Zagazig University Medical Journal
www.zumj.journals.ekb.eg

DOI:10.21608/zumj.2019.15367.1377 *Chest*

ORIGINAL ARTICLE

Assessment of Weaning Practice In Mechanically Ventilated Chronic Obstructive Pulmonary Disease Patients at Respiratory Intensive Care Unit of Zagazig University Hospitals

Mohammed Awad Ibrahim [1],Waheed M.Shouman [1] , Mohamed Hassan Farouk[*1], Abeer Elhawary[1]

[1]*Chest Department, Faculty of Medicine, Zagazig University, Zagazig, Egypt*

*** Corresponding Author:**
Mohamed Hassan Farouk.
Chest Department, Faculty of Medicine, Zagazig University, Zagazig, Egypt.
E-mail:
mohammedhasssanba573@gmail.com

Submit Date: 10-07-2019
Revise Date: 21-07-2019
Accept Date: 22-07-2019

ABSTRACT

Background: Chronic obstructive pulmonary disease is a significant disease which can affect public health and classified as 3rd cause of death ,and described as a preventable and treatable disease associated with air flow limitation which is not completely reversible. 40% to 50% of the duration of the mechanical ventilation (MV) support period can be spent in weaning. So the target of this study to evaluate weaning practice in mechanically ventilated patients with COPD disease due to acute exacerbation. **Methods:** 24 COPD patients admitted to the ICU due to hypercapnic respiratory failure and who required invasive positive pressure mechanical ventilatory support were eligible for enrollment. After the acute phase, all eligible patients were subjected to an initial weaning trial. **Results:** As regard previous history of ventilator support and source of referral there was statistically non significant difference between the patients who failed and succeed weaning. As regard ventilator machine trade name there was statistically non significant difference for weaning success. There was statistically non-significant difference for weaning success regarding diaphragmatic ultrasound parameters (TDI, End inspiratory TDI and end expiratory TDI), but regarding diaphragmatic excursion there was significant difference. As regard Pi max and PaO_2/FiO_2 there was statistically significant difference for weaning success but regarding rapid shallow breathing index (RSBI) there was statistically non-significant difference. There was statistically non-significant difference for weaning success as regard method of weaning. **Conclusion:** Weaning success is very high in specialized tertiary ICU; 91.7%. Pimax, P_aO2/ FIO_2 and diaphragmatic excursion are a good predictor for weaning success.

Keywords: COPD, mechanical ventilation, weaning

INTRODUCTION

COPD is a preventable and treatable disease associated with persistent respiratory symptoms and airflow limitation due to airway and/or alveolar abnormalities this means that alveolar affection not present in all cases, mostly caused by exposure to harmful particles or gases(1). COPD exacerbations characterized by acute worsening of respiratory symptoms resulting in additional therapy. The chief purpose of MV in a COPD patient is to maintain gas exchange while measures are taken to correct respiratory failure whatever the cause and to provide respiratory muscle rest.(2).Weaning categories and subgroups of prolonged weaning are classified as (simple, difficult, prolonged weaning and weaning failure(3). There are many factors affect weaning outcomes e.g diaphragmatic strength,

PO2/FiO2, a sedation dose and duration, patient's own confidence.

METHODS

The study was conducted at RICU, Chest Department, Zagazig University Hospitals during the period from July 2018 to December 2018. Written informed consents were obtained from all patients` relatives. After obtaining approval of IRB-ZU.

Study design: A cross sectional study.

Sample size: The sample was calculated as comprehensive sample; therefore, the sample was 24/6 months.

The work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

Inclusion Criteria:

The study included mechanically ventilated COPD patients who were admitted to RICU during the period of the study due to exacerbation leading to acute on top of chronic respiratory failure underwent trial(s) of weaning using different methods according to **Blackwood et al.,(2011)[4]**

Exclusion criteria:

1. Respiratory arrest, pre intubation cardiac arrest due to arrhythmias and other causes. e.g hypothermia, myocardial infraction, hypo or hyperkalemia,….
2. Post-operative cases.
3. MV due to causes other than acute exacerbation of COPD.
4. Trauma involving the face, burn.
5. metabolic disorders (renal failure ,DKA,…)

- **Collection of the recorded patient`s data:**

1) History and clinical examination considering history of previous mechanical ventilation, and reviewing previous patient`s medications, source of referral

2) Plain X-ray chest and heart.

