



## OUTCOMES OF EXTUBATION AND USING IMMEDIATE NON-INVASIVE VENTILATION (NIV) IN CHRONIC OBSTRUCTIVE PULMONARY DISEASE PATIENTS IN RIYADH

Salem Alqahtani<sup>1</sup>, Prachi Tambur<sup>1</sup>, Waad Yousif Alghamdi<sup>1</sup>, Nouf Naif Almutairi<sup>1</sup>, Inaam Khalifa Alnakazh<sup>1</sup>, Manal Naser Almunea<sup>1</sup>, Kavita Sudersanadas<sup>2</sup> and Winnie Philip<sup>3</sup>,  
Shoeb Qureshi<sup>3</sup>

<sup>1</sup>Respiratory Therapy Department, College of Applied Medical Sciences, King Saud Bin Abdulaziz University for Health Sciences, Riyadh

<sup>2</sup>Department of Nutrition, College of Applied Medical Sciences, King Saud Bin Abdulaziz University for Health Sciences, Riyadh

<sup>3</sup>Department of Research, College of Applied Medical Sciences, King Saud Bin Abdulaziz University for Health Sciences, Riyadh

### ARTICLE INFO

#### Article History:

Received 11<sup>th</sup> April, 2018  
Received in revised form 4<sup>th</sup>  
May, 2018 Accepted 23<sup>rd</sup> June, 2018  
Published online 28<sup>th</sup> July, 2018

#### Key words:

Extubation, Non-Invasive Ventilation (NIV),  
Chronic Obstructive Pulmonary Disease  
(COPD)

### ABSTRACT

**Introduction:** Noninvasive ventilation (NIV), as a weaning-facilitating strategy in predominantly chronic obstructive pulmonary disease (COPD) patients who are on mechanical ventilation is associated with reduction of the reintubation rate, length of intensive care unit (ICU) and hospital stay. However, this benefit remains to be elucidated in our country that is why the study was established. The aim of this study was to determine the efficacy of NIV applied immediately after extubation in contrast to oxygen devices or NIV>48 hours in COPD patients. **Methods:** A quantitative retrospective cross-sectional study was conducted in the NGH hospital in Riyadh. It was carried out in a 6-month period. Included patients were COPD patients require mechanical ventilation with at least 48 hours. Patients were divided into two groups after extubation (immediate NIV or oxygen devices / NIV>48 hours). We compared both groups regarding PaCO<sub>2</sub> and RR after extubation (2-4 hours), reintubation rate, shifting out from ICU. **Result:** Thirty patients fulfilled the inclusion criteria and were divided into the two groups. Fifteen patients received NIV immediately after extubation and fifteen patients received oxygen devices/NIV>48 hours after extubation. The reintubation rate was different in each group. None of the patients who received immediate NIV after extubation was reintubated (0%), whereas nine patients who received oxygen devices or NIV>48 hours after extubation were reintubated (60%). ICU length of stay was different in each group. Thirteen patients of immediate NIV group were shifted from ICU (86.7%) whereas only six patients of oxygen devices or NIV>48 hours group were shifted from ICU (40%). **Conclusions:** In this study, COPD patients who received NIV immediately after extubation with more than 48 hours reduce the reintubation rate and length of ICU stay when compared with the oxygen devices/ NIV>48 hours group.

Copyright©2018 Salem Alqahtani et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

### INTRODUCTION

Immediate use of noninvasive ventilation (NIV) after extubation in critically ill adult patients, especially chronic obstructive pulmonary disease (COPD) patients is associated with the decrease of mortality, reintubation rate, and length of stay in the ICU and hospital. COPD is a chronic respiratory disease which causes irreversible airway obstruction that makes it hard to exhale normally due to narrowing of airways (1,2). The main cause of COPD is smoking cigarettes or exposure to smoking (3).

\*Corresponding author: **Salem Alqahtani**  
Respiratory Therapy Department, College of Applied  
Medical Sciences, King Saud Bin Abdulaziz  
University for Health Sciences, Riyadh

According to the World Health Organization, it is estimated that COPD will become the third leading cause of death worldwide by 2030 (4). In Saudi Arabia, about 2.4% of the population are affected by COPD (5). If there is an acute COPD exacerbation which cannot be maintained by pharmacological agents and non-invasive ventilation, the patient would require invasive ventilation. Once the exacerbation is relieved, the patient should be extubated and put on NIV (6).

