Assiut Scientific Nursing Journal

http://asnj.journals.ekb.eg
http://www.arabimpactfactor.com

Effect of Early Enteral Nutrition Guidelines on Occurrence of Gastrointestinal Complications Among Acute Lung Injury Patients

Safaa Mohamed Adam[1], Mona Aly Mohammed[2], Mervet Anwer Abdel-Aziz[3], Khaled Mohamed Morsy[4] & Naglaa Gamal Eldien AbdElhafez[5].
Assistant Lecturer in Critical Care Nursing & Emergency Department, Faculty of Nursing, Sohag University, Egypt.
Assistant Professor in Critical Care Nursing Department, Faculty of Nursing, Assuit University, Egypt.
Assistant Professor in Critical Care Nursing Department, Faculty of Nursing, Assuit University, Egypt.
Assistant professor in Anesthia &ICU Department Faculty of Medicine, Assuit University, Egypt.
Lecture of Critical Care & Emergency Nursing, Sohag University**,** Egypt.

Abstract
Proper nutrition found to be an essential in health maintenance and restoration in the critically ill patient. **Aim of the study** was to evaluate the effect of early enteral nutrition guidelines on occurrence of gastrointestinal complications among acute lung injury patients. **Design** A quasi-experimental research design was used to conduct this research. **This study was carried out at** Trauma Intensive Care Unit at Assiut University hospital. **Sample:** was consisted of 30 patients in each group**. Tools: Tool I:** Modified patient assessment questionnaire, **Tool II:** Gastrointestinal complications assessment related to enteral nutrition. **Methods**: data about 30 patients receiving enteral nutrition before enteral nutrition guidelines were retrospectively compared with data for 30 patients admitted after implementation of the guidelines. **Results** of the present study showed Patients in the after intervention group had a lower gastrointestinal complications than before intervention group. **Conclusion**: Implementing early enteral nutrition guidelines reduce occurrence of gastrointestinal complications among acute lung injury patient in ICU **Recommendations**: Provision an educational programs for nurses about enteral nutrition guideline.

Key words: Acute Lung Injury, Enteral Nutrition & Gastrointestinal Complications.

Introduction
Acute lung injury (ALI) is common in critically ill patients admitted to intensive care units (ICU). ALI is a diffuse inflammatory lung injury, characterized by bilateral pulmonary infiltrate in a chest radiograph consistent with the presence of edema and no clinical evidence of left atrial hypertension; or a pulmonary wedge pressure of 18 mmHg or less features the PaO_2/FIO_2 ratio be less 300 mmHg: The causes of ALI are multiple and include sepsis –the most common–, pneumonia, aspiration, and severe trauma. **(Vincent., 2018)**

Patients with ALI are characterized by a pro-inflammatory state and protein catabolism. Elaboration of systemic cytokines resulting in increased metabolic and nutritional requirements due to trauma and illness. So that Adequate Nutrition support is therefore essential to meet energy requirement and maintain muscle strength. Nutrition support is necessary to prevent cumulative caloric deficits, malnutrition, loss of lean body mass, and deterioration of respiratory muscle strength. Furthermore, early delivery of enteral nutrition has been associated with the modulation of stress and the systemic immune response as well as the attenuation of disease severity. (**Wilson. & Typpo, 2016)**

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)**

Enteral nutrition is important in the care of patients with ALI. Appropriate nutritional management is best achieved by using a comprehensively designed nutritional care process includes nutrition screening, nutrition assessments, nutrition interventions, and monitoring of nutritional parameters. Nutrition screening can help identify patients early in the hospitalization who have existing nutrition deficits, **(Mehta. et al., 2018).** In general, nutritional assessment continues the data gathering process initiated in the screen. The types of data collected in nutritional assessment are often similar to data collected in the screening process but in more depth **(Reber. et al., 2019).** Nutrition interventions in this patient are targeted at preventing cumulative calorie deficits; identifying, preventing, and treating malnutrition; avoiding deterioration of respiratory muscle strength; and modulating the inflammatory

response associated with ALI. The careful monitoring of nutritional parameters in ALI patients is critical in order to quantify the progress made toward meeting the goals of nutrition therapy. **(Hanson. et al., 2015)**
Complications related to enteral nutrition (EN) include metabolic disorders, such as high blood glucose level and electrolyte abnormality, gastrointestinal complications are commonly associated with enteral feeding like vomiting, bowel movement disorders (i.e., diarrhea and constipation), aspiration, abdominal distention and pain. So, inappropriate management of these symptoms resulting in serious prognosis. Example; diarrhea may cause a decrease in the circulating blood volume; metabolic acidosis with loss of electrolytes and bicarbonate by excretion of large quantities of digestive juices; electrolyte abnormalities with loss of potassium, magnesium, and zinc; and contamination of surgical wounds and pressure ulcers. If such gastrointestinal symptoms do not resolve with appropriate management, EN must be discontinued or interrupted **(Tatsumi., 2019)**
During enteral nutrition, critical care nurses routinely place feeding tube, administering of feeding, prevent and detect complications associated with this form of therapy, obtaining weight measurements, vital signs, and laboratory data and providing enteral tube care throughout the duration of nutrition support therapies. The nurse obtains more objective signs of feeding tolerance through abdominal examinations, which assess bowel sounds .Also, the nurse monitors and records volume and frequency of both urine and stool. However, in more advanced critical care units, nurse calculate patient's needs of calories, body's requirements, analyze daily calories delivery and advocate for early enteral feeding **(Morton., and Fontaine, 2017)**

Significance of the study

Intolerance to enteral feeding has been reported in up to 60% of the ICU patients. The signs and symptoms of intolerance to enteral feeding include vomiting, abdominal distension and/or pain, constipation, and diarrhea. Research has shown that gastrointestinal complications often result in decreased provision of EN and prolonged the ICU or the hospital stay **(Tatsumi, 2019)**. Statistics of trauma intensive care unit at Assuit University Hospital in the years of (2016 & 2017) revealed that the incidence of gastrointestinal intolerance during the year of 2017 was 56% (**Hospital records of Assuit University 2016-2017).**

Operational Definitions

Acute lung injury (ALI)

Acute lung injury is defined as an acute lung disease with bilateral pulmonary infiltrate in a chest radiograph consistent with the presence of edema and no clinical evidence of left atrial hypertension pulmonary wedge pressure was 18 mmHg or less. Additionally, the ratio of arterial oxygen to the fraction of inspired oxygen (PaO2/FiO2) must be less 300 mmHg

Early enteral feeding

Early" has generally implied the initiation of enteral support within 24 h of admission to the ICU for acute lung injury

Patient's outcomes

Improve nutritional status, reduce time to initiation of enteral feeding, decrease gastrointestinal complications.

