Nursing Assessment for Predictors of Failed Weaning Among Prolonged Mechanically Ventilated Patients

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Abstract

Background: For adult patients with prolonged mechanical ventilation (PMV≥7 days), weaning success is an important prognostic factor in patients requiring prolonged mechanical ventilation. Weaning failure has been attributed to various factors. The **aim:** of the study was to identify factors contributing to long term mechanical ventilation. **A Descriptive research design** was adopted to conduct this study. The study was conducted in the intensive and trauma care units at Assuit university. **A convenient sample:** of sixty adult male and female patients admitted to mentioned settings and connected to MV. **Tools:** Tool one: socio-gemograghic data and clinical data, Tool two: weaning criteria scale, Tool three APACHE II score Tool four: Neurological assessment by using FOUR score. **Results**: the most common risk factors delay weaning were cardiovascular (66%) and neuromuscular (54.2%). **Conclusion:** a highly statistically significant relation was found regarding to factors as age, length of ICU stays, RSBI, PH, hemoglobin, WBCs, platelets count and respiratory rate. **Recommendations**: 1-good monitoring of the cardiovascular assessment with cardiologists 2- the weaning indexes have some limitations, related to study population 3- integration with other departments should be morely supported.

Key words: Failed Weaning, Weaning Failure, Prolonged Mechanical Ventilation & Predictors.

Introduction

Mechanical ventilation is a lifesaving intervention, but it is not without complications. Most patients require short periods of respiratory support, but minority require prolonged MV. Shortening the ventilator time has shown to reduce ventilator-related complications **(Andres & Jorge, 2018).**

Weaning is an essential and universal element in the care of critically ill intubated patients. Weaning covers the entire process of gradual withdrawal and liberating the patient from mechanical support and from the endotracheal tube, and it comprises at least 40% of the total duration of MV **(Hossam, et al., 2016).**

The ultimate goal of caring for patients using mechanical ventilator is to obtain spontaneous breathing and successful weaning off the ventilator. Weaning process requires a multidisciplinary care team, including the anesthesiologist, respiratory therapist, physical therapist, nutritionists and nurses have the coordinating role in this team **(Ali, et al., 2015).**

The decision to attempt discontinuation of mechanical ventilation has largely been based on the clinician's assessment **(Hala & Wegdan, 2016).** Commonly, factors affecting the decision making include the verification of hemodynamic stability, resolution of primary cause for which the patient was intubated, cardiovascular stability, no continuous sedation and adequate oxygenation defined as paO2/FiO2of at least 150 mmHg with positive end-expiratory pressure (PEEP) up to 8 cmH2O, nutritional status, mental and cognitive status (**Mariana, et al., 2018)** these criteria should be thought of as considerations rather than as rigid thresholds that patients must meet all of them to be successfully weaned. Because many patients were successfully discontinued from the ventilator although they didn't meet one or more of them **(Hossam, et al., 2016).**

A new classification of patients into three groups is proposed, as suggested by Brochard during the International Consensus Conference, according to the difficulty and length of the weaning process Simple weaning Patients who proceed from initiation of weaning to successful extubation on the first attempt without difficulty, Difficult weaning Patients who fail initial weaning and require up to three spontaneous breathing trial (SBT) or as long as 7 days from the first SBT to achieve successful weaning and Prolonged weaning: Patients who fail at least three weaning attempts or require more than 7 days of weaning after the first SBT **(Adel, et al., 2017).**

