Effect of implementing nursing care protocol about acute lung injury on patients' outcomes

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Abstract

Acute lung injury in trauma patient associated with pernicious values. Cardiopulmonary, neurological, gastrointestinal, and urinary, complications can be potentially avoidable. Therefore, implementing nursing protocol for this patient help prevent complications, promote faster recovery. **Aim:** Identify the effect of implementing nursing care protocol on acute lung injury patients' outcomes. **Method**: Quasi experimental research design was used on 80 patients (study and control groups). **This study was carried out in** trauma intensive care unit at Assiut university hospital. **Tools:** Modified patient assessment sheet, Systemic Assessment Observation Check List and patients' outcomes Assessment sheet. **Results**: Lower complications, length of stay and mechanical ventilator days and better respiratory mechanics among studied group subjects than control group. **Conclusion**: Nursing care protocol help in reducing length of stay and improving patient outcomes. **Recommendations**: Planning educational programs for the critical care nurses with manual booklet about nursing care protocol for acute lung injury patient is required.

Key words: Acute lung injury, nursing protocol, patient outcomes.

Introduction:

Acute lung injury acts a significant factor adding to morbidity and mortality in injury patient and is characterized by the relationship of reciprocal invades and hypoxemia following an underlying affront. Immediate or circuitous lung hazard factors related with ALI like pneumonia, sepsis, pancreatitis, consume injury or extreme injury prompting the improvement of non-cardiogenic aspiratory oedema **(Jabaudon, et al., 2019)**.

The treatment of acute lung injury changing among strong treatment, pharmacological therapies and mechanical ventilation. Where strong strategies cover hemodynamic administration, oxygen support, torment control, early preparation and chest physiotherapy. Liquid substitution is fundamental in injury patients to guarantee satisfactory blood volume, however as liquid over-burden in aspiratory wound may deteriorate pneumonic edema, appropriate liquid equilibrium ought to be kept up and, if vital, diuretics ought to be utilized**.** dietary help, control of blood glucose levels, treatment of nosocomial pneumonia, prophylaxis against deep venous thrombosis apoplexy (DVT) and gastrointestinal (GI) draining are suggested for patient with ALI **(Kallet et al.2018).**

Mechanical ventilation has all the earmarks of being as a critical factor in the treatment of acute lung injury patient with goal of avoidance ventilator induced lung injury. This incorporate the utilization of lower tidal volume.(6–8 mL/kg) , standardized PEEP/FiO2 ratios based on oxygenation, avoids elevation of the plateau pressure beyond 30 cmH_2O and permissive hypercapnia. **(Noorbakhsh & Kriley 2018).**

Best practice and defensive measures are significant parts of nursing care for for acute lung injury patients' who receive mechanical ventilation (MV). Nurses played an effective role in developing best practice standards in an attempt to prevent complications. Along these lines, conventions with normalize care of patients address a likely answer for dealing with various synchronous issues in fundamentally sick patients. Convention of care is one technique to all the more rapidly adjust new data to bedside care, in this manner the use of these convention in the ICU can conceivably improve the consideration of the fundamentally sick patients on account of the

intricacies of really focusing on those patients **(Aysha et al 2016).**

Nursing care convention are proposed to outfit data, in light of an assessment of the current best proof of clinical and cost-adequacy, in regards to restorative intercessions for given conditions. Subsequently, execution of this convention permit all medical caretaker to give normalized care to patient security, help diminishing the mutilations obtained by and by, just as having an instructive reason **(Gabriela., et al 2020).** Along these lines, critical nursing specialists persistently screen and weigh new proof to see whether existing convention should be refreshed and permits medical care suppliers to offer fitting symptomatic therapy and care administrations to patients **(Huang, et al. 2020).**

Significance of the study

Acute lung injury occur in an estimated 10–30 % of critically ill trauma patients, with intubation rates range from 25 % to 75 %, and address a genuine contributing element to moribidity and mortality after injury relying upon the seriousness of injury **(Pfeifer, et al 2017).** Thus, nurese should know about explicit evaluation discoveries related with acute lung injury and immediate recognition of problems and prevention of occurrence complications.

Operational Definitions:

Nursing protocol

A nursing protocol in this study is a set of predetermined criteria that define appropriate nursing interventions which define conditions in which the nurse makes decisions (cardiopulmonary, neurologic, gastrointestinal, metabolic, urinary, and integumentary system management) related to a development of action for effective administration of mutual patient care problems.

Patient's outcomes:

Arterial blood gases, respiratory mechanic, length of ICU stay, mechanical ventilation days, and complications occurrence.

Aim of the study:

This study was aimed to determine the effect of implementing nursing protocol on outcomes of mechanically ventilated ALI patients.

Patients and Method:

Research hypothesis:

- **Hypothesis$_1$.** Significant improvement in arterial blood gases & saturation values among patient receiving nursing protocol compared with control group.
- **Hypothesis $_2$.** length of ICU stay and mechanical ventilation days among acute lung injury patients receiving nursing protocol will be less than that of control group
- **Hypothesis$_3$.** Significances reduction in the occurrence of complications among acute lung injury patient receiving nursing protocol than that of control group

Research design:

A quasi experimental research design (Study and control group).

Study Variables:

Dependent variables in this study: Arterial blood gases values, oxygen saturation, duration of mechanical ventilation, length of ICU stay, complications

Independent variables: Nursing care protocol for acute lung injury

Setting:

The study was done in trauma intensive care units of Assuit university hospitals.

Sample:

purposive sample of 80 adults, males and females' patients who recently admitted to intensive care unit with acute lung injury and mechanically ventilated were randomly divided into two groups. (40 patients in each study and control group)

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

$$\mathrm{n} = \frac{600 \times (1.96)^2 \times (0.245)^2}{(1.96)^2 \times (0.245)^2 + 600 \times (0.05)^2} = 80$$

Where:

$Z = 1.96$ [standard scores],

$e = 0.05$ [error],

$\sigma = 0.245[SD]$

$\mathrm{N} = 600$ [population],

n = 80 [sample]

Inclusion criteria
ALI score 0.1 - 2.5
Mechanically ventilated within 24 hrs.
Age>18 years old

Exclusion criteria:
Severe head injury, cardiac abnormality or contraindicated to mobilization.

Tools:

Three tools were used to gather data in order to attain the aim of the study.

