Journal of Medicinal and Chemical Sciences 4 (2021) 497-597

Journal of Medicinal and Chemical Sciences

Journal homepage: http://www.jmchemsci.com/

Original Article

Effect of Abdominal Massage on Gastrointestinal Outcomes of Critical Ill Patients with Enteral Feeding

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ARTICLE INFO

Article history

Received: 2021-07-06
Received in revised: 2021-08-01
Accepted: 2021-08-29
Manuscript ID: JMCS-2107-1210
Checked for Plagiarism: **Yes**
Language Editor:
Dr. Behrouz Jamalvandi
Editor who approved publication:
Dr. Behrooz Maleki

DOI:10.26655/JMCHEMSCI.2021.5.11

KEYWORDS

Abdominal massage
Enteral feeding
Gastrointestinal outcome

ABSTRACT

Background: Life-threatening problems are risks for critically ill patients. Moreover, they need complex care with carful coordination. In addition, nutritional support considered as fundamental aspect of a standard care of critically ill patients.
Objectives: We aimed at evaluating the abdominal massage effect on gastrointestinal outcomes of critical ill patients with enteral feeding.
Methods: Quasi-experimental research design was used in this study. The Swedish massage technique for abdomen was carried out twice daily for five consecutive days by the trained researcher. A convenience sample of 60 critically adult males with enteral feeding participated voluntarily in the study.
Results: The results of this study revealed that, gastric residual volume was low with the study group than the control group during intervention period after abdominal massage. Also, a significant difference was noticed in last three days of the intervention between the study and control groups. Moreover, it was indicated that abdominal distension, vomiting, and constipation were low with the study group than the control group during the five consecutive days of intervention.
Conclusion: This study provides promising evidence that massage of abdomen can be used with entirely fed critically ill patients to improve their gastrointestinal outcomes. This leads to a reduction in residual volume of gastric, distension of abdomen, constipation, and vomiting.

GRAPHICAL ABSTRACT

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Introduction

Life-threatening problems are risks for critically ill patients. Moreover, they need complex care with carful coordination. In addition, nutritional support considered as fundamental aspect of a standard caring of critical ill patients in intensive care units (ICUs) [1,2]. It was reported that more than 40%to 50% of critically ill patients suffer from malnutrition [3]. In addition, through their initial stay in the ICU they lose about 5-10% skeletal muscle mass weekly [4]. Therefore, nutritional support is considered as one of the essential components in managing critical ill patients [4,5].

Sufficient nutritional support provided in timely manner plays an essential role in improving patient's recovery. In addition, it reduces physiological stress, increases the immunity and reduces malnourishment. Enteral feeding or enteral nutrition (EN) is preferable route and utilized commonly for nutritional support with patients. It keeps muscles peristalsis, supports blood supply, and maintains function and structure for mucosal barrier of the gastrointestinal [6-8].

Though initial EN is a main recommendation for critical ill patients, it has numerous complications [9]. Gastric intolerance is the central complication of gastrointestinal with EN in critically ill patients. It includes nausea, vomiting, diarrhea, excess gastric residual volume (GRV), distention of abdomen and constipation [10,11].

The most common used indicator to evaluate gastric intolerance in ICU is GRV monitoring [6]. It has been reported that patients with high GRV can increase the threat of ventilator associated pneumonia (VAP) five times more than those with faster GRV evacuation time [12]. Monitoring and decreasing the GRV might be a significant measurement to improve nutritional status and decrease complications to critical ill patients [13].

Abdominal distention is among enteral feeding intolerance problems; it is one of the most common problems of consultation in ICU [14]. It can inhibit the development of diaphragms, reduce lung compliance, and increase the respiratory work thereby prolonging the weaning from mechanical ventilation (MV) [15]. Moreover, constipation is another form of gastric intolerance. Several studies have shown that 72% of patients in the ICU experience constipation due to MV after 72 hours and 40.5% were due to various types of nutritional therapy [16]. It can cause abdominal distension, feeding intolerance, vomiting, and can be associated with aspiration pneumonia. In addition, constipation has been associated with worst outcomes, including increase in length of stay increased in ICU, duration of MV and even mortality rate [16].