Aim of the study

The aim of this study was to evaluate the effect early enteral nutrition guidelines on occurrence of gastrointestinal complications among acute lung injury patients.

Research Hypothesis

Hypothesis (1) the mean time to initiation of enteral feeding will be lesser in after intervention group compared to those of before intervention group.

Hypothesis (2) the frequency gastrointestinal complications occurrence complications will be lesser in after intervention group compared to those of before intervention group

Hypothesis (3) the nutritional status in after intervention group will be better than of before intervention group

Patients & Methods

Research Design

A quasi experimental research was used to utilize this study.

Setting

The study was conducted in trauma intensive care unit at Assuit University Hospital.

Subjects:

Purposive sample of 60 adults, males and females patients who recently admitted to intensive care unit with acute lung injury were randomly classified into two groups. (30 patients in each group)

$$n = \frac{N\,Z^2 \quad ^2}{Z^2 \quad ^2 + N\,e^2}$$

$$n = \frac{932 \times (1.96)^2 \times (0.205)^2}{(1.96)^2 \times (0.205)^2 + 932 \times (0.05)^2}$$

= 60 patient.

Z=1.96 [standard scores] e =0.05 [error] =0.205 [SD]
N=932 [population] n =60 [sample]

Inclusion Criteria: having nasogastric or orogastric tube feeding, can tolerate enteral feeding, hemodynamically stable

Exclusion criteria: excluded from the current study the patients had contraindications to enteral nutrition included intestinal obstruction or ileus, abdominal trauma, active gastrointestinal hemorrhage, intractable vomiting or diarrhea, and severe hemodynamic instability.

Tools:

Data were collected using two tools in order to achieve the aim of the study.

Tool I: Patient Assessment questionnaire. This tool was developed by the researcher after reviewing the related literature **((Morton., and Fontaine., 2017), Compton, et al., (2014), (Heyland. et al., 2011), (Lee & Heyland, 2018) (Ahnert, et al., 2019), (Naved et al., 2011) & (Santos & Araújo 2019)**. It includes the following parts

Part I: Socio demographic and clinical data: This part includes socio- demographic data, past medical history, current diagnosis.

Part two: this part consists of following categories:

Assessment of hemodynamic parameters adopted from **(Morton, & Fontaine, 2017**). It included temperature, heart rate, blood pressure, means arterial pressure and central venous pressure reading,

Nutritional assessment

- Anthropometric measurements these included (patient's weight (kg), Height (cm), Mid-Upper Arm Circumference (MUAC in cm) and body mass index measured through dividing weight by kg on the square of height by m^2
- Modified Nutrition Risk in Critically ill (mNUTRIC) score adopted from **(Lee and. Heyland , 2018) & Heyland. et al.,2011)** used to identify patients at nutritional risk according to the following five variables:

1. Age
2. Number of co-morbidities
3. Days from hospital to ICU admission
4. Acute Physiology and Chronic Health Evaluation II (APACHE II) This tool adopted from **Naved et al., (2011),** It was designed to measure the severity of disease for adult patients admitted to ICU. APACHE II uses a point score based upon initial values of 12 routine physiologic measurements (internal temperature, heart rate, respiratory rate, oxygenation, arterial pH, sodium, potassium, creatinine, hematocrit, white blood cells and Glasgow coma score), takes account of the patient's age, chronic health condition and physiological variables.
5. The Sequential Organ Failure Assessment Score SOFA score This tool adopted from **Ahnert, et al., (2019)** used to describe degree of organ dysfunction in critically ill patients over time. Which composed of scores from six organ systems (respiratory, cardiovascular, hepatic, coagulation, renal, and neurological) graded from 0 to 4 according to the degree of dysfunction/failure

"Modified Nutrition Risk in Critically ill (mNUTRIC) score."

Variables	Rang	point
Age	<50	0
	50-<75	1
	> 75	2
APACHE II	< 15	0
	15 - <20	1
	20-28	2
	>=28	3
SOFA	<6	0
	6 - <10	1
	>10	2
Number of Co-morbidities	0 - 1	0
	>=2	1
Days from hospital to ICU admission	0 - <1	0
	>=1	1
TOTAL		

Sum of point: 5-9 high risk of malnutrition ≤4 "low" risk of malnutrition

Laboratory investigation:- adopted from **(Morton, and Fontaine., 2017) & Compton, et al (2014)** included Arterial Blood Gases(PH ,PAO2.PCO2, HCO3), blood picture (WBC_s, RBC_s, hemoglobin, Platelets, hematocrits), renal function(blood urea nitrogen, creatinine, and liver function(albumin, total bilirubin, total protein) theses taken at admission, $7^{th}$and 14^{th} day

Tool II: Assessment Of Gastrointestinal Complications related to enteral feeding administration adopted from **(Santos and Araújo 2019)** which included constipation where (0 no constipation…. 1 presence of constipation), diarrhea (0 no …. 1 yes), distension(0 no ….1 yes), aspiration(0 no …. 1 yes), and vomiting(0 no…. 1 yes). Then sum presence of all GI complications in each patient. So total sum of GI complication will be ranged from 0- 5

Methods

The study was conducted though out three main phases (preparatory phase, implementation phase and evaluation phase).

The study was carried out on two phases:

1- Preparatory phase:

An official Permission was granted by the researcher from the head of trauma intensive care unit at Assuit university hospitals after explanation the aim and nature of the study.

Content validity

The tools were tested for content related validity by 5 specialists in the field of critical care medicine and

critical care nursing from Sohag and Assuit University, and the necessary modifications were done (because of high costly of IL-6 levels sample, NUTRIC score was removed and modified NUTRIC score, which allows the exclusion of IL-6 levels was used)

Pilot study

A pilot study was conducted on 10% of the study subjects to test the feasibility and applicability of the tools and time needed to collect the data. The tools were applicable, little modification was done and the pilot study subjects were excluded from the actual study.