3)-Data related to mechanical ventilation:

1. **The selected machine (brand name):** three ventilators machines were used (Avea, Inspiration, Servo i).
2. **Mode for ventilation.** All patients were ventilated using synchronized intermittent mandatory ventilation with volume control and pressure support (SIMV VC/PS) mode. High inspiratory flow rates were preferred to reduce the inspiratory: expiratory ratio, thus allowing more time for expiration[5].
3. **Primary settings on mechanical ventilation.**

A. **-Tidal volume**: range was 6 - 8 mL/kg predicted body weight.

B. **-Ventilator rate:** 12-16/ min

C. **-Trigger sensitivity** Flow triggering was 2 L/min

D. **-FIO_2**: FiO_2 was setted on 100% for 2 hours then gradually decreased till reach the lowest value required to reach the oxygenation target. This target varies from patient to patient, but a SpO_2 of 92% to 96% is a reasonable goal[6].

E. **-Inspiratory flow rate** High inspiratory flow rates was desired to adjust the I:E ratio (1:2 or 1:3), thus permitting more time for expiration[5]**.**

F.-Positive end expiratory pressure(**PEEP):** External PEEP was kept below 75% to 85% of auto PEEP to avoid any deteriorating of hyperinflation or circulatory compromise[7]**.**

(2) **Arterial blood gas** analysis just before weaning, 2 hrs after weaning.

(3) Laboratory investigations:

A. **CBC ,liver and kidney function tests, electrolyte level (Na,K,Ca) ,cardiac enzymes.**

B. C reactive protein (CRP)

C. Thyroid function: TSH, f T3, f T4.

5) **Diaphragmatic ultrasound**

Ultrasound was performed before 1st trial of weaning using a **Sono scape SSI 4000 ultrasound machine. (China)** to assess the right diaphragm.

Diaphragmatic excursion: Normal values are 2.3–4and 6–7 cm during quiet and deep breathing respectively.

Diaphragmatic thickness: Normal values of diaphragm thickness 2.5-5mm

(8) Data about weaning process

The detections of parameters for invasive mechanical ventilation (IMV) discontinuation is assessed daily and includes many items[8]**:**

a) Improvement in the condition that caused the respiratory failure.

b) A PaO_2 higher than 60mmHg.

c) FiO_2 lower than 0.4.

d) PEEP of 5 cm H_2O or less.

e) Patient's ability to initiate a spontaneous inspiratory effort.

f) A non positive fluid balance.

g) A normal acid-base balance.

-Weaning parameters

1- Rapid Shallow Breathing Index (RSBI). It refers to the number of breaths per minute divided by the tidal volume in spontaneous breathing by liters.normally it is ≤105.

2-Maximal inspiratory pressure (PI_{max}): Normal level -20 to -30 cm H_2O to start weaning trial.

3-P_aO_2/F_iO_2: When PaO_2 / FIO_2> 200 it indicated good weaning outcome.

-Assessment of the strength of the cough reflex[8]

0 = no cough response.

1 = audible movement of air through the endotracheal tube but no audible cough.

2 = strong cough with phlegm under the end of endotracheal tube.

3 = strong cough with phlegm coming out of the end of endotracheal tube

Subsequently, patients undergo a spontaneous breathing trial (SBT) for 30 min. During the SBT, patients who do not experience tachypnea (>35 breaths per minute), tachycardia (>140 beats per minute), desaturation (oxygen saturation of <90%), hypertension (systolic blood pressure >180 mmHg) or hypotension (<90 mmHg), diaphoresis, altered mental status or anxiety are candidates for extubation. Additionally, it is necessary to evaluate the patients' ability to protect their airway, the amount of airway secretions, the strength of the cough, and their level of consciousness[9].

- **Selected method of weaning:** was monitored either Spontaneous breathing test (T. Piece weaning) or gradual reduction in pressure (Pressure support weaning) or Non-invasive positive pressure ventilation weaning.

