



## OUTCOME OF NON-INVASIVE VENTILATION (NIV) AMONG PATIENTS WITH TYPE II RESPIRATORY FAILURE DUE TO ACUTE EXACERBATION OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE (COPD).

Muhammad Atiq ul Mannan<sup>1</sup>, Muhammad Imran Shahzad<sup>2</sup>, Muhammad Waqas Afzal<sup>3</sup>, Humayoun Ghulam Murtaza<sup>4</sup>, Muhammad Waseem<sup>5</sup>, Tahir Khan<sup>6</sup>

1. MBBS, MD, DTCD, FCPS (Pulmonology)  
Senior Registrar Pulmonology  
Nishtar Medical University Multan.
2. MBBS, FCPS (Pulmonology)  
Assistant Professor Pulmonology  
Chaudhary Pervaiz Elahi Institute of Cardiology Multan.
3. MBBS, DTCD, FCPS (Pulmonology)  
Senior Registrar Pulmonology  
Nishtar Medical University Multan.
4. MBBS, DTCD, FCPS (Pulmonology)  
Assistant Professor Pulmonology  
Nishtar Medical University Multan.
5. MBBS, FCPS (Pulmonology)  
Assistant Professor  
Sahiwal Medical College, Sahiwal.
6. MBBS, FCPS (Pulmonology)  
Consultant Pulmonologist  
Fatima Jinnah Chest Hospital  
Quetta.

**Correspondence Address:**  
Dr. Muhammad Atiq Ul Mannan  
Ward no 22, Department of  
Pulmonology  
Nishtar Medical University, Multan.  
atiq\_ul\_mannan@yahoo.com

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**ABSTRACT... Objectives:** To determine the “frequency of ‘success’ of non-invasive ventilation (NIV) among patients with type II respiratory failure due to acute exacerbation of chronic obstructive pulmonary disease (COPD)”. **Study Design:** Cross sectional Study. **Setting:** Department of Pulmonology Nishtar Hospital Multan. **Period:** March 2016 August 2016. **Material & Methods:** A total of 101 study cases meeting inclusion and exclusion criteria of this study were registered using non probability consecutive sampling technique. Arterial samples for arterial blood gases (ABG) were sent. Base line pH and pCO<sub>2</sub> were measured. All the patients were offered with NIV for 12 hours. After 12 hours, ABG was again measured to see any improvement in pH and pCO<sub>2</sub>. Success as labeled as ‘yes’ if pH > 7.35 and pCO<sub>2</sub> is < 60 mm of Hg. The patients were discharged and follow up time was adjusted. **Results:** Out of these 101 study cases, 53 (52.5 %) were male and 48 (47.5 %) were female patients having mean age 61.50 ± 10.77 years. Mean duration of disease was 8.54 ± 5.26 years. Mean BMI levels of our study cases was 23.31 ± 2.18 Kg/m<sup>2</sup>. Mean baseline pH value was 7.32 ± 0.016. Mean baseline pCO<sub>2</sub> value was calculated to be 67.56 ± 6.05 mmHg. Mean pH value at 12 hours after NIV was 7.37 ± 0.02. Mean pCO<sub>2</sub> value at 12 hours after NIV was calculated to be 51.32 ± 6.30 mm Hg. Success was achieved in 98 (97%) of our study cases. Success was stratified with regards to gender, age, BMI and duration of disease and p values calculated were found to be p=1.00, p= 0.591, p=0.026 and p=0.606 respectively. **Conclusion:** Our study results indicate that Non-invasive ventilation (NIV) is effective, reliable, safe and very cost effective method among the patients with respiratory failure due to acute exacerbation of COPD.