Reliability of this tool was done using Cronbach´s coefficient alpha score; it was 0.795

Ethical considerations

1. Research proposal was approved from ethical committee in the faculty of nursing.
2. There is no risk for study subject during application of the research.
3. The study was followed common ethical principles in the clinical research.
4. Written consent was obtained from patients or guidance who were welling to participate in the study. After explaining the nature and purpose of the study.
5. Confidentiality and anonymity was assured.
6. Study subjects had the right to refuse to participate and/or withdraw from the study without any rational a t any time.
7. Study subject privacy was considered during collection of data

Field work

- The data were collected seven days / week until patient for 14 day from trauma intensive care unit (TICU), during period between "November 2017" till "April 2019".
- Data about pre intervention group (control group) receiving enteral nutrition during period from November 2017 to May 2018 was collected.

Procedure

After intervention group (study group): - Each patient of the study group subjects were received enteral feeding guidelines. This covered the following items

- Once patient hemodynamically stable and no oral nutrition intake possible start enteral nutrition (25 mL/hrs. for 6 hrs) then monitor for gastrointestinal symptoms and check gastric residual volume <200 ml increase enteral feeding
- Administration was performed intermittently six times a day at three-hour intervals with a nocturnal pause of six hours
- Feed, feed reservoirs and giving sets must not be reused and should be discarded after 24 hours.
- Check the expiration date of the formula and discards the formula if it is expired. Breaks in the system are minimized, and the use of a closed, prefilled, ready-to-hang solution should be considered.
- Enteral feeding tubes should be flushed regularly with at least 30 ml tap water using a 50 ml syringe and flushing should be documented. Recommendations for flushes are as follow:
- Every 4 to 6 hours during the day
- Before and after feeding
- Before and after drug administration.
- The enteral feeding formula was observed for amount, time, color, consistency, odor and temperature.
- Assess for intolerance to feedings every 4 hours by monitoring gastric residual volumes, abdominal discomfort, nausea/vomiting, and abdominal girth/distention.
- Assess feeding tube placement at 4-hour intervals and before starting each feeding to ensure that the tube has remained in the desired location tube placement was confirmed by the visible marker level, the aspiration of gastric content, and checking sound of instilled air in the stomach by injecting air through a 60 cc syringe and listening to the sound of air using stethoscope over epigastric region.
- Before fed starting, apply abdominal massage for 15 min in a clockwise direction over the intestines on the abdominal wall.
- High-carbohydrate solutions are avoided in ALI patient to prevent excess carbon dioxide production.
- Monitor lipid intake.
- Gastric secretions should be closely monitored for bleeding, (Because these patients are at risk of developing stress ulceration)
- Provide patient with oral care before eating to ensure optimal consumption of diet.
- Do not crush tablets or open capsules unless an alternative formulation or drug is unavailable.
- When different types of medications are administered, each type is given separately, using a bolus method that is compatible with the medication's preparation. The tube is flushed with 20 to 30 mL of water after each dose.
- Never add drugs to enteral feeds as this can affect stability of the feed, increase microbial contamination risk
- Feeding should not be withheld in patients with low levels of potassium, magnesium or phosphate until these have been corrected. Since

the vast majority of these deficits are intracellular, they cannot be corrected without commencing low energy provision.

- For prevention of gastrointestinal intolerance
- Delivery of the feeding in small amounts over long periods reduces the incidence of aspiration, distention, nausea, vomiting, and diarrhea
- Assess patients' bowel movement daily, ensure adequate amount of fluid intake, switching to a fiber formula, encourage early ambulation to promote optimal intestinal motility, promoting activity and exercises, and administer laxatives and stool softener as necessary to avoid constipation.
- Elevated head of bed and check gastric residual before the next feeding, deceased rate of formula administration, or discontinue feeding.to avoid vomiting.
- keeping the head of bed elevated 30 to 45°, using sedatives sparingly, assessing placement of the enteral access device and tolerance to enteral feeding, and ensuring adequate bowel function and defecation, positioning the patient in the right lateral position when possible to encourage gastric emptying, keeping the cuff of endotracheal tube inflated as much as possible during enteral feeding, and being alert to any increase in abdominal distention to avoid aspiration **(VanBlarcom, A., & McCoy, M. A. 2018)**
- Reviewing the medications that the patient is receiving, observing things that can cause diarrhea as a side effect, hypertonic oral suspensions should be diluted before giving as a bolus through a feeding tube, reviewing the formula and gastrointestinal absorptive function, considering the change rate of delivery or formula as indicated (reduced osmolality, fiber enriched, lactose free). To avoid diarrhea related enteral feeding.

Evaluation phase

- Hemodynamic Parameters include temperature, heart rate, blood pressure & mean arterial pressure and CVP reading were assessed daily
- Arterial Blood Gas were made daily to determine any metabolic changes
- Nutritional Assessment using anthropometric measurements these included (patient's weight, Height, Mid-Upper Arm Circumference and body mass index obtain on admission then at discharge to monitor effect of enteral nutrition)

1. Anthropometric measurements these included (patient's weight (kg), Height (cm), Mid-Upper Arm Circumference (MUAC in cm) and body mass index measured through dividing weight on the square of height

A. **Height** was measured with the patient in the supine position

B. **Weight** measured by Ross Laboratories equation
Females: (knee height × 1.01) + (mid arm Circumference × 2.81) - 66.04
Males: (knee height × 1.19) + (mid arm Circumference × 3.21) - 86.82

C. **Mid-upper-arm circumference** by measuring Tap: Mid-Upper Arm Circumference (MUAC) is the circumference of the left upper arm, measured at the mid-point between the tip of the shoulder and the tip of the elbow

D. **body mass index** measured through dividing weight on the square of height BMI (kg/m^2) = [weight (kg)/height (meter) ^{2}].