Assessment of the following items:

- Weaning categories and number of weaning trials: 11 patients (45.8%) needed up to 4 trials of weaning for weaning Success, 2 patients (8.3%) failed all trials of weaning and died.
- End point of weaning trial
  - Primary outcome :(as regard weaning success or failure).
  - Secondary outcome:(as regard mortality):
    - Survival and successful discharge.weaning may be succeeded but patient may died before discharge due to any other non chest causes e.g hepatic encephalopathy
    - Death.

RESULTS

There is statistically non-significant difference between the patients who failed and succeed weaning regarding the source of referral.

There is statistically non-significant difference between the patients who failed and succeed weaning regarding ventilators brand name.

There is significant difference between both groups regarding excursion There is statistically non-significant difference between the patients who failed and succeed weaning regarding TDI, End inspiratory TDI and end expiratory TDI.

There is statistically significant difference between them regarding Pimax and PO_2/FiO_2 while there is statistically non-significant difference between the patients who failed and succeed weaning regarding RSBI.

In each trial, there is statistically non-significant difference between successful and failed weaning trial regarding method of weaning.

The large percentage of final fate of weaning of the studied patients was successful. One eighth of the studied patients died by the end of the study. The largest percentage of studied patients had simple weaning.

In each trial, there is statistically non-significant change over time regarding fate of weaning trial.11 patients (45.8%) needed up to 4 trials of weaning for weaning Success, 2 patients (8.3%) failed all trials of weaning and died.

Table 1. Comparison of source of referral in the studied patients regarding their weaning outcome:

	Weaning			
	Failed	Success	T	P
	N (%)	N (%)		
Source of referral: N(24) General hospital Private hospital Emergency room	N(2) 0 (0) 1 (50) 1 (50)	N(22) 5 (22.7) 3 (13.6) 14 (63.7)	1.964	0.375
History of ventilator support (8) NO (16)	2 (100) 0	6 (27.3) 16(72.7)	Fisher	0.208

Table 2. Comparison of ventilators brand name in the studied patients regarding their weaning outcome:

Brand name	Weaning		T	P
	Failed N (%)	Success N (%)		
Avea Inspiration Servo	1 (50) 0 (0) 1 (50)	3 (13.6) 6 (27.3) 13 (59.1)	2.026	0.363

Table 3. Comparison of diaphragmatic ultrasonographic findings in the studied patients regarding their weaning outcome on 1st weaning trial:

	Weaning			
	Failed	Success	T	P
	Mean ± SD	Mean ± SD		
Excrusion	2 ± 0.41	2.44 ± 0.61	-2.665	0.035*
TDI end inspiration	3.3± 0.28	3.92± 0.5	-1.520	0.143
TDI end expiration	2.45± 0.21	2.78±0.33	-1.381	0.181
TDI	0.34 ±0.02	0.42±0.1	-1.173	0.253

Table 4. Comparison between weaning parameters in the studied patients regarding their weaning outcome:

	Weaning			
	Failed	Success	Z	P
	Mean ± SD	Mean ± SD		
Pimax	-17.5 ± 0.71	-23.77 ± 4.32	-3.813	0.001**
PO_2/FiO_2	214± 52.33	282.27± 54.95	-6.394	<0.001**
	N (%)	N (%)	X2	P
RSBI: >105 85 – 104 <85	 2 (100) 0 (0) 0 (0)	 6 (27.3) 7 (31.8) 9 (40.9)	4.364	0.113

Table 5. Comparison between weaning method and in relation to success in studied patients:

	Success 1	Fail 1	Success 2	Fail 2	Success 3	Fail 3	Success 4	Fail 4
	N (11)(%)	N(13) (%)	N(4) (%)	N(9) (%)	N(4) (%)	N(5) (%)	N (3)(%)	N (2)(%)
Method:								
NIV	3 (27.3)	2 (15.4)	2 (50)	1 (11.1)	4 (100)	1 (20)	1 (33.3)	1 (50)
T.tube	7 (63.6)	7 (53.8)	1 (25)	2 (22.2)	0 (0)	1 (20)	0 (0)	1 (50)
PS	1 (9.1)	4 (30.8)	1 (25)	6 (66.7)	0(0)	3 (60)	2 (66.7)	0 (0)
P	0.397		0.257		0.056		0.233	