COPD patients are presented with progressive airflow obstruction that is incompletely reversible (7). The airflow obstruction is mainly caused by noxious particles and other gases that cause an inflammatory response of the lungs.

Moreover, smokers who are above forty years old have a higher chance to get COPD, which produces significant systemic consequences (8). According to American Thoracic Society (ATS) and Global initiative for term Chronic Obstructive Pulmonary Disease (GOLD) guidelines the use of the term COPD to include both emphysema and chronic bronchitis (8,9). Emphysema is a chronic respiratory disease characterized by over inflation and gradually causes damage of the air sacs (alveoli) in the lungs, causing a dysfunction in the lung (10,11). Chronic bronchitis is a condition that is characterized by the presence of chronic productive coughing that lasts for at least three months for up to two years (12). However, treatment of COPD depends on the patient's status and the severity of the disease. COPD and its exacerbation can be diagnosed with a combination of interview, physical examination, chest radiograph, blood tests, simple spirometry and electrocardiogram (ECG) (7). Management can be done by pharmacological agents and/or mechanical ventilation. Severe COPD has to be treated by noninvasive or invasive ventilation as required (14). Once the exacerbation is relieved, weaning from invasive ventilation should be done as early as possible. If it is not done, it can lead to ventilator dependency (15). From volume control mode Pressure support ventilation trial is given if tolerated then extubate (16).

Extubation is removal of endotracheal tube in invasive mechanical ventilation when it is no longer required (7). After Extubation, NIV should be used for better outcomes (7).

Non-Invasive Mechanical Ventilation (NIV) is defined as noninvasive positive pressure ventilation that delivers mechanical ventilation by a nasal or face mask (17). NIV is subdivided into continuous positive airway pressure (CPAP) and biphasic positive airway pressure (BIPAP) (18). CPAP applies only one pressure during the respiratory cycle (18). Also, generation of positive end expiratory pressure (PEEP) in CPAP will decrease work of breath and auto PEEP in COPD patients (19). BIPAP is NIV mode based on time cycling between two level of pressure, inspiratory positive airway pressure (IPAP), expiratory positive airway pressure (EPAP) (20). IPAP applies during inspiration that assists breathing which means patient can breathe with less effort (18). EPAP prevent airway collapse during expiration (18). Using BIPAP in COPD patients is more effective than CPAP because it improves the arterial  $PO_2$ ,  $O_2$  saturation, and avoiding endotracheal intubation (21). Several studies have proven that early use of NIV decreases the rate of mortality and need for invasive mechanical ventilation (22,23).

There are many previous studies which suggest that using noninvasive mechanical ventilation with COPD on patients who have acute exacerbation is helpful and beneficial for them (24,25). Another similar study which is published in 2009 reported that early extubation with instant usage of NIV compared with invasive mechanical ventilation weaning with t-piece for patients with respiratory failure (26). It stated that as compared with invasive ventilation weaning, NIV weaning resulted in minimized mortality, a reduction in the duration of staying in the ICU, and reduced the chances of getting ventilator associated pneumonia VAP (26).

NIV is considered as a primary treatment for CODP patients who are mechanically ventilated. The effeteness and success of NIV for COPD patients is determined by the disease type,

severity of the disease, secretion management, team professionalism and the daily hours of using NIV (27,28).

The study was planned and proposed because there is insufficiency of data with respect to the effect of extubation and immediate use of NIV on COPD patients. The results of the study will provide possible evidence on advantages of extubation followed by immediate NIV.

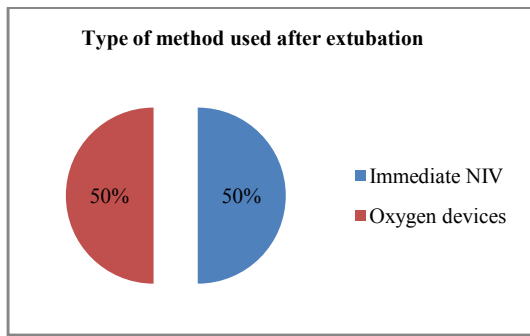
The objectives of this research were to compare the efficacy of NIV with the oxygen mask in preventing reintubation, and decrease ICU length of stay if NIV was used immediately after extubation in patients with COPD requiring mechanical ventilation for more than 48hours and to evaluate the differences between the study groups concerning ICU length of stay.