In addition, vomiting is one of the major dangerous complications linked to enteral feeding via nasogastric tube as it perhaps increases the possibility for aspiration pneumonia [14]. Previous studies have reported that incidence of vomiting in enteral feeding patients differs between 12% and 50 % [11]. Because of these potential complications of feeding intolerance, there are many lines of therapeutic management of these complications. Treatment with prokinetics are considered the first therapeutic choice for gastrointestinal dysmotility patients and feeding intolerance, as it may improve gastric emptying and nutrition delivery; however, multiple side effects associated with these drugs for example bronchospasm, abdominal cramps, allergies, disorders of pancreas and heart [17,18].

Critical care nurse is responsible for safety and preventing complications of critically ill patients. They are an important link in nutritional support as they play a fundamental role in facilitating the basic needs of patients related to gastrointestinal function, especially nutrition, elimination and preventing gastrointestinal complications in critically ill patients. Also, their responsibility includes assessment and evaluation of the side effects of enteral feeding by measuring GRV and monitoring the incidence of vomits and its frequencies as well as existence of abdomen distension and constipation [19-21].

Uysal et al (2012) indicated that abdominal massage is effective in prevention of high GRV, vomiting, abdominal distension, and constipation [22]. However, few research studies have been carried out to examine the effectiveness of abdomen massage intervention on the

gastrointestinal clinical outcomes in critical ill patients who receive EN; consequently, there is a need for other studies (Uysal, 2017, Dehghan et al., 2018; Kosasih et al, 2019) [23,7,16]. Hence, this study was carried out to evaluate the abdominal massage effect on gastrointestinal outcomes of critical ill patients with enteral feeding.

Significant *of the Study*

Abdominal massage presents several benefits for patients in the ICU. It supports ICU patients with enteral feeding by increasing stimulation of blood flow to and from the organs, nerve plexuses and muscles in the abdominal region, enhance production of hormones and hasten removal of waste. Moreover, it improves the organs of digestive system in conversion of food into energy. In addition, it allows contraction of the diaphragm more fully and increases the capacity of lung and strength breathe [9].

Several studies in Egypt, Turkey, Iran, Germany and others have suggested and described using the abdominal massage for patients in ICUs as a complementary therapy for improving gastrointestinal outcomes such as "high GRV, vomiting, abdominal distension, constipation [24].

Purpose of the study

The purpose of this study was to evaluate the abdominal massage effect on gastrointestinal outcomes of critical ill patients with enteral feeding.

Research Hypothesis

Massage of abdomen will affect positively on gastrointestinal outcomes for critical ill patients with enteral feeding.

Operational Definition

Measures of gastrointestinal outcomes that covered in this study contain volume of gastric residual, distension of abdomen, vomiting, and constipation incidence.

Material and methods

Research Design

Quasi-experimental research design was used to conduct the current study.

Participants

A convenience sample of 60 critically ill adult males with enteral feeding participated in the study. They divided randomly to study and control group (30 for each group). Inclusion criteria includes age 18-60 years, hemodynamically stable, HR: 60-120 b/min, SBP> 90 <200 mmHg, MAP > 60 mmHg, no active bleeding, no dysrhythmia requiring the administration of a new anti-arrhythmic agent), RR < 35 b/min, Fio2 ≤ 60%, PEEP ≤ 10 cmH2O, oxygen saturation (Sao2) ≥ 88%. Exclusion criteria includes continuously feed, have surgery in abdomen recently, radiotherapy, bleeding of gastrointestinal, injury of spinal cord, obstruction of intestine, ileus, diarrhea, HR >120 or < 60beats/min for 5 min, SBP < 90 > 200 mm Hg for 5 min, MAP < 60 mm Hg, and oxygenation inadequacy: RR > 35 breaths/min for 5 minutes, SaO2 < 88% for 5 minutes.

Setting

This study was conducted in the following ICUs, unit I that included 8 beds, unit II that included 8 beds and unit III that included 15 beds at Alexandria Main University Hospital.

Instrument

Gastrointestinal Outcomes of Abdominal Massage Assessment Record was developed by the researchers after reviewing the related literature for data collection [12,23,25]. It includes three parts:

Part I: **Patients' related data***:* It included age, medical diagnosis, and past medical history. Physiological parameters included heart rate, blood pressure, respiratory rate, mean arterial pressure, oxygen saturation (Sao2), positive end expiratory pressure (PEEP), and fraction of inspired oxygen (FiO2),

Part II: **Feeding-related data***:* It consisted of type, source, content, formula density, and amount of feeding.