Prolonged mechanical ventilation is variously defined as need for positive pressure ventilation for more than 3 days as **(patricia & Dorrie, 2018)** or 7 days as **(Béduneau, et al., 2017)** or for more than 14 days as **(Guillermo, et al., 2016) (Hough, et al., 2015)** or for more than 21 days as regard for **(Loss, et al., 2015).**

weaning success is an important prognostic factor in patients requiring prolonged mechanical ventilation. Failure to wean from mechanical ventilator is a

significant clinical and economic problem. Prolonged mechanical ventilator is associated with numerous complications including increase morbidity and mortality, increase respiratory tract problems, hemodynamic instability, cardiovascular disorder, sedatives dependency, skin fragility, gastrointestinal stress and reduced functional status and quality of life **(Mifsud, et al., 2016).**

provision of nursing care to the patient receiving MV requires further attention, because, if not provided properly, it can lead to complications and aggravation of the patient's clinical condition. Monitoring patients receiving ventilatory support is a factor of primary importance. Patients receiving MV require accurate nursing care, such as tracheal suction; control of the balloon (cuff) pressure of the ETT, change of decubitus; safe transportation to other hospital units; actions to prevent complications such as aspiration pneumonia or ventilator-associated pneumonia, pressure ulcers, unplanned extubation, barotrauma, and pneumothorax **(Elizabeth, et al., 2014)** Identifying strategies to reduce the duration on MV and to restore ventilatory autonomy is an immediate priority from the moment of its commencing **(Rojek, et al., 2015)** Most international researcher have attempted to find better indexes or parameters (predictors) which can predict the weaning outcome in the best possible way **(Ali, et al., 2015)** to date, results are still controversial and the best strategy has not yet been established due to the multifactorial origin of liberation from mechanical ventilation **(Elkins & Dentice, 2015)** several weaning predictors have been used in clinical practice trying to objective assist the decision making of the weaning process **(Quellette, et al., 2017).**

Over the past several years, many risk factors affect the weaning process. Factors that should be considered in all patients include misadjusted ventilator settings, infections, airway patency and respiratory muscle performance. Malnutrition, heart failure or coronary ischemia. A number of electrolyte imbalances and psychological problem **(Adel, et al., 2017).**

Significance of the study

Prolonged mechanical ventilator is associated with numerous complications including increase morbidity and mortality, increase respiratory tract problems, hemodynamic instability, cardiovascular disorder, sedatives dependency, skin fragility, gastrointestinal stress and reduced functional status and quality of life. **(Herwanto, et al., 2018).**

In 2016, the number of patients connected with mechanical ventilation at trauma intensive care unit was about (410) patients and about (320) patients at general intensive care unit. (**Assuit university hospital records, 2017**).

Hence, the purpose of this study is to identify risk factors associated with weaning failure in mechanically ventilated patients.

(Herwanto, et al., 2018).

Aim of the study

To identify the Predictors of weaning failure among prolonged mechanically ventilated patients among critically ill patient.

Research question

What are the risk factors of weaning failure among prolonged mechanically ventilated patients among critically ill patients at Assuit university hospital?

Operational definition

Prolonged mechanically ventilated patients are Patients who fail at least three weaning attempts or require more than 7 days of weaning after the first SBT.

Research Design

Descriptive research design was utilized to conduct the aim of this study.

Setting

The study was conducted in the General intensive care unit and trauma intensive care unit at Assuit university hospital.

Study Subjects

60 adult male and female patients underwent the study were admitted to the above-mentioned settings will be included in the study and failed at least 1st spontaneous breathing trial **(SBT)** or require mechanical ventilation for more than 7 days will be included in the study.

Exclusion criteria

- patient who mechanically ventilated due to malignant lung tumors, neurological disorders as myasthenia gravis, Guillain barre syndrome, brain tumors and brain stem death and patients who discharged before seven days after the first attempt of weaning were excluded from this study.

Tools

Four tools were used to collect the data in this study and developed by the researcher based on reviewing of related literature

Tool I: "patient assessment sheet"

This tool is developed by the researcher to assess the patient's demographic data and health relevant data during period of intubation and it comprised 4 parts:

Part 1: sociodemographic and clinical data which include (age, sex, weight of patient, body mass index (BMI), date of admission, medical diagnosis, length of stay and duration on mechanical ventilation)

Part 2: Hemodynamic monitoring which include (vital signs, CVP, pulsy oximeter).