**Key words:** Acute Exacerbation, COPD, Non-invasive Ventilation.

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## INTRODUCTION

Chronic Obstructive Pulmonary Disease (COPD) is commonly encountered by pulmonologists and physicians worldwide. Typical symptoms of chronic obstructive pulmonary disease (COPD) patients are “chronic bronchitis and emphysema, but the classic triad also includes asthma”. Chronic bronchitis may be regarded as persistence of chronic productive cough for duration of more than 3 months during last 2 consecutive years while other reasons of coughing be excluded. Emphysema can be termed pathologically as permanently abnormal enlargement of air spaces which are distal to the terminal bronchioles, associated with destruction of their walls having no typical signs of fibrosis.<sup>1</sup>

Worldwide exact magnitude of the COPD still needs to be elaborated while different estimates have reported varying ranges from 7 – 19 % in different parts of the world with 10.1% prevalence rate all over the world as reported by burden of Obstructive Lung Disease (BOLD) study.<sup>2</sup>

Acute exacerbation of COPD is a period for acute deterioration that largely affects the physical health status of COPD and leads to frequent hospital admissions, emergency visits as well as increased rates of mortality.<sup>3</sup> Different estimates have reported mortality rates ranging from 4 to 30 % in different population subsets, however higher rates of mortality have been observed among

acute respiratory failure (ARF) patients which are associated with increasing age and having co-morbidities (up to 50%) while patients who are admitted to intensive care unit (ICU) have mortality rate of 11 – 26%.<sup>4</sup>

Non-invasive ventilation (NIV) is regarded as employment of artificial ventilation of these patients with no use of tubal access of endotracheal or tracheostomy tube.<sup>5</sup> These days, NIV has gained a major role in the treatment of patients having acute respiratory failure. NIV helps to prevent different complications related with invasive ventilations such as; airway issues, nosocomial pneumonia up to 21% and sinusitis which ranges 5-25% by avoiding endotracheal intubation.<sup>6</sup>

Noninvasive mechanical ventilation may be employed in ICU setting as well as among in-patients by a highly trained team of healthcare professionals effectively and safely to get desired outcomes.<sup>7</sup> However, NIMV treatment is not globally recommended as per guidelines of the American Thoracic Society (ATS) and the British Thoracic Society (BTS) for every patient presenting with acute respiratory failure. NIMV may not be regarded as an alternate for intubation and invasive mechanical ventilation especially when latter is obviously more appropriate<sup>8</sup> as NIMV failure rates among respiratory failure patients of COPD has been shown to be 5 – 40%.<sup>9</sup>

In a recent study conducted by Pnadey, et al<sup>10</sup> in Nepal reported twelve hours after bi-level ventilation, 78.7% patients had normal pH and 42.8% had pCO<sub>2</sub> above 60 mm Hg showing successful in 27 patients (96.4%).

Acute exacerbation of COPD is very common in a developing country like Pakistan. The mortality is also very high. For such patients, ideal treatment is mechanical ventilation. However, it is not possible to arrange ICU care for every patient with acute exacerbation of COPD. Previously, Pnadey et al, have shown promising results with NIV among such patients. However, this is the only study which have shown a success rate of > 90%. This study was conducted only in a limited sample

size of 28 patients. Therefore results cannot be generalized on such population hence this study was designed with adequate sample size and if success is found to be high then same modality would be used in such patients in future.

## MATERIAL & METHODS

One hundred and one patients with type II respiratory failure due to acute exacerbation COPD were registered through department of Pulmonology, Nishtar Medical University, Multan in this descriptive case series. All the patients with acute exacerbation of COPD leading to type II respiratory failure (Baseline pH < 7.35 and pCO<sub>2</sub> > 60 mm Hg has been considered of either gender aged ranging from 40 – 80 years were included in this study. Patients having tuberculosis (cough) at the time of admission, lung malignancy, bronchiectasis were excluded from this study. Demographic history [including age (in years) and sex (male or female) were taken. Arterial samples for arterial blood gases (ABG) were sent. Base line pH and pCO<sub>2</sub> were measured. All the patients were offered with NIV for 12 hours. After 12 hours, ABG was again measured to see any improvement in pH and pCO<sub>2</sub>. Success as labeled as 'yes' if pH > 7.35 and pCO<sub>2</sub> is < 60 mm of Hg. The patients were discharged and follow up time was adjusted and data was analyzed by SPSS - 20. The categorical data like demographics (sex; male or female), Obesity (BMI>30) and success (yes or no) have been presented as frequency distribution. Quantitative data like age (in years), duration of disease, base line pH and pCO<sub>2</sub>, and 12 hours pH and pCO<sub>2</sub> have been presented as means and standard deviations. The main outcome variable is success which has been presented as frequency and percentage. Age, gender, duration of disease and obesity (BMI>30) have been controlled through stratification applying Chi-square test. P value ≤ 0.05 was taken as significant.

