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Weaning outcomes of the Mechanically Ventilated Patients: Pressure Controlled Volume Guaranteed Versus Synchronized Intermittent Mandatory Ventilation

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Abstract: **Pressure controlled-volume guaranteed mode combines the benefits of both pressure controlled ventilation and pressure controlled ventilation modes for the mechanically ventilated patients in ICUs Aim: is to assess weaning outcomes of the mechanically ventilated patient after using Pressure controlled ventilation-volume guaranteed and synchronized intermittent mandatory ventilation mode Design: A quasi-experimental research design. Setting: General intensive care unit at Assuit university hospital. Patients and methods: Purposive sample of 80 patients who were intubated for >24 hrs, divided into two groups equally, study group (PCV-VG group) and control group (SIMV-VC group). Pressure controlled ventilation-volume guaranteed mode was selected for study group and control group patients was mechanically ventilated on synchronized intermittent mandatory ventilation mode Tool I : Patient assessment Tool II: Mechanical ventilator parameters assessment Tool III: Weaning outcomes assessment *Results:* Concerning weaning outcomes; 57% of SIMV-VC group experienced weaning failure versus 35% in PCVG group, more than half of SIMV group re-intubated versus one third in PCVG group and less duration of mechanical ventilation for PCVG group versus SIMV group. Conclusion: Pressure controlled-volume guaranteed mode was more effective than synchronized intermittent mandatory ventilation mode in improving weaning outcomes Recommendations: Provide ICU nurses an educational program about Pressure controlled volume guaranteed and nursing care to improve waning outcomes.**

Keywords: **Weaning outcomes, Pressure controlled volume guaranteed, & Synchronized intermittent mandatory ventilation.**

1. INTRODUCTION

Weaning from mechanical ventilator is a process where mechanical ventilator is gradually withdrawn and the patient resumes spontaneous breathing, it involves two steps; weaning from the machine (after using a suitable weaning mode as continuous positive airway pressure) and extubation thereby meaning liberation or freedom from ventilator. Difficult-to-wean patients are defined as those who require more than 7 days of weaning after first spontaneous breathing trial (SBT). Prolonged mechanical ventilation and difficult weaning leads to high resource utilization and poor outcomes **(Talwar, 2016) &(Aziz et al., 2018).**

Mechanical Ventilator adjustments is a corner stone for treating patients with multiple diagnoses, it aims to relieve patient distress, protect the airway, reduce work of breathing, prevent hypoxemia and hypercapnia. Invasive or non-invasive mechanical ventilator has proven to relieve distress associated with respiratory failure. In some cases, non- invasive ventilation not tolerated by patient due to gastric insufflation and mask pressure So invasive ventilation will be the substitute **(Campbell,2018).**

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Volume controlled ventilation mode is frequently used among the mechanically ventilated patients whereas tidal volume (Tv) is calculated and pressure is determined according to lung compliance, but it carry the disadvantage of barotrauma occurrence. On the other hand, in Pressure controlled ventilation mode inspiratory pressure is chosen by anesthesist so it limits the previous disadvantage but has the disadvantage of variable tidal volume that can lead to volu-trauma and even lung rupture. Pressure controlled-volume guaranteed (PC-VG) is a type of dual mode that combines the benefits of both pressure controlled ventilation and volume controlled ventilation **(Ali et al., 2016).**

Pressure controlled-volume guaranteed (PC-VG) is a newly introduced mode in mechanical ventilators for intubated patients, It automatically calculates the pressure limits according to the lung compliance calculated by the ventilator and delivers a preset tidal volume with the lowest airway pressure.it has the decelerating flow rate feature thus has the benefits of both PCV and VCV modes **(Kothari & Baskaran, 2018).**

Nursing care to relieve discomfort and mange patient is crucial, one of the nursing interventions is chest physiotherapy which plays an important role for the mechanically ventilated patients as it is necessary for removal the retained secretions intubation, improve oxygenation, re-expand atelectatic lung, optimize ventilation and perfusion, improve changes in breath sounds, improve vital signs encourage weaning success reduce ICU length of stay and decrease hospital cost **(Gamal et al., 2015).**

The Aim of the present study is to assess weaning outcomes of the mechanically ventilated patient after using Pressure controlled ventilation-volume guaranteed and synchronized intermittent mandatory ventilation mode.

