Editors Committee

Effect of Implementing Gastric Residual Volume Protocol on Critically Ill Patient Outcomes

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Abstract
Introduction: Malnutrition is prevalent in intensive care unit patients and is associated with increased morbidity and mortality. Early administration of enteral nutrition to critically ill patients has been associated with a reduced length of hospital stay, enteral nutrition often is complicated by intolerance, as indicated by elevated volumes of gastric residuals. **Aim of this study:** Was to investigate the effect of implementing gastric residual protocol on critically ill patient outcomes. **Design:** A quasi- experimental research design was adopted to conduct this study. **Setting:** The general, trauma and anesthesia intensive care unit at Assiut university hospital**. Subjects:** A simple random sample of 68 adult critically ill patients who are mechanically ventilated and receiving enteral feeding assigned into two groups (35 patient in control group and 33 patient in intervention group). **Results:** There was a significant decrease in total amount of GRV, Length of ICU stay, mechanical ventilation duration, and mortality in the intervention groups than control groups, there was significant increase in delivered feeding amount, total calories in intervention groups than control groups p-value <0.05 **Conclusion:** Implementing gastric residual volume protocol had a positive effect on critically ill patient outcomes. **Recommendation:** Instruct health team in intensive care unit about gastric residual measurement, and management of high GRV.

Key words: Enteral Nutrition , Gastric Residual Volume, Critically Ill, Protocol & Outcomes.

Introduction
In critically ill patients who are unable to resume oral food intake, artificial nutrition has evolved into a primary therapeutic intervention with the aim to improve the outcome by attenuating the stress-induced catabolic response and preventing adverse outcomes related to nutrition deficits or preexisting malnutrition. There is widespread agreement among international nutrition guidelines that early enteral nutrition should be initiated within the first 24–48 hours after intensive care unit admission in patients without an absolute contraindication to enteral nutrition. Apart from the nutrition benefits, early enteral nutrition is considered to maintain structural and functional gut integrity, thus preventing increases in intestinal permeability, and support the immune system **(Dhaliwal, et al., 2014)**

Gastrointestinal dysfunction, including impaired gastric emptying and intestinal dysmotility, is a common event during critical illness and can be both a trigger and a consequence of more diseases. **(Malbrain, et al., 2012)**

The pathophysiology of gastrointestinal dysfunction is multifactorial and complex, involving inadequate tissue perfusion and secretion, dysmotility, and a dysregulated intestinal microbiota and host immune interaction (**Nguyen, et al., 2013).**

Gastrointestinal dysfunction comprises motility disorders that include a delayed passage with slow gastric emptying and constipation as well as an accelerated passage with impaired small intestinal nutrient absorption or nutrition-related diarrhea, respectively **(Heyland, 2015).** The term feeding intolerance is frequently being used as a synonym for gastrointestinal dysfunction that generally indicates an insufficient enteral nutrition intake resulting from impaired gastro duodenal motility and absorption **(Blaser & Starkopf, et al., 2014).**

The highest rates of feeding intolerance were observed among patients with cardiovascular, gastrointestinal, and sepsis admission categories. This is in accordance with previous reports in which delayed gastric emptying was found in almost 50% of mechanically ventilated patients and up to 85% in certain diagnostic groups, including patients with polytrauma, traumatic brain injury, and sepsis **(Blaser et al., 2014).**

An elevated gastric residual volume is considered parameter indicating gastrointestinal motility disorders in general and slow gastric emptying in particular. Monitoring gastric residual volume and holding or interrupting enteral nutrition for large or elevated gastric residual volume has had a firm place in the recommendations of critical care or nutrition guidelines within the past years. It is also probably one of the most traditional and widely accepted nursing practices in the intensive care unit. A national survey among the American Association of Critical

Care Nurses showed that more than 97% of the nurses reported measuring gastric residual volume **(Starkopf, et al., 2014).**

By monitoring gastric residual volume the nurse may detect patient with delayed gastric emptying earlier and intervene with appropriate strategies, therefore this research was conducted to evaluate the effect of implementing gastric residual volume protocol on critically ill patient outcomes.

Significance of the study

The prevalence of feeding intolerance varied markedly (range, 2%–75%; pooled proportion of 38.3% **(Blaser, et al., 2014)** accordance with previous reports, in which delayed gastric emptying was found in almost 50% of mechanically ventilated patients and up to 85% in certain diagnostic groups, including patients with polytrauma, traumatic brain injury, and sepsis **(Gungabissoon, Hacquoil & Bain, et al., 2014)**.

