https://menj.journals.ekb.eg
Print ISSN: 2735-3974
Online ISSN: 2735-3982
DOI: ----------

MNJ
Menoufia Nursing Journal
Faculty of Nuring
Menoufia University

Relationship between Mechanical Ventilation Outcomes and Body Mass Index at Emergency Hospitals

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Abstract: Background: It is unknown whether body-mass index (BMI) is associated with higher mortality rates and poor outcomes among patients on mechanical ventilation. **Purpose of this study:** to evaluate the relation between BMI and mechanical ventilator outcome among critically ill patients. **Research Design:** A descriptive correlational research design was used. Setting: this study was conducted at emergency hospitals in Egypt (General Damietta Hospital). Sampling; A purposive sample of 150 critically ill mechanically ventilated patient **Instruments:** Three instruments were used. Instrument one was used for data collection related to patients' demographic and medical data, Instrument two: BURNS Wean Assessment Program (BWAP) checklist. Instrument three: Sequential Organ Failure Assessment (SOFA score). **Results:** 76.7% of the studied sample received continuous mandatory ventilation (CMV) mode. Two thirds of them (66.7%) had within normal BMI and difficult weaning from the mechanical ventilators. A negative statistical significant relationship was found between BMI categories and ICU length of stay among the studied sample. **Conclusion:** No statistical significant relationship was found between BMI and selected mechanically ventilated patients' outcomes. In addition, the current study revealed that the highest percentages of death were found among patients who were in the age group of 40-60 years, males, had within normal BMI. Unexpectedly, the greatest mean length of ICU stay was found among the underweight patients. **Recommendation:** Replication of the study is required on a larger probability sample selected from different geographical areas in Egypt to obtain more generalizable data.

Key words: *Body mass index, Mechanical ventilation*

Introduction

Critically ill patients have life threatening illnesses which require a range of interventions and actions to that treatment can be unpredictable. Among these patients are the mechanically ventilated patients (Arrar & Mohammed, 2020). To depend on mechanical ventilation after critical illness is a challenge to both the patient and the critical care nurses; so, the intensive care unit (ICU) nurse must use a holistic approach while providing nursing care for mechanically ventilated patients (Minton& Batten). As well, the caring team should always plan for weaning the patient from mechanical ventilation (Cederwall et al., 2018).

Regarding the mechanical ventilation which used to support the respiratory system, the ICU nurse should assess the factors which influence the weaning process and also the prognosis or patient's outcomes (Rak et al., 2020).

In addition, mechanically ventilated patients need special and comprehensive nursing care which enables to decrease the costs, length of stay, and mortality rates (Escalon et al., 2020).

The mechanically ventilated patient's outcomes may be influenced by many factors such as; the hemodynamic status, the level of consciousness. the respiratory muscles strength, the presence of blood stream infection, and

also the patient's body weight (Pham et al., 2017).

Body weight changes daily throughout a patient's stay in ICU as a result of many factors including fluid balance, nutritional status, type of acute illness, and presence of comorbidities. So, the ICU nurse should be able to examine the relationship between changes in body weight and clinical outcomes such as mechanical ventilation (MV) duration, length of ICU stays, and mortality (Ni et al., 2017).

There are many factors affecting the weaning process and can be categorized as: the lungs ability to participate in ventilation, cardiovascular performance, and finally the psychological readiness. The rapid shallow breathing index and weaning intolerance indicators can help to predict the weaning success (Moore, 2020).

Therefore, when caring for a mechanically ventilated patient, the ICU nurse should focus nursing intervention on two approaches: maximizing oxygenation, ventilation, and prevention of complications of artificial airways and mechanical ventilator (Carter et al., 2020).

The ICU nurse should also be aware that prolonged mechanical ventilation has adverse clinical outcomes with higher rates of morbidity and mortality. More specifically, the more body mass index (BMI) is, the more patients' needs for ICU admission and mechanical ventilation, longer hospital length of stay, and more chances for tracheostomy placements (de Koning, et al., 2020).

Mechanical ventilation should be weaned as soon as possible with planning for that from the first day of ventilation. This because of prolonged mechanically ventilated patients have higher rates of morbidity and mortality with the worst outcomes as compared to those with short term mechanical ventilation (Dale et al., 2020).

Significance of the study:

Mechanical ventilation is a lifesaving management approach for critically ill patients. Therefore. Management of mechanically ventilated patients requires a multidisciplinary team approach with some predictions of patient’s progress or outcomes and a comprehensive nursing care to enhance these patient's outcomes (Bissett, Gosselin & Van Haren, 2020).

However, it has been observed over a period of 4 years of experience as a clinical instructor that mechanically ventilated patients experience many problems such as difficulty in weaning from mechanical ventilators. Prolonged stay in the ICU, and repeated mechanical ventilation after disconnection. These problems were more frequent among obese and underweight patients. However, limited data on the effect of BMI on outcomes of mechanically ventilated patients were reported.

Purpose:

The purpose of this study is to assess the relationship between mechanical ventilation outcomes and body mass index in two hospitals in Egypt.

Research Questions:

- Q1: What is the body mass index profile of critically ill patients on mechanical ventilator for a period of eight months?
- Q2: What is the relationship between critically ill patient's body mass index, weaning from mechanical ventilation, frequency of organ dysfunction, length of hospitalization, and mortality rate?

Methods

Design:

A descriptive correlational research design was used to conduct the study.

Setting:

This study was conducted at the Emergency Department in the General Damietta Hospital.

Sampling:

A purposive sample of all adult critically ill patients who been have hospitalized during the period extending from January to August 2016 constituting 150 patients (120 males and 30 females) their age ranged from l8-60 years. They should have been mechanically ventilated for at least 3 days

Exclusion criteria:

Patients who are completely dependent on mechanical ventilators, e.g. brain stem infarction, neuromuscular disorder; chronically debilitated and terminally ill.