To fulfill this aim; the following research hypothesis was formulated:

Research hypotheses:

- Pressure controlled ventilation volume guaranteed (PCV-VG) is expected to be more effective than synchronized intermittent mandatory ventilation mode in improving weaning outcomes.

2. PATIENTS AND METHODS

Research design

A quasi-experimental research design was used to conduct this study.

Setting

The study was conducted in general ICU at Assiut university hospital.

Subjects:

A purposive sample included eighty adult male and female patients, aged from (18-60 years old) who admitted to general ICU and who were eligible for inclusion in the sample for about 1year (from January, 2019 to January, 2020).

Inclusion criteria:

The study group (PCVG group) included patients who had the following criteria: -

- Intubated patients who were mechanically ventilated for >24 hrs.
- Patients disagnosed with pulmonary diseases

Exclusion criteria

The study excluded patients with the following criteria: -

- Patients with metabolic acidosis, anemia, drug poisoning, psychogenic disorders or neuromascular disorders
- Noninvasive ventilation (NIV)
- Pregnancy

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Study tools:

- Three tools were used in this study:

Tool I: Patient assessment tool

This tool developed by the researcher after reviewing the related literature. It was used to assess personal and clinical data of patient; it covered the following:

-Personal characteristics which include age, body mass index (BMI) and sex.

-Clinical data which covered: medical diagnosis, past medical history, date of admission, date of discharge, vital signs (respiratory rate, heart rate, body temperature and mean arterial blood gases),central venous measurement and arterial blood gases (pH, PaO_2 in mmHg,$PaCO_2$ in mm Hg, Pao2/FIO_2, SaO_2).

Tool II: Mechanical ventilator parameters; This part was used to assess mechanical ventilator mode and parameters, it covered the following items: mode of ventilation, dynamic compliance C dynamic, and rapid shallow breath index (RSBI) which calculated is calculated as the ratio of tidal volume (TV) in liters to respiratory rate (RR) in breaths/minute: RSBI = TV/RR, Peak inspiratory pressure (PIP) **(Silva & Rocco, 2018).**

Tool III: weaning outcomes assessment tool:

This tool aimed to assess the effect of PCV-VG mode and the provided nursing care other than SIMV mode on weaning outcomes, it covered: percentage of patients experienced successful weaning or weaning failure, date of discharge, length of stay, type of discharge, duration of mechanical ventilation, mortality rate and occurrence of other morbidities.

Methods: -

- **The study was conducted on three main phases**, which were preparatory phase, implementation phase and evaluation phase: -

l-Preparatory phase

Permission to conduct the study was obtained from the dean of faculty of nursing at Assuit University and from hospital responsible authorities after explanation of the aim and nature of the study. Development of tools after reviewing the related literature and tools were reviewed by 5 juries for face and content validity (two medical staff and three critical care nursing staff) from Assiut University.

Ethical considerations:

Research proposal was approved from ethical committee in the faculty of nursing, there was no risk on study subjects during application of the research, the study followed common ethical principles in clinical research, oral consent was obtained from the responsible person for the unconscious patients, confidentiality and anonymity were assured, study subjects had the right to refuse to participate or withdraw from the study without rational and subjects privacy was considered during collection of data.

A pilot study was conducted on 10% of study sample (8 patients) who met the determined selection criteria to test the feasibility and applicability of the tool and necessary modification was done and the eight patients of the pilot study were excluded from the study.

II-Implementation phase:

-Pressure controlled-volume guaranteed (PCV-VG) mode was selected for the study group and synchronized intermittent mandatory ventilation (SIMV-VC) mode for the control group, implementation phase was done as following:

On admission the researcher introduced herself to staff and to patients and personal and clinical data documented from hospital sheet. Also patient's vital signs, ABG and mechanical ventilator parameters were assessed before intervention, then the following nursing care applied for study group (PV-VG group) every shift up to seven consecutive days and routine hospital care given to control group (SIMV-VG group)