At Assiut university hospital, the medical records of the general intensive care unit patients indicated that the incidence of gastrointestinal dysfunction during the year of 2017 was 56% (11% elevated gastric residual volume only) with 52% mortality **(Assiut University Hospital Record, 2017).**

Aim of the study

The aim of this study was to evaluate the effect of implementing gastric residual volume protocol on critically ill patient outcomes.

Operational definitions

Patient outcomes: Patient outcomes include gastric residual volume, delivery of nutrition, gastrointestinal complications, duration of mechanical ventilation ,length of ICU stay, and mortality.

Gastric Residual Volume (GRV): Refers to the amount of fluid/contents that are in the stomach. Excess residual volume may indicate an obstruction or some other problem that must be corrected before tube feeding can be continued **(Lovett, et al., 2013).**

Gastric residual volume protocol: Is a protocol developed to manage elevated GRV.

Hypothesis

Patients who will receive the gastric residual volume protocol will experience Improving of feeding tolerance, delivery of nutrients and calories than other patients in control group .

Patients who will receive gastric residual volume protocol will have decreased length of ICU stay, mechanical ventilation duration, and mortality than patients in control group.

Research question

What was the effect of implementing gastric residual volume protocol on critically ill patient outcomes?

Materials & Methods

Materials

Design

A quasi- experimental research design was used.

Setting

General, trauma and anesthesia intensive care unit at Assiut University Hospital.

Sample

A simple random sample of 68 adult critically ill patient of both sexes assigned into two groups (35 patient in control group and 33 patient in intervention group). Two patients in the study group were excluded because of gastrointestinal bleeding.

Inclusion criteria: adult male or female patients (20-60 years old), on mechanical ventilation who receiving enteral feeding within 24 hours of admission.

Exclusion criteria: patients with abdominal surgery and gastrointestinal bleeding, acute pancreatitis, esophageal reflux, and pregnancy.

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

n = sample size

z = level of confidence according to the standard normal distribution (for a level of confidence of 95%, z = 1.96)

p = estimated proportion of the population that presents the characteristic (when unknown we use p = 0.5)

d = tolerated margin of error (for example we want to know the real proportion within 5%) =0,05

total number of patients on General, trauma and anesthesia intensive care unit at Assiut university hospital in 2017 was 1400 patient, incidence of elevated gastric residual was 11% from this patients =154 patient ,so the sample size was

$$n = \frac{154\times0.5(1-0.5)}{153(.05^2\div1.96^2)+0.5(1-0.5)} = 68 \text{ patient.}$$

Tools: Three tools were used to collect data.

Tool 1:-Patient's assessment tool

This tool is developed by the researcher after reviewing of literature **(Hurt, et al., 2010), (Martindale, et al., 2015) & (Shankar& Chakravarti, et al., 2018)** to form base line data for the patients. This tool composed of three parts**.**

Part one: Patient demographic and clinical data

It include demographic data (code number, age, sex), clinical data which include (patient diagnosis, date of intensive care unit admission and discharge,..etc)

part two: Hemodynamics assessment (Temperature, blood pressure, pulse, and respiration and oxygen saturation).

Part three: Mechanical ventilation setting.
Include (mode of mechanical ventilation, fraction of inspired oxygen, positive end expiratory pressure, respiratory rate, maximum pressure, …….etc).

Tool 11: Gastric residual volume assessment tool
this tool is developed by the researcher after reviewing of literature **(Starkopf, et al., 2014) & (Lovett, et al., 2013)** to assess gastric residual volume.

- Gastric Residual Volume < 200 mL: residual amount was returned**,** increasing infusion rate by 10ml Q4h to goal rate **(Nickson, et al., 2019)**.
- Gastric Residual Volume 200-500 mL: residual amount was returned **(Zirpe, et al., 2018)**. formula was continue at previous infusion rate, increasing to goal rate by 10 mL Q4H, prokinetic was taken (**Chalela, et al., 2015)**.
- Gastric Residual Volume >500 mL, Patients were Clinically examined for signs of intolerance: abdominal distention, fullness, discomfort, or presence of emesis. return 200 mL, discard the remainder, and hold tube feeding for 2 hours. recheck residuals after 2 hours, if GRV remains >200 mL: Continue to hold tube feeding, Check head of bed, patient position, Consider kidney ureter bladder x-ray abdominal x-ray to rule out ileus/obstruction, Consider gastric motility agent, small bowel feeding, changing to elemental formula if absorption issue is presumed, changing to volume restricted formula or decreasing goal rate, total parenteral nutrition **(Shankar & Chakravarti, et al., 2018)**.