Instruments:

Data collection instruments were as follows:

<u>Instrument One:</u> characteristics of patients:

It was developed by the investigator. It covers data such as patient's age, gender, diagnosis, co-morbidity diseases, length of ICU stay, selected anthropometric measurements (body weight, height, ulnar length and mid arm circumference). Mechanical ventilator connection/disconnection date and patient's smoking habits.

.If MUAC is < 23.5 cm, BMI is likely to be 20 kg/m^2 indicating underweight. However, if MUAC is > 32.0 cm, BMI is likely to be 30 kg/m2 indicating the overweight, and in between that is likely to be within normal BMI.

<u>Instrument two:</u> BURNS Wean Assessment Program (BWAP) checklist.

This instrument was developed by Burns S.M. (1998) It provides a more comprehensive assessment of weaning readiness. It is used to monitor the progress of weaning for the mechanically ventilated patients through general and respiratory assessment. The BWAP is a twenty-six-items checklis, It covers two major areas of assessment. The first one is general assessment of the patient which involves (the hemodynamically stability, hematocrit, serum albumin, electrolytes, pain, sleep pattern bowel problems, level of anxiety, and the chest x-ray) and the second one is respiratory assessment which involves gas flow, breathing. Airway clearance, strength, endurance and arterial blood gases).

The scoring system of BWAP was as follows:

The BWAP score is calculated by dividing the total number of yes responses by 26. The BWAP checklist requires the assignment of 1 from 3 answers (yes, no, or not assessed) on the basis of the previous 24 hours. Yes, response =1 indicates that the factor meets the criteria of the checked item while zero was assigned to "No" response or "Not assessed" = 0 and indicate that; the factor does not meet the criteria; the response (not assessed) is used when not enough data are available. Patients with BWAP total scores greater than 50% are considered having successful weaning and positive outcomes. However, BWAP score less than 50% is assigned for patients having difficulties to maintain spontaneous breathing during their spontaneous breathing trial. Such patients almost have unsuccessful weaning (Burns, et al, 2012).

<u>Instrument three:</u> It is entitled

'Sequential organ failure assessment (SOFA score) sheet': has been developed by Vincent (1996). It is used to determine the extent of a patient's organ function or rate of dysfunction during their ICU stay (Acharya, Pradhan, & Marhatta, 2006).

It is used to assess the function of six different body systems.

a) Respiratory system: is mainly assessed based on calculating the ratio of (PaO2)/ (FiO2).
b) Cardiovascular system: is assessed through calculating the mean arterial blood pressure using equation of MAP= SBP + 2(DBP) / 3; and assessing the dose of vasoactive drugs.
c) Renal system: is assessed based on monitoring serum creatinine level or diuresis (amount of daily urine output).
d) Hepatic system: is assessed based on monitoring total serum bilirubin level.
e) Neurological system: is assessed through estimation of Glasgow Coma Scale Score. To specify the level of consciousness. For sedated patients, the value of GCS score before sedation is preferable to be used (Livingston, Mackenzie, MacKirdy, & Howie 2000).
f) Hematological system: is assessed based on documenting the platelet count.

The scoring system of Sequential organ failure assessment was done as follows:

SOFA score is a likert scale ranging from 0- 4 the greater the score, the worse the condition (Morsy, & Elfeky, Mohamed, 2013). These scores were classified as follows:

- 0 ≤ 8 point = mild organ dysfunction.
- 8 ≤ 16 point = moderate organ dysfunction.
- 16 ≤ 24 point = severe organ dysfunction

Pilot Study:

A pilot study was applied on 10% of patients (n=15) to test the feasibi1ity, objectivity, and applicability of the data collection instruments. No modifications were done.

Validity:

After the tools were designed by the researcher, their content validation was evaluated by a panel of 5 experts; 2 experts were professors from Nursing Faculty at Ain Shams University and the other 3 experts were assistant professors from Nursing Faculty at Mansoura University Some modifications were done accordingly fulfill suggestions and comments.

Reliability:

Reliability of BWAP checklist instrument was confirmed by Cronbach alpha, and it was .85. Relaibility of sequential organ failure assessment sheet was calculated by Alpha Cronbach test. It was .921.

Procedure:

A letter was submitted from the Dean of the Faculty of Nursing to the directors of the selected settings including the purpose and methods of data collection.
After obtaining the names of patients who were admitted to the critical care unit and ventilated characteristics of patients were recorded using instrument one. In order to calculate BMI, the investigator measured the ulnar length (distance between olecranon process of the elbow and the styloid process of wrist.
Body mass index was measured based on specifying the mid-upper arm circumference at the midpoint between the shoulder acromion process and the elbow olecranon process. This instrument was filled in l0 minutes
The investigator assessed the mechanically ventilated patient's stability and readiness for weaning daily before starting the weaning process through the assessment of hemodynamic status and conscious level. If the patient was sedated. The

sedation should be ceased temporary to assess the readiness of weaning. Then the investigator utilized BURNS Wean Assessment Program (BWAP) checklist (instrument two) on daily basis. This checklist required 25-30 minutes to be fulfilled. The investigator used patient's file to obtain some of the needed data especially the previous 24-hour data such as; the hemodynamic status (pulse & cardiac output), the hematocrit, the serum electrolytes (Ca++, Mg+, & PO4), serum albumin, arterial blood gases (pH, & PaCO2).

The investigator utilized the BWAP checklist at the day shift on daily basis after 72 hours of mechanical ventilation. The investigator answered the questions related to the general condition of patients then the investigator answered the questions related to respiratory assessment (this is assessed off the ventilator while measuring #20-23).