Inhalation therapy

Inhalation therapy by using the prescribed nebulized medication was given before start of performing chest physiotherapy to reduce mucus viscosity, if patient had thick secretions. Positioning**;** bed head elevated and patient was placed in sitting position at degree of 30 and more, relax his shoulders and neck muscles **(Mezidi & Guérin, 2018).**

Chest physiotherapy:

Chest physiotherapy included vibration and percussion which were performed after auscultating patient's chest, as following:

Vibration

It made during expiration, shaking patient chest to loosen secretion and dislodge it from its place to reach the main bronchi and then patient was motivated to cough after making percussion (if was conscious), the cycle of vibrations took 10-15 min, after 3-4 vibrations every shift up to 7 consecutive days, patient was given period of rest in phases during the cycle and was asked about his tolerance and vibrations was avoided over sternum, ribs, breast, or spine **(Gupta & Gupta, 2018).**

Percussion

The researcher cover patient chest with towel or piece of cloth, percussing sternum, ribs, breast, spine or stomach were avoided, hand was cupped to strike the chest, percussion shouldn't be painful to patient, percussion was usually done for 3-5mins.

Suctioning:

Researcher explained the procedure to the patient (conscious or unconscious)**,** hyperoxygenation (100%) and hyperventilation up to 5 breaths was given before procedure, vacuum pressure was adjusted to be 100-120 CmH_2O for adult, endotracheal tube (ETT) was disconnected from oxygen source, catheter proceeded into ETT to be 0.5-1 cm out of the tube, catheter then removed backward, cleaned with sterile water or saline, patient was hyper-oxygenated in between and after suctioning, only 3 suctioning attempts during the procedure, reassessment by auscultating patient chest was done **(Number et al., 2020).** Suctioning was done by the researcher every shift, even more as needed and up to 7 consecutive days.

Raising head of the bed

Head of the bed elevated (HOBE) for the mechanically ventilated patients. HOBE significantly increases lung volume; therefore, unless contraindicated, all mechanically ventilated patients should be positioned with HOBE **(Rn et al., 2014).**

Oxygen therapy monitoring;

Anesthetists might increase oxygen concentration (FIO_2) on the mechanical ventilator up to 60 % (maximum) if patient was hypoxemic and, the researcher noticed patient response to increased oxygen concentration as increase in SPO_2, increased PO_2, tachypnea disappeared, and respiratory rate returned to normal.

- PEEP may be increased up to 10 cm H_2O or more.
- Nurse and researcher noticed a patient response to mode, to increased PEEP and to other interventions. Data was record in patient sheet.

Re-evaluation of patient by the researcher after interventions. Weaning outcomes (success or failure), Vital signs and arterial blood gases were also assessed by the researcher after intervention in the 1st, 3rd and 7th day and patients followed up to investigate the effect of intervention on duration of mechanical ventilation, weaning outcomes (success or failure) and length of stay.

Statistical analysis

- Statistical analysis was performed using the software package spss,version 20.

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3. RESULTS

The main results yielded by the present study were:

Table 1: Comparison between the PCVG group and SIMV group in relation to Personal characteristics and clinical data (n=80)

Items	PCV-VG Group		SIMV Group		P-Value
	No.	%	No.	%	
Age					
18-35	10	25%	10	25	
36-50	14	35%	12	30	0.65
51-65	16	40%	18	45	
Age M ±SD	45±16.5		46±14		0.67
Sex					
Male	21	52.5%	16	40 %	0.2
Female	19	47.5%	24	60%	
BMI	19±2		19.5±3		0.7
Consciousness level					
Conscious	10	25%	10	25%	
Unconscious	30	75%	30	75 %	1
Medical diagnoses					
Respiratory causes	**40**	**50%**	**40**	**50%**	
Pulmonary embolism	4	10%	3	7.5%	
Pneumonia	6	15%	7	17.5%	
COPD	9	22.5%	6	15%	
COPD+Respiratory failure	7	17.5%	5	12.5%	
Pulmonary Edema	4	10%	5	12.5%	
Bronchopneumonia	3	7.5%	5	12.5%	0.76
Asthma	4	10%	4	10%	
Respiratory failure	3	7.5%	5	12.5%	
Past history of diseases					
Hypertension (HTN)	7	17.5%	12	30%	
Diabetes (DM)	6	15%	8	-	0.5
Congestive heart failure	4	10%	-	-	
COPD	5	12.5	1	2.5%	
Non	18	45%	19	47.5%	