Part III: **Gastrointestinal outcomes occurrence record:** It included the amount of gastric residual, increased or decreased, and the

difference between the first and the last gastric residual volume, abdomen distension record which included abdomen circumference, soft, tense and hard of the abdomen, constipation record which included presence or absence of constipation increased or decreased bowel movement, and vomiting record which entailed presence or absence of vomiting.

Data Collection

Six experts in the study field of critical care medicine and critical care nursing and emergency checked the content validity of the instrument. Moreover, reliability of the instrument was tested using Cronbach's Alpha test. The tool was reliable and the tests values were 0.86, 0.80, and 0.89 respectively. Evaluation of the applicability and clarity of the instrument was done by selection of six patients to carry out a pilot study. In addition, necessary modifications were done. Collection of data lasted from September 1, 2016 to October 20, 2017.

Intervention

In *preparation phase,* the principal researcher completed two weeks (5 days per week) training program, for abdominal massage at Alexandria University, Faculty of Medicine, physical medicine and rehabilitation department, to be qualified in applying abdominal massage technique. Moreover, in *implementation phase*, the massage of abdomen was carried out manually and daily by the trained researcher for five days' intervention period. During the daily visits the abdominal manual massage technique was provided twice daily (8:00 am & 8:00 pm) for 20 minutes. In addition, the patient and caregivers were instructed in the massage technique and were given the opportunity to practice and ask questions. The abdominal massage began with Stand on the right side of the patient. Then, the patient was placed in supine position while keeping the knees flexed with the head-of-bed angle elevated at 30°–45°. A gentle relaxation strokes up the abdomen wall was performed. The Swedish techniques of manual massage for abdomen were utilized where four major strokes (stroking, effleurage, kneading and vibration were implemented using nine steps (see Figure 1&2). [26] Furthermore, in *evaluation phase*, outcome data were collected for both control and study groups at daily baseline during the five days' intervention period of abdominal massage. Regarding gastric residual volume, before feeding the patient, a 50-ml syringe was used for aspiration of gastric contents from the nasogastric tube while patient was in semi-Fowler position. Also, abdominal distension was assessed through measuring circumference of abdomen by a 150- cm flexible measure, the beginning point for the measurement was the patient's umbilicus. Abdominal palpation was applied with sufficient pressure from one to two cm depression for light palpation and from 2.5-7.5cm depression for deep palpation, abdominal wall was inspected and palpating for any bulging or tenderness. In addition, constipation was assessed by abdomen auscultation for detection of bowel sounds and movement. Regarding vomiting occurrence, it was assessed by asking the patient and/or reading the vomit document of the patients.

Ethical Consideration

Ethical approval was obtained from the faculty of nursing ethics committee at Alexandria University. Moreover, privacy, anonymity, and confidential data were assured.

Statistical Analysis

Data were reviewed and fed to the computer to be analyzed by the IBM SPSS software package version 24. Descriptive statistics included frequency and percentage. Inferential statistics was presented as t-test to determine difference between the two groups. P-values of ≤ 0.05 was used to measure the statistical significance.