Then, the investigator assessed for the occurrence of organ dysfunction utilizing the SOFA score (instrument three 3). This sheet was filled out through repeated visits to each included patient: on admission, and every 48 hours until discharge from the ICU.

The systematic assessment of respiratory system which is done by obtaining the ratio of partial arterial oxygen pressure (PaO2)/fraction of inspired oxygen (FiO2) using the following steps: (1) Obtaining the PaO2 value in mmHg, from the records or arterial blood gases, (2) Converting the percentage of FIO2 into decimal: FIO2=FIO2 (%)/100%; (3) Calculating the PaO2/FIO2 ratio, through dividing PaO2 value by the percentage of FIO2.

In order to assess the cardio vascular system, the researcher calculated the mean arterial blood pressure using the equation of MAP= SBP + 2(DBP) / 3 and assessing the dense of vasoactive drugs. Especially the noradrenaline or dopamine infusion. Then, the investigator converted the given dose from ml/hr to mcg/kg/min The following software formula was used: The first step: rate/(ml available) ×dose available = milligrams/hour. Then, after the milligrams/hour has been determined, the investigator used the next formula to convert from milligrams/hour to mcg/kg/min.

The second step: mg/(60 minutes) ×1000/kg= mcg/(kg/min)

Afterwards, the investigator assessed the renal system according to the serum creatinine level and hepatic system based on total serum bilirubin level. Meanwhile, the neurological assessment was done according the value of GCS, whereas, the hematological system was assessed according to the platelet count.

After the summing of the score of every system the investigator classified the SOFA score utilizing the previously mentioned scoring system. To fulfill this instrument 15 minutes were required.

Ethical Considerations:

An official permission to carry out the research was obtained from the Faculty of Nursing and the directors of General Damietta Hospital. Written consents were obtained from patients or responsible members if the patient was unconscious after clarifying the objectives of the study.

Patient/relatives were told that `they can withdraw at any time without any explanation and obtained data will not be used in any other research. Coding of data was done to assure the confidentiality and anonymity of the obtained data.

Statistical Analysis:

Collected data were analyzed and tabulated using SPSS program version 21. Mean and standard deviations were used. Also, inferential statistics frequency; percentage; chi-square test;

and analysis of variance (ANOVA) were used.

Results:

Figure (1) approximately one quarter (28.7%) of patients were in the age group of 18 to 28 years old and the same was in the age group of 40-50 years old, with a mean age of 39.766 ± l 3.51.

Figure (2) shows that more than three-quarters (80%) of patients were males.

Figure (3) more than three-quarters (76.7%) of patients had continuous mandatory ventilation (CMV) mode.

Table (1) clarifies that more than one quarter (26.7%) of patients were admitted with neurological emergencies such as road traffic accident and disturbed level of consciousness. Also, more than one quarter (26.7%) were admitted with surgical emergencies (ruptured renal vein, perforated duodenum, abdominal trauma).

Figure (4) shows that two thirds (66.7%) of patients had within normal body mass index.

Figure (5) clarifies that two thirds (66.7 %) of patients had difficult weaning from the mechanical ventilators.

Figure (6) illustrates that 50 % of the patients stayed from 7 to14 days in the ICUs. with a mean length of ICU stay = 15.3 ± 11.653.

Table (2) clarifies a significant statistical relationship between BMI categories and length of ICU hospitalization among patients (X2= 11.31, P value ≤ 0.79).

Table (3) clarifies that two thirds (66.7%) of patients died during their hospitalization in the ICU. The highest percentage of deaths was for obese group followed by the underweight group (75 % and 66.7% respectively). However, no significant statistical relationship was present between BMI categories and the mortality rate (X2= 0.15, P value ≤ 0.928).

Table (4) clarifies that the highest percentages of weaning difficulties were found among patients who had normal BMI followed by the underweight patients (43.3 % and 13.3% respectively). However, no significant statistical relationships were present between BMI categories and the weaning trials from mechanical ventilation (X2= 0.15, P value ≤ 0.928).

Table (5) clarifies that 76.7% of patients had mild organ dysfunction. No significant statistical relationship was present between BMI categories and the presence of organ dysfunction X2= 2.54, P value ≤ 0.637).

Table (6) clarities a significant statistical positive correlation between days of mechanical ventilation and length of ICU stay (r/p = 0.836/0.000). Also, there is a significant statistical negative correlation between the mean 5OFA scores, the mean BWAP scores, and length of ICU stay (r/p = -0.663/0.000, and -0.362/0.049) respectively. However, no significant statistical correlations were found between ages, days of mechanical ventilation, mean SOFA scores, mean or BWAP scores, and length of ICU stay.

Table (7) clarifies no significant statistical difference mean BWAP scores, mean SOFA scores, and length of ICU stay in relation to BMI categories (F/P = 0.631/0.540, 0.519/0.601, 0.087/0.917) respectively. In addition, the highest mean BWAP scores were found among the underweight group mean± SD = 11.53 ± 2.93) indicating more readiness for weaning from mechanical ventilation. The highest mean SOFA scores wear found among patients who had within normal BMI ($\bar{x}$ ± SD = 6.64 + 3.95) indicating their susceptibility for multiple organ dysfunction finally.

The greatest mean length of ICU stay was found among the underweight group ($\bar{x}$ ± SD = 16 ± 9.53).

Table (8) reveals that 69.57% of patients who were on CMV mode and 57.14% who were on CPAP mode died. No significant statistical relationship was found between mode of mechanical ventilator and mortality rate (X2= 0.373, P value ≤ 0.429).

Figure (1): Distribution of the Studied Sample according to Age Groups (N=150).