## **MATERIALS AND METHODS**

This study was a cross-sectional study based on the National Guard Health Affairs NGHA hospital in Riyadh. Our research was approved by Institutional Review Board, registered number was (SP17/222/R). Inclusion criteria of this study were all COPD patients who used oral tracheal mechanical ventilation (female and male) between 18-90 years old, during the study period of 2014-2015-2016. We excluded all COPD patients outside the ICU in NGHA, patient with VAP and patients with tracheostomy. Therefore, all COPD patients with invasive mechanical ventilation (more than 48 hours) in the ICU of NGHA were selected for the study. The sample size of this study was calculated to include 60 intubated COPD patients. After extubation, the patients categorized into two groups based on the initiation of NIV. Consecutive sampling was taken from the medical files and Best Care (digital files) during 2014, 2015 and 2016. All the data collected retrospectively from the medical charts. Then, the data were entered into Microsoft Excel sheet and exported into SPSS statistical software version 22 for analysis of data. The tables and figures were used to represent the result. Descriptive statistics such as mean and standard deviation were used for continuous variables. Categorical variables were represented as frequencies and percentages. Appropriate statistical test was used depending on the type of variable. Both groups were compared regarding reintubation rate, ICU length of stay, ABG and vital signs after extubation. The different variables before and after extubation were compared using student's 't' test based on normality of the collected data.

## **THE RESULT**

Over the 6-month study period, a total of 60 patients are diagnosed with COPD in three years (2014-2015-2016) admitted to the ICU required mechanical ventilation (orotracheal intubation) for period more than 48 hours. Thirty of them fulfilled the inclusion criteria and were divided into the two groups. Fifteen patients received NIV immediately after extubation and fifteen patients received oxygen devices or NIV>48 hours after extubation (figure1).



**Figure 1** Type of method used after extubation

Eleven patients were male (36.7%) while 19 patients were female (63.3%). Mean age was 72.97±10.486 year old (table1). Minimum age was 52 year and the maximum age was 89 year (table1).

**Table 1** Demography of study Subjects

Variable	Number of patient	Percentage
<b>Gender</b>		
Male	11	36.7
Female	19	63.3
Total	30	100.0
<b>Age (in years)</b>	Mean	SD
	72.97	10.486
	Minimum age	Maximum age
	52	89

Mean PaCO<sub>2</sub> after 2-4 hours from extubation was 51.21±15.07mm Hg in the immediate NIV group and 49.27± 8.66 mm Hg in the Oxygen devices or NIV>48 hours group (P = 0.670) (table2).

Mean respiratory rate after 2-4 hours was 23.13±7.49breaths/min in the immediate NIV group and 23.73± 4.57 breaths/min in the Oxygen devices or NIV>48 hours group (P = 0.793) (table2).

**Table 2** Comparison of PaCO<sub>2</sub> and RR values after 2-4 in the two groups

Variable	Type of method used after extubation	Mean±SD	Test statistic	P value
PaCO <sub>2</sub> 2-4 hours	Immediate NIV	51.21±15.07	T=	0.670
	Oxygen device	49.27±8.66	0.432	
RR 2-4 hours	Immediate NIV	23.13±7.49	T= -	0.793
	Oxygen device	23.73±4.57	.265	

The reintubation rate was different in each group. None of the patients who received immediate NIV after extubation was reintubated, whereas nine patients who received oxygen devices or NIV>48 hours after extubation were reintubated (60%) (table 3).ICU length of stay was different in each group. Thirteen patients of immediate NIV group were shifted from ICU (86.7%) whereas only six patients of oxygen devices or NIV>48 hours group were shifted from ICU (40%) (table 3).