Table 6. Weaning practice and final fate in the studied patients:

Weaning	N	%	P
Simple	13	54.2	
Difficult	8	33.3	0.043*
Prolonged	3	12.5	
Failure	2	8.3	<0.001**
Success	22	91.7	

Table 7. Outcome of weaning in each trial in the studied patients:

	First trial	Second trial	Third trail	Fourth trial	P
Fate:					
Success	11 (45.8)	4 (30.8)	4 (44.4)	3 (60)	0.029*
Failure	13 (54.2)	9 (69.2)	5 (55.6)	2 (40)	

DISCUSSION

Although IMV is an important issue in critical care medicine, minimizing the duration of this support reduces the risk of ventilator associated complications.**(10).**The decision of discontinuing mechanical ventilation is difficult, proved by the fact that a third of patients in intensive care worldwide are mechanically ventilated. Weaning from mechanical ventilation represents 40-59% of the whole duration of MV in COPD patients (11)**.**Therefore, the target of this study is to evaluate weaning practice in mechanically ventilated patients with COPD due to acute exacerbation in Respiratory Intensive Care Unit of Chest Department, Zagazig University Hospitals. In this study the final outcome the successful weaning was reported in 22 patients (91.66%) while weaning failure was reported as 2 patients (8.3%).

In the current study, there was no significant difference between weaning outcome and previous history of ventilatory support .In contrast,**Esquinas and Markus(12)**found that repeated IMV indicates poorly controlled underlying disease , repeated exacerbations and more and more decline in pulmonary reserve that may reach to a critical level not responding to assisted ventilation with high risk of weaning failure and poor outcome.

There was statistically non significant difference between the patients who failed and succeed weaning regarding source of referral. Failure weaning group was classified as 50% referred from Private hospital and 50% from emergency department. **Davies et al.,(13)** found that high levels of weaning success (72%) and satisfactory long term outcomes can be happened in a specialized weaning units. **Lane et al.,**(14) found that improved AECOPD

survival and reduced the hospital stay in both non-ventilated and ventilated patients were accompanied with respiratory specialist emergency care .

In the current study there was statistically non significant difference between both groups regarding ventilator machine used during mechanical ventilation or during weaning. **Morita et al.,(15)** reported that Servo ventilator has the highest safety and user experience and mentioned that FDA reported that devices with poor usability can lead to patient harm. While **Terado et al (16)** found that Bennet ventilators are better as regard rapid response for PSV which is of help in current study than other ventilators.

Regarding diaphragmatic ultrasound there was statistically non important difference between the patients who failed and succeeded weaning regarding TDI, End inspiratory TDI and end expiratory TDI, while there was important difference between both groups concerning excursion. It is in match with **Ferrari et al.,(17)** who found that detection of diaphragmatic excursion support weaning and identify diaphragmatic impairment or to optimize ventilator-patient's interaction in mechanically ventilated patients

In the current study, there was important difference between 2 groups exposed to weaning concerning PaO2 / FIO2. This result is matched with **Ramachandran et al.(18)** who found that the PaO2/ FiO2 ratio in the group with successful weaning was higher than the mean value in the group with failed weaning

This result is not matched with **Dehghani(19)** who concluded that PaO2 / FiO2 was not a good predictor for weaning outcome which could be due to the dependence of this parameter on Pao2 and Paco2 which showed no significant effect on weaning outcome in population studied in this study.

Regarding PImax there was important difference between patients with weaning failure and those with successful weaning respectively**.** This is matched with **Elgazzar et al.(20)** and **Dehghani(19)** who found that PImax values higher in those whom succeeded although the difference was not significant.

On the other hand, **Osler(21)** and **Zein et al.(22)** shown a statistically significant greater negative values of PImax in the success group compared with failure group during correlating weaning outcome with PImax values in their studies.

The RSBI as an indicator for weaning in the current study was no important difference between patients who successfully weaned and those who failed**.** It may be due to difficulty to estimate the respiratory reserve accurately during unresolved disease.This is with **Tanios et al.(23)** and **Elgazzar et al.(20)** who found similar results in their studies.