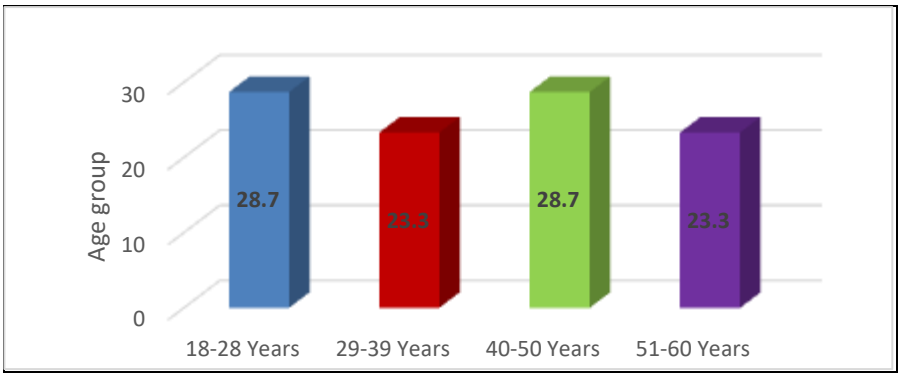

Figure (2): Distribution of the Studied Sample according to Gender (N=150)

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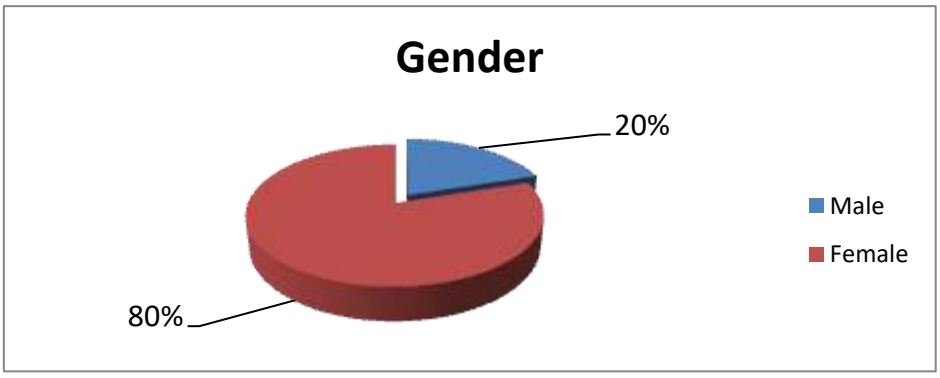
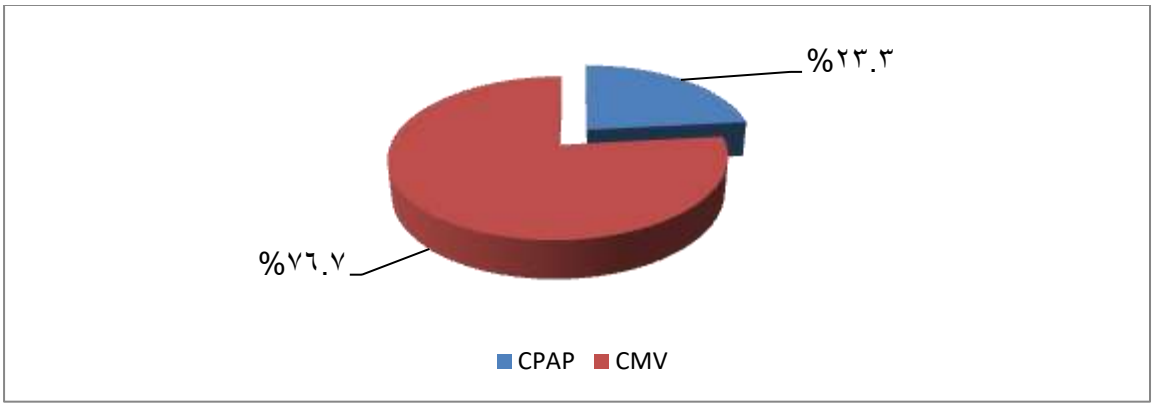


Figure (3): Distribution of the Studied Sample according to Mode of Mechanical Ventilation (N=150).



CMV: Controlled Mandatory Ventilation **CPAP**: Continuous Positive Airway Pressure

Table (1): Frequency Distribution of the studied patients according to Medical Diagnosis (N= 150).

Medical diagnosis	N	%
Cardiovascular emergencies	12	10
Respiratory emergencies	18	13.3
Neurological emergencies (RTA*/DCL**)	42	26.7
Gastrointestinal emergencies	36	23.3
Surgical emergencies	42	26.7
Total	150	100

*Road traffic accident **Disturbed conscious level

Figure (4): Distribution of the Studied Sample Regarding BMI category. (N=150)

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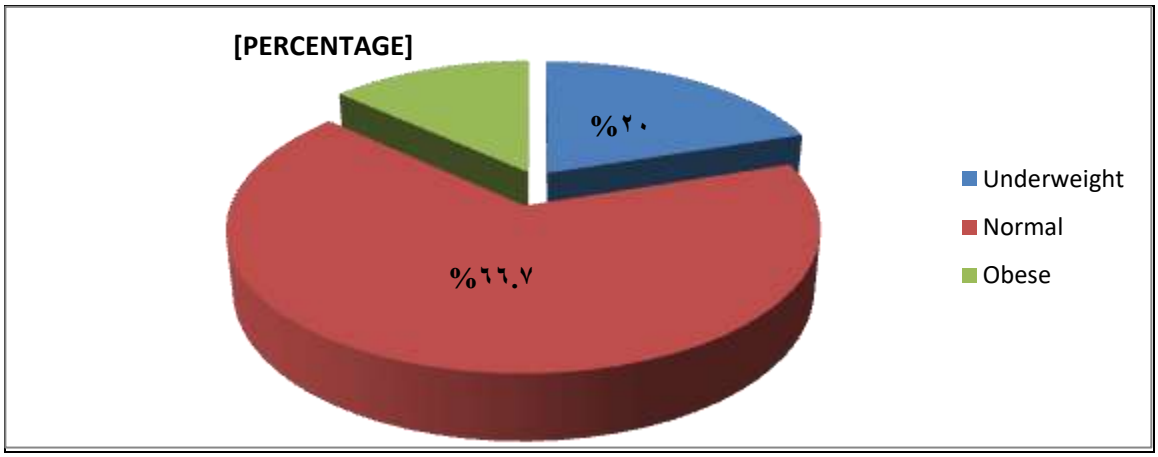

Figure (5): Distribution of the studied patients regarding Fate of Weaning from Mechanical Ventilation. (N=150).