Part 3: mechanical ventilator parameters which include (mode of ventilation, tidal volume, respiratory rate, fraction of inspired oxygen, pressure support, positive end expiratory pressure and Rapid shallow breathing index)

Part 4: lab investigations which include (CBC, serum electrolytes, hepatorenal function, ABG interpretation).

Tool II: weaning criteria scale

According to the international consensus conference recommendations in 2005, some of derivate criteria of readiness for weaning trial are tabled and these criteria should be thought of as considerations rather than as rigid thresholds that patients must meet all of them to be successfully weaned. Because many patients were successfully discontinued from the ventilator although they didn't meet one or more of them **(Hossam, et al., 2016).**

Tool III: Acute Physiology & Clinical Health Evaluation II (APACHE II)

APACHE II score is a severity-of-disease classification system it is one of several ICU scoring systems which applied within 24 hours of admission of a patient to an intensive care unit (ICU): The first APACHE score was presented by Knaus et al in 1981**(Knaus, et al., 1985).**

The APACHE II score is made of 12 physiological variables all ICU patients had all 12 physiologic measurements available. The worst physiological variables were collected within the first 24 hours of ICU admission. The "worst" measurement was defined as the measure that correlated to the highest number of points. The study did not continually calculate an APACHE II scores beyond the first 24 hours of ICU admission. The APACHE II score ranges from 0 to 71 points; higher scores correspond to more severe disease and a higher risk of death. however, it is rare for any patient to accumulate more than 55 points **(Michael & Lucila, 2014).**

Apache II Score / Approximate Mortality

0 to 4 points:	4% non-op, 1% post-op
5 to 9 points:	8% non-op, 3% post-op
10 to 14 points:	15% non-op, 7% post-op
15 to 19 points:	24% non-op, 12% post-op
20 to 24 points:	40% non-op, 30% post-op
25 to 29 points:	55% non-op, 35% post-op
30 to 34 points:	Approx. 73% both
35 to 100 points:	85% non-op, 88% post-op

(Mohammad, et al., 2017)

Scoring of age regarding to the APACHE scoring

Age in years	APACHE score
≤44	0
45-54	2
55-64	3
65-74	5
≥75	6

(Mohammad, et al., 2017)

Tool IV: Neurological assessment by using Full Outline of Unresponsiveness (FOUR) score

The FOUR Score is a clinical grading scale designed for use by medical professionals in the assessment of patients with impaired level of consciousness. It was developed by Eelco F.M at 2005. The FOUR Score is a 17-point scale (with potential scores ranging from 0 - 16). Decreasing FOUR Score is associated with worsening level of consciousness. The FOUR Score assesses four domains of neurological function: eye responses, motor responses, brainstem reflexes, and breathing pattern.

By contrast to the Glasco coma scale **(GCS)**, the FOUR score doesn't rely on a verbal response. In the ICU, a variety of conditions such as intubation, sedation, or delirium preclude reliable assessment of a verbal response and, therefore, the FOUR score is an attractive tool **(Wijdicks, et al, 2005).**

Score	Item
0-7	Sever
8-14	Moderate
15-16	Mild

Operational design

It includes preparatory phase, field work phase "implementation phase" and evaluation phase.

preparatory phase

after reviewing the recent related literatures, study tools were developed.

Content validity

Content validity of the developed tools was carried out by a jury of 7 specialists in the field of critical care nursing and critical care medicine, the necessary modifications were done in the first tool and we ought to change the fourth tool which was Glasgow coma scale by the full outline of un responsiveness.

The overall reliability of the tools was tested using (α) Cronbach's test for the pilot study results.

Pilot study

A pilot study was carried out before starting of data collection to test the feasibility, applicability and the clarity of the study tools on 10% (6 patients) of the sample and the necessary modifications were done. The pilot study patients were included in the study sample.

The overall reliability of the tools was tested using (α) Cronbach's test (.90) for the pilot study results.

Field work "implementation phase"

An official permission from the dean of faculty of nursing to conduct this study was delivered to the hospital authorities at Assuit university hospital and approval to conduct this study was obtained after explanation of the aims of study.