* Significant at (P<0.05) -BMI: body mass index -COPD: chronic obstructive pulmonary disease – HTN: hypertension

*****Statistical significant difference (P≤ 0.05) - T-test

Table (2): Comparison between PCVG group and SIMV group in relation to Arterial blood gas Parameters (ABG) one hour after intervention (n=80)

ABG parameters	PCVG group M ± SD	SIMV group M ± SD	P-value
1st day			
PH	7.39 ±0.09	7.33±0.08	0.06
PCO2	41.2±13	46.1±18	0.1
PO2	97 ±38	93.8±46	0.68
Sao2	95 ±4	93±7	0.10
PF ratio	205±66	184.5±89	0.23
On the 3rd day			
PH	7.40±.09	7.35±0.07	0.06

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PCO2	38.4±20	39.9±12	0.05*
PO2	110±31	107.4±45	0.08
Sao2	96.3±3	91.7±15	0.05*
PF ratio	238±81	217±115	0.3
On the 7th day			
PH	7.40±.1	7.35±.07	0.008*
PCO2	40±10	42±16	0.03*
PO2	111±30	108±45	0.007*
Sao2	96±3	92±0.15	0.05*
PF ratio	241±80	209±108	0.014*

*****Statistical significant difference (P≤ 0.05) - T-test PH: acidity or power of hydrogen -PaO2: partial pressure of oxygen -PaCO2 partial pressure of carbon Dioxide -SaO2: oxygen saturation – PF ratio :PO2/FIO2- FIO2: fraction of inspired oxygen.

Table (3): Comparison between PCVG group and SIMV group of Patients in relation to mechanical ventilator parameters

Items	**PCVG group No. %**	**SIMV group No. %**	**P-value**
1st day			
PIP (CmH2O) **40-45** **35-40** **30-35** **20-25** **15-20**	 1(2.5) 4(10) 5(12.5) 27(67.5) 13(32.5)	 3(7.5) 20(50) 3(7.5) 12(30) 2(5)	**0.009***
C dynamic	65±23	48±23	**0.003****
Rapid shallow breath index(RSBI)	60±8	54±20.2	**0.02***
3rd day			
PIP (CmH2O) **40-45** **35-40** **30-35** **20-25** **15-20**	 1(2.5) 3(7.5) 18(45) 11(27.5) 7(17.5)	 - 17(42.5) 11(27.5) 10(25) 2(5)	**0.001****
C dynamic	64±23	48±23	**0.003****
Rapid shallow breath index(RSBI)	62.8±23.6	55.6±8	**0.02***
7th day			
PIP (CmH2O) **35-40** **30-35** **20-25** **15-20**	 3(7.5) 4(10) 5(12.5) 28(70)	 2(5) 15(37.5) 4(10) 19(47.5)	**0.007***
C dynamic	64±23	49±23	**0.004****
Rapid shallow breath index(RSBI)	60±7	55±20.2	**0.001****

-Chi square test *Statistical significant difference (P≤ 0.05)

-independent sample t-test -C dynam : dynamic compliance -RSBI: Rapid shallow breath index

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Table (4): Weaning outcomes among PCVG group and SIMV group:

Items	PCVG Group (n=40) 50%	SIMV group (n=40) 50%	P value
	M±SD	M±SD	
Weaning failure Weaning success	14(35%) 26(65%)	23(57.5%) 17(42.5%)	0.03*
Duration on MV	8.8±3	11.4±5.5	0.01*
Length of stay in ICU	14.8±12	21±2.3	.004**
Mortality rate N (%)	15(37.5%)	26(65%)	0.014*

*Statistically significant difference (P≤ 0.05) -independent sample t-test

MV:mechanical ventilator -ICU : intensive care unit

Table (5) Comparison between PCVG group and SIMV group in relation to complications (n=80)