Tool I: Patient assessment sheet: the researcher developed this tool after reviewing the related literature **(Morton & Fontaine, 2018); (Wang2018)**. It includes the following parts:

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

Part II: Acute Physiology and Chronic Health Evaluation II (APACHE II) was adopted from **Naved et al., (2011), (Wang 2018)**, it was utilized to estimate the severity of disease for adult patients admitted to ICU. APACHE II includes a point score based upon initial values of (12) routine physiologic measurements (temperature, mean arterial blood pressure, 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**.**

Part III: Lung injury score adopted from (Huber et al 2020) It planned to assess patient for the existence and extent of a pulmonary damage. It was used at the onset of a lung disorder and during the course of the illness to monitor prognosis lung involvement. Parameters used are 1-chest X-ray evaluated for alveolar consolidation (2) ratio of the partial pressure of oxygen in arterial blood to the inspiratory fraction of oxygen (3) PEEP level if ventilated (4) respiratory compliance .The score was calculated based on the results of logistic regression analysis. Score = sum values parameters maximum summation of parameters =16, minimum summation of parameters =0, score 0: no lung injury, score 0.1 - 2.5: mild-to-moderate lung injury, score > 2.5: severe lung injury (ARDS**)**

Tool II: Systemic Assessment Observation Check List. It was developed by the researcher based on literature review. It classified into five divisions and includes the following:

1. **Cardiopulmonary evaluation**: includes breath sounds, secretions (color and viscosity) pao2/fio2, Ventilator parameters (Mode of ventilation, Tidal volume (vt), Respiratory rate (f), Fraction of inspired oxygen (fio2) Positive end expiratory pressure (PEEP) ,Peak inspiratory pressure (PIP) , plateau pressure (PpL),pressure support, lung compliance, rapid shallow breathing index, arterial blood gases, respiratory pattern, color of skin and nails, , heart rate, central venous pressure, mean arterial pressure and cardiopulmonary complications.
2. **Neurological evaluation**: by using Glasgow Coma Scale (GCS) **(Bhaskar 2017)** is used to determine the general level of consciousness in critically ill patients. The score is determined by the sum of the score in each of the 3 categories, which include eye opening, verbal response and best motor response. Where total GCS ranging from 3-15.
3. **Gastrointestinal tract evaluation**: This includes routes of nutrition, serum electrolytes test, blood glucose, liver function test, complete blood count, bowel movement, nutritional assessment in the form of Modified Nutrition Risk in Critically ill (MNUTRIC) score adopted fro**m (Lee and. Heyland , 2018)** used to identify patients at nutritional risk according to the following five variables: age, APACHE II score, SOFA score, number of co-morbidities, days from hospital admission to ICU admission and anthropometric measurements these included (patient's weight (kg), Height (cm), Mid-Upper Arm Circumference (MUAC in cm) and body mass index and gastrointestinal complication**s.**

4. **Urinary evaluation**: This includes intake and output, and urinary tract complications.
5. **Integumentary evaluation:** This includes skin condition and pressure ulcer.

Tool III: patients' outcomes assessment sheet: developed by the researcher based on review of related literature and cover the following parts:

Part 1: The Sequential Organ Failure Assessment Score SOFA score This tool adopted from **Ahnert, et al (2019).** It 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

Part 2:- Duration of mechanical ventilation, ICU stay, mortality

Methods:

The study was carried out on three phases:

1- Preparatory phase:

Developed the study tools. After explanation the aim and nature of the study, researcher granted an official permission from the head of trauma intensive care unit at Assuit university hospitals

Content validity: The tools of the study were tested for content validity by five jury experts, three from critical care nursing staff, and two anesthesiologists

Pilot study: It was carried out on 10% of the study subjects to evaluate the feasibility and applicability of the tools and time needed to gather data. The tools were applicable, and the pilot study subjects were excluded from the actual study.

Reliability were done using Cronbach´s coefficient alpha score (0.85**)**

Ethical considerations:-

1. Research proposal was sustain from ethical committee in the faculty of nursing.
2. No risk for patients during operation of the research.
3. Common ethical principles in the clinical research has been followed in this study
4. Informed consent has been obtained
5. Confidentiality and anonymity was assured.
6. Study subjects had the right to reject participation and/or retire from the study at any time without any rational.
7. Study subject privacy was respect during data collection

Field work

– The data were collected from (Mayo2018 to Mayo 2019) for seven days of trauma intensive care unit (TICU).

2- Implementation phase

Nursing care protocol was developed based on related literature. It performed by researcher on acute lung injured patients with goals of decreasing systemic compromise, length of ICU stays and mortality rate. It was performed by researcher every day from time of admission for seven days the protocol of care started as follows all patients in both groups were assessed by using ALI score on admission to determine their eligibility for enrollment in the study (ALI score 0.1 - 2.5) then score was used to assess progress of ALI.

control group: - The control group subjects were receiving the routine hospital care only and evaluated in the same way as the study group subjects

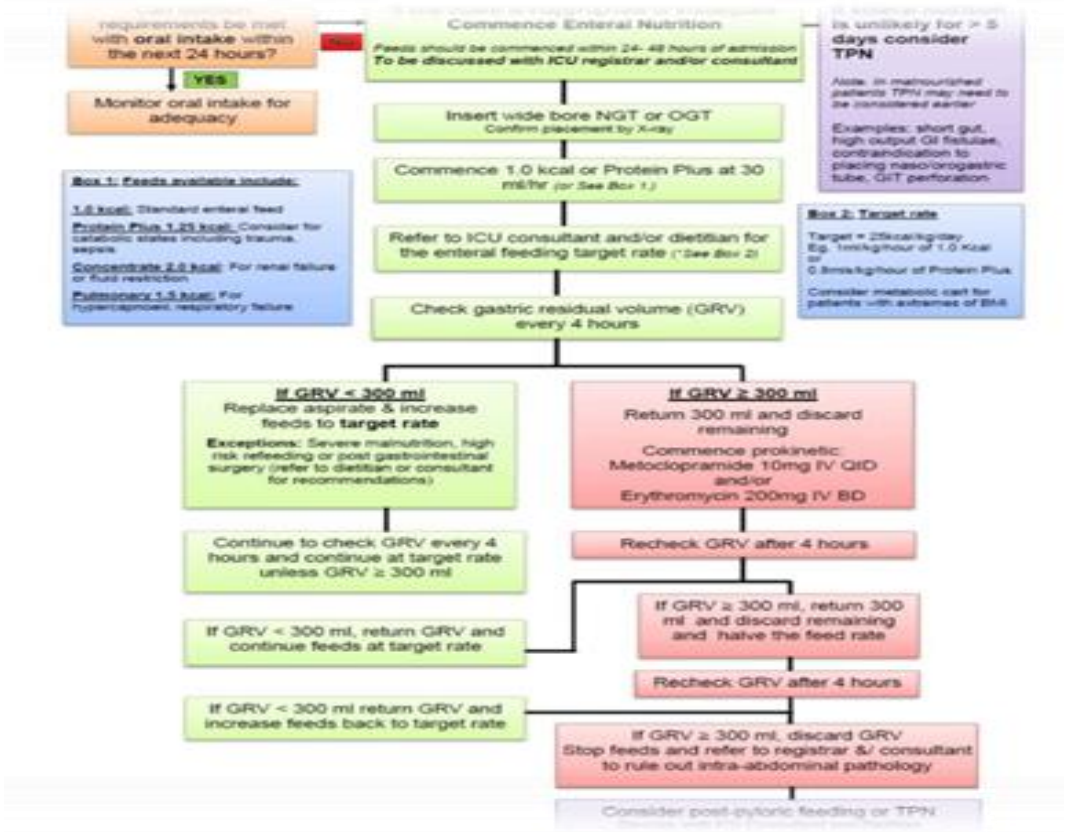
. **Procedure**:

Study group: Each patient of the study group subjects were exposed nursing care protocol which covered the following items:

Cardiopulmonary management through: Nebulization with 5 mL of 0.9% saline as a study drug in addition to bronchodilator. Chest physiotherapy (postural drainage position, percussion and vibration, manual hyperinflation). Suction was done not more10 sec by using sterile catheter and following a sterile technique, hyper-oxygenation with 100% $o_2$before and after suction. and the amount, color and viscosity of secretions were recorded, tube care was done. Change patient position every 2 hours (side to side, sit upright, Trendelenburg position and Prone position Aavoiding use of saline instillation reduce the transmission of bacteria into the lungs and using sterile technique. each patient of the study group subjects was received three sessions/day of physiotherapy session every8houres .for 7 days from ICU according to physician prescription and his condition on daily bases. Each session was taken about 30 minute not include time for fulfilling each tool Patient level of conscious was assessed before session. For maintaining effective airway clearance and gas exchange study subjects

. Assess hemodynamic changes resulting from initiation of mechanical ventilation (eg, decreased venous return and cardiac output). Monitor electrocardiogram (ECG) for dysrhythmias due to hypoxemia. Central venous pressure reading should be taken. Monitor vital signs for optimal cardiac output. Prevent DVT with the use of antiembolic stockings pneumatic compression and subcutaneous low molecular weight heparin as prescribed.

- **Gastrointestinal management through the following:** Screening for risk for malnutrition by using mNutric score on admission then every week till discharge.Assess anthropometrics measurements. Provide meticulous oral hygiene every 4 hours. Provide enteral nutrition early
- Assure placement of tube before starting feeding. Enteral feeding tubes should be flushed regularly with at least thirty ml of tap water. Assess feedings intolerance (monitoring gastric residual volumes, abdominal discomfort, nausea/vomiting, and abdominal girth/distention).every four hours. Avoid high-carbohydrate solutions in ALI patient to prevent excess carbon dioxide production. Elevate head of bed 30 degrees. The daily caloric, protein, and water requirements were estimated for 15 consecutive days from date of enteral formulas initiation by using Harrise and Benedict's equation. Administer stress ulcer prophylaxis as order.



Mechanical ventilation management by the following: Tidal volume is set to 4-8 mL/kg predicted body weight, in the absence of metabolic acidosis amount of PEEP a patient requires is determined by evaluating both arterial hemoglobin oxygen saturation and CO plateau pressure should be monitored

continuously and should not exceed 30 cmH_2O to reduce mortality **(Papazian, et al 2019)** Permissive hypercapnia uses low tidal volume ventilation in conjunction with normal respiratory rates.ventilation with a pressure mode allowing spontaneous ventilation.

Neurological management by make neurological checks every shift and assessment level of sedation

Urinary management. Monitor urine output every hour. Monitor the appearance of urine (Cloudy, foul-smelling urine, with sediments indicates a urinary tract or bladder infection).Maintain aseptic technique with catheter care

☒ **Maintain skin integrity through:** Implement of Early mobility protocol by

perform passive range of motion exercises for all extremities for unconscious patient. Active assisted and active range of motion exercises Once patients became strong. Turning from side to side on the bed; transfers to and from the bed, chair, and; and coming to a standing position. The patient was allowed to walk according to patient tolerance. Subjects were allowed to rest between training sets, and pulse oxygen saturation (Spo2) and any sign or symptom that indicated intolerance were closely monitored throughout the training session. Assess all body surfaces and document skin integrity at least every 8 hours.

Provide skin care every 4 hours. Consider use of specialty mattresses based on skin and risk factor assessments.

Evaluation phase:

Hemodynamic parameters include heart rate, mean arterial pressure, spo2 reading were assessed daily (before, hrs. after intervention**).** mNUTRIC score were evaluated on admission then at 3rd, and 7^{th} day. arterial blood gas were taken before and after one hour of intervention. Assessment of respiratory system and ascultatory findings was evaluated immediately before starting and at the end of the care. Lung mechanics estimated every day and included the following: Peak inspiratory pressure (PIP (cmH2O): maximum pressure take out during inspiration. Plateau pressure (Pplt (cmH2O)): by close expiratory tubes at inspiration termination with no air flow. Positive end expiratory pressure [PEEP (cmH2O)] required. lung compliance = (Exhaled tidal volume)/ (Plateau pressure - PEEP) **Kacmarek et al (2019).** All patients in both group was assessed by using APACHE II score on admission and at discharge to determine severity of illness.

☒ Length of ICU stay, no. of days on mechanical ventilation, mortality rate, and complications occurrence once occurred(Pulmonary, cardiovascular, renal, gastrointestinal and skin complications) were record.

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 $P > 0.05$.