**Table 3** Outcomes for the study groups

Outcomes	Immediate NIV (n=15)	Oxygen devices or NIV >48 hours (n=15)
Reintubation rate, number (%)	0 (0)	9(60%)
shifting out from ICU, number (%)	13(86.7%)	6(40%)

**DISCUSSION**

Our study results support the immediate use of NIV after extubation in COPD patients more effective than oxygen devices. Also, the primary objective of the study was to

prevent reintubation and to shift them out from ICU.The similar researches which were published recently proved that using NIV after immediate extubation has positive outcomes comparing with O<sub>2</sub> therapy in patients with acute respiratory failure (29). The immediate application of NIV after extubation decreases the length of stay in ICU and the incidence of reintubation (26). NIV maintain the airway open and it improves oxygenation as well as ventilation. Moreover, vital signs and arterial blood gas result are better in patients who reserved NIV. Ornicco *et al* in 2013 examined all acute respiratory failure patients and reported that using NIV after immediate extubation was more beneficial (29). They did not apply all CPAP types and emphasized only on nasal CPAP (29). We found that 86.7% of COPD patients who received NIV immediately after extubation were shifted out from ICU compared to 40% of patients who received O<sub>2</sub> therapy immediately after extubation. 20% of patients on O<sub>2</sub> therapy were reintubated versus 0% with NIV. This study showed that the significant success of early NIV using after extubation improves the ventilation and oxygenation due to continuous pressure which keep the airway open (21). Consequently, it prevents respiratory muscle fatigue, lung collapse incidence and respiratory distress. It is important that NIV should be used immediately after extubation. We hope that in the future the researchers publish more studies about the adverse effects of using immediate O<sub>2</sub> therapy after extubation.

**Limitations and strengths**

Certain limitations of this research must be recognized. First, the sample size of patients was small. Sample size of 15 in each group. Also, some data was missing that reduce the statistical power, and have significant effect on conclusion. Conclusion

Noninvasive ventilation compared with oxygen device is beneficial in prevent reintubation and decreased ICU length of stay if done immediately after extubation in COPD patients requiring invasive mechanical ventilation for more than 48 hours.

**References**

- Currie, G. (2011). ABC of COPD. 2nd ed. Chichester, West Sussex, UK: Wiley-Blackwell, BMJ Books, p.1.
- Mahboub B, Alzaabi A, Soriano J, Salameh L, Mutairi Y, Yusufali A *et al*. Case-finding of chronic obstructive pulmonary disease with questionnaire, peak flow measurements and spirometry: a cross-sectional study. BMC Research Notes. 2014;7(1):241.
- Mannino DM, Croft JB, Brown DW. Chronic obstructive pulmonary disease. In: Schraufnagel DE, ed. Breathing in America: Diseases, Progress, Hope. United State Senator, Idaho: the American Thoracic Society.2010; p47.
- Sin D, Anthonisen N, Soriano J, Agusti A. Mortality in COPD: role of comorbidities. *European Respiratory Journal*. 2006;28(6):1245-1257.
- Al Ghobain M. The prevalence of chronic obstructive pulmonary disease in Saudi Arabia: Where do we stand?. *Ann Thorac Med*, 2011 Oct-Dec; 6(4): 185–186.
- Plant P, Owen J, Elliott M. Early use of non-invasive ventilation for acute exacerbations of chronic obstructive pulmonary disease on general respiratory