Complications	Study (n=40)		Control (n=40)		P – value
	No.	%	No.	%	
Ventilator associated pneumonia (VAP)	2	5%	8	20%	0.043*
Hypoxemia/hypoxia	13	32.5%	23	57.5%	0.8
Respiratory failure	2	5%	5	12.5%	0.23
Pulmonary edema	-	-	1	2.5%	-
Pulmonary embolism	2	5%	8	20%	0.04*
Progressive (ARDS)	5	12.5%	13	32.5%	0.018*
Respiratory failure	4	10%	6	15%	0.49
Bed sores	4	12.5%	8	20%	0.24
Constipation	4	12.5%	9	22.5%	0.13

-Chi square test *Statistically significant difference (P≤ 0.05)

Table (1): This table reveals personal characteristics and clinical data among the PCVG group and SIMV group**.** It shows that about 40% of PCVG group and SIMV group were in the age group of (51-65) years old,75% of both groups were unconscious and no statistical significance difference in relation to sex (P=0.2) and BMI(P=0.7). Most of PCVG group and SIMV group had no Past medical history (P=0.5)

Table (2) Shows comparison between SIMV group and PCVG group in relation to ABG, there is no statistically significant difference between study group and control group in the 1st day one hour after intervention in relation to PH, PCO_2, PO_2, SaO_2 and PF ratio. Also**,** there is statistical significant difference between study group and control group in the 3rd day one hour after intervention in relation to PCO2 & SaO_2 (P=0.05). Also, there is a statistical significant difference within normal range between study group and control group in the 7th day one hour after intervention in relation to PH (P=0.008), PCO_2 (0.03), PO_2 (0.007) and PF ratio (0.01) respectively.

Table (3) Shows comparison between PCVG group and SIMV group in relation to mechanical ventilator parameters, PIP values were significantly decreased with the PCVG group and lung compliance was improved with PCVG group than with SIMV group.

Table (4) Shows that regarding to weaning outcomes, weaning failure rate was high (57.5%) for SIMV group in comparison to (35%) for PCVG group with high significant statistical difference between both groups (P=0.03). the Mean duration on mechanical ventilator for PCVG group and SIMV group was (8.8±3) and (11.4±5.5) respectively with high significant statistical difference (P=0.01), Regarding to Mean Length of stay in ICU was found (14.8±12) and (21±2.3) for PCVG group and SIMV group respectively with highly significant statistical difference between them(P=.004), Concerning Mortality rate was (37.5%) and (65%) for PCVG group and SIMV group respectively with high significant statistical difference.

Table (5) Shows comparison between PCVG group and SIMV group in relation to complications. Shows comparison between study group and control group in relation to complications. It was found that there was statistical significant difference between both groups as regard ventilator associated pneumonia (VAP), acute respiratory distress syndrome (ARDS), and Post-traumatic stress disorder (PTSD) (P=0.004, P=0.01, and P=0.004) respectively.

The most common complications were hypoxia, and progressive ARDS respectively

4. DISCUSSION

The management of weaning from mechanical ventilation comprises a significant proportion of the care of critically ill intubated patients in Intensive Care Units. Both prolonged dependence on mechanical ventilation and premature extubation expose patients to an increased risk of complications and increased health care costs. As a consequence, patients with prolonged ventilation might experience airway trauma, drug dependencies, post-extubation delirium, ventilator induced pneumonia, other forms of increased morbidity and even higher fatality rates. There are also non-clinical effects including increased costs and greater pressure on hospital resources **(Jia et al., 2021).**

Volume controlled ventilation mode is most widely used among patients in intensive care units. It follows constant flow pattern to deliver a preset tidal volume through a preset inspiratory time. This flow makes high inspiratory pressure that can cause barotrauma or volutrauma to the lungs leading to atelectasis and inflammatory process occurrence.

Pressure controlled ventilation-volume guaranteed (PCV-VG) is auto-regulated and pressure controlled. The machine establishes the lowest possible pressure according to the calculated compliance and deliver the targeted tidal volume so combining the benefits of volume controlled ventilation and pressure controlled ventilation gaining better patient oxygenation and more lung compliance than pressure controlled ventilation mode **(Kothari & Baskaran, 2018),** So this study aimed to assess the effect of PCVG mode versus SIMV mode on improving weaning outcomes among mechanically ventilated patients.