This tool composed of three parts

Part one: Assessment of naso or orogastric tube
Position of naso\orogastric tube, diameter of naso or orogastric tube.

Part two: Assessment of formula selected
Type of formula selected (as Standard intact formula, elemental, renal formula, and volume restricted formula), and amount of formula

Part three: Assessment of gastric residual amount
Nurses withdraw this fluid via the feeding tube by pulling back on the plunger of a large (usually 60 mL) syringe **(Theresa, et al., 2010).** Only gastric tubes should be aspirated. Jejunal and fine bore NGTs should not be aspirated (**Nickson, et al., 2014),** Check gastric residual volume every 4 hours for continuous feedings or prior to bolus feedings **(Lovett, et al., 2013).**

Tool 3: Patient outcomes assessment tools
This tool is developed by the researcher after reviewing of literature **(Malbrain, et al., 2012) & (Blaser, Starkopf, et al., 2014)** to assess patient outcomes .this tool composed of three parts.

Part one: Tolerance ,and delivery of nutrients and calories.
Feed intolerance is An inability to reach or maintain the targeted rate of feed delivery during enteral nutrition, commonly due to large gastric residual volumes and delayed gastric emptying **(Nickson, et al., 2019)**.

Part two: Gastrointestinal complication which include
Diarrhea, constipation, distention, emesis, and presence of high residual.

Part three: Mortality rates in the control group and study group, the researcher assessed if patients died or no.

Method

Administrative design
The study was applied after the official approval for data Collection was obtained from the head of the intensive care unit.

Ethical consideration
Research approval was approved from ethical committee in the faculty of nursing. There was no risk for study subject during application of the research. The study followed common ethical principles in clinical research. Informed consent was taken from one of the near relatives (father ,mother , husband, or wife) after explaining the nature and purpose of the study. confidentiality was assured.

Technique for data collection: the study was conducted throughout four main phases

1) Preparatory phase
The phase involved:

- Official and non-official permission to carry out the study was taken from the responsible authorities general, anesthesia and trauma intensive care unit at Assiut University after explanation the aim of study.
- Development of the tool after reviewing the related literature.
- Content validity of the tool and all necessary modification was established by panel of 7 expert who reviewed the instrument for clarity, relevance, comprehensive, understanding, applicability and easiness for administer modification will be required.
- The reliability was done on tool to conduct the study by using Cronbach's alpha the result was 86.
- A pilot study was carried out (10% of the sample) a number of seven patients to test the clarity, validity and applicability of the tools.

2) Assessment phase
The researcher assessed both control and study group:

- Patient demographic and clinical data, hemodynamics, and mechanical ventilator parameters scale were assessed by using tool 1.

- Gastric residual volume was assessed by using tool 2 Nurses withdraw this fluid via the feeding tube by pulling back on the plunger of a large (usually 60 mL) syringe **(Theresa, et al., 2010)**.

3) Implementation phase

The control group

The control group received the routine hospital nursing care regarding residual volume management.

The study group

This group received gastric residual volume protocol.

Gastric Residual Volume protocol (GRV)