- Modified Nutrition Risk in Critically ill (mNUTRIC) score developed by **(Lee and. Heyland , 2018) & Heyland. et al.,2011)**. were used to identify patients at nutritional risk according to the following five variables: age, number of co-morbidities, days from hospital to ICU admission, and total score of the Acute Physiology and Chronic Health Evaluation II (APACHE II) and Sequential Organ Failure Assessment (SOFA). Patients with mNUTRIC scores ≥5 were classified as "high," meaning that they had a higher risk of malnutrition while those with scores ≤4 were considered "low" risk. "Modified Nutrition Risk in Critically ill (mNUTRIC) score." admission, score were evaluated on admission then at 7^{th} , and 14^{th} day
- Gastrointestinal complications were assessed for both groups on daily bases all over the study period using tool 2.
- Patients were observed for vomiting and assessed for abnormal content. The feeding was stopped and the feeding tube was opened. The feeding was re-started after positive feeding test was confirmed.
- Patients were considered to have diarrhea when passing three largely watery stools per day.
- Patients were considered to be constipated if they didn't pass stool for three days
- Abdominal distension; it was confirmed through palpitation and percussion of the stomach

Statistical analysis

All data were recorded in a special chart for every patient. The collected data were coded, analyzed and tabulated .Data entry and analysis were done using SPSS 19.0 statistical software package. Data were presented using descriptive statistics in the form of frequencies and percentages for qualitative variables, and means and standard deviations for quantitative variables. Quantitative continuous data were

compared using analysis of variance test in case of comparisons between two independent groups. Using independent T-test and chi-square test to determine significant, it is considered significant when $P \leq 0.05$ significant and non- significant when $P > 0.05$.

Results and analysis of data

Table (1): personality distribution of demographic and clinical data in the after & pre intervention groups (n=60).

socio-demographic & clinical data	After intervention (n= 30)		Before intervention (n=30)		P-value
	No.	%	No.	%	
Age: (years)					0.461
Mean ± SD	50.27± 12.98		52.77± 13.13		
Sex:					1.000
Male	17	56.7%	17	56.7%	
Female	13	43.3%	13	43.3%	
Past-medical disease:					0.150
Cardiac disease/ DM / HTN	1	3.3%	1	3.3%	
Cardiac disease/DM	0	0.0%	1	3.3%	
DM	3	10.0%	2	6.7%	
DM / HTN	0	0.0%	2	6.7%	
HTN	0	0.0%	2	6.7%	
No past history	26	86.7%	22	73.3%	
Current diagnosis:					0.259
Brain edema &EDH	3	10.0%	2	6.7%	
Brain edema &SDH	3	10.0%	3	10.0%	
Drowning	1	3.3%	0	0.0%	
Lung contusion	12	40.0%	10	33.3%	
Multiple fracture	4	13.3%	6	20.0%	
Pneumonia	3	10.0%	3	10.0%	
Sepsis	4	13.3%	6	20.0%	

*Chi-square test & Independent samples t-test. * Statistical significant difference (p<0.05) DM: Diabetes mellitus, HTN: Hypertension, EDH: extradural hematoma, SDH: Subdural hematoma*

Table (2): Assessment of study sample in relation to hemodynamic parameter (n=60).

Hemodynamic parameters	After intervention (n= 30)	Before intervention (n=30)	P-value
	Mean ± SD	Mean ± SD	
Frist day (baseline)			
Heart rate (HR)	92.60 ± 11.45	92.80± 11.19	0.785
Systolic blood pressure (SBP)	118.33±11.52	120.23±17.50	0.261
Diastolic blood pressure (DBP)	77.97±9.43	77.57±8.82	0.866
Mean arterial pressure(MAP)	91.42 ±9.42	91.79 ±10.54	0.888
Central venous pressure (CVP)	10.28 ±5.20	9.04 ±7.30	0.328
Temperature (T)	37.33 ±0.72	37.26 ±0.73	0.709
Pulse oximetery	89.07 ±4.37	87.13±4.73	0.106
7th day			
Heart rate	86.23± 7.64	92.00± 9.50	0.012*
Systolic blood pressure	120.53± 6.36	118.63± 10.71	0.322
Diastolic blood pressure	80.03± 6.01	81.90± 8.69	0.338
Mean arterial pressure	92.66 ± 4.94	93.98 ± 8.73	0.473
Central venous pressure	11.40 ±2.61	9.15 ±3.44	0.047*
Temperature	37.19 ±0.80	37.63 ±0.88	0.046*

Hemodynamic parameters	After intervention (n= 30)	Before intervention (n=30)	P-value
	Mean ± SD	Mean ± SD	
Pulse oximetery	92.93±2.31	92.23±2.65	0.272
14th day			
Heart rate	84.30± 9.53	92.93± 9.14	0.001*
Systolic blood pressure	114.97± 7.07	117.87± 7.47	0.128
Diastolic blood pressure	81.03± 5.01	84.80± 5.62	0.008*
Mean arterial pressure	92.34± 4.82	95.58 ± 4.91	0.013*
Central venous pressure	10.12 ±1.39	10.88 ±1.77	0.101
Temperature	37.23 ±0.64	37.81 ±1.08	0.014*
Pulse oximetery	96.73 ±2.46	93.87±3.65	0.001*

*Independent samples t-test. * Statistical significant difference (p<0.05)*

Table (3): Assessment of study sample in relation to arterial blood gases (n=60).

Arterial blood gases	After intervention (n= 30)	Before intervention (n=30)	P-value
	Mean ± SD	Mean ± SD	
Frist day (baseline)			
PH	7.33 ±0.093	7.34 ±0.102	0.968
Pao2	88.43±12.53	92.30±9.02	0.176
paco2	56.07±17.49	52.97±14.45	0.457
HCO_3	25.73±5.15	25.17±7.12	0.640
Sao2	86.73±3.79	86.07±4.87	0.552
7th day			
PH	7.37 ±0.047	7.35 ±0.062	0.130
Pao2	109.83±17.11	100.30±15.82	0.029*
paco2	49.70±12.66	49.83±15.07	0.272
HCO_3	23.33±4.06	25.50±4.76	0.063
Sao2	92.10±2.86	89.23±2.68	0.000*
14th day			
PH	7.40 ±0.042	7.37 ±0.043	0.018*
Pao2	137.40±36.30	104.00±24.21	0.000*
paco2	41.87±7.00	46.23±8.93	0.039*
HCO_3	22.57±2.66	24.40±4.46	0.058*
Sao2	94.93±2.71	92.20±3.75	0.002*

*Independent samples t-test. * Statistical significant difference (p<0.05)*
***Pao2** :partial pressure of arterial oxygen **paco2**:-partial pressure of arterial carbon dioxide **Sao2** :arterial oxygen saturation*

Table (4): Assessment of study sample in relation to mNutric Score (n=60).

