreased among study group patients (36.7%) compared with control group patients (63.3%) with a statistically significance difference (X²=4.266, P=0.03). Also, a statistical significance difference was found in GRV between study and control group patients when comparing changes in GRV between the first and last day of the study ($X^2=6.56$, P=0.037). Conclusion this study concluded that abdominal massage could decrease GRV and thus decreasing the risk of VAP among intubated and enterally fed patients. Recommendations Abdominal massage as a noninvasive, inexpensive, and safe method can be used to decrease GRV and aspiration among mechanically ventilated intubated and enterally fed patients.

Key words: Ventilator-Associated Pneumonia, Abdominal Massage, Enteral Feeding, Nursing.

1. Introduction:

Mechanical ventilator (MV) should help in exchange of gases without causing trauma to the lungs. Unfortunately, it can affect lungs by the strain and stress that can produce to the lung. High pressure and volume can cause barotrauma and volutrauma to the lungs, which is followed by biotrauma and addition atelectrauma. In to these complications ventilator associated pneumonia (VAP) can result (Charles et al., 2014).

Ventilator associated pneumonia is defined as a type of nosocomial bacterial pneumonia (infection of the lung parenchyma) that occurs

in patients who are receiving invasive MV by endotracheal tube (ETT) or tracheostomy for at least 48 hours at the time of diagnosis. Ventilator associated pneumonia is associated with increase in morbidity and mortality rates (Papadakos, Lachmann & Visser-Isles, 2008). It can be diagnosed VAP when chest X-ray represent new infiltration, and at least one of the following (fever, leukocytosis, or purulent tracheo-bronchial secretions) is present. Ventilator associated pneumonia is considered the second most common hospitalacquired infection (Coppadoro, Bittner & Berra, 2012).

The incidence of VAP in Egyptian university hospitals in the last 10 years ranges from 16% to 75% while the incidence of VAP worldwide, 10–28% and 9 -27% in the United States. This shows that incidence of VAP in Egyptian ICUs is about 2.5 times higher (AbdElhafez et al. 2013). Furthermore, VAP increases a patient's stay in hospital by approximately 7-9 days and can increase hospital costs by an average of \$40,000 per patient (Amanullah, Posner, Byrd, Talavera & Mosenifar, 2013). Moreover, VAP accounts for more than one-half of all antibiotic use in the ICU (Zilberberg and Shorr 2010).

Enteral nutrition has been considered a risk factor for the development of nosocomial pneumonia, because of increased risks of alkalization of gastric contents, gastroesophageal reflux, and gastropulmonary aspiration (Torres and Ewig 2011). Increased GRV related to enteral feeding will lead to pulmonary aspiration which is one of the most serious complications that result in the development of VAP (Memis, Hekimoglu, Ahin, and Sezer 2007).

Instead of causing undernourishment for patients due to gastric intolerance, the literature includes suggestions to increase the gastric emptying rate such as using prokinetic drugs (which have serious side effects), slowing down the feeding rate (causing undernourishment). As these suggestions have side effects, searching for alternative solution is important (Uysal, Eser & Akpinar, 2012). It was suggested be Kahraman, and Ozdemir, (2015) that abdominal massage could prevent the development of VAP that result from gastropulmonary route by reducing GRV as it promotes secretion of digestive fluids, promotes absorption of products of digestion and increases peristalsis movement which in turn accelerates passage of food through the gastrointestinal system.

Aim of the study:

The presented study was conducted to fulfill the following aims:

- 1. Examine the effect of abdominal massage on decreasing VAP in enterally fed patients.
- 2. Determine the effect of abdominal massage on GRV seen in enterally fed patients.

1. Methods:

Research Hypotheses:

- The study group who receives abdominal massage had decreased gastric residual volume than the control group.
- The development of ventilator associated pneumonia decreased among study group who receives abdominal massage than the control group.

2.1. Research Design:

A Quasi experimental design was used.

2.2. Setting:

The study was conducted at the emergency and general ICU in Benha University Hospital in Egypt.