Sampling was started from the first of October 2017 until the end of August 2018.

Ethical considerations

An approval was obtained from the local ethical committee and the study followed the common ethical principles in clinical research, written consent was obtained from patient or from the responsible person for the unconscious patients after explanation of the nature and the purpose of the study, patients and their families were assured that the data of this research will not be used without second permission, confidentiality of subjects data and anonymity of patients were assured, there is no risk for study subjects during application of the study and the patient had the right to refuse to participate or withdraw from the study without any rational at any time.

Statistical analysis

The collected data were coded then transformed into coding sheets. The results were checked. Then, the data were entered into statistical packing for social science (SPSS) version (16) using personal computer. Output drafts were checked against the revised coded data for typing and spelling mistakes. Finally, analysis and interpretation of data were conducted. Descriptive statistics including frequency, distribution, mean and standard deviation were used to describe different characteristics. P-value is considered significant when $p<0.05$.

Results

Table (1): Distribution of the Sociodemographic and clinical data of patients on mechanical ventilator (n=60).

Item		Success (n= 36) Mean ± SD	Failed (n= 24) Mean ± SD	P-value
Age (years)		40.75 ± 15.86	49.54 ± 16.69	0.040*
Sex: No. (%)	male	29 (80.6%)	15 (62.5%)	0.121
	female	7 (19.4%)	9 (37.5%)	
Weight		76.47 ± 12.36	77.08 ± 15.11	0.964
Height		170.89 ± 8.38	167.71 ± 8.26	0.059
Body Mass Index		26.04 ± 2.51	27.26 ± 4.16	0.473
Primary diagnosis:	Respiratory	7 (19.4%)	6 (25.0%)	0.609
	CVS	4 (11.1%)	8 (33.3%)	0.050*
	Neurological	17 (47.2%)	4 (16.7%)	0.015*
	Surgical	5 (13.9%)	4 (16.7%)	1.000
	Hepatorenal	3 (8.3%)	2 (8.3%)	1.000

Table (2): comparison between the succeed and failed groups in relation to parameters of mechanical ventilator (n=60)

Item		Success (n= 36) Mean ± SD	Failed (n= 24) Mean ± SD	P-value
Tidal volume (Vt)	1st day on MV	471.56 ± 58.38	448.75 ± 59.06	0.124
	7th day on MV	451.33 ± 60.16	479.17 ± 42.32	0.058
	Last day on MV	442.78 ± 40.43	471.87 ± 37.96	0.002*
Respiratory rate (F)	1st day on MV	13.61 ± 1.95	14.46 ± 3.83	0.994
	7th day on MV	15.64 ± 3.97	18.42 ± 7.51	0.432
	Last day on MV	17.89 ± 4.11	28.04 ± 6.67	0.000*
Pressure support (PS)	1st day on MV	17.56 ± 9.11	13.33 ± 5.33	0.082
	7th day on MV	14.56 ± 8.47	17.25 ± 5.62	0.001*
	Last day on MV	11.69 ± 5.10	18.33 ± 4.67	0.000*
Fio_2	1st day on MV	51.81 ± 11.72	51.21 ± 10.95	0.901
	7th day on MV	41.11 ± 9.86	48.54 ± 11.84	0.002*
	Last day on MV	35.56 ± 3.11	48.12 ± 10.30	0.000*
PEEP	1st day on MV	7.06 ± 2.18	6.21 ± 1.72	0.150
	7th day on MV	5.97 ± 2.31	7.71 ± 2.03	0.003*
	Last day on MV	5.47 ± 1.83	8.21 ± 1.38	0.000*

PEEP *positive end expiratory pressure* ***Fio_2*** *fraction of inspired oxygen*

Table (3): Mean distribution of succeed and failed patients regarding to Arterial blood gases.