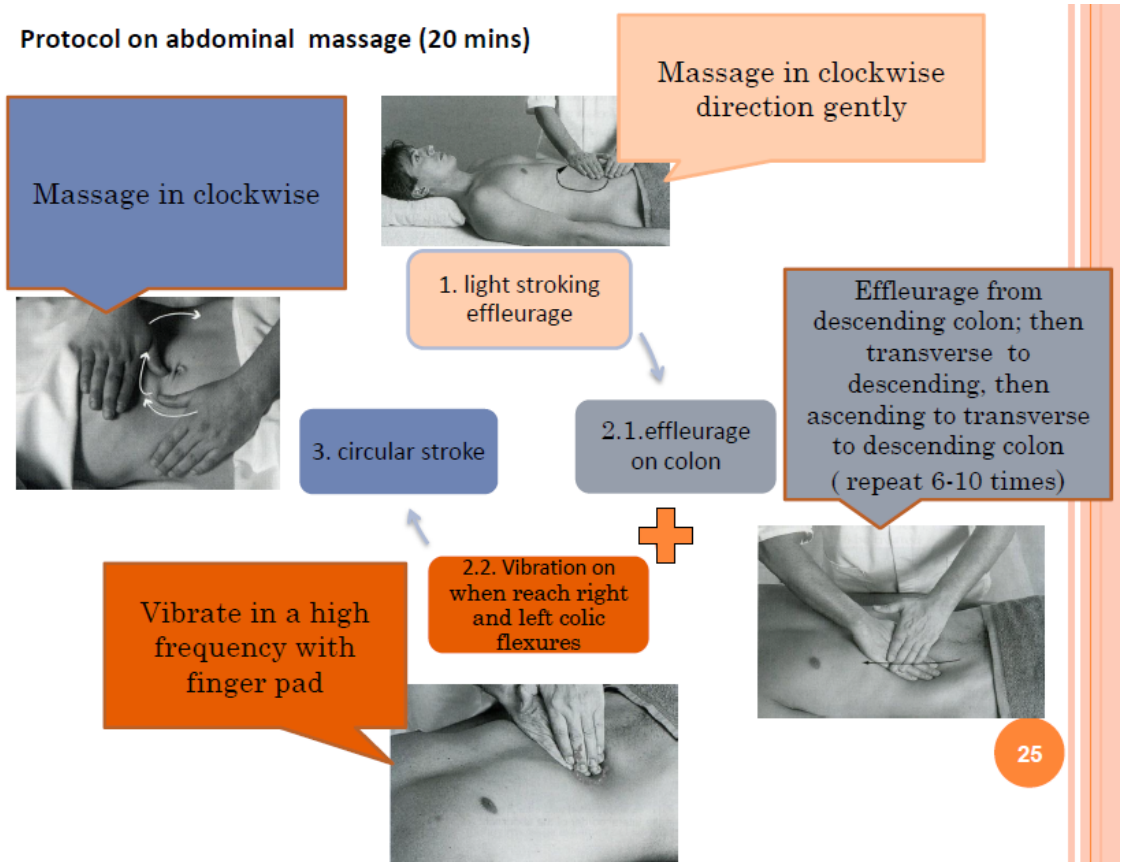

Figure 1: The protocol of abdomenal massage (Fritz, 2016)