2.3. Subjects:

Sample size was calculated according to a pilot study of the first 6 patients. The number of patients developed VAP was taken as the primary outcome. Assuming that the power =80% and alpha error =0.05 with 1:1 allocation ratio, the determined var 1/ var 0 ratio was 0.375 and the critical F =0.524, 28 patients in each group was satisfactory. To avoid drop out, 30 patients in each group were considered as illustrated in figure (1). The study was conducted on convenience sample with the following inclusion criteria:

- Patients with mechanical ventilation for at least 48 hours with no manifestations of infection and no infiltration on chest X-ray for 48 hours after intubation.
- Have intermittent nasogastric enteral-feeding.

Exclusion criteria:

The patients with tracheostomy, any abdominal surgery, radiotherapy, paralytic ileus, or diarrhea.



Figure (1): Flow chart of the study sample through each stage of the study

2.4. Tools of data collection:

Tool I) Patient Assessment Tool:

It was developed by the researcher based on review of recent literature, Moustafa et al. (2016); Kahraman and Ozdemir (2015) and it includes patient's age, gender, smoking, date of admission, beginning date of mechanical ventilation, date of extubation, date of discharge, how patient discharged form ICU, causes of ICU admission, past medical history, medications, duration on mechanical ventilation, and length of ICU stay.

Tool II) Glasgow Coma Scale (GCS):

It was used to assess patient's level of consciousness by evaluating eye opening,

om, Oliver and Clouse (2008) reported that the best verbal response was estimated as appears able to converse, ability to converse is in question, or generally unresponsive. Possible scores ranged from 3 (worst) to 15 (best).

Scoring system:

- Mild impairment. 13-15
- Moderate impairment 9-12
- Severe impairment 3-8

Tool III) Enteral Feeding Assessment Tool:

It was developed by the researcher based on review of relevant recent literature, Perry, Potterand Ostendorf (2016); Perry and Potter (2015); Kahraman and Ozdemir (2015);Weber and Kelley (2014); Ignatavicius and Workman (2013); Uysal, Eser and Akpinar (2012) to assess the impact of abdominal massage on gastric emptying.

It was used to record date & hour of follow up, type & amount of feeding content, amount of GRV, abdominal circumference measurement, number of vomiting episodes, and frequency of defecation.

Tool IV) Abdominal Massage Protocol (AMP):

It was developed by the researcher based on review of relevant recent literature Kahraman and Ozdemir (2015); Wong (2013); Uysal, Eser and Akpinar (2012) and Bastin et al. (2004).

It includes preparation of practitioner and patient, description of abdominal massage technique, total duration of massage to be applied, and frequency & time of massage.

Tool III) VAP Assessment Tool: Modified Clinical Pulmonary Infection Score (MCPIS):

It was adopted from Singh, Rogers, Atwood, Wagener and Yu (2000) and it was used to assess the clinical diagnosis of VAP. Modified Clinical Pulmonary Infection Score consists of 5 parameters as body temperature, white blood cells count, tracheal secretions, oxygenation and chest X- ray.

Scoring system:

Each parameter scored from 0 to 2 except oxygenation, where zero indicates normal result and 2 indicates abnormal result. While oxygenation parameter zero indicates presence of acute respiratory distress syndrome (ARDS) and 2 indicate absence of ARDS. Points for each parameter of MCPIS were summed yielding a total MCPIS. The score varied from 0 to 10

The score varied from 0 to 10.

- MCPIS > 5 it was diagnosed VAP.
- MCPIS \leq 5 indicates absence of VAP.

2.5. Intervention:

An official permission was obtained from the director of Benha University Hospital and head of ICU department.

- 1. Patient assessment tool (tool I) was used to collect characteristics and related data of patients involved in the study.
- 2. Assess level of consciousness.
- 3. Ventilator associated pneumonia was examined using MCPIS at 1st day of monitoring.
- 4. Before start feeding for the patient, GRV and abdominal circumference were measured for all patients in the study and control group twice daily at 7:00 am and 7:00pm.

- 5. Gastric residual volume was measured by aspirating slowly total gastric contents using a 60-ml syringe before each feeding. Extra syringes were used if the amount exceeds more than one syringe. The measurement was repeated, when stomach contents were no longer aspirated to verify whether the stomach was empty.
- 6. Abdominal circumference was measured using a soft, flexible, 150 cm plastic measuring tape. Umbilicus was the beginning point for measurement with the tape aligned at the upper part of the iliac crest.
- 7. Assess the type and amount of the feeding given, presence of vomiting and frequency of defecation.
- 8. Gastric residual volume measurement, abdominal circumference, presence of vomiting and frequency of defecation were documented on the "Enteral Feeding Assessment Tool".