Table (1): Comparison between the study & control groups as regard socio-demographic (n=80)

socio-demographic	Study (n= 40)		Control (n= 40)		P-value
	No.	%	No.	%	
Sex:					
Male	24	53.3%	21	46.7%	0.326
Female	16	45.7%	19	54.3%	
Age: (years)					
Mean ± SD	47.62± 13.15		49.75± 13.64		0.480

Chi-square test& Independent samples t-test * Statistical significant difference (p<0.05)

Table (2): Comparison between the study & control groups as regard Clinical data (n=80)

Clinical data	Study (n= 40)		Control (n= 40)		P-value
	No.	%	No.	%	
Past-medical disease:					
Yes	10	25.0%	12	30.0%	0.401
No past history	30	75.0%	28	70.0%	
Current diagnosis:					
Brain edema	8	20.0%	4	10.0%	
Lung contusion	17	42.5%	16	40.0%	
Multiple fracture	9	22.5%	6	15.0%	0.138
Pneumonia	6	15.0%	10	25.0%	
Sepsis	0	0.0%	4	10.0%	
APACHE II score	Mean ± SD				
At admission	16.72 ± 3.25		19.42± 2.05		0.000*
At discharge	16.10 ± 3.49		19.65± 2. 99		0.000*

Chi-square test & Independent samples t-test. * Statistical significant difference (p<0.05)
APACHE II score: Acute Physiologic Assessment and Chronic Health Evaluation

Table (3): Comparison between the study & control groups as regard hemodynamic parameter

Hemodynamic parameters	Before intervention(baseline)			After intervention		
	Study(n= 40)	Control(n=40)	P-value	Study(n= 40)	Control (n=40)	P-value
	Mean ± SD	Mean ± SD		Mean ± SD	Mean ± SD	
1st day						
HR	92.32 ± 12.32	94.65± 16.64	0.639	97.95 ± 11.97	106.22 ± 15.63	0.749
MAP	89.36±9.91	91.42±10.84	0.376	90.30± 8.40	91.81± 11.05	0.201
Spo2	91.13±5.40	89.70±6.62	0.278	93.11±4.71	89.40±4.08	0.000*
3rd day						
HR	90.75 ±14.84	95.22±14.44	0.176	89.70±10.21	93.57±10.15	0.093
MAP	89.71±9.42	92.17±11.62	0.304	92.78±7.03	91.11±10.23	0.399
Spo2	93.12±2.14	93.22±1.95	0.889	95.10±1.97	92.08±2.82	0.000*
7th day						
HR	85.10± 8.88	95.35± 15.62	0.000*	84.50± 8.61	92.80± 9.47	0.000*
MAP	92.13± 4.82	94.45± 4.35	0.026*	92.27± 3.80	95.86± 4.87	0.000*
Spo2	96.95±2.29	93.88±4.02	0.000*	98.55±2.28	94.90±3.97	0.000*

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

Table (4): Comparison between the study & control groups as regard arterial blood gases (n=80)

Arterial blood gases		Before intervention		P-value	After intervention		P-value
		Study (n= 40)	Control (n= 40)		Study (n= 40)	Control (n= 40)	
		Mean ± SD	Mean ± SD		Mean ± SD	Mean ± SD	
1st day	PH	7.34 ±0.084	7.35 ±0.108	0.854	7.36 ±0.078	7.36 ±0.106	0.746
	PaO_2	92.88±21.20	97.75±18.60	0.060	102.52±29.35	92.92±12.41	0.278
	$PaCO_2$	54.64±16.74	53.39±16.74	0.734	51.33±16.39	53.69±17.82	0.540
	HCO3	25.62±4.80	25.36±4.23	0.794	25.33±4.57	26.67±5.51	0.241
	SaO_2	87.81±4.26	86.19±5.24	0.145	88.33±4.86	87.36 ±4.64	0.380
3rd day	PH	7.39 ± 0.05	7.39 ± 0.06	0.925	7.40 ± 0.04	7.39 ± 0.07	0.304
	PaO_2	112.15±25.36	99.00±17.29	0.008*	108.70±20.35	100.03±13.39	0. 936
	$PaCO_2$	46.34±12.72	52.40±12.10	0.032*	43.79±12.39	50.94±11.38	0.008*
	HCO3	23.63±3.80	26.25±4.84	0.000*	23.20±3.30	27.59±5.71	0. 000*
	SaO_2	93.29±3.56	89.38±2.87	0.000*	95.12±3.23	90.58±2.94	0. 000*
7th day	PH	7.39 ±0.40	7.41 ±0.07	0.095	7.40 ±0.03	7.43 ±0.06	0.024*
	PaO_2	144.80±36.40	107.40±26.29	0.000*	153.48±47.16	98.65±24.77	0.000*
	$PaCO_2$	47.61±15.31	49.38±13.46	0.585	42.83±10.29	50.51±12.55	0. 004*
	HCO3	22.77±2.43	24.68±4.36	0.018*	23.11±2.18	25.66±4.89	0.003*
	SaO_2	94.67±2.65	91.70±4.24	0.000*	97.25±2.65	92.92±3.31	0.000*

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

Table (5): Comparison between the study & control groups as regard mechanical ventilation parameters (n=80)

Mechanical ventilation parameter	Study (n= 40)	Control (n= 40)	P-value
	Mean ± SD	Mean ± SD	
VT	552.32± 113.33	457.62± 115.96	0.000*
Total Respiratory rate	21.18± 3.99	28.25± 4.43	0.000*
Fio2	44.48 ± 8.54	47.75± 8.46	0.089
PEEP	5.98± 1.09	6.38± 1.39	0.157
PpL	15.65± 2.84	20.55± 6.33	0.000*
PIP	25.08± 3.45	29.88± 4.85	0.000*
Cstat	60.93 ± 18.06	50.02± 11.74	0.002*
RSBI	39.73± 10.39	67.82± 27.77	0.000*
Pressure support	11.45± 1.96	12.20± 1.82	0.081

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

Vt : Tidal volume PEEP:-Positive end expiratory pressure, PS = pressure support, PIP = peak inspiratory pressure, FIO_2:- Fraction of inspired oxygen, RSBI: rapid shallow breathing index, Cstat: static compliance, PpL: plateau pressure

Table (6): Comparison between both study & control groups in relation to respiratory assessment for (Breathing sounds and tracheal secretion)

Breathing sounds and tracheal secretion	Study (n= 40)		Control (n=40)		P-value
	No.	%	No.	%	
Breath sound					0.004*
Normal	29	74.4%	15	37.5%	
Wheezing	8	20.5%	17	42.5%	
Crepitation	2	5.1%	8	20.5%	
Color of secretion					0.000*
Clear	36	90.0%	20	50.0%	
Yellow	3	7.5%	13	32.5%	
Green bloody	1	2.5%	7	17.5%	
Amount of secretion					0.000*
Free	31	77.5%	13	32.5%	
Small	7	17.5%	12	30.0%	
Moderate	2	5.1%	11	27.5%	
Large	0	0.0%	4	10.0%	
Viscosity					0.021*
No	31	77.5%	19	47.5%	
Loose(watery)	3	10.0%	7	17.5%	
Thick(viscid)	6	15.0%	14	35.0%	