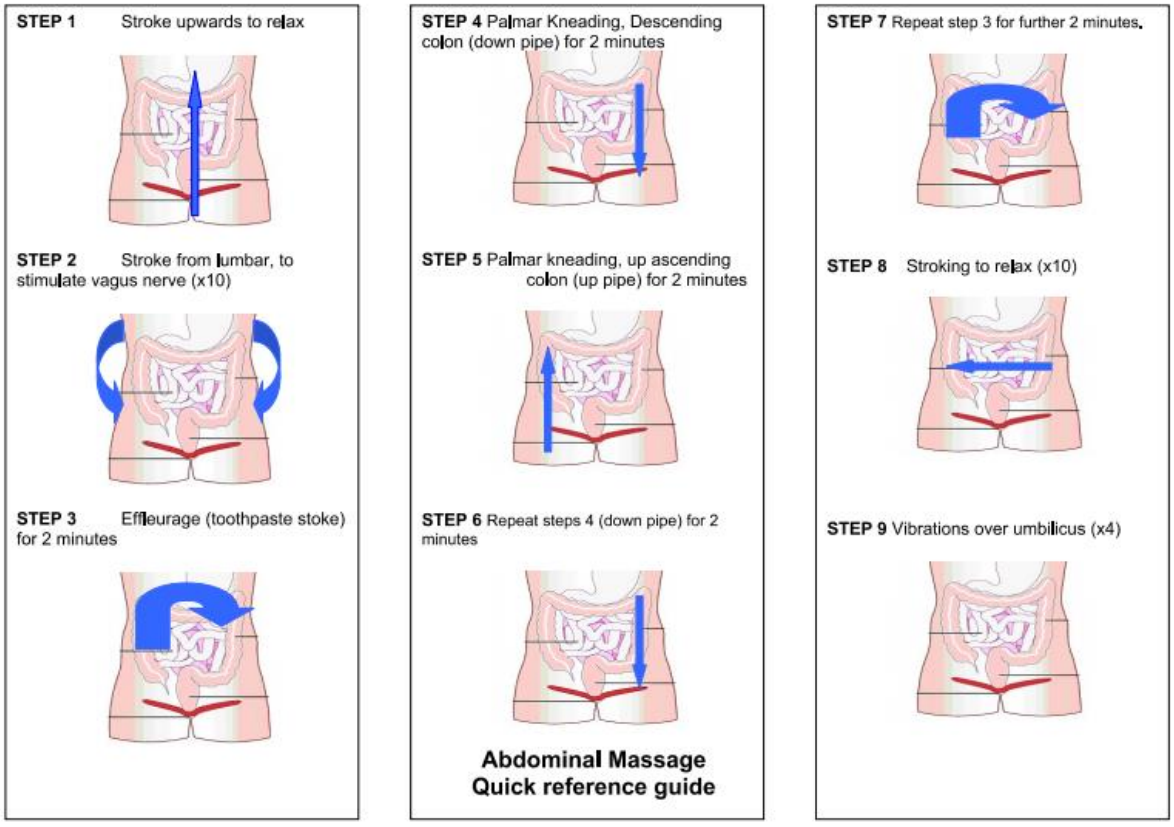

Figure 2: Abdominal Massage steps (Fritz, 2016)

Result and Discussion

Table 1 shows that no statistically significant difference between both experimental and control groups (p=0.917) regarding their age. Also, the same Table indicates no statistically significant difference between both experimental and control groups relating diagnosis and past medical history (P = 0.952 and 0.748 respectively).

Table 1: Demographic characteristics distribution of the study and control groups

Characteristics	Study group (n = 30)		Control group (n = 30)		Total (n = 60)		*p*-value
	No	%	No	%	No	%	
Age (years):							
18 – 29	1	3.3	2	6.7	3	5.0	0.917
30 – 39	3	10.0	3	10.0	6	10.0	
40 – 49	8	26.7	9	30.0	17	28.3	
50- 60	18	60.0	16	53.3	34	56.7	
Diagnosis:							
Respiratory diseases	9	30.0	8	26.7	17	28.3	0.952
Renal diseases	7	23.3	6	20.0	13	21.7	
CNS diseases	5	16.7	7	23.3	12	20.0	
Cardiovascular diseases	4	13.3	5	16.7	9	15.0	
GIT diseases	5	16.7	4	13.3	9	15.0	
Past medical history:							
Diabetes mellitus	10	33.3	8	26.7	18	30.0	0.748
Respiratory disease	9	30	7	23.3	16	26.7	
Liver disease	4	13.3	7	23.3	11	18.3	
Neurological problem	3	10	5	16.7	8	13.3	
Gastrointestinal bleeding	4	13.3	3	10	7	11.7	

P-value > 0.05 is statistically insignificant

Figure 3 shows that the participants of the experimental and control groups were alike in the characteristics of their feeding as type, source, content, formula density and amount.