- Gastric Residual Volume < 200 mL: residual amount was returned**,** increasing infusion rate by 10ml Q4h to goal rate **(Nickson, et al., 2019)**.
- Gastric Residual Volume 200-500 mL: residual amount was returned **(Zirpe, et al., 2018)**. Enteral nutrition (EN) was continue at previous infusion rate, increasing to goal rate by 10 mL Q4H,prokinetic was taken (**Chalela, et al., 2015)**.
- Gastric Residual Volume >500 mL, as recommended by the American Society for Parenteral and Enteral Nutrition guidelines 2016, up to 500 ml of gastric residual volume (GRV) should be used as cutoff (**Tyagi, et al., 2018)**, Patients were Clinically examined for signs of intolerance: abdominal distention, fullness, discomfort, or presence of emesis .return 200 mL, discard the remainder, and hold tube feeding (TF) for 2 hours. recheck residuals after 2 hours, if GRV remains >200 mL: Continue to hold tube feeding, Check head of bed (HOB), patient position, Consider kidney ureter bladder x-ray (KUB) abdominal x-ray to rule out ileus/obstruction, Consider gastric motility agent, small bowel feeding, changing to elemental formula if absorption issue is presumed, changing to volume restricted formula or decreasing goal rate, total parenteral nutrition (TPN) **(Shankar & Chakravarti, et al., 2018)**.
- Metoclopramide used as prokintics. European Society for Clinical Nutrition and Metabolism guidelines for adult enteral nutrition recommend the use of metoclopramide or erythromycin for the treatment of patients who do not tolerate enteral feeding (typically measured as an elevation in residuals) **(Evans & Martindale, et al., 2015)**
- Inappropriate cessation of enteral nutrition should avoid. Holding enteral nutrition for GRV <500 mL in absence of other signs of intolerance avoided **(Garg, et al., 2018)**.
- The gastric residual volume was stopped checks when the patient was clinically stable, had no apparent tolerance issues, and had shown relatively low gastric residual volume for 48 hours **(Nickson, et al., 2019)**.
- Enteral Nutrition (EN), Head Of Bed (HOB), Kidney Ureter Bladder x-ray (KUB), Tube Feeding (TF), Total Parenteral Nutrition (TPN).

Types of enteral formula

Polymeric formulae (standard intact)

Polymeric formulae require normal digestion and absorption processes within the gastrointestinal tract (GIT) and macronutrients are used in intact form. These formulae are balanced (meeting 100% RDA) for most micronutrients when between 1-1.5 liters of a given product is consumed daily. Available with different energy densities (1–2 kCal/ml) **(Escuro& Preisser, et al., 2016 & Brown, et al., 2015).**

Semi-elemental formula(elemental formula)

To assist with the digestion and absorption of nutrients, semi-elemental formulae contain macronutrients that are hydrolyzed (partially or fully) (**Escuro, et al., 2016, Roehl, et al., 2015, & Harvey, et al., 2017)**. These products will typically be used for patients with an impaired GIT (surgery or disease affecting the total available surface length, or exocrine pancreatic insufficiency**) (Betz, et al., 2015)** Although these products are not intended for routine use, **(Taylor, et al., 2014**) patients with severe malnutrition and hypoalbuminemia where GIT oedema and resultant malabsorption is expected, as well as patients with GIT impairment and patients who did not tolerate (failed management) a polymeric formula will likely benefit from semi-elemental enteral products **(Escuro, et al., 2016).**

Renal

Many factors affect the medical and nutritional management of a patient with renal impairment. Protein, sodium, potassium, phosphorus and fluid restriction need to be considered. Enteral formulae marketed specifically for patients with renal impairment address these aspects by either decreasing or increasing the respective nutrients within a given volume **(Escuro, et al., 2016).**

Disease-specific formulae

Specialized enteral formulae comprise of a wide range of formulae tailored for a variety of clinical scenarios. The aim is to improve patient outcome (**Hummell, et al., 2016)**.

Fluid Restricted formula: Intact nutrients, calorically dense (2.0 kcal/mL**) (Escuro, et al., 2016)**

4) Evaluation phase

The two groups are evaluated for gastrointestinal function, tolerance, delivery of nutrients, total calories and, complications (vomiting distention, diarrhea, constipation, length of hospital stay, duration of mechanical ventilation, and mortality.

Statical analysis

-independent samples t-test for comparing two group, chi-square test for qualitative variables.

Results

Table (1): Frequency distribution of patients regarding demographic characteristics and clinical data(n=68).