This is in contrast with those of **Vitacca(24)** and **Youssef et al.(25)** in which RSBI of their patients who tolerated the SBT was lower than 100 matched with those who failed.

This result was emphasized **,** as when RSBI was < 105 breath/min/L, 27.3 % of patients were successfully weaned, while when RSBI was < 85 breath/min /L , success rate increased to 40.9 % .This is matched with **Fadaii et al.(26)** in their study in which 63 patients had RSBI ≤105 among them 49 (77%) patients had been weaned successfully while 51 subjects out of 63 had RSBI <80 of which 46 (90.2%) patients had successful weaning.

Regarding weaning method in each trial there is statistically non-significant difference between successful and failed weaning trial regarding method of weaning among both groups.

Munshi et al (27) and **Perkins et al(28)** found that NIV can be used as an early extubation and weaning method in patients who are "Difficult to Wean" or with those with "border line" weaning criteria. In this situation, NIV permits earlier extubation and decreases the period of MV during the weaning period without aggregate the hazard of weaning failure over that with traditional weaning.

Talwar and Dogra(29) found that NIPPV can minimize the length of MV, weaning period, length of ICU stay, incidence of nosocomial pneumonia and outcome.

On the other hand **Ornico et al.(30)** found that (non invasive ventilation) NIV was not mandatory in patients who develop acute respiratory failure after extubation and **Abdel Aziz et al.(31)** reported that the success of non invasive ventilation could be dependent on the experience of the health care team using the technique. Post extubation, NIV could not prevent the need for re-intubation and was accompanied with a higher ICU death rate in comparison with usual medical therapy (including oxygen and bronchodilators) risky patients who had been extubated after a successful spontaneous breathing trial (SBT).

Also, **Farias et al,(32)** reported that T tube methods were frequently used for weaning in their study. However , weaning method weaning did not affect weaning results. **Munshi et al(27)** reported that SBT may cause ventilator muscle overload and fatigue. **Brower et al,(33)** mentioned that daily SBT with stable support in between SBTs provided the most rapid ventilator discontinuation.

Boles et al,(34) mentioned that SBT is the chief diagnostic trial to detect if patients can be extubated successfully.

Matic et al,(35) found PSV to be more prefered than T tube for difficult to wean patients with COPD based on smaller period needed for weaning from MV, total MV period and time spent in ICU.

As regards weaning outcome at 1st trial of weaning on different methods, the successful weaning was reported in 45.8% while weaning failure was reported in 54.2% .This is consistent with **Ferrari et al.(17)** who reported 63% failure rate.

However, this is controversy with **Crisafulli et al(36)** who showed failure rate about 20%, 26.7%, 23.3% and 26.5% respectively. This may be due to different severity of COPD and severity of exacerbation between studies.

CONCLUSION

In MV-AECOPD patients, weaning success is very high in specialized tertiary ICU; 91.7%. Pi_{max} and P_aO_2/ FiO_2 are a good predictor for weaning success. Brand name of ventilators have no role in determining outcome of weaning. Frequently, COPD patients have difficult or prolonged weaning.

Recommendations

Higher Scale study with larger number of COPD patients is looked for to confirm the results of this study. Mechanical ventilation of AECOPD patients is to be carried out at highly experienced RICU

Conflict of Interest: Nothing to declare.
Financial Disclosures: Nothing to declare.