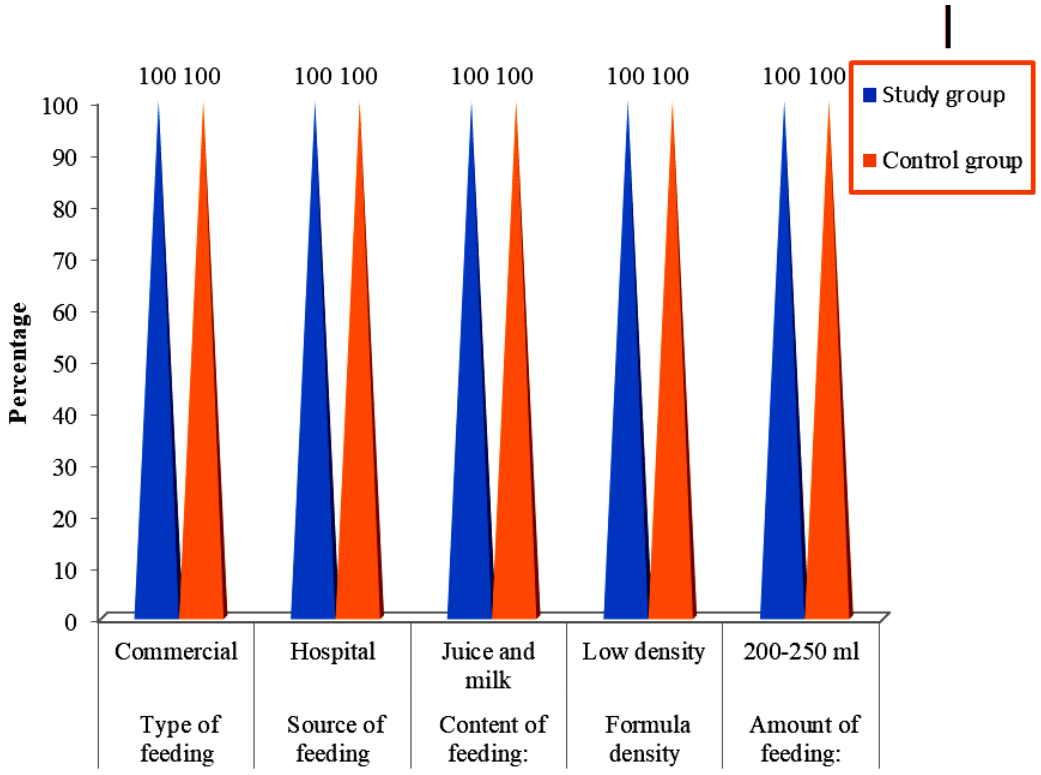

Figure 3: Distribution of the study and control groups according to the enteral feeding data

As Table 2 illustrates, no statistically significant difference was found between the study and control groups related to gastric residual volume in the first two days. Additionally, it was observed from the same Table that the experimental group was lesser than the control group in relation to presence of gastric residual volume during the intervention period of abdomen massage. Also, statistically significant difference was observed in the last three days of the abdomen massage intervention between the experimental and control groups (p=0.038, p=0.020, p=0.009) respectively.

Table 2: Gastric residual volume (GRV) distribution of the experimental and control groups after abdomen massage intervention.

Days	GRV	Study group (n = 30)		Control group (n = 30)		P_1
		No	%	No	%	
Day 1	<50 ml/meal	13	43.3	12	40.0	0.793
	≥50 ml/meal	17	56.7	18	60.0	
Day 2	<50 ml/meal	13	43.3	11	36.7	0.598
	≥50 ml/meal	17	56.7	19	63.3	
Day 3	<50 ml/meal	18	60.0	10	33.3	0.038*
	≥50 ml/meal	12	40.0	20	66.7	
Day 4	<50 ml/meal	20	66.7	11	36.7	0.020*
	≥50 ml/meal	10	33.3	19	63.3	
Day 5	<50 ml/meal	22	73.3	12	40.0	0.009*
	≥50 ml/meal	8	26.7	18	60.0	
P_2		0.009*		0.793		

* Statistically significant
P1: comparison between the control and the study groups
P2: comparison between the first and fifth day for each group

Table 3 shows that in the first three days of the study there was no statistically significant difference between the experimental and control groups regarding the abdomen distension, while it was noticed that, lower abdomen distension was with the experimental group than the control group during the intervention period, p=0.010, p=0.015, respectively.

Table 3: Abdomen distension comparison between the experimental and control groups after abdominal massage

Days	Abdominal distension	Study group (n = 30)		Control group (n = 30)		P_1
		No	%	No	%	
Day 1	No distension	20	66.7	17	56.7	0.426
	distension	10	33.3	13	43.3	
Day 2	No distension	20	66.7	17	56.7	0.426
	distension	10	33.3	13	43.3	
Day 3	No distension	21	70.0	18	60.0	0.417
	distension	9	30.0	12	40.0	
Day 4	No distension	26	86.7	17	56.7	0.010*
	distension	4	13.3	13	43.3	
Day 5	No distension	27	90.0	19	63.3	0.015*
	distension	3	10.0	11	36.7	
P_2		0.028*		0.598		

P1: comparison between the control and the study groups
P2: comparison between the first and fifth day for each group

Table 4 displayed that, concerning occurrence of constipation, there was no significant difference between the study and control groups in the first three days of the study. Nonetheless it was

observed that, occurrence of constipation was higher in the control group than the study group during the intervention period. Also, a significant difference was existed in the last two days of the study between the control and study groups (p=0.004, p=0.001) respectively.