Nutric Score	After intervention (n= 30)	Before intervention (n=30)	P-value
	Mean ± SD	Mean ± SD	
First day(baseline)	4.97 ± 2.63	5.03 ± 2.72	0.924
7th day:	2.37 ± 1.19	3.77 ± 2.01	0.002*
14th day:	2.20 ± 1.52	4.13 ± 2.06	0.000*

Independent samples t-test P >0.05 non significant P <0.05 statistical significant

Table (5): Assessment of study sample in relation to Anthropometric measurement (n=60).

Anthropometric measurement	After intervention(n= 30) Mean ± SD	Before intervention (n=30) Mean ± SD	P-value
At admission			
Weight	63.49 ± 33.2	76.63± 9.40	0.042*
Height	1.65 ± 0.090	1.69.43 ± 0.092	0.106
Mid arm circumference	20.54 ± 4.22	18.80 ± 4.86	0.046*
BMI	23.16 ± 11.81	27.03 ± 4.58	0.099
At 7th			
Weight	77.53 ± 12.51	70.53 ± 10.63	0.023*
Height	1.65 ± 0.090	1.69.43 ± 0.092	0.106
Mid arm circumference	23.11 ± 5.48	18.80 ± 4.86	0.047*
BMI	28.49 ± 5.29	24.83 ± 4.63	0.005*

Independent samples t-test P <0.05 significant BMI: body mass index

Table (6): Assessment of study sample in relation to gastrointestinal complications related to enteral feeding (n=60).

GI complications related to enteral feeding		After intervention (n= 30)		Before intervention (n=30)		P-value
		No.	%	No.	%	
Constipation	yes	2	6.7%	8	26.7%	0.052*
	No	28	93.3%	22	73.3%	
Diarrhea	yes	3	10.0%	10	33.3%	0.045*
	No	27	90.0%	20	66.7	
Vomiting	yes	2	6.7%	4	13.3%	0.245
	No	28	93.3%	26	86.7%	
Aspiration	yes	2	6.7%	4	13.3%	0.245
	No	28	93.3%	26	86.7%	
Distention	yes	1	3.3%	2	6.7%	0.676
	No	29	96.7%	28	93.3%	

Independent samples t-test P <0.05 statistical significant difference

Table (7): relation between reported complications and hemodynamic parameters in pre and after intervention groups (n=60).

	Study		Control	
	r	P value	r	P value
Heart rate	-.102	.053	.115	.272
Systolic blood pressure	-.119	.266	.066	.364
Diastolic blood pressure	-.276	.070	.095	.308
Mean arterial pressure	-.139	.232	-.010	.479
Central venous pressure	-.043	.417	.257	.113
Temperature	-.188	.161	.155	.206
Pulse oximter	-.215	.127	-.010	.479

**P <0.05 significant correlation (pearson correlation)*

Table (8): relation between complications and nutritional status in pre and after intervention groups (n=60).

	study		Control	
	r	P value	r	P value
mNUTRIC score	.288	.061	.498*	.027*
Mid arm circumference	-.058	.380	-.395*	.041*
BMI	-.209	.134	-.349*	.049*

**P <0.05 =significant correlation (Pearson correlation) BMI: body mass index mNUTRIC: Modified Nutrition Risk in Critically ill*

Table (9): correlation between all variables related to intervention in pre and after intervention groups (n=60).

		After intervention (n= 30)		Before intervention (n=30)		P-value
		Mean ± SD		Mean ± SD		
mNutric Score 7th day:		2.37 ± 1.19		3.77 ± 2.01		0.002*
Anthropometric measurement At 7th						
Weight		77.53 ± 12.51		70.53 ± 10.63		0.023*
Height		1.65 ± 0.090		1.69.43 ± 0.092		0.106
Mid arm circumference		23.11 ± 5.48		18.80 ± 4.86		0.047*
BMI		28.49 ± 5.29		24.83 ± 4.63		0.005*
Time to initiation of enteral feeding (hour)		10.6 ± 9.16		26.1± 10.3		0.001*
GI complications		**No.**	**%**	**No.**	**%**	
	No	20	66.7%	8	26.7%	0.025*
	yes	10	33.3%	22	73.3%	0.009*

P <0.05 significant GI gastrointestinal

Table (10): Assessment of study sample in relation to laboratory investigation for (Complete blood count) (n=60).

Complete blood count	After intervention (n= 30)	Before intervention (n=30)	P-value
	Mean ± SD	Mean ± SD	
Frist day (baseline)			
White blood cells	9.86 ± 3.59	10.21 ± 3.70	0.717
Red blood cells	4.03 ± 0.48	3.94 ± 0.57	0.498
Hemoglobin	11.43 ± 2.59	12. 14 ± 2.01	0.128
Hematocrit	38.73 ± 4.16	36.25 ± 4.03	0.067
Platelet count	294.30± 61.18	263.50 ± 71.99	0.080
7th day			
White blood cells	9.20 ± 1.56	11.75 ± 3.35	0.000*
Red blood cells	3.96 ± 0.40	3.86 ± 0.41	0.344
Hemoglobin	12.43 ± 1.59	12.51 ± 2.15	0.876
Hematocrit	38.73 ± 4.16	36.25 ± 4.03	0.022*
Platelet count	240.69 ± 55.61	236.70 ± 48.99	0.778
14th day			
White blood cells	9.36 ± 1.79	12.73 ± 3.91	0.000*
Red blood cells	4.03 ± 0.34	3.94 ± 0.63	0.524
Hemoglobin	12.43 ± 1.23	9.30 ± 2.14	0.014*
Hematocrit	37.90 ± 4.45	34.50 ± 4.15	0.006*
Platelet count	251.79 ± 58.74	229.15 ± 39.08	0.042*

Independent samples t-test . P <0.05 statistical significant difference

Table (11): Assessment of study sample in relation to laboratory investigation for (Renal function& Liver function test) (n=60)