Item		Control (n =35)		Intervention (n =33)		P- value
		n	%	n	%	
Age	20-30	8	22.9%	11	33.3%	.697
	31-40	2	5.7%	3	9.1%	
	41-50	4	11.4	3	9.1%	
	51-60	21	60.0%	16	48.5	
Sex	Male	27	77.1%	26	78.8%	.870
	Female	8	22.9%	7	21.2%	
diagnosis	COPD	6	17.1%	8	24.2%	.470
	septic shock	2	5.7%	0	0%	
	traumatic brain injury	8	22.9%	8	24.2%	
	chest trauma	3	8.6%	3	9.1%	
	post arrest	3	8.6%	0	0%	
	Renal failure	1	2.9%	1	3.0%	
	Cancer	2	5.7%	1	3.0%	
	Organophosphorous poisoning	0	0%	1	3.0%	
	electrical shock	1	2.9%	0	0%	
	pulmonary embolism	1	2.9%	0	0%	
	DCL	1	2.9%	0	0%	
	Pneumonia	1	2.9%	2	6.1%	
	cerebrovascular accident	1	2.9%	0	0%	
	Spinal cord injury	1	2.9%	0	0%	
	heart failure	1	2.9%	0	0%	
	DM,septic shock	2	5.7%	3	9.1%	
	chest and head trauma	1	2.9%	5	15.2%	
	respiratory failure	0	0%	1	3.0%	

** Significant difference p .value <0.05. -chi-square test for qualitative variables.*

Table (2): Comparison between the two groups in relation to hemodynamics.

Item	Control (n =35)	Intervention (n =33)	P- value
Temperature	37.86±0.61	37.63±0.49	0.098
Heart rate	101.77±13.13	103.39±15.35	0.641
Patient respiratory rate	24.51±10.91	18.24±3.47	0.002*
Systolic blood pressure	122.29±11.65	117.27±13.29	0.102
Diastolic blood pressure	73.71-± 8.06	72.12±9.60	0.461
Spo2	96.43±1.91	96.89±2.60	0.483

** significant difference p .value < 0.05.*
-independent samples t-test for comparing two groups.

Table (3): Comparison between the two groups in relation to mechanical ventilation parameter.

Item	Control (n =35)	Intervention (n =33)	P- value
RR by mechanical ventilation	13.89±2.61	14.28±3.30	0.662
Tidal volume	510.42±66.96	470.83±51.03	0.223
Maximum pressure	23.38±14.30	17.29±10.20	0.166
Pressure support	13.93±3.84	11.60±3.32	0.015*
PEEP	7.14±2.00	5.94±1.48	0.007*

**significant difference p .value <0.05.*
-independent samples t-test for comparing two groups.

Table (4): Comparison between the two groups in relation to selected feeding formula.

Item		Control(n =35)		Intervention (n =33)		P- value
		N	%	N	%	
selected formula	Standard intact formula	7	(20.0%)	26	(78.8%)	.000*
	elemental formula	23	(65.7%)	1	(3.0%)	
	Renal formula	1	(2.9%)	5	(15.2%)	
	volume restricted formula	2	(5.7%)	0	(0%)	
	volume restricted, elemental formula	2	(5.7%)	0	(0%)	
	disease specific formula	0	(0%)	1	(3.0%)	
Nothing per mouth	Yes	9	(25.7%)	0	(0%)	.002*
	No	26	(74.3%)	33	(100%)	
Use of parenteral nutrition	Yes	9	(25.7%)	2	(6.1%)	.028*
	No	26	(74.3%)	31	(93.9%)	

** significant difference p .value <0.05. -chi-square test for qualitative variables.*

Table (5): Comparison between the two groups in relation to gastric residual volume.

Item	Control (n =35)	Intervention (n =33)	P- value
Largest GRV	280.00±197.11	342.73±256.06	0.260
Days of residual	2.80±1.18	1.48±0.80	0.000*
Total amount of GRV	967.14±740.03	608.18±446.64	0.019*

** significant difference p .value <0.05. -independent samples t-test for comparing two groups .*

Table (6): Comparison between the two groups in relation to delivery of nutrients .

Item	Control (n=35)	study(n=33)	P-value
Delivered feeding amount \ day	1034.11± 573.74	2642.90±329.88	0.00 *
Total calories per day	600.34±416.53	2276.06±476.19	.000*

** significant difference p .value < 0.05. -independent samples t-test for comparing two groups*

Table (7): Comparison between the two groups in relation to Gastrointestinal complication.

Item		Control (n =35)		Intervention (n =33)		P- value
		N	%	N	%	
Diarrhea	yes	9	(25.7%)	4	(12.1%)	.154
	no	26	(74.3%)	29	(87.9%)	
Constipation	yes	16	(45.7%)	5)	(15.2%	.006*
	no	19	(54.3%)	28	(84.8%)	
Vomiting	yes	3	(8.6%)	4	(12.1%)	.0466
	no	32	(91.4%)	29	(87.9%)	
Distention	yes	15	(42.9%)	4	(12.1%)	.005*
	no	20	(57.1%)	29	(87.9%)	

** significant difference p .value < 0.05. -chi-square test for qualitative variables.*

Table (8): Comparison between the two groups in relation to patients out comes (Length of ICU stay, Duration of connection with mechanical ventilation, and mortality).