As clear from Table 5, in the first three days of the study, no statistically significant difference was observed concerning the incidence of vomiting between the study and control groups. On the other hand, it was noticed that in the last two days of the study, a significant difference was found between both groups (p=0.005, p=0.010, respectively).

Table 4: Constipation comparison after abdomen massage between the experimental and control groups

Days	Constipation	Study group (n = 30)		Control group (n = 30)		P_1
		No	%	No	%	
Day 1	Present	15	50.0	16	53.3	0.796
	Absent	15	50.0	14	46.7	
Day 2	Present	15	50.0	16	53.3	0.796
	Absent	15	50.0	14	46.7	
Day 3	Present	13	43.3	14	46.7	0.438
	Absent	17	56.7	16	53.3	
Day 4	Present	3	10.0	13	43.3	0.004*
	Absent	27	90.0	17	56.7	
Day 5	Present	1	3.3	12	40.0	0.001*
	Absent	29	96.7	18	60.0	
P_2		0.001*		0.301		

* Statistically significant

P1: comparison between the control and the study groups

P2: comparison between the first and fifth day for each group

Table 5: Vomiting comparison after abdomen massage between the study and control groups

Days	vomiting	Study group (n = 30)		Control group (n = 30)		P_1
		No	%	No	%	
Day 1	Yes	5	16.7	6	20.0	0.739
	No	25	83.3	24	80.0	
Day 2	Yes	4	13.3	6	20.0	0.488
	No	26	86.7	24	80.0	
Day 3	Yes	2	6.7	6	20.0	0.129
	No	28	93.3	24	80.0	
Day 4	Yes	0	0.0	7	23.3	0.005*
	No	30	100	23	76.7	
Day 5	Yes	0	0.0	6	20.0	0.010*
	No	30	100	24	80.0	
P_2		0.010*		0.739		

P1: comparison between the control and the study groups

P2: comparison between the first and fifth day for each group

Gastrointestinal complications are common with the critically ill patients. They include nausea, vomiting, diarrhea, constipation abdominal distention and excess gastric residual volume [10]. Currently, pharmacological and non-pharmacological methods are being used to prevent these gastrointestinal problems [7]. Many studies have revealed that massage of abdomen could play an essential part in improving gastrointestinal outcomes of Enteral feeding for patients [9].

In the current study, assessment was done about the study demographic criteria prior massage of abdomen. The results indicated that no statistically significant differences were observed between both the control and experimental groups. These outcomes are in agreement with Uysal (2017), reporting that there were no

statistically significant differences in relation to demographic criteria [23].

Gastric residual volume is the amount of aspirated content from stomach during nasogastric enteral feeding [25]. Reduce and Control the GRV might be a remarkable standard for nutrition status improvement [26]. Massage of abdomen had a good influence to diminish the volume of stomach residual and decrease the rate of stomach retention. Its effect may be owing to stimulating the parasympathetic division of the autonomic nervous system during various of compressive activities and encouraging rectal loading by increasing muscle activity and relaxing the sphincter in the gut and consequently increasing intra-abdominal pressure and improving peristalsis and bowel sensation resulting in increasing the gastric emptying and decreasing the residual volume. [16]

In addition, it was clear that GRV was high in the control group than experimental group after intervention of abdomen massage. These results were similar to those of El-Feky and Ali (2020) and Momenfar et al., (2018). [6,13]. They highly suggested daily massage of abdomen for ICU inpatients. On contrary, Dehghan et al (2018) findings indicated that there is no much difference between both the control and experimental groups according to GRV after abdomen massage. This might be owing to the variance in massage period (15 minutes) or day's number [7].

Additionally, the study results indicated that regarding gastric residual volume, the experimental group showed a significant difference between the first day and last day after abdominal massage (p= 0.00). At the same time, no significant difference was found with control group. The results of Kahraman and Ozdemir (2015) and Warren (2016) agree with these results [12,29].