Table (7): Comparison between both study & control groups in relation to acute lung injury score (Murray Score) (n=80)

	study (n= 40)	control (n= 40)	P-value
	Mean ± SD	Mean ± SD	
On admission(baseline)	1.38 ± 0.54	1.51 ± 0.42	0.246
3rd day	1.09 ± 0.59	1.45 ± 0.47	0.004*
7th day	0.95 ± 0.60	1.49 ± 0.499	0.001*

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

Table (8): Comparison between both study & control groups in relation to respiratory assessment for oxygenation index (PaO_2/ FiO_2) (n=80)

PaO_2/FiO_2	Study group (n= 40)	Control group (n= 40)	P-value
	Mean ± SD	Mean ± SD	
On admission	193.71 ± 61.92	194.33 ± 40.79	0.958
3rd day	269.72± 77.56	204.68 ± 34.62	0.000*
7th day	358.27 ± 121.71	216.24 ± 76.06	0.000*

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

Table (9): Comparison between both study and control groups in relation to mNutric Score (n=80)

mNutric Score	study (n= 40)	Control (n=40)	P-value
	Mean ± SD	Mean ± SD	
First day(baseline)	4.95 ± 2.62	5.20 ± 2.76	0.679
3rd day:	2.90 ± 1.64	4.87 ± 2.40	0.000*
7th day:	2.30 ± 1.57	4.08 ± 1.86	0.000*

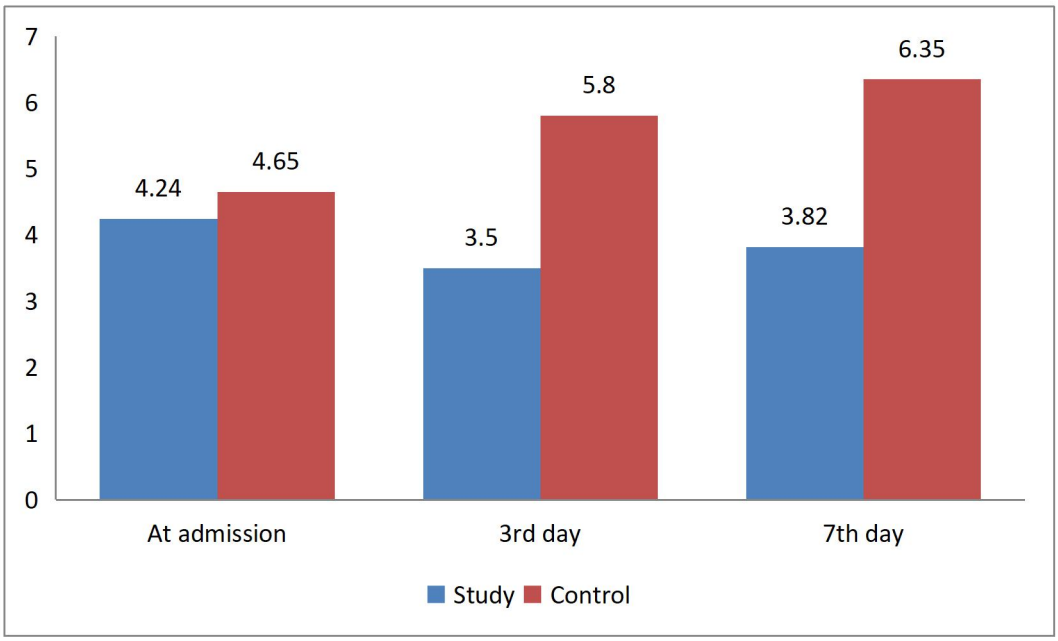
Independent samples t-test P >0.05 non significant. P <0.05 statistical significant difference

Table (10): Comparison between both study & control groups in relation to nutritional assessment (Anthropometric measurement) (n=80)

Anthropometric measurement	Study (n= 40)	control (n=40)	P-value
	Mean ± SD	Mean ± SD	
At admission			
Weight	70.58± 11.32	73.62± 10.08	0.207
Height	1.66 ± 0.08	1.70 ± 0.098	0.067
Mid arm circumference	20.73 ± 4.40	22.71 ± 5.50	.0.081
BMI	25.54± 3.45	25.80± 4.69	0.783
At 7th			
Weight	77.60± 12.06	65.00 ± 9.97	0.000*
Height	1.65 ± 0.090	1.69.43 ± 0.092	0.067
Mid arm circumference	22.11 ± 5.48	18.80 ± 4.86	0.042*
BMI	28.62 ± 4.62	2267 ± 3.66	0.000*

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

Figure (1): Comparison between both study & control groups in relation to (SOFA) (n=80)



Independent samples t-test P >0.05 non significant. P <0.05 statistical significant difference
SOFA sequential organ failure assessment score

Table (11): Comparison between both study & control groups in relation to complications (n=80)

Complications	Study (n= 40)		Control (n= 40)		P-value
	No.	%	No.	%	
Pulmonary complication					
Pulmonary edema	0	0.0%	6	15.0%	0.013*
Pneumothorax	3	7.5%	7	17.5%	0.155
Ventilator associated pneumonia	2	5.0%	10	25.0%	0.013*
Progressive ARDS	6	15.0%	17	42.5%	0.047*
Cardiovascular complications					
Pulmonary embolism	0	0.0%	3	7.5%	0.120
Abnormal heart rhythms	4	10.0%	5	12.5%	0.500
Gastrointestinal complications					
Gastrointestinal bleeding	2	5.0%	5	12.5%	0.216
Diarrhea	5	12.5%	16	40.0%	0.005*
Aspiration	2	5.0%	9	22.5%	0.024*
Renal complication					
Acute renal Failure	3	7.5%	4	10.0%	0.549
skin complication					
Bed sore	1	2.5%	7	17.5%	0.028*

Independent samples t-test P >0.05 non significant. . P <0.05 statistical significant difference
ARDS: acute respiratory distress syndrome

Table (12): Comparison between the study and control groups as regard to outcomes (n=80).

Outcomes	Study (n= 40)		Control (n=40)		P-value
	No.	%	No.	%	
Mortality	6	15.0%	14	35.0%	0.035*
Re-intubation	2	5.0%	9	22.5%	0.024*
Number of days on MV:					0.009*
Mean ± SD	9.98 ± 5.19		13.58±6.77		
Number of days in ICU:					0.004*
Mean ± SD	12.02±5.06		16.20±6.34		

Chi-square test &Independent samples t-test. P >0.05 non significant. P <0.05 statistical significant difference

Table (1) illustrate personality distribution of demographic in the both groups. It was found that the mean age in study group was 47.62± 13.15 years versus 49.75± 13.64 years in control group with no significant difference (p=0.480). Also, higher percent of both groups was male with no significant difference.