## RESULTS

Our study included 101 patients having type II respiratory failure due to acute exacerbation of chronic obstructive pulmonary disease. Of these 101 study cases, 53 (52.5 %) were male and 48 (47.5 %) were female patients having mean age

61.50 ± 10.77 years while 53 (52.5%) belonged to age group of 60 to 80 years.

Mean duration of disease was 8.54 ± 5.26 years (Minimum disease duration was 2 years and maximum was 30 years). Mean BMI levels of our study cases was 23.31 ± 2.18 Kg/m<sup>2</sup> (with minimum BMI was 17 Kg/m<sup>2</sup> while maximum BMI value was 28 Kg/m<sup>2</sup>).

Mean baseline pH value was 7.32 ± 0.016 (Minimum baseline pH was 7.29 while maximum baseline pH value was 7.34). Mean baseline pCO<sub>2</sub> value was calculated to be 67.56 ± 6.05 mmHg (with minimum pCO<sub>2</sub> level was 60 while maximum was 80mmHg).

Mean pH value at 12 hours after NIV was 7.37 ± 0.02 (Minimum pH was 7.33 while maximum pH value at 12 hours after NIV was 7.45). Mean pCO<sub>2</sub> value at 12 hours after NIV was calculated to be 51.32 ± 6.30 mm Hg (with minimum pCO<sub>2</sub> level was 40 while maximum was 76mmHg).

Success was achieved in 98 (97%) of our study cases while only in 03 (3%) of our study cases could not attain desired results. Success was stratified with regards to gender, age, BMI and duration of disease and p values calculated were found to be p=1.00, p= 0.591, p=0.026 and p=0.606 respectively.

BMI (In Kg / m <sup>2</sup> )	Success		P-Value
	Yes (n = 98)	No (n = 03)	
16 – 18.5 (n =04)	03	01	0.026
18.6 – 25 (n =81)	79	02	
25.1 – 30 (n =16)	16	Nil	
Total	101		

**Table-I. Stratification of success with regards to BMI (n=101)**

pH	Mean	Standard Deviation	P-Value
Baseline value	7.32	0.01	0.000
At 12 hours after NIV	7.37	0.02	

**Table-II. Comparison of baseline pH values with pH values at 12 hours after NIV (n=101)**

pCO <sub>2</sub>	Mean	Standard Deviation	P-Value
Baseline value	67.56	6.05	0.000
At 12 hours after NIV	51.32	6.30	

**Table-III. Comparison of baseline pCO<sub>2</sub> values with pCO<sub>2</sub> values at 12 hours after NIV (n=101)**

**DISCUSSION**

For last couple of decades use of non-invasive ventilation (NIV) has gained much interest as there have been series of case reports, observational studies, systematic reviews and randomized controlled trials favoring this mode of treatment in acute care.<sup>11-15</sup>

The present study was conducted to document the success rate of NIV in our population presenting with acute respiratory failure due to acute exacerbation of chronic obstructive pulmonary disease.

One hundred and one, 53 (52.5 %) were male and 48 (47.5 %) were female. Pnadey et al<sup>10</sup> reported 40 % male patients and 60% female patients with type II respiratory failure in their study. Their findings are different from that of our study results.