Item		Success (n= 36)	Failed (n= 24)	P-value
		Mean ± SD	Mean ± SD	
PH	1st day on MV	7.39 ± 0.10	7.34 ± 0.14	0.230
	7th day on MV	7.45 ± 0.05	7.41 ± 0.11	0.322
	Last day on MV	7.45 ± 0.05	7.38 ± 0.11	0.008*
$PaCO_2$	1st day on MV	37.08 ± 11.54	41.58 ± 14.35	0.186
	7th day on MV	38.33 ± 7.88	41.08 ± 10.26	0.209
	Last day on MV	37.44 ± 7.43	40.25 ± 8.75	0.183
PaO_2	1st day on MV	123.94 ± 63.48	135.08 ± 76.73	0.546
	7th day on MV	127.69 ± 45.17	135.54 ± 78.79	0.821
	Last day on MV	122.61 ± 34.15	121.08 ± 44.60	0.769
HCO_3	1st day on MV	22.49 ± 5.53	22.14 ± 4.97	0.958
	7th day on MV	26.23 ± 5.94	24.99 ± 5.80	0.424
	Last day on MV	25.58 ± 5.29	25.26 ± 5.57	0.803
SaO_2	1st day on MV	94.31 ± 7.29	94.36 ± 11.62	0.559
	7th day on MV	96.49 ± 4.53	95.12 ± 6.37	0.234
	Last day on MV	97.35 ± 2.16	94.29 ± 5.95	0.001*

Ph *power hydrogen ion,* ***$PaCO_2$*** *Partial pressure of carbon dioxide,* ***PaO_2*** *pressure of oxygen* ***HCO_3*** *concentration of bicarbonate* ***SaO2*** *Oxygen saturation*.

Table (4): Percentage distribution of studied patients as regard to Weaning criteria scale for all patient (n=60).

Item		Success (n= 36)		Failed (n= 24)		P-value
		No.	%	No.	%	
Subjective assessment	Adequate cough	8	22.2	3	12.5	0.500
	No neuromuscular blocking agent	35	97.2	18	75.0	0.018*
	Absence of excessive secretion	7	19.4	4	16.7	1.000
	Reversal of the underlying cause	27	75.0	5	20.8	0.000*
	No adequate sedation	36	100.0	21	87.5	0.059
Objective measures	Stable cardiovascular status	30	83.3	15	62.5	0.068
	Heart rate ≤ 140 beat/ minute	33	91.7	20	83.3	0.422
	No active myocardial ischemia	36	100.0	21	87.5	0.059
	Adequate hemoglobin level ≥8 g/dl	33	91.7	17	70.8	0.073
	Systolic Blood pressure 90-160 mmhg	36	100.0	19	79.2	0.008*
	Afebrile 36-38℃	22	61.1	12	50.0	0.395
	No or minimal vasopressor ≤5micro/ kg/minute	35	97.2	17	70.8	0.005*
Adequate oxygenation	Tidal volume ≥ 5 ml/ kg	35	97.2	17	70.8	0.005*
	Respiratory rate ≤25/minute	35	97.2	21	87.5	0.292
	Pao2≥ 60	36	100.0	19	79.2	0.008*
	Paco2≤ 60	36	100.0	21	87.5	0.059
	PEEP≤ 8 cmH2o	33	91.7	17	70.8	0.073
	PH ≥ 7.30	36	100.0	18	75.0	0.003*
	Sa02 ≥ 90%	33	91.7	17	70.8	0.073

SaO2 *Oxygen saturation.*

Table (5): Relationship between duration on mechanical ventilation and incidence of risk factors contributing to delay weaning for all patient (n=60).