The findings of the present study illustrate that there were no significant differences among study groups and control group regarding basic data upon admission which include age, Body mass index BMI, and sex. The present study presents that the majority of both groups were in age group of fifty to sixty years old, this can be attributed to the fact that the occurrence of diseases increases after the age of thirty-five years also due to increasing exposure to life stressors that is considered a bad psychological factors precipitate to experience of breathlessness, this is in line with **(Mabkhoot & Israa Abed, 2018)**, who studied the prevalence and risk factors of dyspnea among general population of Arar City-Saudi Arabia and reported that pulmonary impairment increases with age. Also, in the line with **(Pesola & Ahsan, 2016),** who studied dyspnea due to pulmonary diseases and reported that dyspnea increases with age.

Arterial blood gas test is the test the gives indications ventilation and gas exchange.it is important to analyze and assess arterial blood gases to predict any respiratory disorder. Arterial blood gas measure partial pressure of oxygen giving information about oxygenation **(Castro and Michael, 2020).**

The current study shows statistically significant difference between PCV-VG group and SIMV group in relation to arterial blood gases, In relation to arterial oxygen saturation (SaO_2), the present study reported that the mean value of SaO_2 for study group significantly improved from the 3rd day to the 7th day than for control group. The improvement can be attributed to the effective nursing interventions provided for patients of study group as assisting patient in high fowler's position during oxygen inhalation, suctioning that makes the airway patent for effective oxygenation and oxygen therapy (PCV-VG mode for study group and SIMV-VC for control group).

This is in the line with **(Burri et al., 2011),** who studied the value of arterial blood gases in the patients with acute dyspnea and reported that there was an abnormal finding of arterial blood gases as increase of $PaCO_2$, decreased oxygen tension (PaO_2) and were improved after resolving the cause. In contrast with **(Hassan et al., 2020),** who studied Pressure controlled ventilation-volume guaranteed versus volume controlled ventilation and reported that there was difference between two groups favoring PCV-VG group but that difference failed to be significant regarding to arterial partial pressure of oxygen (PaO2) between the two groups. Also, in contrast with**(Gad et al., 2019)**, who studied pressure controlled ventilation -volume guaranteed mode and volume controlled ventilation and reported that No significant differences were reported as regards the ABG analysis, oxygenation, and hemodynamic data between both groups.

The present study shows that there is a statistical significant difference between both groups in relation to mechanical ventilator parameters after intervention (Peak inspiratory pressure, rapid shallow breath index RSBI, and dynamic compliance C dynamic). This is agree with **(Toker et al., 2019),** who reported that PC-VG group of patients were associated with lower PIP and greater dynamic compliance than in volume controlled ventilation.**.** Also, agree with **(Kothari & Baskaran, 2018)**, who studied pressure controlled ventilation mode and reported that peak airway pressure (Ppeak) and plateau airway pressure in the PCV-VG group decreased significantly. Pulmonary dynamic compliance (Cydn) in the PCV-VG group was significantly higher than that in the VCV group. Also, agree with (**Ahmed et al,2015)** who compared pressure-controlled ventilation mode with synchronized intermittent mandatory ventilation mode (SIMV) in patients with chronic obstructive pulmonary disease (COPD) complaining of respiratory failure and reported that Peak inspiratory pressure (PIP) became lower with PCV-VG mode.

The current study illustrates that there is a significant difference between PCV-VG group and SIMV-VG in relation to weaning outcomes. The results show that more than third of study group and more than half of control group experienced weaning failure, this is can be attributed to the positive effect of suctioning, chest physiotherapy and PCV-VG mode in relieving dyspnea. This is in the line with **(Ali et al., 2016),** who compared two groups of mechanically ventilated patients and reported that the outcomes were better in PCV-VG group, most of patients were weaned successfully, seven percent died and seven percent experienced weaning failure. In comparison to forty percent of SIMV group were successfully weaned, twenty percent died and more than one-third experienced weaning failure.