Renal function test	After intervention (n= 30)	Before intervention (n=30)	P-value
	Mean ± SD	Mean ± SD	
Frist day (baseline)			
Blood urea nitrogen	3.25±1.60	3.87±0.99	0.083
Creatinine	62.20±18.31	62.33±18.11	0.977
Total bilirubin	1.33 ± 0.89	1.73 ± 0.99	0.179
Total Protein	5.12 ± 1.33	4.63 ± 0.49	0.188
Albumin	3.29 ± 0.76	3.41 ± 1.66	0.766
7th day			
Blood urea nitrogen	4.19±1.31	4.32±1.62	0.422
Creatinine	60.29±14.33	64.53±16.11	0.412
Total bilirubin	1.30 ± 1.17	1.52 ± 0.71	0.416
Total Protein	5.41 ± 1.63	4.74 ± 0.76	0.096
Albumin	3.38 ± 0.97	4.47 ± 1.30	0.002*
14th day			
Blood urea nitrogen	4.37±1.60	4.65±1.63	0.507
Creatinine	70.77±21.13	71.37±14.67	0.799
Total bilirubin	1.00 ± 0.70	1.32 ± 0.60	0.063
Total Protein	5.68 ± 1.66	4.93 ± 0.61	0.024*
Albumin	3.75 ± 1.37	4.85 ± 0.82	0.013*

Independent samples t-test P <0.05 statistical significant difference.

Table (1): Represents personality distribution of demographic and clinical data in the after & pre intervention groups It was found that the mean age in after intervention group was 50.27± 12.98 years versus 52.77± 13.13 years in pre intervention group with no statistical significant difference (p=0.461). Also, more than half of gender in both groups was male with no statistical significant difference.

Tables (2): Illustrates that no statistical significant differences between the two groups on first day as regarded hemodynamic parameters, while there were statistical significant differences between after & pre intervention groups as regard(HR, T, and CVP) on the 7th day with (P=0.012, 0.047 and0.047 respectively). Finally, in the 14th day there were statistical significant differences between both groups as regard hemodynamic parameters (HR, DBP, MAP, T, and pulse oximetry) except (CVP, SBP).

Tables (3): Illustrates that there were no statistical significant differences found between the two groups on first day in relation to all items arterial blood gases parameters. But on 14th day all items arterial blood gases parameters were show statistical significant differences between both group with (p<0.05)

Table (4): Represents Assessment of study sample in relation to mNutric Score. It was found that there was only statistical significant differences between the two groups on the 7th and 14th day (p = 0.002 and 0.000 respectively).

Table (5): Illustrates that no statistical significant differences between the two groups in relation to height on admission and at discharge. While weight and mid arm circumference were show statistical significant differences between both group on admission and at discharge (p=0.042&0.046 and 0.023&0.047).

Table (6): Represents Assessment of study sample in relation to gastrointestinal complications related to early enteral feeding. It was noticed that the most common GI complications were constipation, diarrhea and vomiting in pre intervention group. And largest number of patients in both groups had diarrhea.

Table (7): Illustrate relation between GI complications and hemodynamic parameters in pre and after intervention groups it shows that there was no relation between gastrointestinal complications and hemodynamic parameters in both groups.

Table (8): Represents relation between complications and nutritional assessment in pre and after intervention groups. It show that there was positive moderate relation between both mNutric score and gastrointestinal complications (r =.498) in control group only. While there was no relation between both mNutric score and gastrointestinal complications in study group. Table also show negative moderate correlation was observed between mid arm circumference and BMI and gastrointestinal

complications in control group only

Table (9): Demonstrate correlation between all variables related to intervention in pre and after intervention groups. It founded that there were highly significance decrease in gastrointestinal complication after intervention. And reduce time to initiate enteral feeding after application of enteral feeding guidelines. Also statistical significant differences between the two groups in relation to BMI, mNUTRIC score

Table (10): Illustrate assessment of study sample in relation to complete blood count. It was founded there were statistical significance differences at 7th and WBC and Hematocrit with (p= 0.000 &0.022) while on14th WBC & hematocrit and hemoglobin (0.000 & 0.006 &0.024 respectively)

Table (11): Demonstrates that both groups show a slight increased in mean values of renal function tests but still within normal values. There were founded statistical significance differences between both groups as regard to albumin on 7th and T. protein and albumin on 14th day.

Discussion

Acute onset of respiratory failure with protein-rich pulmonary edema attributable to increased permeability of alveolar epithelium and endothelial injury in pulmonary vessels is the characteristic features of acute lung injury (ALI) (**Turnbull. et al., 2014, Kubat, et al., 2019**) Gastrointestinal complications include vomiting, abdominal distension and/or pain, constipation, and diarrhea occur approximately in 60% of critically ill patients receiving nutritional support. (**Parrillo & Dellinger, 2017).** Early enteral nutrition (EEN), could effectively increase the blood flow of gut mucosa, stimulate the intestinal motility, maintain the gut integrity, prevent bacterial and endotoxin translocation, and decrease the incidence of infectious complications. **(Schörghuber, et al., 2018).**

The discussion will cover the main result findings as follows

Regarding hemodynamic parameters, our study illustrated that no statistical significant differences between the two groups on first day (baseline).

Our finding was supported with **National Heart, Lung, and Blood Institute Acute Respiratory Distress Syndrome (ARDS) Clinical Trials Network et al., (2012) when evaluated** initial trophic enteral feeding in patients with acute lung injury reported that no statistical significant differences between both groups as regarded baseline mean of mean arterial pressure and central venous pressure

Regarding arterial blood gases, the finding of the current study revealed that there were no statistical significant differences found between the two groups on first day in relation to all items arterial blood gases parameters. Versus results in the 14th day This result is supported with findings of (**Na, et al., 2010**) in study about "Physician Compliance with Tube Feeding Protocol Improves Nutritional and Clinical Outcomes in Acute Lung Injury Patients" who reported that arterial blood gas analysis did not show any significant differences on admission**.,** but disagree with their finding on last day who reported that only PaO2 in arterial blood gas analysis show significant differences

Regarding to mNutric Score, the current study revealed that mNutric Score in study and control groups on first day > 5 with no statistical significant differences**.** This finding supported by **(Greco, et al., 2017**) who conducted "Initial Trophic Vs. Full Enteral Feeding in Patients with Acute Lung Injury and High Nutritional Risk"

Regarding to anthropometric measurements, the finding of the current study revealed that there was significant differences between study and control group on admission and at discharge regarding weight and mid arm circumference. That not supported with the result of (**Na, et al., 2010)** which showed no significant differences between both group on admission and at 7th day

Our study revealed that mean BMI on admission for both study & control groups (23.16 ± 11.81& 27.03 ± 4.58 respectively), this is agreed with **National Heart, Lung, and Blood Institute Acute Respiratory Distress Syndrome (ARDS) Clinical Trials Network et al., (2012)** reported that mean BMI on admission for both study & control groups 29.9 ±7.8 vs**.** 30.4 ±8.2) with no significant differences**.**

Regarding laboratory investigations, our study showed that there were no statistical significance differences between both groups regarded WBC on admission. But on 7th, highly significance increase in WBC among control group than study group. Our results supported with findings of **Kim, et al., (2017)** who conducted "The impact of implementation of an enteral feeding protocol on the improvement of enteral nutrition in critically ill adults".