During the procedure, the researcher maintains the following:

- Head of bed elevation 30–45-degree 24 hour a day, except for the cases with medical prohibition.
- All patients receive chlorhexidine antiseptic oral gel as prescribed.
- Cuff pressure of ETT was maintained < 20 mmHg.
- 9. Abdominal massage technique (For study group only).
 - Keep patient in supine position and head of bed at 30-degree during application of the massage to relieve tension of abdominal muscles and the researcher standing on the right side of the patient during the massage practice.
 - Abdominal massage was administered to the abdominal wall in the direction of the bowel track. It was initiated with superficial effleurage. Then later deep effleurage, petrissage, and vibration massage practices was performed.
 - The total duration of abdominal massage was 15 minutes.

 Abdominal massage was administered to study group patients twice per day before feeding to decrease risk of regurgitation.

Finally for all study and control group patients:

- 10. Ventilator associated pneumonia was examined using MCPIS at the last day of the study (3-5 days).
- 11. The researcher documented "date of extubation, date of discharge, how patient discharged form ICU, duration on mechanical ventilation and length of ICU stay".
- 12. Data collection was carried out from February 2016 to the end of July 2017.

2.6. Ethical considerations:

The ethical research considerations in this study were including the following:

- The researcher clarified the objective and aim of the study to the patients or to their families.
- The researcher assured maintaining anonymity and confidentiality of the subject data.
- Patients or their families informed about their rights to participate or withdraw from the study at any time.

2.7. Statistical design:

The obtained data were organized, categorized and statistically analyzed using statistical package for social sciences (SPSS) software version 20. A descriptive analysis of the collected data was presented in the form of frequencies and percentages. Description of qualitative variables as mean, SD and range were also used. Statistical significance was considered at P < 0.05. t-Test was used to determine the difference of gastric residual volume and abdominal circumference. Chi square test was used for analysis of other data.

3. Results:

3.1. Characteristics of studied patients:

A total 60 patients were enrolled in the study (30 for each study and control group) with mean age $X \pm SD$ (60 + 19.70) years for study group and (55.07 + 20.16) years for control group. It was noted that (60%) in the study group and (53.3%) in the control group were males. It was found that neurological problems were the most common cause of ICU admission in both groups (60%) for study group and (56.7%) for control group. Also, it was found that (33.3%) among study group and (36.7%) among control group patients had free medical history "any medical or surgical disease". There was statistical no significance difference between the two groups in their selected demographic data as well as past medical history, medications and Glasgow coma scale.

3.2. The impact of abdominal massage on GRV and abdominal circumference:

Comparison of changes in gastric residual volume and abdominal circumference measurements between the first and last day (3- 5 days) among studied patients as illustrated in table (1) which revealed that there was statistically significant difference between study and control group regarding to change in GRV between the first and last day of the study ($X^2 = 6.56$, P= 0.037).

** • • •	Study (no=30)		Control (no=30)		X ²	P-Value		
Variables								
	No.	%	No.	%				
Gastric residual volume (GRV):								
 Increased 	9	30.0	8	26.67				
 Equal 	20	66.67	14	46.67	6.56	0.037*		
 Decreased 	1	3.33	8	26.67				
Abdominal circumference:								
 Increased 	6	20.0	9	30.0				
 Equal 	6	20.0	4	13.3	1.028	0.59		
 Decreased 	18	60.0	17	56.67				

Table (1) Comparison of changes in gastric residual volume and abdominal circumference measurements between first and last day among the studied patients (no=60):

3.3. The impact of abdominal massage on the development of Ventilator Associated Pneumonia:

At the last day of the study (36.7%) of study group and (63.3%) of control group developed VAP and there was statistical significance difference between the two groups ($X^2 = 4.266$, P=0.03) as illustrated in table (2).

Table (2) Comparison of the development of VAP between the study and the control groups at the last day of the study among the studied patients (no=60).