The present study revealed that there is a significant decrease in length of stay of PC-VG group when compared with SIMV-VC group. The mean days spent in ICU for study group was fourteen day and was twenty-one day for control group. The shorter duration of stay for study group can be attributed for the positive effects of the provided nursing care (Suctioning, inhalation therapy, chest physiotherapy) and PCV-VG mode that allowed improving the quality of care while keeping hospital length of stay to acceptable minimum time through early recognition and intervention. This is agree with **(Li et al., 2020)**, who studied pressure controlled volume guaranteed mode and reported that it was associated with shorter duration of hospital stay. Also, the results of the current study were in an agreement with **(Ali et al., 2016),** who reported that PC-VG mode is associated with shorter duration on mechanical ventilator than SIMV mode and hence shorter length of hospital stay.

Concerning to duration on mechanical ventilator, the present study revealed that there is a significant decrease in duration on mechanical ventilator for study group when compared with control group. The mean days on mechanical ventilator for PCV-VG group was eight days and was eleven days for SIMV-VG group. This is can be attributed to the effectiveness of nursing intervention provided for patient as chest physiotherapy and suctioning that help in airway clearance. Also, due to the effectiveness of pressure-controlled volume guaranteed mode in lowering the peak inspiratory pressure and oxygenation is also better due to high flow rate. This agree with **(Ali et al., 2016),** who reported that PC-VG mode is associated with shorter duration on mechanical ventilator.

Regarding to mortality rate, the current study shows that there is a significant decrease in mortality rate for study group when compared with control group. This agree with (**Ali et al., 2016)**, who reported that the prognosis was better with a lower mortality rate in the PRVC group. This finding in contrast with **(Unal et al., 2017),** who reported that PC-VG was not associated with overventilation or a difference in mortality or morbidity when compared to SIMV-VC

5. CONCLUSION

Pressure controlled-volume guaranteed mode is better than synchronized intermittent mandatory ventilation mode in improving weaning outcomes.

6. RECOMMENDATIONS

- Providing educational program about pressure controlled-volume controlled ventilation mode and nursing care to improve weaning outcomes
- Applying the study on large number of patients and in another ICUs

REFERENCES

[1] Ali, A. A. E.-R., El Wahsh, R. A. E.-R., Agha, M. A. E.-S., & Tawadroos, B. B. (2016). Pressure regulated volume controlled ventilation versus synchronized intermittent mandatory ventilation in COPD patients suffering from acute respiratory failure. *Egyptian Journal of Chest Diseases and Tuberculosis*, *65*(1), 121–125. https://doi.org/10.1016/j.ejcdt.2015.08.004

[2] Aziz, E. M., Ebrahim, A. E. S., Mohammed, M. A., & Mohamed, M. (2018). *Factors affecting extubation outcomes after using semi - quantitative cough strength scale Keywords : Semi-Quantitative Cough Strength Score (Scss), Extubation Outcome & Mechanically*. *April*, 20–28.

[3] Burri, E., Potocki, M., Drexler, B., Schuetz, P., Mebazaa, A., Ahlfeld, U., Balmelli, C., Heinisch, C., Noveanu, M., Breidthardt, T., Schaub, N., Reichlin, T., & Mueller, C. (2011). Value of arterial blood gas analysis in patients with acute dyspnea : an observational study. *Critical Care*, *15*(3), R145. https://doi.org/10.1186/cc10268

[4] Gad, M., Gaballa, K., Abdallah, A., Abdelkhalek, M., Zayed, A., & Nabil, H. (2019). *Pressure - Controlled Ventilation with Volume Guarantee Compared to Volume - Controlled Ventilation with Equal Ratio in Obese Patients Undergoing Laparoscopic Hysterectomy*. 347–353. https://doi.org/10.4103/aer.AER

[5] Gamal, N., Hariedy, E. A., Youssef, W., Aly, M., & Mervat, M. (2015). *Chest Physiotherapy and Recruitment Maneuvers : Effects on Lung Mechanics and Pulmonary Complications among Mechanically Ventilated Patients with Acute Lung Injury*. *4*(4), 17–32. https://doi.org/10.9790/1959-04421732

[6] Gupta, C. L., & Gupta, H. (2018). *Physiotherapy for Respiratory Conditions. Adv Nursing Patient Care Int J 2018, 1(1): 180003*. *1*(1), 1–8.