Mean age of our study cases was 61.50 ± 10.77 years mean age 61.50 ± 10.77 years while 53 (52.5%) belonged to age group of 60 to 80 years. Pnadey et al<sup>10</sup> reported 66.5 years mean age of these patients in their study and also reported that majority of patients were in age range of 60 – 80 years of age. These findings are in compliance with that of our study results. Titles tad et al<sup>16</sup> reported mean age of such patients 74 years which is bit high than that of our finding.

Mean baseline pH value was 7.32 ± 0.016 (Minimum baseline pH was 7.29 while maximum baseline pH value was 7.34). Mean baseline pCO<sub>2</sub> value was calculated to be 67.56 ± 6.05 (with minimum pCO<sub>2</sub> level was 60 while maximum was 80). Titlestad et al<sup>16</sup> reported baseline pH value to be 7.26, these findings are close to that of our study results.

Mean pH value at 12 hours after NIV was 7.37 ± 0.02 (Minimum pH was 7.33 while maximum pH

value was 7.45). Significant improvement was seen in our study cases in terms of their pH levels ( $p=0.000$ ). Budweiser et al<sup>17</sup> reported mean pH 7.41 in their study, these study results are in compliance with that of our study results.

Mean  $pCO_2$  value at 12 hours after NIV was calculated to be  $51.32 \pm 6.30$  mm Hg (with minimum  $pCO_2$  level was 40 while maximum was 76mm Hg). Significant improvement was observed in  $pCO_2$  levels among our study cases after 12 hour NIV ( $p=0.000$ ). Thibout et al<sup>18</sup> reported mean  $pCO_2$  level to be  $53 \pm 8$  mm Hg, which is close to our study results.

Many randomized controlled trials have documented usefulness of NIV in different population subsets in patients with respiratory failure and COPD.<sup>10,15</sup> Success was achieved in 98 (97%) of our study cases while only in 03 (3%) of our study cases could not attain desired results. Budweiser et al<sup>17</sup> reported 88.9% success rate in their study, these findings are close to that of our study results. Pnadey et al<sup>10</sup> reported 96.4% success rate in their study at 12 hours after NIV. Our study results are in compliance with that of those reported by Pnadey et al.<sup>10</sup> Success rate was stratified with regards to gender, age, BMI and duration of disease and p values calculated were found to be  $p=1.00$ ,  $p=0.591$ ,  $p=0.026$  and  $p=0.606$  respectively.

## CONCLUSION

Our study results indicate that Non-invasive ventilation (NIV) is effective, reliable, safe and very cost effective method among the patients with respiratory failure due to acute exacerbation of COPD. Our study findings are in favor of current recommendations/guidelines regarding the use of NIV.

The patients with type II respiratory failure due to acute exacerbation of COPD benefited significantly with the use of NIV. Being a cost effective as well as safe mode of treatment, it may be employed in patients with type 2 respiratory failure due to COPD on priority basis. NIV is being employed currently in a various healthcare settings such as from the ICU to home care

facilities. The appropriate selection of patients and the technical expertise of the health care staff and the patients to meet required adaptation to the procedure are of paramount importance for success of NIV. Being cost effective, it can add to the national health economies as well as beneficial for the sufferer families.

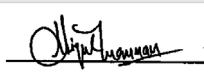
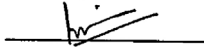

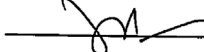
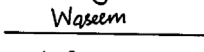
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### AUTHORSHIP AND CONTRIBUTION DECLARATION

Sr. #	Author(s) Full Name	Contribution to the paper	Author(s) Signature
1	M. Atiq ul Mannan	1st Author	
2	M. Imran Shahzad	2nd Author	
3	M. Waqas Afzal	3rd Author	
4	Humayoun Ghulam Murtaza	4th Author	
5	Muhammad Waseem	5th Author	 Waseem
6	Tahir Khan	6th Author	