Table (2) represents comparison between the study and control groups as regard their clinical data. It was noticed that lung contusion was the most common current diagnosis in both groups. Also, greater than half of both groups with no past medical history (75 % vs. 70% respectively), and APACHE II score in control group higher than that of study group

Tables (3) illustrates that there were statistical significant differences between the two groups as regarded all hemodynamic parameters on 7th day while no differences between the two groups on admission and 3rd day , also there was slight rise in heart rate in study group after intervention but remain with the normal range.

Table (4): demonstrate comparison between two groups as regard arterial blood gases. It was show that there were significant improvements in ABG from 3rd day in study group. Also there were no significant differences between the two groups on admission day as regarded arterial blood gases parameters

Table (5): represent comparison between the study & control groups in relation to mechanical ventilation parameters. This study revealed significance difference between study and control group as regarded (VT, PpL ,PIP, RSBI, and Cstat)

Table (6) presents characteristic of both study and control groups in relation to respiratory assessment (breathing sounds and tracheal

secretion).It was founded that there were statistical significant difference between both group as regarded to breath sound, color, amount and viscosity of tracheal secretion (p=0.004& 0.000 & 0.000 &0.021 respectively).

Table (7): shows that there were significant difference between two study & control groups in relation to acute lung injury score on 3rd and 7th day with (p= 0.004& 0.001)

Table (8): demonstrates comparison between both study and control groups in relation to oxygenation index .It was founded that there highly significant difference between both group on 3rd &7th days (p=0.000).

Table (9): represents comparison between both study and control groups in relation to mNutric Score. It was found that there was significant differences between the two groups on the 3rd and 7th day (p = 0.000 and 0.000 respectively).

Table (10**)** illustrates that no statistical significant differences between the two groups on admission as regarded anthropometrics measurements. While weight, mid arm circumference and BMI show statistical significant differences between both group on 7th day (p=0.000&0.042 and 0.000).

Figure (1): shows there were statistical significant difference between both groups in relation to SOFA score

Table (11): show comparison between both study control groups in relation to complications .it was founded that control group had higher rate of complications.

Table (12) illustrates that the mean number of days on MV and number of days in ICU were lower in study group than that of control group. also higher rate of mortality present among control group.

Discussion:

Concerning personal characteristics, our investigation show that the mean age of patients was around fifty years in both study and control group. Regarding gender, the present uncovered that more noteworthy than half of the two gatherings were males with no significant differences. **Moss et al., (2016)** contemplated the impact of exercise based recuperation program for patients with acute respiratory failure and revealed that the mean age additionally around fifty in the two gatherings and higher level of sex in both gathering were males.

Regarding APACHE II score, the present study reported that study group had lower mean of APACHE II score on admission and discharge compared with control group with significant differences. Our discoveries upheld with aftereffect of **Wang, et al., (2018)** who assessed the impact of chest physiotherapy treatment convention and early preparation and reported that mean APACHE II score at admission in the intervention group was lower than control groups.

As a regarding hemodynamic parameters:

Our study uncovered that statistical significant differences regarding heart rate between the two groups. Also there was slight increase in heart rate in study group after intervention (after ten minutes) however stay with the normal range.

Expansion in pulse give off an impression of being because of incitement of thoughtful nerves during exercise so adequate blood is taken to the working muscles to give them enough supplements and oxygen. **Wang, et al., (2018)** likewise upheld out outcomes in regards to this issue**.**

Regarding peripheral oxygen saturation (spo2). Our examination uncovered there were huge contrasts between the two groups. A critical expansion in oxygen immersion was seen after chest physiotherapy in mediation bunches because of impact of postural seepage in improving fringe lung leeway, expanding practical lingering limit, and speeds up bodily fluid freedom. Likewise postural seepage related to ventilator help and PEEP is thought to increment trans-aspiratory pressure, improve ventilation-perfusion proportions, and increment lung consistence. **Jiandani & Patel (2018)** established that there were expansion in pulse and circulatory strain after application physiotherapy yet stay inside the physiologic reach. Additionally there was critical improved in oxygen immersion following thirteen minutes of the treatment**.**

As regarding to arterial blood gases, oxygenation, and respiratory indexes. This study, addressed that, there was a significant

improvement in ABG from 3rd day in study group. Also there were no significant differences between the two groups on admission day regarding arterial blood gases parameters. In this unique circumstance, **Wang, et al., (2018**). detailed that, chest physiotherapy convention in type of (manual excessive inflation, vibration, percussion, suctioning, upper and lower appendages exercise and finishing position) was improved blood vessel blood gases of mechanical ventilated patients intensely. Our outcomes is concurred with discoveries **of Wang, et al., (2018**). discovered that Chest physiotherapy help lessening aggregation of aviation route emission, forestalling imploded lung, improving lung compliance. **Thomas et al., 2020** detailed that subglottic discharge waste, postural cleanliness, and ventilator out of control inflation for basically sick populace advancing bodily fluid freedom during mechanical ventilation. **Battaglini, et al (2020)** Established that position lessen the danger of auxiliary respiratory bacterial contaminations in precisely ventilated patients, encouraging bodily fluid leeway and assembling emissions, in this manner improving lung volumes, perfusion, and oxygenation. **Lestari, et al., (2018**). Who assessed the impact bronchodilator, mucolytics, and ordinary saline joined with chest physiotherapy in the investigation gathering. announced that mix of nebulization and chest physiotherapy improved respiratory status likewise forestall respiratory plot blockage by unnecessary sputum creation and effectsly affected pulse, respiratory rate, and oxygen immersion. **Hariedy et al., (2015)** uncovered that most elevated number of patient who get normal CPT and RM had huge measure of discharges while patients who get standard nursing care gave moderate measure of emissions and there were as statistically significance difference between both groups.(p=0.001). This difference is because of impact of chest physiotherapy which prepare the respiratory discharges from integral to fringe aviation route and builds the measure of trachobroncial bodily fluid cleared from the respiratory tract.

As a regarding to mechanical ventilated parameters.

This study showed significance difference between both groups as regarded (VT, PpL ,PIP, RSBI, and Cstat**).** This is agreed with the study of **Moreira et al. (2015)** found an increase in dynamic lung compliance, tidal volume, and peripheral oxygen saturation, after applying the early respiratory physiotherapy protocol. **Mezidi & Guérin (2018**) Stated that, positioning influenced lung at the upper most area expands enrollment and advances seepage from the lung portion, so lung capacity and atelectasis can be improved.

Regarding to gastrointestinal complications, the current study uncovered that occurrence of loose bowels, goal, GI draining were higher in control gatherings. This finding upheld by **Li, et al. (2020).** Who assess Effect of early enteral nourishment on injury patients, they announced that higher pace of loose bowels and gastrointestinal seeping in bunch who got late enteral feeding care of than early feeding.