[7] Hassan, B. E. E., El-Shaer, A. N., Elbeialy, M. A. K., & Ismail, S. A. M. (2020). Comparison between volume-controlled ventilation and pressure-controlled volume-guaranteed ventilation in postoperative lung atelectasis using lung ultrasound following upper abdominal laparotomies: a prospective randomized study. *Ain-Shams Journal of Anesthesiology*, *12*(1). https://doi.org/10.1186/s42077-020-00076-9

[8] Jia, Y., Kaul, C., Lawton, T., Murray-smith, R., & Habli, I. (2021). Prediction of weaning from mechanical ventilation using Convolutional Neural Networks. *Artificial Intelligence In Medicine*, *117*(December 2020), 102087. https://doi.org/10.1016/j.artmed.2021.102087

[9] Kothari, A., & Baskaran, D. (2018). Pressure-controlled volume guaranteed mode improves respiratory dynamics during laparoscopic cholecystectomy: A comparison with conventional modes. *Anesthesia: Essays and Researches*, *12*(1), 206. https://doi.org/10.4103/aer.aer_96_17

[10] Lee, J. M., Lee, S. K., Kim, K. M., Kim, Y. J., & Park, E. Y. (2019). Comparison of volume-controlled ventilation mode and pressure-controlled ventilation with volume-guaranteed mode in the prone position during lumbar spine surgery. *BMC Anesthesiology*, *19*(1), 1–7. https://doi.org/10.1186/s12871-019-0806-7

[11] Li, J., Cai, B., Yu, D., Liu, M., & Wu, X. (2020). *Pressure-Controlled Ventilation-Volume Guaranteed Mode Combined with an Open-Lung Approach Improves Lung Mechanics , Oxygenation Parameters , and the Inflammatory Response during One-Lung Ventilation : A Randomized Controlled Trial*. *2020*.

[12] Mabkhoot, A. A. E., & Israa Abed, M. A. (2018). Prevalence and Risk Factors of Dyspnea among General Population of Arar City, Kingdom Saudi Arabia. *The Egyptian Journal of Hospital Medicine*, *72*(2), 3930–3934. https://doi.org/10.21608/ejhm.2018.9072

[13] Mezidi, M., & Guérin, C. (2018). *Effects of patient positioning on respiratory mechanics in mechanically ventilated ICU patients*. *6*(19). https://doi.org/10.21037/atm.2018.05.50

[14] Number, V., Number, R., Interval, R., By, A., By, A., Facilitator, C. N., & Intranet, O. H. (2020). *Guideline for suctioning*.

[15] Pesola, G. R., & Ahsan, H. (2016). Dyspnea as an independent predictor of mortality. *Clinical Respiratory Journal*, *10*(2), 142–152. https://doi.org/10.1111/crj.12191

[16] Rn, A. J. S., Rn, A. C., Rn, N. A. S., Barnett, A. G., Caruana, L. R., Hammond, N. E., Mn, R. N., Fraser, J. F., Ffarcsi, M., & Fcicm, F. (2014). *Head-of-Bed Elevation Improves End-Expiratory Lung Volumes in Mechanically Ventilated Subjects : A Prospective Observational Study*. 1583–1589. https://doi.org/10.4187/respcare.02733

[17] Silva, P. L., & Rocco, P. R. M. (2018). The basics of respiratory mechanics: ventilator-derived parameters. *Annals of Translational Medicine*, *6*(19), 376–376. https://doi.org/10.21037/atm.2018.06.06

[18] Talwar, D. (2016). *Weaning from mechanical ventilation in chronic obstructive pulmonary disease : Keys to success*. *December*. https://doi.org/10.4103/2320-8775.183839

[19] Toker, M. K., Altıparmak, B., Uysal, A. İ., & Demirbilek, S. G. (2019). Comparison of pressure-controlled volume-guaranteed ventilation and volume-controlled ventilation in obese patients during gynecologic laparoscopic surgery in the Trendelenburg position. *Brazilian Journal of Anesthesiology (English Edition)*, *69*(6), 553–560. https://doi.org/10.1016/j.bjane.2019.10.002

[20] Unal, S., Ergenekon, E., Aktas, S., Altuntas, N., & Beken, S. (2017). *Effects of Volume Guaranteed Ventilation Combined with Two Different Modes in Preterm Infants*. 1525–1532. https://doi.org/10.4187/respcare.05513