Item		Duration on MV	P-value
		Mean ± SD	
Infections	Yes	16.73 ± 16.41	0.025*
	No	10.26 ± 4.54	
Respiratory disorder	Yes	13.64 ± 12.31	0.216
	No	9.60 ± 3.25	
C.V.S disorder	Yes	13.19 ± 13.10	0.677
	No	12.00 ± 7.85	
Electrolyte disturbance	Yes	9.83 ± 3.87	0.105
	No	14.50 ± 13.46	
Neuromuscular dysfunction	Yes	11.06 ± 3.99	0.467
	No	13.31 ± 12.75	
Nutritional disorder	Yes	14.05 ± 13.12	0.171
	No	10.00 ± 3.44	
Renal impairment	Yes	10.52 ± 7.98	0.207
	No	14.14 ± 12.46	
Hepatic impairment	Yes	14.91 ± 10.78	0.448
	No	12.12 ± 10.96	

Table (6): Relationship between length of stay and incidence of risk factors contributing to delay weaning for all patient (n=60).

Item		Length of ICU stay	P-value
		Mean ± SD	
Infections	Yes	18.59 ± 18.83	0.037*
	No	11.68 ± 5.15	
Respiratory disorder	Yes	15.13 ± 14.09	0.326
	No	11.47 ± 3.78	
C.V.S disorder	Yes	14.72 ± 15.34	0.741
	No	13.64 ± 8.13	
Electrolyte disturbance	Yes	10.96 ± 4.79	0.097
	No	16.39 ± 15.25	
Neuromuscular dysfunction	Yes	12.11 ± 4.11	0.394
	No	15.12 ± 14.56	
Nutritional disorder	Yes	15.54 ± 15.02	0.265
	No	11.76 ± 4.00	
Renal impairment	Yes	12.16 ± 8.39	0.282
	No	15.69 ± 14.57	
Hepatic Impairment	Yes	15.36 ± 11.50	0.738
	No	13.96 ± 12.71	

Table (7): Assessment of predictors of weaning at the 7th day of mechanical ventilation & APACHE score, RSBI and FOUR score

Item		Success (n= 36)	Failed (n= 24)	P-value
		Mean ± SD	Mean ± SD	
APACHE score		17.69 ± 4.19	18.29 ± 5.92	0.694
RSBI		41.47 ± 8.52	60.40 ± 16.44	0.000*
FOUR score	1st day on MV	7.91 ± 3.55	7.17 ± 3.48	0.380
	7th day on MV	11.39 ± 2.40	8.57 ± 3.60	0.002*
	Last day on MV	13.14 ± 1.03	9.14 ± 3.85	0.000*

Table (8) summary of possible factors considered predictors for weaning failure from mechanical ventilator.

Item		Failed weaning Mean±SD	P value
Age		49.54±16.69	0.04
Sex	**Male no %**	15&62.5%	0.121
	Female no %	9&37.5%	
APACHE		18.29±5.92	0.694
RSBI		60.40±16.44	0.000
FOUR		8.57±3.60	0.002
Pao2		121.08±44.60	0.769
Paco2		40.25±8.75	0.183
Ph		7.38±.11	0.008
Albumin		1.85±.66	0.001
Creatinine		113.12±61.74	0.645
Hemoglobin		9.31±1.5	0.008
WBCs		15.37±4.20	0.001
Platelets		150.92±82.39	0.000
Heart rate		115.58±23.04	0.634
Respiratory rate		28.04±6.67	0.000
Length of ICU stay		16.22±15.34	0.005
Duration on MV		13.61±13.54	0.792

Table (1): This table represents the Sociodemographic and clinical data of patients on mechanical ventilator, it was noticed that there was a significant difference between the both groups as regard to age p= (.040). As regard to weight, height and body mass index it was found that there was no significant difference among both groups. Concerning the primary diagnosis for initiation of mechanical ventilation, there was significance difference with cardiovascular and neurological cause among the both groups success and failed weaning.

Table (2): this table clarifies that ventilator parameters values show a significant statistical difference (p=0.005, 0.000, 0.000, 0.000 and 0.000) found between both groups in relation to (Vt, F, PS, FIO_2 and PEEP) respectively at the last day on mechanical ventilator. As for, the 7^{th} day on ventilator there was a high significant difference among both group in relation to (PS, FIO_2 and PEEP) with (p=0.001, 0.002 and 0.003) respectively. Concerning the 1^{st} day on ventilator there was no significant difference among both groups regarding all ventilator parameters.