Regarding to anthropometric measurements, there was no statistical significant differences between the two groups on admission. While weight, mid arm circumference and BMI show statistical significant differences between both group on seventh day. That not supported with the result of (**Padar, et al., (2017).** at the point when executed enteral feeding of convention in an emergency unit established that there was no critical contrasts as respected weight and BMI between the two the groups. The careful nutritional evaluation of all patients at the time of admission to ICUs and identification of pre-existing malnutrition are essential in both diagnosis and treatment management of the patients. This baseline evaluation helps us to identify those patients at risk of developing malnutrition or extra nutritional deterioration due to their existing illness. This assessment also allows early supportive nutritional intervention to augment the nutrient intake. **Khademi et al., (2019).**

As regarded to outcomes (Complications, LOS on ICU & No. of days on MV, Mortiality)

Our study revealed that uncovered that shows there were statistical significant difference between both groups in relation to SOFA score on third and seventh day. . Likewise the mean number of days on MV and number of days in

ICU were higher in control group than in the study group with significant differences.

Tee, et al., (2018)) who assessed the viability of sequential estimation of a serial measurement of several scoring systems (APACHE II AND SOFA scores) in patients with acute severe pancreatitis.. This was noticed on admission, however it likewise proceeded until day 14 of the illness, indicating persistent organ failure, which carries a higher risk of mortality. They established that in sequential assessment, APACHE II at 48hours and SOFA score at day 7 were accepted (good) prediction.

Saleh et al., (2016) detailed that, increment mean of APACHEII , and SOFA scores were related with increment the actual mortality rate when performing "Comparison of the Mortality Prediction of Different ICU Scoring Systems (APACHE II and III, SAPS II, and SOFA) in Acute Respiratory Distress Syndrome". **Mendez-Tellez et al., (2013)** referenced that when decided elements related with inception of non-intrusive treatment in acute lung injury patients they reported that there was significant difference mean value of SOFA score between study &control group. **Padar, et al (2017)** when executed enteral taking care of convention in an emergency unit established that there were decrease in mortality, mechanical ventilator days, VAP, circulatory system disease and urinary tract infection. **Hodgson, et al., (2018)** add, patients on ventilators ought to be urged to take an interest in assembly treatment. This treatment has been related with diminished days on the ventilator, in the ICU, and in the clinic for patients with acute respiratory failure. **Sabatino et al., (2017**) who analyzed impact of the conveyance of enteral taking care of gave inside 24 h of injury versus standard consideration among grown-up injury patients. in concentrated consideration they established that arrangement of early enteral taking care of was related with a huge decrease in mortality. **Zheng et al 2019** The provision of early standard enteral feeding, resulting in the preservation of gut-associated lymphoid tissue, gut barrier function, and reduce bacterial translocation so resulting in a reduction in infections , pneumonia and length of hospital stay. **Xiol, et al. (2017)**. In study about "Body Position and Ventilator-Associated Pneumonia Prevention". Reported that semirecumbent position (head of bed elevated to 30−45° above horizontal plane) in critically ill intubated prevent gastro-pulmonary aspiration of pathogens and VAP.

Thomas et al., 2020 reported that chest physical physiotherapy reduce the incidence of complications, encourage weaning from mechanical ventilation, and facilitate recovery of functional autonomy.

Zeng M, et al 2017 investigate the effect of chest physiotherapy (CPT) on mechanically ventilated patients. They reported that control group had higher rate of complications (ventilator associated pneumonia (VAP) , atelectasis, deep vein thrombosis) while no such complications were found in the CPT group. Also the duration of MV and the length of ICU stay in CPT group were significantly lower than those of the control group . **Zhang et al 2019** assess the impact of early assembly of basically sick patients in the emergency unit. The outcome showed that early mobilization in the study group was associated with a lower incidence of deep vein thrombosis than control group.**Wang, et al.,(2018)** Compared to the control group, patients in the intervention group had a significantly lower reintubation rate (8% vs. 16%; $p = 0.01$). This study demonstrated that chest physiotherapy comprising chest wall mobilization, rib cage compression, airway secretion clearance, and early mobilization can be associated with a reduction in the amount of extubation failure and with enhanced RSBI scores in patients with mechanical ventilation.

Meawad et al (2018) approved that the importance of accumulation chest physiotherapy program to early MV patients as it raise PAO2, SAO2, diminutions complications in patients undergoing MV, decrease ICU duration. **Andersen (2019)** described that oral decontamination with chlorhexidine on intensive care unit patients: significantly reduced VAP occurrence compared with routine oral care.

Conclusion

Based on the findings of the present study, it can be concluded that:- patients with acute lung injury who engaged in an nursing protocol had better arterial blood gases and lower complications rate, reducing mechanical ventilation support need and, improve outcomes.

Recommendations:

Provide educational program about nursing protocol for acute lung injury. Provide booklet about acute lung injury patient nursing protocol.

References:

Ahnert, P., Creutz, P., Horn, K., Schwarzenberger, F., Kiehntopf, M., and 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)

Andersen B.M. (2019) Oral Hygiene. In: Prevention and Control of Infections in Hospitals. Springer, Cham pp 265-272

Aysha ZMS, Alaa El-Din SM, Attia NR, and Akab MI. **2016** Efficacy of Implementing Nursing Care Protocol on the Incidence of Ventilator Associated Pneumonia in Intensive Care Unit at Tanta Emergency Hospital. J Am Sci;12(2):40-52]. ISSN 1545-1003 (print); ISSN 2375-7264

Battaglini, D., Robba, C., Caiffa, S., Ball, L., Brunetti, I., Loconte, M., Giacobbe, D. R., Vena, A., Patroniti, N., Bassetti, M., Torres, A., Rocco, P. R., & Pelosi, P. (2020). Chest physiotherapy: An important adjuvant in critically ill mechanically ventilated patients with COVID-19. Respiratory physiology & neurobiology, 282, 103529.

Bhaskar S. Glasgow Coma Scale (2017): Technique and Intepretation. Clin Surg.; 2: 1575

Dogrul, B. N., Kiliccalan, I., Asci, E. S., & Peker, S. C. (2020). Blunt trauma related chest wall and pulmonary injuries: An overview. Chinese journal of traumatology = Zhonghua chuang shang za zhi, 23(3), 125–138. https://doi.org/10.1016/j.cjtee.2020.04.003

Hodgson, C. L., Capell, E., & Tipping, C. J. (2018). Early Mobilization of Patients in Intensive Care: Organization, Communication and Safety Factors that Influence Translation into Clinical Practice. Critical care (London, England), 22(1), 77.