Our study demonstrated that there were statistical significance differences between both groups regarding albumin on 7th and 14th day. Also there were no statistical significance differences between both groups as regard to mean values of renal function. Our results disagreed with findings of **Kim, et al., (2017)** who conducted "The impact of

implementation of an enteral feeding protocol on the improvement of enteral nutrition in critically ill adults" who reported that there were significance differences between both groups as regard to BUN and creatinine.

National Heart, Lung, and Blood Institute Acute Respiratory Distress Syndrome (ARDS) Clinical Trials Network et al., (2012) reported that mean baseline of Albumin, mg/dL and Total protein, g/dL in study and control group (2.3 ±0.7 vs. 2.3 ± 0.7) and (5.0 ±1.1 vs. 5.0 ±1.1 7) respectively

Greco, et al., (2017) was supported our finding that no statistical significance differences between both groups as regarded to albumin on the first day with (p= 0.533)

Regarding time to initiate enteral feeding, the finding of the current study revealed that reduce time to initiate enteral feeding after application of enteral feeding guidelines. This supported with finding (**Koontalay**. **Et al., 2020 Padar** et al 2017) who show that implementation of enteral nutrition guidelines led to the achievement of the initialed early enteral nutrition reach within 8.67 hours, significantly after the implementation versus 24.5 hours prior implementation.

Regarding gastrointestinal complications, the finding of the current study revealed that there was a highly significant increase GI complication in control groups versus the intervention group with statistically significant difference. The largest number of patients in control group had **diarrhea**. Which supported with finding in study done to determine the effect of early versus late enteral nutrition by **Dvorak et al., (2004)** reported that diarrhea were more likely in the late group.

Despite of largest number of patients in both groups had diarrhea. There was significance decrease in diarrhea rate in study group than control group. This reflects effect of guideline regarding reducing enteral feeding induce diarrhea.

Increases in WBC, temperature reflect presence of Bacterial overgrowth which cause diarrhea. Reduced gastric and small bowel motility may lead to small intestinal overgrowth, which can alter intestinal micro flora.

The present findings indicated that higher frequency of **vomiting** among the control group subjects than the study group with statistical significance difference. This supported with **Kompan, et al., (2004)** who conducted "early enteral nutrition a risk factor for gastric intolerance and pneumonia" which show that vomiting is higher in control group than study group

Fluid volume deficit resulting from enteral feeding induce diarrhea and vomiting cause decrease in CVP, blood pressure in pre intervention group.

Our study showed statistical significant differences between both groups as regarded to constipation which was supported with findings of **Kim, et al., (2017)** who conducted "The impact of implementation of an enteral feeding protocol on the improvement of enteral nutrition in critically ill adults which show that constipation and diarrhea were higher in control group than study group with statically significant difference.

Our results disagreed with **Ibrahim et al., (2002)** who reported that diarrhea associated among patients receiving early enteral feeding.

Regarding relation between GI complications and hemodynamic parameters in pre and after intervention groups it shows that there was no relation between gastrointestinal complications and hemodynamic parameters in both groups. Which was supported with findings of **Hamrefors, et al., (2019**) in study about "Susceptibility to diarrhea is related to hemodynamic markers of sympathetic activation in the general population." reported that there was no relation between gastrointestinal complications and hemodynamic parameters.

Conclusion

Based on the findings of the present study, it can be concluded that:- early enteral nutrition guideline reduce risk of gastrointestinal complications, and improve patient's nutritional status, reduce time to initiate enteral nutrition

Based on the finding of the current study, the following recommendations are suggested

- Provide educational program for nurses about enteral nutrition guidelines.
- Repeat this research on a large sample size and different governmental hospital for generalization.

References

1. **Ahnert, P., Creutz, P., Horn, K., Schwarzenberger, F., Kiehntopf, M., & Scholz, M., (2019):** Sequential organ failure assessment score is an excellent operationalization of disease severity of adult patients with hospitalized community acquired pneumonia – results from the prospective observational PROGRESS study. Critical Care, 23(1)
2. **Compton, F., Bojarski, C., Siegmund, B., & van der Giet, M., (2014):** Use of a Nutrition Support Protocol to Increase Enteral Nutrition Delivery in Critically Ill Patients. American Journal of Critical Care, Volume 23 Number (5), 396–403.
3. **Dvorak M., Noonan V., Bélanger L., Bruun B., Wing P., Boyd M., & Fisher C., (2004):** Early versus Late Enteral Feeding in Patients with