Table (3): This table revealed that there was no statistical difference between both groups in relation to $paco_2$, pao_2 and Hco_3 in all days (1^{st}, 7^{th} and last day on MV). But it noticed that there were a highly significant difference regard PH and Sao_2 at the last day on MV with (p=0.008&0.001) respectively.

Table (4): This table reflects the percentage distribution of the weaning criteria sale studied groups at the 7^{th} day on MV. The table shows that there was a significant difference in relation to subjective assessment in No neuromuscular blocking agent and Reversal of the underlying cause with (p=0.018&0.000) respectively. Concerning to objective measures, there were a significant difference regarding to systolic Blood pressure 90-160 mmhg and no or minimal vasopressor ≤5micro/ kg/minute with (p=0.008 &0.005) respectively. According to adequate oxygenation there were significant differences between both groups related to tidal volume ≥ 5 ml/ kg, Pao2≥ 60 and PH ≥ 7.30 with (p= 0.005,0.008 and 0.003) respectively.

Table (5): Denotes relationship between duration on mechanical ventilation and incidence of risk factors contributing to delay weaning for all patients, it was found that there was a significant difference between patients regarding to the incidence of infections with (p=0.025).

Table (6): Denotes relationship between length of stay and incidence of risk factors contributing to delay weaning for all patients, it was found that there was a significant difference between patients regarding to the incidence of infections with (p=0.037).

Table (7): This table demonstrates no significant difference between both groups regarding to the APACHE score system (p=0.694) on admission. As regard FOUR score and RSBI score it was noticed that there was a statistically significant difference with (p=0.000).

Table (8): This table summarized some of risk factors contributing to long term mechanical

ventilation and there was significant difference between both groups in relation to considered risk factors.

Discussion

Based on the results of the present study; the mean age in group I was smaller than the mean age in group II with statistically significant difference between both groups with. this result is in line with **(Yasuyuki, 2018)** and **(Hong, et al., 2017)** who found that there was significant difference with regarding to age

(Alaa, et al., 2013) (Hoda, et al., 2016) disagree with the results of this study and said that there was no significant difference between success and failed groups regarding to age in success and failed groups.

Both groups were matched according to sex and body mass index showing no statistically significant difference. These findings were supported by **(Adel, et al., 2017) & (Boniatti, et al., 2015)** who found that there was no significant difference between both groups as regard to sex and body mass index.

As regard primary diagnosis during ICU admission, the current study clarifies that the majority of patient were primarily diagnosed as cardiovascular and neurological disorder. This result is confirmed with **(Cécile, et al., 2017)** who found that there was a significant difference according to cardiovascular and neurological causes. But, **(Boniatti, et al., 2015)** disagree with the current result as they found the significant difference matched with surgical causes and **(Hong, et al., 2017)** found that the significant difference related to the respiratory and cardiovascular causes.

The present study illustrated the ventilator parameters showing significant difference related to pressure support and fraction of inspired oxygen. This result is confirmed by **(Ya-chun, et al., 2018)** who found a significant difference regarding to fraction of inspired oxygen and it disagreed with (**Yvon, et al., 2012)** who report no significant difference related to pressure support and fraction of inspired oxygen.

As regard tidal volume, the current study showed that the succeed group had a higher tidal volume than the failed group and this result agree with **(Sarah, et al., 2014)** who reported higher tidal volume in succeed group. But, this result mismatched with **(Ali, et al., 2015)** & **(Ahmed, et al., 2018)** who reported that there was no significant difference related to tidal volume for the succeed group.

In relation to PEEP, the present study reported that the failed group patients showed a higher PEEP than the succeed group and this result disagree with (**Yvon, et al., 2012)** who showed that is no significant difference related to PEEP among both groups.