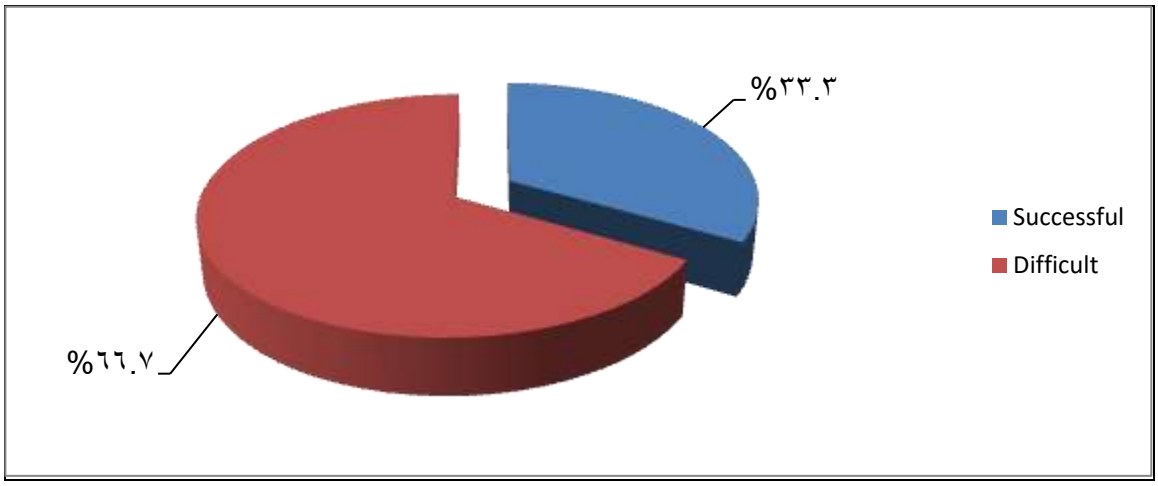

Figure (6): Distribution of the studied patients regarding Length of ICU Stay. (N=150).

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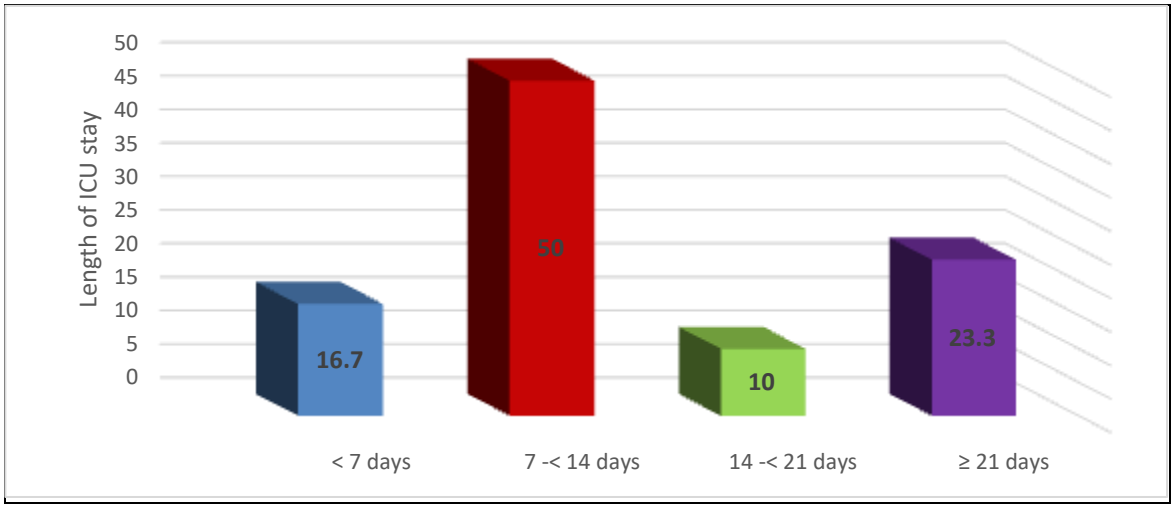

Table (2): Associative relation between BMI Categories and Length of ICU hospitalization (N= 150).

BMI / Length of ICU stay	BMI categories						Total		(X^2)	P value
	Underweight n= 18		Normal n= 120		Obese n= 12		No.	%		
	No.	%	No.	%	No	%				
1. < 7 days	3	16.7	45	15	3	25	21	l 6.7	11.31	0.79 NS
2. 7 ≤ 14 days	6	33.3	75	60	3	25	28	50		
3. 14 ≤ 21 days	3	16.7	0	0	6	50	9	10		
4. ≥21	6	33.3	30	25	0	0	12	23.3		
Total	**18**	**100**	**40**	**100**	**12**	**100**	**150**	**100**		

Table (3): Associative relation between BMI Categories and (N=150)

BMI / Mortality Rate	BMI categories						Total		(X^2)	P value
	Underweight n= 6		Normal n= 40		Obese n= 12		No.	%		
	No.	%	No.	%	No.	%				
1. Died	12	66.7	75	65	9	75	96	66.7	0.15	0.928 NS
2. Survived	6	33.3	45	35	3	25	54	33.3		
Total	**18**	**100**	**120**	**100**	**12**	**100**	**150**	**100**		

Table (3): Relationship between weight categories and ease of weaning (N= 150).