Item		Control (n =35)	Intervention (n =33)	P-value
Length of ICU stay		29.8٩±29.08	11.7٣±7.60	0.001*
mechanical ventilation duration		26.80±28.01	7.24±5.2٨	.000*
Mortality	yes	26 (83.9%)	5 (16.1%)	.000*
	no	9 (24.3%)	28 (75.7%)	

** Significant difference p .value <0.05. -chi-square test for qualitative variables.*
-independent samples t-test for comparing two groups .

Table (1): Shows frequency distribution of the study and the control groups regarding demographic characteristics and clinical data: Regarding to age the results of the current study revealed that the mean age of study and control group were (43.58±16.12) versus (47.77±13.63) respectively .Regarding to sex, it was noticed that a highly percent of patients in study and control group were male (78.8%) versus (77.1%) respectively. Regarding to diagnosis, results revealed a relatively high percent of patients in the study and control group were traumatic brain injury (22.9%), 8 (24.2%) and COPD (17.1%), 8 (24.2%) and there was no statistically Significant difference between the two groups in all patient socio-demographic data with p. value >0.05.

Table (2): Shows comparison between the two groups in relation to hemodynamics: This table showed that there was no statistically Significant difference between the two groups with p. value >0.05 regarding temperature, heart rate, Systolic blood pressure, diastolic blood pressure, and Spo2.

Concerning with respiratory rate, respiratory rate of control group and study group were (24.51±10.91) versus (18.24±3.47) indicate there was statistically Significant difference between the two groups with p. value <0.05 regarding respiratory rate.

Table (3): Shows comparison between the two groups in relation to mechanical ventilation parameter: this showed that there was a statistically Significant difference between the two groups with p. value <0.05 regarding Pressure support, PEEP and there was no statistically Significant difference between the two groups with p. value >0.05 regarding RR, Tidal volume, and Maximum pressure.

Table (4): Shows comparison between the two groups in relation to selected feeding formula: Concerning with selected feeding formula there was statistically Significant difference between the two groups with p. value <0.05, most of cases in study group received Standard intact formula (78.8%) in the other hand (65.7%) from the control groups received elemental formula. Concerning with Nothing per mouth status there was statistically Significant difference between the two groups with p. value <0.05, no cases in intervention group had Nothing per mouth status versus (25.7%) managed with Nothing per mouth in the control groups Concerning with use of parenteral nutrition, the percentage of cases received parenteral nutrition of the control group and study group were (25.7%) versus (6.1%) respectively. There was statistically Significant difference between the two groups with p. value <0.05.

Table (5): Shows comparison between the two groups in relation to gastric residual volume: concerning Largest GRV there is no significant difference with p .value > 0.05 between the two groups .there was a significant decrease in days of residual of the study groups than control groups (1.48±0.80) versus (2.80±1.18) respectively.in addition, there was a significant decrease in Total amount of GRV in the study groups than control groups (608.18±446.64) versus (967.14±740.03) respectively. There was statistically Significant difference between the two groups with p. value <0.05. Regarding days of residual, and Total amount of GRV.

Table (6): Shows comparison between the two groups in relation to delivery of nutrients and calories. There a significant increase in delivered feeding amount, total calories in study groups than control groups (2642.90±329.88) and (2276.06±476.19) versus (1034.11±573.74)and (600.34±416.53) respectively.

Table (7): Shows comparison between the two groups in relation to Gastrointestinal complication: there was no significant difference between the two groups with p .value > 0.05 regarding diarrhea and vomiting. Regarding constipation and distention there was significant difference between the two groups with p .value < 0.05.

Table (8): Shows comparison between the two groups in relation to patients out comes (Length of ICU stay, Duration of connection with mechanical ventilation, and mortality): Concerning to Length of ICU stay there was Significant decrease in the Length of ICU stay in in the study group than the control group (11.73±7.60) versus (29.89±29.08) respectively. Concerning with Duration of mechanical ventilation duration, there was Significant decrease in the study group mechanical ventilation duration than the control group (7.24±5.28) versus (26.80±28.01) respectively. Concerning to mortality rate there was a highly in the Significant increase in the mortality rate in the control group versus the study group. There was statistically Significant difference between the two groups with p. value <0.05.