Ventilator Associated	Study (no=30)		Control (no=30)		X ²	P-Value
Pneumonia	No.	%	No.	%		
 Developed 	11	36.7	19	63.3		
 Not developed 	19	63.3	11	36.7	4.266	0.03*

3.4. The impact of length of ICU stays and days on MV on the development of VAP:

As illustrated in table (3) (93.33%) of patients who developed VAP stayed in hospital \geq 7days and (86.67%) stayed on MV \geq 7days. There was statistically significance difference between VAP development and length of ICU as well as duration of MV stay (X² =6.72, P=0.035) and (X² = 4.35, P=0.036) respectively.

Table (3) Relation between VAP development and health related data among the studied patients (no=60):

	VAP development				X ²	P- value		
Health related data	Present (No=30)		Absent (No=30)					
	No.	%	No.	%				
Length of ICU stay/ days								
• 3-4	2	6.67	2	6.67				
5 -6	0	0.0	6	20.0	6.72	0.035*		
■ <u>≥</u> 7	28	93.33	22	73.33				
Days of mechanical ventilation (MV)								
• <7	4	13.33	11	36.67				
■ <u>≥</u> 7	26	86.67	19	63.33	4.3556	0.036*		

4. Discussion:

Enteral nutrition with nasogastric tube is used to fulfill nutritional requirements for critically ill patients, but it is considered as one of the major risk factors for VAP as it led to decreased gastric acidity. which may alkalinize gastric contents and increase gastric residual volume (GRV). This will increase the risk of gastroesophageal reflux, aspiration and subsequently VAP (Chen, 2009). The findings of the current study revealed that there was no statistical significance difference between both groups "study and control" groups on admission regarding characteristics of studied patients which could explain and confirm the homogeneity / similarity of the two groups (study & control groups). 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. This could support hypothesis one that the study group who receive abdominal massage had decreased gastric residual volume than the control group. As abdominal massage was effective on decreasing intraabdominal pressure and facilitates peristaltic movements leading to decreasing GRV among study group patients. These findings were similar to the findings of Yaghoubinia, Tabatabaei, Jahantigh and Mohammadi, (2017); Kahraman and Ozdemir (2015); Tekgündüz, Gürol, Apay and Caner (2014); Uysal, Eser and Akpinar (2012).

Abdominal circumference was measured as one of the signs of abdominal distension. The finding of the current study revealed that statistically there was no significant difference between study and control group in signs of abdominal distension. This finding was gone in the same line with Uysal, Eser and Akpinar (2012), while contradicted with Kahraman and Ozdemir (2015) who revealed statistically that there was significant difference between both groups.

The finding of the current 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. This could support hypothesis two that the development of VAP decreased among study group who receive abdominal massage than the control group as abdominal massage decreases GRV, and intern decreases risk of gastroesophageal reflux & aspiration. These findings were coinciding with Yaghoubinia et al. (2017), who find that none of the patients in the study group developed VAP after execution of the program, while more than half of the control group was developed. While these findings were contradicted with Kahraman and Ozdemir (2015) as their findings revealed that statistically there was no significant difference between both groups, and the VAP ratio decreased in the control group rather than the study group but not reach to the statistically significant level.

The finding of the current study revealed that there was strong association between (increased days on MV & long duration of length of ICU stay) and development of VAP in both groups. As the length of stay at the hospital is prolonged, the patients have more chances to get hospital-acquired infections. This result coincides with the findings of Elbilgahy et al. (2015); Bonten (2011); Rodrigues et al. (2009).

Therefore, it is important to offer a nonpharmacological measure effective in preventing complications such as high GRV, abdominal distension, and vomiting (which are commonly observed in intermittently enterally fed patients). This can be done through applying abdominal massage which is easy to apply, inexpensive, non-invasive and free of harmful side effects.

5. Conclusion:

Ventilator Associated pneumonia decreased study after among group patients implementing abdominal massage. than control group. There was difference between study and control groups regarding the amount of GRV, as it was improved in study than control group. A strong positive correlation found between long duration on mechanical ventilation & length of ICU and the development of VAP.

6. Recommendations:

- 1. Abdominal massage could be used as an effective, inexpensive, noninvasive, and safe method in decreasing GRV and aspiration for patients on mechanical ventilation and received enteral feeding.
- 2. Abdominal massage could be done twice daily for 15 minutes before feeding to decrease risk of regurgitation.
- 3. Gastric residual volume should be checked before feeding for all patients to assess gastrointestinal intolerance.
- 4. Comparison the effect of abdominal massage on gastric emptying between obese and non-obese patients.

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