- wards: a multicentre randomised controlled trial. *The Lancet*. 2000;355(9219):1931-1935.
7. Robert L, James R, Philip M. Chronic Obstructive Pulmonary Disease. In: Karol-Lee Trakalo (eds.) *Respiratory Disease*. 3rd ed. library of congress cataloging; 2007. p 68-98
  8. A.G.N. Agusti, A. Noguera, J. Sauleda, E. Sala, J. Pons. X. Busquets Systemic effects of chronic obstructive pulmonary disease. *European Respiratory Journal*. 2003; 21: 347–360.
  9. Celli B.R, MacNee W. Standards for the diagnosis and treatment of patients with COPD: a summary of the ATS/ERS position paper. *European Respiratory Society Journals*. 2004; 23: 932–946
  10. Kasahara.Y, Waltenberger.J, Norbert F. Voelkel. Inhibition of VEGF receptors causes lung cell apoptosis and emphysema. *The journal of clinical investigation* 2000;106(11):1311-1319
  11. Demedts I, Demoor T, Bracke K, Joos G, Brusselle G. Role of apoptosis in the pathogenesis of COPD and pulmonary emphysema. *Respiratory Research*. 2006;7(1)50-53.
  12. Gibson P.G, Denburg J, Dolovich J, Ramsdale E.H, Hargreave F.E. *The Lancet*. chronic cough: eosinophilic bronchitis without Asthma. 2003; 333 (8651):1346-1348
  13. Thornton.A, Lee.P. BMC Pulmonary Medicine: Systematic review with meta-analysis of the epidemiological evidence relating smoking to COPD, chronic bronchitis and emphysema. 2011;11(36).1186-1471
  14. El-Shimy W, Barima M., Abo El-Magd G, Mansour S. Non invasive ventilation versus synchronized intermittent mandatory ventilation with pressure support in weaning of COPD patients: Comparative study. *Egyptian Journal Of Chest Diseases And Tuberculosis*, (2013); 62(1): 159-166.
  15. Muir, J., Ambrosino, N., & Simonds, A. Noninvasive mechanical ventilation (1st ed.). Sheffield: *European Respiratory Society Journals*. (2001);17(1).1271-1281.
  16. Haberthür C, Mols G, Elsasser S, Bingisser R , Stocker R, Guttman J. Extubation after breathing trials with automatic tube compensation, T-tube, or pressure support ventilation. *wiley online library*. 2002;46(8): 973–979
  17. Barreiro TJ, Gemmel DJ. Noninvasive ventilation. *Crit Care Clin*. 2007; 23(2):20122.
  18. Khilnani GC, Banga A. Noninvasive ventilation in patients with chronic obstructive airway disease. *Int J Chron Obstruct Pulmon Dis*, 2008; 3(3): 351–357.
  19. Lopes A, Nery F, Sousa F, Guimaraes F, Dias C, Oliveira J *et al*. CPAP Decreases Lung Hyperinflation in Patients With Stable COPD. *Respiratory Care*. 2011;56(8):1164-1169.
  20. Putensen C, Wrigge H. Biphasic positive airway pressure and airway pressure release ventilation. *Crit Care*. 2004; 8(6): 492–497.
  21. Ameen A, Zedan M, El Shamly M. Comparison between continuous positive airway pressure and bilevel positive pressure ventilation in treatment of acute exacerbation of chronic obstructive pulmonary disease. *Egyptian Journal of Chest Diseases and Tuberculosis*. 2012;61(3):95-101.
  22. Plant P, Owen J, Elliott M. Early use of non-invasive ventilation for acute exacerbations of chronic obstructive pulmonary disease on general respiratory wards: a multicentre randomised controlled trial. *The Lancet*. 2000;355(9219):1931-1935.
  23. Plant P. One year period prevalence study of respiratory acidosis in acute exacerbations of COPD: implications for the provision of non-invasive ventilation and oxygen administration. *Thorax*. 2000;55(7):550-554.
  24. Garpestad E, Hill N. Noninvasive ventilation for acute lung injury: how often should we try, how often should we fail?. *Critical Care*. 2006; 10(4):147.
  25. Ferrer M, Valencia M, Nicolas J, Bernadich O, Badia J, Torres A. Early Noninvasive Ventilation Averts Extubation Failure in Patients at Risk. *American Journal of Respiratory and Critical Care Medicine*. 2006;173(2):164-170.
  26. Prasad SB, Chaudhry D, Khanna R. Role of noninvasive ventilation in weaning from mechanical ventilation in patients of chronic obstructive pulmonary disease: An Indian experience. *Indian J Crit Care Med*, 2009 Oct-Dec; 13(4): 207–212.
  27. Servera E, Sancho J, Zafra M, Marín J. Secretion Management Must Be Considered When Reporting Success or Failure of Noninvasive Ventilation. *Chest*. 2003;123(5):1773.
  28. Nava S, Navalesi P, Conti G. Time of non-invasive ventilation. *Intensive Care Medicine*. 2006;32(3):361-370.
  29. Ornicco S, Lobo S, Sanches H, Deberaldini M, Tófoli L, Vidal A *et al*. Noninvasive ventilation immediately after extubation improves weaning outcome after acute respiratory failure: a randomized controlled trial. *Critical Care*. 2013; 17(2):R39.

**How to cite this article:**

Salem Alqahtani *et al* (2018) 'Outcomes of Extubation and Using Immediate Non-Invasive Ventilation (Niv) in Chronic Obstructive Pulmonary Disease Patients In Riyadh', *International Journal of Current Advanced Research*, 07(7), pp. 14269-14272. DOI: <http://dx.doi.org/10.24327/ijcar.2018.14272.2580>

\*\*\*\*\*