Acute Cervical Spinal Cord Injury SPINE Volume 29, Number 9, pp E175–E180

4. **Greco A., Wheeler A., Rice T., (2017):** Initial Trophic Vs. Full Enteral Feeding in Patients with Acute Lung Injury and High Nutritional Risk, American Journal of Respiratory and Critical Care Medicine, Vol.(195):A7130
5. **Hamrefors, V., Fedorowski, A., & Ohlsson, B., (2019**): Susceptibility to diarrhea is related to hemodynamic markers of sympathetic activation in the general population. Scandinavian Journal of Gastroenterology, 1–7.
6. **Hanson C., Rutten E., Rollins C., & Dobak S., (2015)**: Nutrition and acute lung injury in critical care: Focus on nutrition care process, In Diet and Nutrition in Critical Care Springer New York, (pp. 49-61).
7. **Heyland, D., Dhaliwal R., Jiang X., & Day A., (2011):** Identifying critically ill patients who benefit the most from nutrition therapy: the development and initial validation of a novel risk assessment tool, Critical care (London, England), vol.(15), NO.(6),pp. 795-803
8. **Ibrahim E., Mehringer L., Prentice D., Sherman G., Schaiff R., Fraser V., and Kollef M., (2002**): early versus late enteral feeding on mechanically ventilated Results of a Clinical Trial. Journal Of Parenteral And Enteral Nutrition Vol. (26), No. (3)
9. **Kim S., Park C., Seo J., Choi M., Lee DS, Chang DK, Rha M., Yu S., Lee S., Kim E., Cho Y., (2017):** The impact of implementation of an enteral feeding protocol on the improvement of enteral nutrition in critically ill adults. Asia Pac J Clin Nutr. 26(1):27-35. doi: 10.6133/apjcn.122015.01.
10. **Kompan L., Vidmar G., Spindler-Vesel A., Pecar J., (2004):** Is early enteral nutrition a risk factor for gastric intolerance and pneumonia? Clinical Nutrition (2004) 23, 527–53
11. **Koontalay A., Sangsaikeaw A.. & Khamrassame A., (2020):** Effect of A Clinical Nursing Practice Guideline of Enteral Nutrition Care on the Duration of Mechanical Ventilator for Critically Ill Patients, Asian Nursing Research Asian Nursing Research . pp.(17-23)
12. **Kubat, Ö., Gökçek, E., & Kaydu, A., (2019):** An Analysis of Patients Followed Up in the Intensive Care Unit with the Diagnosis of Acute Respiratory Distress Syndrome. Turkish journal of anaesthesiology and reanimation, 47(1), 62–68.
13. **Lee Z., & Heyland D., (2018)**: Determination of Nutrition Risk and Status in Critically Ill Patients: What Are Our Considerations?, Nutrition in Clinical Practice, Vol. (34), Issue (1) pp 1–16
14. **Mehta, Y., Sunavala, J., Zirpe, K., Tyagi, N., Garg, S., Sinha, S., Shankar, B., Chakravarti, S., Sivakumar, M. N., Sahu, S., Rangappa, P., Banerjee, T., Joshi, A., & Kadhe, G., (2018):** Practice Guidelines for Nutrition in Critically Ill Patients: A Relook for Indian Scenario. Indian journal of critical care medicine : peer-reviewed, official publication of Indian Society of Critical Care Medicine, 22(4), 263–273.
15. **Morton G., & Fontaine K., (2017):** Critical care nursing a holistic approach, Chapter 40 Patient Management: Gastrointestinal System,11th edition, Wolters Kluwer, Pages 892-914.
16. **Na S., Lee H., Koh S., Park A., & Han A., (2010):** Physician Compliance with Tube Feeding Protocol Improves Nutritional and Clinical Outcomes in Acute Lung Injury Patients, Korean Journal of Critical Care Medicine Vol. (25), No.(3), pp. 136-143
17. **National Heart, Lung, and Blood Institute Acute Respiratory Distress Syndrome (ARDS) Clinical Trials Network, Rice T., Wheeler A., Thompson B., Steingrub J., Hite R., & Rock P., (2012)**: Initial trophic vs. full enteral feeding in patients with acute lung injury: the EDEN randomized trial, JAMA vol. (307),No.(8), pp 795-803.
18. **Naved S., Siddiqui S., & Khan F., (2011):** APACHE-II Score Correlation With Mortality And Length Of Stay In An Intensive Care U nit, Journal of the College of Physicians and Surgeons Pakistan, Vol. 21 (1) PP 4 : 8

1. **Padar, M., Uusvel, G., Starkopf, L., Starkopf, J., & Reintam Blaser, A., (2017):** Implementation of enteral feeding protocol in an intensive care unit: Before-and-after study. World journal of critical care medicine, 6(1), 56–64.
2. **Parrillo & Dellinger, (2017):** Critical Care Medicine: Principles of Diagnosis and Management in the Adult, 5th Edition, chapter (78) Nutritional Support, part (9) other critical care disorder and issues in the critically ill, Elsevier Health Sciences. pp 1273 -1288
3. **Reber, E., Gomes, F., Bally, L., Schuetz, P., & Stanga, Z., (2019):** Nutritional Management of Medical Inpatients. Journal of clinical medicine, 8(8), 1130. https://doi.org/10.3390/jcm8081130
4. **Rice T., Mogan S., Hays M., Bernard G., Jensen G., and Wheeler A., (2011):** Randomized Trial of Initial Trophic versus Full-Energy Enteral Nutrition in Mechanically Ventilated Patients with Acute Respiratory Failure. Crit Care Med., Vol.(39) No.(5), pp 967–974.
5. **Santos H., & Araújo I., (2019):** Impact of protein intake and nutritional status on the clinical

outcome of critically ill patients. Rev Bras Ter Intensiva., Vol. (31), No. (2), pp.210-216.

6. **Schörghuber, Michael & Fruhwald, Sonja. (2018):** Effects of enteral nutrition on gastrointestinal function in patients who are critically ill. The lancet. Gastroenterology & hepatology. 3. 281-287.
7. **Shirai, K., Yoshida, S., Matsumaru, N., Toyoda, I., & Ogura, S., (2015):** Effect of enteral diet enriched with eicosapentaenoic acid, gamma-linolenic acid, and antioxidants in patients with sepsis-induced acute respiratory distress syndrome. Journal of intensive care, 3(1), 24.
8. **Tatsumi H., (2019):** Enteral tolerance in critically ill patients.. Journal of Intensive Care, vol (7), no.(30).
9. **Turnbull, A., Lau, B., Ruhl, A., Mendez-Tellez, P., Shanholtz, C., & Needham, D., (2014):** Age and decisions to limit life support for patients with acute lung injury: a prospective cohort study. Critical care (London, England), vol. 18, No (3), R107.
10. **VanBlarcom, A., and McCoy, M., (2018):** New Nutrition Guidelines: Promoting Enteral Nutrition via a Nutrition Bundle. Critical Care Nurse, 38(3), 46–52.
11. **Verghese P., Mathai A., Abraham V., & Kaur P., (2018):** Assessment of malnutrition and enteral feeding practices in the critically ill: A single-centre observational study, Indian J Anaesth, Vol. (62), No.(1), pp. 29-35
12. **Vincent J., (2018):** The management of ARDS: what is really evidence-based ? Journal of Intensive Care and Emergency Medicine, vol(14), No.(2).
13. **Wilson B., & Typpo K., (2016):** Nutrition: A Primary Therapy in Pediatric Acute Respiratory Distress Syndrome. Front. Pediatr. Vol. (4)No.(10).