Huang, L., Lin, G., Tang, L. Lingna Yu & Zhilai Zhou. (2020). Special attention to nurses' protection during the COVID-19 epidemic. Crit Care 24, 120

Jabaudon, M., Blondonnet, R., & Constantin, J.-M. (2019). ARDS in patients with chest trauma: Better safe than sorry. Anaesthesia Critical Care & Pain Medicine, 38(3), 221–222.

Jiandani MPand Patel A. (2018). Cardiorespiratory response to chest physiotherapy in intensive respiratory care unit. Int J Health Sci Res.; 8(7):159-165.

Kacmarek M R،Stoller KJ ،Al Heuer: (2014). Egan's Fundamentals of Respiratory Care10th Edition chapter 40 airway clearance therapies. pages 960-985

Kallet RH, Zhuo H, Yip V, (2018). Spontaneous Breathing Trials and Conservative Sedation Practices Reduce Mechanical Ventilation Duration in Subjects With ARDS. Respir Care; 63:1.

Khademi G, Imani B, Mehdizadeh A. (2019). Assessment, Intervention, and Monitoring: Stepwise Nutritional Management in Pediatric Intensive Care Units: A Short Review, J Compr Ped. ; 10(1):e66474

Lee Z., and 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

Lestari, N. E., Nurhaeni, N., & Chodidjah, S. (2018). The combination of nebulization and chest physiotherapy improved respiratory status in children with pneumonia. Enfermería Clínica, 28, 19–22.

Li, P.-F., Wang, Y.-L., Fang, Y.-L., Nan, L., Zhou, J., & Zhang, D. (2020). Effect of early enteral nutrition on postoperative complications trauma patients requiring intensive care. Chinese Journal of Traumatology

Meawad MA, Abd El Aziz A, Obaya HE, Mohamed SA, Mounir KM (2018):effect of Chest Physical Therapy Modalities on Oxygen Saturation and Partial Pressure of Arterial Oxygen in Mechanically Ventilated Patients The Egyptian Journal of Hospital Medicine Volume 72, Issue 8 Summer 2018, Page 5005-5008

Mendez-Tellez, P. A., Dinglas, V. D., Colantuoni, E., Ciesla, N., Sevransky, J. E., Shanholtz, C., … Needham, D. M. (2013). Factors associated with timing of initiation of physical therapy in patients with acute lung injury. Journal of Critical Care, 28(6), 980–984.

Mezidi, M., & Guérin, C. (2018). Effects of patient positioning on respiratory mechanics in mechanically ventilated ICU patients. Annals of Translational Medicine, 6(19), 384–384

Moreira, AD. Gabriela S, Nascimento, EL, Malfussi, LBH, Hermida, PMV, & Nascimento, KS (2020). Implementation of the protocol of nursing care in trauma in aeromedical service. Revista Brasileira de Enfermagem, 73(3), e20180516.

Morton G., and Fontaine K., (2018): Critical care nursing a holistic approach, Chapter 40 Patient Management: Gastrointestinal System,11th edition, Wolters Kluwer, Pages 892-914.

Moss M, Nordon-Craft A, Malone D, Van Pelt D, Frankel SK, Warner ML, Kriekels W, McNulty M, Fairclough DL, Schenkman M. A (2016 Randomized Trial of an Intensive Physical Therapy Program for Patients with Acute Respiratory Failure. Am J Respir Crit Care Med. May 15;193(10):1101-10.. 63.

Naved S., Siddiqui S., and 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

Noorbakhsh MR and Kriley IR 2018 Management of severe respiratory failure in complex trauma patients**.** J Emerg Crit Care Med;2:26

Padar, M., Uusvel, G., Starkopf, L., Starkopf, J., and 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**.**

Papazian, L., Aubron, C., Brochard, L. et al. (2019). Formal guidelines: management of acute respiratory distress syndrome. Ann. Intensive Care **9,** 69.

Pfeifer, R., Heussen, N., Michalewicz, E., Hilgers, R.-D., & Pape, H.-C. (2017). Incidence of adult respiratory distress syndrome in trauma patients. Journal of Trauma and Acute Care Surgery, 83(3), 496–506.

Sabatino A., Theilla M., Hellerman M., Singer P., Maggiore U., Barbagallo M., Regolisti G., Fiaccadori E. **2017** Energy and protein in critically Ill patients with AKI: A prospective, multicenter observational study using indirect calorimetry and protein catabolic rate. Nutrients.

Saleh, A., Ahmed, M., and Abdel-lateif, A. (2016). Comparison of the Mortality Prediction of Different ICU Scoring Systems (APACHE II and III, SAPS II, and SOFA) in Acute Respiratory Distress Syndrome Patients. Chest, 149(4), A147.

Tee, Y. S., Fang, H. Y., Kuo, I. M., Lin, Y. S., Huang, S. F., & Yu, M. C. (2018). Serial evaluation of the SOFA score is reliable for predicting mortality in acute severe pancreatitis. Medicine, 97(7), e9654.

Thomas P., Baldwin C., Bissett B., Boden I., Gosselink R., Granger C.L., Hodgson C., Ym A., Michelle J., Kho E., Moses R., Ntoumenopoulos G., Parry S.M., Patman S., Van Der Lee L. (2020). Physiotherapy management for COVID-19 in the acute hospital setting: clinical practice recommendations. J. Physiother.; 66:73–82

.**Wang, T.-H., Wu, C.-P., & Wang, L.-Y. (2018).** Chest Physiotherapy with Early Mobilization may Improve Extubation Outcome

in Critically Ill Patients in the Intensive Care Units. The Clinical Respiratory Journal ;12(11):2613-2621

Xiol, E., Pagliara, F., Hua, Y., Torres, A., & Bassi, G. (2017). Body Position and Ventilator-Associated Pneumonia Prevention. Seminars in Respiratory and Critical Care Medicine, 38(03), 371–380. doi:10.1055/s-0037-1603111

Zhang L, Hu W, Cai Z, Liu J, Wu J, Deng Y, Yu K, Chen X, Zhu L, Ma J, Qin Y (2019): Early mobilization of critically ill patients in the intensive care unit: A systematic review and meta-analysis. PLoS One. Oct 3; 14 (10): e0223185.

Zheng X, Jiang L, and Huang M 2019 Early versus delayed enteral nutrition in critically ill patients: a meta-analysis of randomized controlled trials Int J Clin Exp Med;12(5):4755-4763.