BMI / Weaning from M.V	BMI categories						Total		(X^2)	P value
	Underweight		Normal		Obese					
	No.	%	No	%	No	%	No	%		
1. Easy and Successful	6	6.7	21	23.3	3	3.3	30	33.3	0.15	0.928
2.Difficult	12	13.3	99	43.3	9	10	120	66.7		
Total	**18**	**20**	**120**	**66.7**	**12**	**13.3**	**150**	**100**		

Table (4): Associative relation between weight categories and degree of organ dysfunction (N= 150).

BMI / Degree of organ dysfunction	Weight categories						Total		(X^2)	P value
	Underweight n=18		Normal n= 120		Obese n= 12		No.	%		
	No	%	No	%	No.	%				
1.Mild organ dysfunction	18	100	90	70	9	75	117	76.7	2.54	0.637
2.Moderate organ Dysfunction	0	0	15	15	3	25	18	20		
3.Severe organ Dysfunction	0	0	15	15	0	0	15	3.3		
Total	**18**	**100**	**120**	**100**	**12**	**100**	**150**	**100**		

Table (5): Correlation between Age. Days of Mechanical Ventilation, Mean SOFA Sores, Mean BWAP Scores, and Length of ICU Stay, (N= 150).

Variables		Age	Days of Mechanical Ventilation	Mean SOFA	Mean BWAP
Age	r: p:				
Days of Mechanical Ventilation	r: p:	0.193 0.306			
Mean SOFA Scores	r: p:	0.009 0.962	-0.189 0.317		
Mean BWAP Scores	r: p:	0.207 0.272	-0.115 0.544	-0.663 0.000**	
Length of ICU stay	r: p:	-0.013 0.947	0.836 0.000**	-0.362 0.049**	0.062 0.745

Table (6): One Way ANOVA for Comparison of mean BURN score, Mean SOFA score, and Mean length of ICU stay in relation to BMI categories (N= 150):

$\bar{x}$ ± SD / BMI	Patient's outcomes		
	BWAP scores ± SD$\bar{x}$	SOFA scores ± SD$\bar{x}$	Length of ICU stay ± SD$\bar{x}$
1. Obese	9.05 ± 4.64	6.425 ± 1.7	13 ± 7.53
2. Normal	10.46 ± 3.32	6.64 ± 3.95	15.55 ± 13.16
3. Underweight	11.53 ± 2.93	5 ± 1.77	16 ± 9.53
Total	10.49 ± 3.39	6.28 ± 3.39	15.3 ± 11.65
F. test	0.631	0.519	0.087
P. value	0.540	0.601	0.917

Table (7): Relationship between mode of mechanical ventilation and Mortality Rate among the Studied Patients (N= 150).

Mode of Mechanical Ventilator / Mortality Rate	Mode of mechanical ventilator				Total		(X^2)	P value
	CMV* n = 120		CPAP* n = 30		No.	%		
	No.	%	No.	%				
1.Died	90	69.57	21	57.14	111	66.7	**0.373**	**0.542**
2.Survived	30	30.43	9	42.86	39	33.3		
Total	**120**	**100**	**30**	**100**	**50**	**100**		

*CMV: Controlled Mandatory Ventilation **CPAP: Continuous Positive Airway Pressure

Discussion

The current study revealed that two-thirds of patients had within normal BMI This was in line with that of Girard et al., (2022In contrast, Halasz et al., (2021) revealed the presence of obesity and overweight among nearly two thirds of the studied sample.

Concerning BMI and frequency of organ dysfunction; the current study revealed no significant statistical relation between BMI and organ dysfunction. In-spite of having the BMI of two thirds of studied sample within normal. In this regard, Lakkis and Weir, (2018) found a significant relationship between obesity and the development of acute kidney injury (AKI). Moreover, Panitchote et al., (2019) conducted study on 357 critically ill patients and revealed that BMI is a possible indicator of AKI. AKI was associated with BMI, heart failure, and peak airway pressure .

From the investigator's point of view, the more BMI, the worse the body functions. Obese patients are at high risk for occurrence of atherosclerosis, hypertension and diabetes mellitus leading to alteration of the blood supply to the tissues. In this regard, Schetz et al., (2019) reported that obesity elevates the risk of many

diseases as hypertension, hyperlipidemia, type II diabetes mellitus, and coronary heart disease.

As regards BMI and ICU length of stay; The current study revealed no significant statistical relationship between body mass index (BMI) and ICU length of stay among the studied sample. This finding is in congruence with that of Kooistra et al, (2022) who found no statistically significant differences in ICU/hospital LOS were present between the different BMI categories. In contrast Elmhiregh et al, (2022) conducted a study and revealed that, obesity was associated with increased total hospital stay which could be explained by various comorbid conditions associated with obesity.

Consequently, the current study revealed no significant statistical relation between BMI and mechanical ventilation weaning trials. This finding is in congruence with that of Al-Banna, Morsy, Feky & Abdelmohsen, (2016) who found no differences in the duration of mechanical ventilation, or weaning in relation to body mass index categories.

Concerning BMI and weaning from mechanical ventilation; The current study delineated that, two thirds of patients had difficult weaning from mechanical ventilators. This finding is in line with Jiang, et al, (2014) who revealed difficult weaning among the majority of the studied sample. In contrast, Nikitas et al, (2022) revealed that more than half of patients has a successful weaning from mechanical ventilator.

