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## ORIGINAL ARTICLE

# Effectiveness of non invasive positive pressure ventilation in chronic obstructive pulmonary disease patients

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### KEYWORDS

NIPPV;  
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**Abstract** 27 patients diagnosed as chronic obstructive pulmonary disease (COPD) came with acute hypercapnic respiratory failure due to COPD and met the inclusion and exclusion criteria. They were managed by non invasive positive pressure ventilation (NIPPV). 21 cases showed success and 6 cases showed failure and were put on invasive mechanical ventilation within the first 24 h. It was shown that before initiation of NIPPV, the failed cases had significantly higher Body Mass Index (BMI) 34.7 compared to 28.1 in successful cases and significantly lower pH  $7.20 \pm 0.05$  compared with  $7.27 \pm 0.04$ . After 1 h of initiation of NIPPV, the successful group showed improvement regarding pH and PaCO<sub>2</sub>, while the failed group showed worsening of the same parameters, with a significant difference ( $p$  value  $< 0.001$ ,  $0.005$ ), respectively. After 4 h, there was improvement in both groups regarding pH which reached normalization in the successful group, PaCO<sub>2</sub>, and PO<sub>2</sub>, with no statistical significant difference. There were significant differences in the respiratory rate ( $p$  value  $< 0.001$ ), and the expiratory positive airway pressure (EPAP) ( $p$  value  $0.024$ ) between the two groups. Thus we can conclude that the use of NIPPV in such patients can be successful in around 78% of cases, however failure can be predicted by high BMI, initial lower pH and higher PaCO<sub>2</sub>, insignificant response to NIPPV after 1 h. They also show increased respiratory rate and need for higher expiratory positive airway pressure.

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## Introduction

The first-line treatment of patients with acute respiratory failure (ARF) is mechanical ventilation either with positive or negative pressure, invasively or noninvasively [1]. A great deal of clinical research has shown that non-invasive ventilation (NIV), is a valuable form of treatment for ARF. NIV is not yet firmly established in acute care in all institutions [2]. Many potential advantages of non-invasive over invasive ventilation include greater patient comfort and ease of

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administration (at least in chronic settings), reduced morbidity and mortality, and more economical administration [3].

Indications of use of NIPPV include hypercapnic ARF, hypoxemic ARF, cardiogenic pulmonary edema, the perioperative phase, early weaning and the postextubation phase, NIV in pediatrics and palliation [2]. Although NIPPV showed great success in the management of acute hypercapnic exacerbations of COPD, yet there is a certain percentage of failure and those failing patients will require invasive mechanical ventilation [4].

### Rationale

Evaluation of the effectiveness of NIPPV in the management of acute respiratory failure in COPD patients.

### Methodology

This is a prospective observational study that was conducted in the Respiratory Intensive Care Unit (RICU) Chest Department Cairo University Hospitals. COPD patients presenting with ARF treated by NIV in the period from May 2010 to April 2011 had been enrolled.

All patients were subjected to full medical history and clinical examination, radiological assessment by plain Chest X-ray, arterial blood gases and Routine laboratory investigations such as kidney and liver function tests. Then patients

were subjected to NIPPV according to the inclusion criteria mentioned below and others who met the exclusion criteria will be discarded.

### Inclusion criteria

Patients who fulfill the definition of acute respiratory failure [5]:

Clinical signs and symptoms of acute respiratory distress: dyspnea, respiratory rate more than 24 breaths per minute, use of accessory muscles of respiration, presence of paradoxical breathing and,

Arterial blood gas (ABG) analysis with: PH < 7.35, partial pressure of oxygen in arterial blood (PaO<sub>2</sub>)/fraction of inspired oxygen concentration (FiO<sub>2</sub>) ratio less than 200 (or PaO<sub>2</sub> less than 60 mmHg).

### Exclusion criteria

These include respiratory arrest, medically unstable condition (hypotension, uncontrolled cardiac ischemia/arrhythmia etc.), inability to protect airway (excess secretions, stuporous or comatose patient), abnormalities which preclude proper fit of the interface (agitated or uncooperative patient, facial trauma or burns, facial surgery or facial anatomical abnormality).

Noninvasive ventilation will be administered by the use of portable noninvasive ventilator (RESMED, VPAP IV). NIPPV will be delivered to patients in bed at an angle of 30–45° and in all patients a full face mask will be used as an interface for delivery of positive pressure.

At the outset the patient will start on an IPAP of 8 and EPAP of 4 cm H<sub>2</sub>O. The pressures will be gradually adjusted as tolerated based on continuous pulse-oximetry, arterial blood gases alleviation of patient's dyspnea, decrease in respiratory rate and good patient – ventilator synchrony.

27 COPD patients with ARF were subjected to NIPPV with 21 cases showing success (ABG improvement without a need for invasive MV in the first 24 h) and 6 cases showing failure and needed invasive mechanical ventilation eventually. (These cases were COPD with comorbidities; 2 cases were diabetic, 2

**Table 1** Descriptive statistics, results of Student's *t*-test and chi-square test for comparisons between demographic data in successful and failed groups.

Parameters	Successful ( <i>n</i> = 21)	Failed ( <i>n</i> = 6)	<i>P</i> -value
Age (Years)	57.9 ± 8.8	62.3 ± 5	0.252
BMI (kg/m <sup>2</sup> )	28.1 ± 3.3	34 ± 3.7	0.001*
<i>Gender (n,%)</i>			
Male	18 (85.7)	5 (83.3)	0.885
Female	3 (14.3)	1 (16.7)	

\* Significant at *P* ≤ 0.05.

**Table 2** Descriptive statistics and results of Student's *t*-test and Mann–Whitney *U* test (for PaCO<sub>2</sub> data) for comparisons between ABG in successful group and failed group.

Time	ABG	Successful COPD ( <i>n</i> = 21)	Failed COPD ( <i>n</i> = 6)	<i>P</i> -value
Before NIPPV	pH	7.27 ± 0.04	7.20 ± 0.05	0.001*
	PaCO <sub>2</sub> (%)	84 ± 15.5	85.3 ± 18.9	1.000
	PO <sub>2</sub> (%)	54.5 ± 14.7	56.2 ± 16.6	0.813
After 1 h	pH	7.30 ± 0.03	7.19 ± 0.08	< 0.001*
	PaCO <sub>2</sub> (%)	70.2 ± 14.7	87.5 ± 7.3	0.005*
	PO <sub>2</sub> (%)	65.6 ± 24.2	53.8 ± 23	0.299
After 4 h	pH	7.35 ± 0.03	7.32 ± 0.07	0.137
	PaCO <sub>2</sub> (%)	60 ± 15.3	62.2 ± 15.7	0.559
	PO <sub>2</sub> (%)	67.8 ± 15.5	70.3 ± 12.5	0.714
After 24 h	pH	7.40 ± 0.05	7.37 ± 0.07	0.245
	PaCO <sub>2</sub> (%)	57.1 ± 13.3	55.8 ± 20.7	0.320
	PO <sub>2</sub> (%)	69.8 ± 14	76.3 ± 14.3	0.323

\* Significant at *P* ≤ 0.05.

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