Abdominal distension is a sense of increased abdominal pressure that encloses an actual measurable change in the circumference of a patient's abdomen. Research has demonstrated that the occurrence of abdomen distension could be reduced through abdomen massage intervention [30, 31]. Moreover, this study presents that regarding abdominal distension, from day 1 to day 3 of intervention there were no apparent differences between the control and the study group, while it was noted that the study group exhibited abdominal distension lesser than the control group during the intervention period of abdomen massage. Also, in the fourth and fifth day of the intervention, both groups revealed a significant difference regarding abdominal distension. Additionally, concerning the abdomen distension, the present study indicated that after the intervention of abdominal massage in the experimental group, a significant difference was found between the first and fifth days. At the same time, no significant difference was found with the control group. This result agrees with the previous results of Fareed and Sayad (2017), Kahraman and Ozdemir (2015), Warren (2016) [9, 12, 29]. Also, the impact of massage in abdomen on decreasing abdominal distension in the present study may be caused by hasting peristalsis and blood-flow motions, stimulating the nutrients absorption, and facilitating the passage of nutritional components in the intestine, resulting in decreasing abdominal distension [16].

In addition, the current study displayed that occurrence of constipation was higher in the control group than the experimental group during the intervention period of abdomen massage. Also, a significant difference was seen in the last two days of the study between the control and study groups. It can be attributed to reasons of bowel sensation, stimulating the peristaltic reflex, and increasing colonic motility.

By the way, Dehghan et al (2018) conducted a study on the 70 ICU patients with an endotracheal tube to investigate the effect of abdomen massage intervention on patients with constipation. They found that constipation rate was decreased significantly in the experimental group than the control group after abdomen massage intervention [7]. Moreover, a study conducted by Hasmi et al (2020) reported that successive abdomen massage intervention has an impact on improvement of the quality of life of constipated patients. [32]

In addition, the current study revealed that occurrence of vomiting was lower in the experimental group than the control group after abdomen massage intervention. Massage of abdomen cause stimulation of the parasympathetic, followed by activation of intestine and stomach that cause easy digestion of food in the stomach [16,33]. This result is similar with that of Fareed and Sayad (2017), Uysal (2017), and Seiiedi et al (2020), who showed that occurrence of vomits reduced significantly with the experimental group than the control group after abdomen massage intervention [9,23,30]. Also, the findings of this study revealed that regarding to the occurrence of vomiting, the experimental group showed a significant difference between day 1 and day 5 of massage intervention. These results are supported by Fareed and Sayad (2017) and Tekgunduz *et al*. (2014) [9,34].

Daily critical care nurses are facing many challenges. One of these challenges is the practice of managing, implementing and evaluating the care of patients with enteral feeding. The study results provide promises that massage of abdomen leads to reducing of gastric intolerance complications and this indicates the importance of the current study and benefits of abdominal massage for critically ill patients and reflect the role of nursing staff in ICU in facing the challenges with enteral feeding.

Conclusion

Massage of abdomen was influential in the enhancement of gastrointestinal outcomes for critical ill patients with enteral feeding. This leads to a reduction in residual volume of gastric, distension of abdomen, vomiting, and constipation.

The study limitations were inability to generalize the results due to conveniently selection of sample which include only male patients and the size of the sample was little; in addition, the study was conducted in one clinical setting.

Recommendations for policy, practice and research

1. Applying routine abdominal massage for enteral feeding patients in ICU by critical care nurses,
2. Providing training program about abdomen massage to enhance gastrointestinal motility for patients with critical illness,
3. Scheduling appropriate timing and duration to apply abdomen massage for patients with critical illness,
4. Replicating the study with large probability sample of both genders to increase generalizability of the results, and
5. Conducting further study to investigate the impact of the abdomen massage intervention on functions of gastrointestinal and physiological parameters among hospitalized patients in ICUs.

Funding

The study was self-funded.

Authors' contributions

All authors contributed toward data analysis, drafting and revising the paper and agreed to be responsible for all the aspects of this work.

Conflict of Interest

No conflict of interest to declare.

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HOW TO CITE THIS ARTICLE
Murhaf Aldugiem, Abeer Abdelkader, Azza El-Soussi, Tayseer Zeitoun, Fadia Ahmed Abdelkader, Amal Sayed Ali Abdelrahem, Masouda Abd-Elhamid. Effect of Abdominal Massage on Gastrointestinal Outcomes of Critical Ill Patients with Enteral Feeding, *J. Med. Chem. Sci*., 2021, 4(5) 497-507
DOI: 10.26655/JMCHEMSCI.2021.5.11
URL: http://www.jmchemsci.com/article_136101.html