As well, it was noticed that the highest percentages of difficult weaning (in the current study) among patients who had within normal BMI followed by the underweight patients. On the same line with this finding was that of Soh. et al, (2014) who revealed that low BMI might be associated with delayed ventilator weaning. In attempt to explain causes of delayed weaning from mechanical ventilation, Attiaet al., (2022) indicated that weaning patients from MV is influenced by a wide range of characteristics, including age, education level, occupation, medical diagnosis, BMI, smoking habits, and physical and mental health.

As regards BMI and mortality rate: the recent study showed that two-thirds of the studied sample died during their stay in the ITU. This finding may be due to having more than one-quarter of the sample admitted as a result of post-traumatic injury. In this regard, the World Health Organization (2018) revealed that, trauma is considered as the first cause of death in young adult males.

On the same line, the World Health Organization Zakeri et al., (2021) indicated that Road Traffic accidents consider one of the most critical and challenging public health issues in low- and middle-income countries.

The current study revealed no significant statistical relationship between BMI and the mortality rate. This finding is in concordance with that of Na, et al., (2019), who conducted a study and found no significant statistical relation between BMI and ICU mortality however, liver cirrhosis, malignancy, history of cardiac arrest treatment were independent predictors of 28-day mortality.

On the contrast, Alamdari et al., (2020) found that patients with BMI more than 40 had more probabilities of mortality compared to those with BMI more than 35 and concluded that a strong relation between having metabolic syndrome and elevated risk of severe complications and mortality among ICU-admitted patients.

As regards, the relationship between mortality rate and modes of mechanical ventilation, the recent

study revealed that the highest frequency of death was found among patients who were on controlled mandatory ventilation mode. This may be attributed to patients' dependence on mechanical ventilation and difficult weaning. In this regards Lanspa, et al (2019) found that tidal volume was linked with 30-day mortality whereas driving pressure was not.

Finally, the current study clarified no significant statistical relation between BMI, mean BWAP score, mean SOFA score, and length of ICU stay value. These findings are in agreement with that of Al-Banna et al., (2016) who found no differences in the mechanically ventilated patients' outcomes based on BMI categories. Unexpectedly. Jong, Verzilli & Jaber, (2019) found that, obese patients with acute respiratory distress syndrome have a similar prognosis or better than non-obese patients.

To conclude the ICU nurse has an significant role in the provision of optimum nursing care tor critically ill mechanically ventilated patients. As one of the multidisciplinary team the nurse can play an important role in the nutritional care process which starts with assessment of critically ill patients' nutritional status, and ends with evaluating patients' outcomes (Koontalay, Sangsaikaew & Khamrassame, 2020).

Conclusion

It can be concluded based on the study findings that, in spite of the importance of BMI as an indicator of nutritional status, the current study revealed no significant statistical relationship between BMI and selected mechanically ventilated patients' outcomes. In addition, the current study revealed that, the highest percentages of death were found among patients who were in the age group of 40-60 years, males, had within normal BMI, on CMV mode, and admitted with surgical, neurological, and cardiovascular emergencies. Unexpectedly, the greatest mean length of ICU stay was found among the underweight patients.

Recommendations

Replication of the study on a larger probability sample selected from different geographical areas in Egypt is recommended to obtain more generalizable data.

References

Alamdari, N. M., Rahimi, F. S., Afaghi, S., Zarghi, A., Qaderi, S., Tarki, F. E., ... & Besharat, S. (2020). The impact of metabolic syndrome on morbidity and mortality among intensive care unit admitted COVID-19 patients. Diabetes & Metabolic Syndrome: Clinical Research & Reviews, 14(6), 1979-1986.

Al-Banna, M. M., Morsy, W. Y. M., El-Feky, H. L., & Abdelmohsen, A. H. (2016). Mechanical ventilation: relationship between body mass index and selected patients' outcomes at a university hospital in Cairo. Journal of Education and Practice, 172(2), 173-177.

Arrar, A. A., & Mohammed, S. J. (2020). Effectiveness of an Educational Program on Nurses' Knowledge and Practices Concerning Nursing Care for Critically–Ill Patients at Critical Care Units in Misan Governorate Hospitals. Medico-Legal Update, 20(3), 557-563.

Attia, A. A. E., Abdullatif, D. A., Mohamed, S., & AbdElGhany, D. (2022). Factors Affecting Weaning of Mechanically Ventilated Patients. Egyptian Journal of Health Care, 13 (2).82-97.

Bissett, B., Gosselink, R., & Van Haren, F. M. (2020). Respiratory muscle rehabilitation in patients with prolonged mechanical ventilation: a targeted approach. Annual Update in Intensive Care and Emergency Medicine 2020, 595-609.

Carter, C., Osborn, M., Agagah, G., Aedy, H., & Notter, J. (2020). COVID-19 disease: invasive ventilation. Clinics in Integrated Care, 1, 100004.

Cederwall, C. J., Olausson, S., Rose, L., Naredi, S., & Ringdal, M. (2018). Person-centred care during prolonged weaning from mechanical ventilation, nurses' views: an interview study. Intensive and Critical Care Nursing, 46, 32-37.

Dale, C. M., Carbone, S., Istanboulian, L., Fraser, I., Cameron, J. I., Herridge, M. S., & Rose, L. (2020). Support needs and health-related quality of life of family caregivers of patients requiring prolonged mechanical ventilation and admission to a specialised weaning centre: A qualitative longitudinal interview study. Intensive and Critical Care Nursing, 58, 102808.

de Koning, M. S. L. Y., Koekkoek, W. A. C., Kars, J. C. N., & van Zanten, A. R. H. (2020). Association of protein and caloric intake and clinical outcomes in adult septic and non-septic ICU patients on prolonged mechanical ventilation: the PROCASEPT Retrospective Study. Journal of Parenteral and Enteral Nutrition, 44(3), 434-443.