REFERENCES

1. **Global initiative for chronic obstructive lung disease GOLD (2019).** Global Initiative for Chronic Obstructive Lung Disease Global Strategy for the Diagnosis, Management and Prevention of COPD 2019. National heart, lung, and blood institute/World Health Organization (NHLBI/WHO) workshop report; executive summary, revised 2019.
2. **José Parrilla F, Morán I, Roche-Campo F, Mancebo J.**Ventilatory Strategies in Obstructive Lung Disease. Semin Respir Crit Care Med 2004;35:431–440.
3. **Schönhofer B, Geiseler J, Dellweg D, Moerer O, Barchfeld T, Fuchs H, et al.,** Guide line Prolonged Weaning. Pneumologie2015; 69: 595–607
4. **Blackwood B, Alderdice F, Burns K, Lavery G, Halloran P.**Use of weaning protocols for reducing duration of mechanical ventilation in critically ill adult patients: Cochrane systematic review and meta-analysis. BMJ 2011;342:c7237.
5. **Jolliet P, Watremez C, Roeseler J, Ngengiyumva K ,Clerbaux T,Tassaux D et al.,** Comparative effects of helium-oxygenand external positive end-expiratory pressure on respiratory mechanics, gas exchange, and ventilation-perfusion relationships in mechanically ventilated patients with chronic obstructive pulmonary disease. Intensive Care Med 2003;29(9):1442–50 .
6. **Caironi P, Cressoni M, Chiumello D, Ranieri M, Quintel M, Russo SG, et al.,** Lung opening and closing during ventilation of acute respiratory distress syndrome.Am J Respir Crit Care Med 2010;181(6):578-586 .
7. **Mowery NT .**Ventilator Strategies for Chronic Obstructive Pulmonary Disease and Acute Respiratory Distress Syndrome Surg Clin N Am 2017; 97(6):1381-1397. doi: 10.1016/j.suc.2017.07.006

8. **Khamiees M, Raju P, Degirolamo A and Manthous CA.** Predictors of extubation outcome in patients who have successfully completed a spontaneous breathing trial. CHEST 2001;120:1262–70.
9. **McConville JF and Kress JP .** Weaning patients from the ventilator. N Engl J Med 2012;367(23):2233-2239.
10. **Emine and Andreas.** Ventilator associated pneumonia and infection control Ann Clin Microbiol Antimicrob 2006; 5: 7.
11. **Ghoneim AHA, El-Komy HM, Gad DM and Abas A.** Assessment of weaning failure in chronic obstructive pulmonary disease patients under mechanical ventilation in Zagazig University Hospitals Egyptian Journal of Chest Diseases and Tuberculosis 2017 ;Volume 66, Issue 1, , Pages 65-74.
12. **Esquinas AM and Markus S.** Admissions and patterns of mechanical ventilation of critical COPD: an old and common friend, are we still prepared? Eur Respir J 2013; 42: 873–874
13. **Davies M G ,Quinnell T G ,Oscroft N S, Clutterbuck SP, Shneerson JM, I. E. Smith.** Hospital outcomes and long term survival after referral to a specialized weaning unit British Journal of Anaesthesia 2017; Volume 118, Issue 4, Pages 563-569
14. **Lane ND, Brewin K, Hartley TM, Gray WK, Burgess M, Steer J, et al.,** Specialist emergency care and COPD outcomes. BMJ Open Resp Res 2018;5:e000334. doi:10.1136/ bmjresp-000334
15. **Morita PP, Weinstein PB, Flewwelling CJ, Bañez CA, Chiu TA, Mario Iannuzzi M, et al.,**The usability of ventilators: a comparative evaluation of use safety and user experience Crit Care 2016; 20: 263.
16. **Terado M, Ichiba S, Nagano O and Ujike Y.** Evalaution Of Pressure Support Ventilation With Seven Different Ventilators Using Active Servo Lung 5000.Acta Med Okayama 2008; 62{2}: 127-133.
17. **Ferrari G, Filippi GD, Elia F, Panero F, Volpicelli G and Aprà F.** Diaphragm ultrasound as a a new index of discontinuation from mechanical ventilation. Crit Ultrasound J 2014;6(1):8.
18. **Ramachandran V, Grap MJ and Sessler C.** Protocol-directed weaning: a process of continuous performance improvement Crit Care 2005; 9(2): 138–140.
19. **Dehghani A, Abdeyazdan GH and Davarido E.**An Overview of the Predictor Standard Tools for Patient Weaning from Mechanical Ventilation. Electron Physician. 2016; 8(2): 1955–1963.
20. **Elgazzar A, Walaa M, Salah A and Yousif A .** Evaluation of the minute ventilation recovery time as a predictor of weaning in mechanically ventilated COPD patients in respiratory failure. EJCDT 2013; 62:287-292.
21. **Osler W.** Discontinuing mechanical ventilation. In Marino`s ICU BOOK, chapter 30 (Fourth edition) 2014, P:571
22. **Zein H, Baratloo A, Negida A and Safari S.** Ventilator Weaning and Spontaneous Breathing Trials; an Educational Review. Emerg (Tehran) 2016;4(2):65–71. [PubMed: 27274515].
23. **Tanios M, Nevins M, Hendra K, Cardinal P, Allan JE, Naumova EN, et al.,** A randomized, controlled trial of the role of weaning predictors in clinical decision-making. Crit Care Med 2006; 34:2530-2535.
24. **Vitacca M, Vianello A, Colombo D, Clini E, Porta R, Bianchi L, et al.,** Comparison of Two Methods for Weaning Patients with Chronic Obstructive Pulmonary Disease Requiring Mechanical Ventilation for More Than 15 Days. American Journal Of Respiratory And Critical Care Medicine 2001; Vol 164
25. **Youssef AI, El-Hayawan HM, Abd El-Salam HM and Mostafa D.** Predictors of weaning outcome in COPD patients requiring mechanical ventilation.EJCDT 2004;53:121-129.
26. **Fadaii A , Amini S, Bagheri B,and Taherkhanchi B.** Assessment of Rapid Shallow Breathing Index as a Predictor for Weaning in Respiratory Care Unit. Tanaffos 2012; 11(3): 28-31.
27. **Munshi L, Ferguson ND and Naill D.** Weaning From Mechanical Ventilation: What Should Be Done When a Patient's Spontaneous Breathing Trial Fails? ;JAMA 2018 ;320(18):1865-1867.
28. **Perkins GD, Mistry D, Gates S, Gao F, Snelson C, Hart N, et al.,** Effect of Protocolized Weaning With Early Extubation to Noninvasive Ventilation vs Invasive Weaning on Time to Liberation From Mechanical Ventilation Among Patients With Respiratory Failure: The Breathe Randomized Clinical Trial. JAMA 2018;320(18):1881-1888.
29. **Talwar D and Dogra V.**Weaning from mechanical ventilation in chronic obstructive pulmonary disease: Keys to success.J Assoc Chest Physicians 2016;4(2):43–9
30. **Ornico SR, Lobo SM, Sanches HS, Deberaldini M, Tófoli LT, Vidal AM, et al.,**Noninvasive ventilation immediately after extubation improves weaning outcome after acute respiratory failure: a