Discussion

Early and adequate enteral nutrition is associated with reduced morbidity and mortality in the critically ill patient (**Neyens & Melissa, et al., 2015)** Many patients do not achieve goal enteral nutrition, partially attributable to patient intolerance defined as abdominal pain or distention, vomiting, and most commonly high gastric residual volumes (GRV) (**Huber, & Chalela, et al., 2015).**

Regarding to age and sex, the current study revealed that the study and control groups were similar in terms of demographic variables including gender and there was not any significant difference), these findings were supported by **(Soroush & Abdi, et al., 2018)** study, which was conducted as a clinical trial in Ahwaz, and studied the effect of abdominal massage on the gastric residual volume in patients hospitalized in intensive care units, which also showed no statistically difference between the two groups regarding the sex and age.

Regarding to diagnosis of study sample, the finding of the current study revealed that the most common diagnosis was traumatic brain injury and COPD and there was no statistically Significant difference between the two groups. These findings were supported by **(Wong & Lee, et al., 2011)**, who studied the Impact of disease severity on gastric residual volume in critical patients in a medical ICU of a tertiary medical center, Chicago, USA, which also showed no statistically difference between the two groups. Patients with increased intracranial pressure after a head injury have been found to have slow gastric empty, and elevated intracranial pressure is thought to be the main mediator of impaired gastric motility and emptying.

Regarding to gastric residual volume, the current study revealed that there was a significant decrease in total amount of gastric residual volume in the study group than control groups. Regarding days of residual, and total amount of GRV, this difference was as aresult of using prokinetics, the current results are matching with **(Almenawer & Alshamsi, et al., 2016)**, who searched MEDLINE, EMBASE, and Cochrane Library and conducted a systematic review and meta-analysis of randomized trials about The efficacy and safety of prokinetic agents in critically ill patients receiving enteral nutrition study, which show that prokinetic agents significantly reduced feeding intolerance; $P = 0.03$, Prokinetics also reduced the risk of developing high gastric residual volumes.

Regarding to delivery of nutrients and total calories received, There a significant increase in delivered feeding amount, total calories in study groups than control groups. This finding supported by **(Guo, et al., 2015)**, who conducted Gastric residual volume management in critically ill mechanically ventilated patients study in a Singapore General Hospitals, which revealed that a higher GRV threshold allows for a higher delivery of enteral nutrition calories.

Regarding to gastrointestinal complication the current study finding revealed that there was no significant difference between the two groups regarding diarrhea and vomiting. Regarding constipation and distention there was significant difference between the two groups, this result the current results are matching with **(Montejo & Miñambres, et al., 2010),** who studied the effect of abdominal massage on the gastric residual volume in patients hospitalized in intensive care units, as a clinical trial in Ahwaz, and showed that Frequency of gastrointestinal complications was higher in the control group.

Regarding to length of ICU stay and mechanical ventilation duration of the study sample ,the finding of the current study revealed that there was significantly shorter in the ICU stay and mechanical ventilation duration of study group when compared to control group. the current results were matching with **(Fontes et al., 2013)**, who performed a Subjective global assessment about" a reliable nutritional assessment tool to predict outcomes in critically ill patients". study which revealed that the presence of malnutrition during critical illness has been shown to be associated with impaired immune function, increased risk of infectious complications, prolonged mechanical ventilation, and increased ICU and hospital length of stay.

Regarding to mortality rate, the finding of the current study revealed that there was a highly in the Significant increase in the mortality rate in the control group versus the intervention group. There was statistically Significant difference between the two groups. The current results were supported by **(Shpata, et al., 2013),** who conducted " Malnutrition affects negatively the outcome of intensive care unit (ICU) patients" study, in the ICU of University Hospital Center of Tirana, which show that Malnutrition, is an independent risk factor on higher complications, higher infectious complications, and increased mortality.

Conclusions

Implementing Gastric residual volume protocol had appositive effect on critically ill patient outcomes as delivery of nutrients and calories, duration of mechanical ventilation, length of hospital stay, and mortality

Recommendation

- Empower registered dietitians or nutrition support teams to initiate and manage enteral nutrition order.
- Provider education through strong multidisciplinary collaboration.

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