Elmhiregh, A., Ahmed, A. F., Dabboussi, A. M., Ahmed, G. O., Abdelrahman, H., & Ibrahim, T. (2022). The impact of obesity on polytraumatized patients with operatively treated fractures. Injury.

Elshimy, A., Shash, R., & Seddik, A. (2015). Effectiveness of Adjunctive Inhaled Colistin in Treatment of Ventilator Associated Pneumonia. Egypt. J. Med. Microbiol, 24, 23-30.

Escalon, M. X., Lichtenstein, A. H., Posner, E., Spielman, L., Delgado, A., & Kolakowsky-Hayner, S. A. (2020). The effects of early mobilization on patients requiring extended mechanical ventilation across multiple ICUs. Critical Care Explorations, 2(6).

Girard, L., Djemili, F., Devineau, M., Gonzalez, C., Puech, B., Valance, D., ... & Vidal, C. (2022). Effect of body mass index on the clinical outcomes of adult patients treated with venoarterial ECMO for cardiogenic shock. Journal of Cardiothoracic and Vascular Anesthesia, 36(8), 2376-2384.

Halasz, G., Leoni, M. L., Villani, G. Q., Nolli, M., & Villani, M. (2021). Obesity, overweight and survival in critically ill patients with SARS-CoV-2 pneumonia: is there an obesity paradox? Preliminary results from Italy. European Journal of Preventive Cardiology, 28(9), e15-e17.

Jiang, J. R., Yen, S. Y., Chien, J. Y., Liu, H. C., Wu, Y. L., & Chen, C. H. (2014). Predicting weaning and extubation outcomes in long-term mechanically ventilated patients using the modified B urns W ean A ssessment P rogram scores. Respirology, 19(4), 576-582.

Jong, A. D., Verzilli, D., & Jaber, S. (2019). ARDS in obese patients: specificities and

management. Annual Update in Intensive Care and Emergency Medicine 2019, 71-84.

Kooistra, E. J., Brinkman, S., van der Voort, P. H., de Keizer, N. F., Dongelmans, D. A., Kox, M., & Pickkers, P. (2022). Body mass index and mortality in coronavirus disease 2019 and other diseases: A cohort study in 35,506 ICU patients. Critical care medicine, 50(1), e1.

Koontalay, A., Sangsaikaew, 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, 14(1), 17-23.

Lakkis, J. I., & Weir, M. R. (2018). Obesity and kidney disease. Progress in cardiovascular diseases, 61(2), 157-167.

Lanspa, M. J., Peltan, I. D., Jacobs, J. R., Sorensen, J. S., Carpenter, L., Ferraro, J. P., ... & Grissom, C. K. (2019). Driving pressure is not associated with mortality in mechanically ventilated patients without ARDS. Critical Care, 23(1), 1-8.

Minton, C., & Batten, L. (2016). Rethinking the intensive care environment: considering nature in nursing practice. Journal of clinical nursing, 25(1-2), 269-277.

Moore, C. J. (2020). Mechanical Ventilation: Weaning Process (Respiratory Therapy). Elsevier.

Na, S. J., Park, T. K., Lee, J. M., Song, Y. B., Choi, J. O., Hahn, J. Y., ... & Yang, J. H. (2019). Association between body mass index and mortality in patients requiring cardiac critical care. Circulation Journal, CJ-18.

Ni, Y. N., Luo, J., Yu, H., Wang, Y. W., Hu, Y. H., Liu, D., ... & Liang, Z. A. (2017). Can body mass index predict clinical outcomes for patients with acute lung injury/acute respiratory distress syndrome? A meta-analysis. Critical care, 21(1), 1-10.

Nikitas, G. T., Kykalos, S., Ntikoudi, E., Vasileiadis, I., Koutsoukou, A., & Nikiteas, N. I. (2022). A Novel Non-invasive Index of Cardiopulmonary Reserve for the Prediction of Failure of Weaning From Mechanical Ventilation. Cureus, 14(7).

Panitchote, A., Mehkri, O., Hastings, A., Hanane, T., Demirjian, S., Torbic, H., ... & Duggal, A. (2019). Factors associated with acute kidney injury in acute respiratory distress syndrome. Annals of intensive care, 9(1), 1-10.

Pham, T., Brochard, L. J., & Slutsky, A. S. (2017). Mechanical ventilation: state of the art. In Mayo Clinic Proceedings (Vol. 92, No. 9, pp. 1382-1400). Elsevier.

Rak, K. J., Ashcraft, L. E., Kuza, C. C., Fleck, J. C., DePaoli, L. C., Angus, D. C., ... & Kahn, J. M. (2020). Effective care practices in patients receiving prolonged mechanical ventilation. An ethnographic study. American journal of respiratory and critical care medicine, 201(7), 823-831.

Schetz, M., De Jong, A., Deane, A. M., Druml, W., Hemelaar, P., Pelosi, P., ... & Jaber, S. (2019). Obesity in the critically ill: a narrative review. Intensive care medicine, 45(6), 757-769.

Soh, S., Park, J. H., Kim, J. M., Lee, M. J., Koh, S. O., Paik, H. C., ... & Na, S. (2014). Predicting Delayed Ventilator Weaning

after Lung Transplantation: The Role of Body Mass Index. The Korean journal of Critical Care Medicine, 29(4), 273-280.

World Health Organization. (2018), Global Status Report on Road Safety 2018. World Health Organization; Geneva, Switzerland: 2018. [(accessed on 22 august 2022)]. Availableonline: http://www.who.int/violence_injury_prevention/road_safety_status/2018/en/

Zakeri, R., Nosratnejad, S., Sadeghi-Bazargani, H., Dalal, K., & Yousefi, M. (2021). The economic burden of road traffic injuries until one-year after hospitalization: A survey study. Accident Analysis & Prevention, 163, 106459.