randomized controlled trial. Crit Care 2013; 17(2):R39.

31. **Abdel Aziz AO, Abdel El Bary IM, Abdel Fattah MT, Magdy MA and Osman AM, et al.,**Effectiveness and safety of noninvasive positive-pressure ventilation in hypercapnia respiratory failure secondary to acute exacerbation of chronic obstructive pulmonary disease. Egypt J Bronchol 2017;11:215-23.
32. **Farias JA, Retta A, Alía I, Esteban A, Golubicki A, Allende D, et al.,**A comparison of two methods to perform a breathing trial before extubation in pediatric intensive care patients. Intensive Care Med 2001;27:1649–54.
33. **Brower RG, Lanken PN, MacIntyre N, , Matthay MA, Morris A, Ancukiewicz M, et al.,**Higher versus lower positive end expiratory pressures in patients with the acute respiratory distress syndrome. N Engl J Med 2004;351(4):327-336.
34. **Boles JM, Bion J, Connors A, Herridge M, Marsh B, Melot C, et al.,**Weaning from mechanical ventilation: Statement of the Sixth International Consensus Conference on Intensive Care Medicine. Eur Respir J 2007; 29(5):1033-1056.
35. **Matić I, Danic D, Kogler M V, Jurjević M, Mirković I, and Vučinić MN** Chronic obstructive pulmonary disease and weaning of difficult towean patients from mechanical ventilation: Randomized prospective study. Croat Med J 2004; 48(1): 51–58.
36. **Crisafulli E, Barbeta E, Ielpo A and Torres A .** Management of severe acute exacerbations of COPD: an updated narrative review Multi discip Respir Med 2018; 13: 36.

How to cite

Farouk, M., Shouman, W., Awad, M.,Elhawary A., Assessment of Weaning Practice In Mechanically Ventilated Chronic Obstructive Pulmonary Disease Patients at Respiratory Intensive Care Unit of Zagazig University Hospitals. *Zagazig University Medical Journal*, 2020; (883-891): -. doi: 10.21608/zumj.2019.15367.1377