The present study added that regarding to arterial blood gases there was a significant difference between both groups related to pH. and no statistical difference concerning to partial pressure of oxygen, carbon dioxide and bicarbonate. And this result supported with **(Hala & Wegdan, 2016)** who revealed a significant difference related to PH without difference according to pao2 and paco2. But, **(Viviane, et al., 2014)** & **(Sarah, et al., 2014)**. mentioned the significant difference related to partial pressure of carbon dioxide and this is conflicted with the results of the of the current study.

Regarding to oxygen saturation, this current study demonstrates that the failed group had a lower oxygen saturation than the succeed group and this result is in the same line with **(Mohamed, et al., 2014)** who found that the failed group had a lower oxygen saturation than succeed group. but (**Daniela, et al., 2016)** mentioned that there was no significant difference between both groups as regard to oxygen saturation

The current study applied the weaning criteria scale at the 7^{th} day on mechanical ventilator and demonstrated that there was a significant difference related to subjective assessment regarding to reversal of under lying cause and no neuromuscular blocking agents. According to objective measures, the significant difference was found related to systolic blood pressure 90-160 mmhg and no or minimal vasopressor ≤5 micro /kg /minute. As for, adequate oxygenation, the significant difference was found in relation to tidal volume≥ 5ml /kg, pao2 ≥ 60% and PH ≥ 7.30.

Difficult weaning from mechanical ventilator proved to be multifactorial. In the present study, risk factors that found to be responsible for failure of weaning trials were respiratory disorder which detected in 45 patients (75%) of total patients in both groups (n=60), nutritional disorders noticed in 39 patients (65%), cardiovascular disorder detected in 27 patients (45%), hepato-renal impairment detected in 36 patients (60%), electrolytes and trace elements disturbance 24 patients (40%), infection (pulmonary and extrapulmonary) detected in 22 patients (36.66%), and neuromuscular disorders presented 18 patients (30%).These results matches with the result of **(Yehia, et al., 2013)** who mentioned that risk factors that found to be responsible for failure of weaning trials were as regard to previous study (69.1%, 87%, 58%, 48%, 83.8, 100% and 45%) respectively.

In relation to duration of MV & length of ICU stay and occurrence of factors leading to difficult weaning, the current study revealed that increasing the duration on mechanical ventilation and length of ICU stay leading to increase the incidence of infections (pulmonary and extrapulmonary) this

result was in the same line with **(Boniatti, et al., 2015)** who mentioned that there was significant difference related to infection. regarding to respiratory, cardiovascular, electrolytes, neuromuscular, nutritional, renal and hepatic factors (complications) the present study show no significant difference between both groups. But, **(Vivek, et al., 2017)** disagreed with the present study as they found a significant difference related to respiratory, neuromuscular, cardiovascular, renal, and electrolytes complications.

The present study demonstrated that the success group had a shorter length of ICU stay and this result is on line with **(Mohamed, et al., 2014)** and **(Yasuyuki, 2018)** who found that the length of ICU stay had a significant difference between the both groups. But they disagree with the results of current study concerning the duration on mechanical ventilation as the current study show no statistically significant difference related to duration of mechanical ventilation.

Concerning the results of current study, there was no significant difference related to APACHE score between both groups and this result is supported by **(Ya-chun, et al., 2018)** who found that there was no significant difference related to the APACHE score with. but **(Vasilios, et al., 2011)** disagree with the results who found significant difference related to it.

In relation to weaning predictors, this study found that there was significant difference among both groups related to recurrent spontaneous breathing trials and FOUR score and this is confirmed with **(Said, et al., 2016), (Hala & Wegdan, 2016)** & **(Yehia, et al., 2013)** who found significant difference among the both groups. **(Ahmed, et al., 2018)** & **(Alaa, et al., 2013)** disagree with the current study as they found no significant difference regarding to RSBI among both groups.

Conclusion

a highly statistically significant relation was found regarding to factors as age, length of ICU stays, RSBI, PH, hemoglobin, WBCs, platelets count and respiratory rate.

Recommendations

1-good monitoring of the cardiovascular assessment with cardiologists

2- the weaning indexes have some limitations, related to study population

3- integration with other departments should be morely supported.

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