The Egyptian Journal of Critical Care Medicine (2014) 2, 29–36

The Egyptian College of Critical Care Physicians

The Egyptian Journal of Critical Care Medicine

http://ees.elsevier.com/ejccm
www.sciencedirect.com

ORIGINAL ARTICLE

# The effectiveness of non-invasive ventilation in management of respiratory failure in Palestine a prospective observational study

**Baraa Jihad Ibrahim** [a,*], **Dina Khalid Jaber** [b]

[a] *An-Najah National University, Nablus, State of Palestine*
[b] *An-Najah National University, Teaching Hospital, Department of Critical Care Medicine, State of Palestine*

Received 11 March 2014; revised 9 July 2014; accepted 12 July 2014
Available online 30 July 2014

**KEYWORDS**

Respiratory failure, Non-invasive ventilation;
Palestine;
Mechanical ventilation

**Abstract** In clinical practice, physicians have recently attempted to avoid mechanical ventilation (MV) as much as possible and have started to use non-invasive ventilation (NIV) in patients with respiratory failure. A prospective observational study was conducted to assess the applicability, effectiveness, and safety of NIV in managing patients with respiratory failure in Palestine. Fifty-two patients (39 patients from West Bank and 13 patients from Gaza Strip) who fulfilled criteria for inclusion were admitted to the two medical care units of the An-Najah National Teaching Hospital during a 10-month period. These patients formed the study population to receive NIV. The results came with baseline (mean ± SD) pH, $PaO_2$, and $PaCO_2$ measurements of 7.36 ± 0.1, 75.62 ± 32.7, and 46.5 ± 20.86 mmHg, respectively. The primary indication for NIV was hypoxemic respiratory failure ($n$ = 38, 73%). The success rate with NIV was 78%, with 40 out of 52 patients weaned successfully. Significant improvements were observed in the first hour following institution of NIV in pH (7.38 ± 0.07, $P < 0.001$), $PaO_2$ (90.4 ± 52.4, $P < 0.001$), and $PaCO_2$ (40.4 ± 12.6, $P < 0.001$). These physiological parameters continued to improve up to the time of weaning: pH (7.39 ± 0.07, $P < 0.001$), $PaO_2$ (99.9 ± 44.3, $P < 0.001$), and $PaCO_2$ (38.6 ± 13.9, $P < 0.001$). The parameters were maintained within 12 h post-weaning: pH (7.39 ± 0.08, $P < 0.001$), $PaO_2$ (97 ± 30.3, $P < 0.001$), and $PaCO_2$ (36.9 ± 10.3, $P < 0.001$). This study has shown benefits of NIV in avoiding the call for invasive MV in patients exhibiting respiratory failure of varied etiology, with similar results comparable to previous studies in developed countries. Thus,

* Corresponding author. Tel.: +970 569049584.
E-mail addresses: Braa_add@yahoo.com (B.J. Ibrahim), Dandon29@hotmail.com (D.K. Jaber).
Peer review under responsibility of The Egyptian College of Critical Care Physicians.

Production and hosting by Elsevier

http://dx.doi.org/10.1016/j.ejccm.2014.07.002

increased usage of NIV in respiratory failure is likely to affect favorably in countries with limited resources such as Palestine.



## 1. Introduction

Respiratory failure is a common cause of illness and death, the cost to society in terms of lost productivity and shortened lives is enormous [1]. Mortality rates in Intensive Care Units (ICUs) in Europe were around 40% [2,3], and epidemiological studies suggest that respiratory failure will become more common as the population ages, increasing by as much as 80% in the next 20 years [1].

For many years, patients who developed respiratory failure had to be put on invasive MV, but it caused many severe complications in those patients, so the recent critical care literature has shown an outburst of articles on non-invasive respiratory ventilation for patients with respiratory failure of varied etiology, with numerous published randomized controlled trials and meta-analysis on this topic [4–8]. Abundant data supporting NIV impact on respiratory failure have been published from the western countries [9–20], but hardly any data from the Middle East.

Also, Palestinian hospitals lack any experience with NIV, but the An-Najah National University teaching hospital has recently started to equip their critical care centers (Intensive Care Unit and Cardiac Care Unit) with non-invasive ventilator and well-trained teams with critical care specialists and has started dealing with patients from all over the West Bank and Gaza Strip including those who are referred by the ministry of health. This study evaluates the applicability, effectiveness, and safety of NIV as a first-line intervention for respiratory failure in this hospital. Also, we expect from this study to increase the awareness in Palestinian health society and the region of the NIV role in respiratory failure.

## 2. Subjects and methods

After approval by the local ethics committee of research institutions at the An-Najah National University, Nablus, Palestine (Chairperson Prof. Samar Musmar) on December 23, 2012, we enrolled patients with respiratory failure who were admitted to the two critical care units of An-Najah hospital from the West Bank and Gaza Strip during the period from January 2013 to November 2013. After obtaining written informed consent, the study sample consists of 52 patients with a mean age of 59.6 and male predominance of 57%.

The inclusion Criteria were (1) patient with respiratory failure with either [21]: (1) hypoxemic respiratory failure (type 1) defined by a $PaO_2$ of $<60$ mmHg or $PaO_2$ to $FiO_2$ ratio $>300$ mmHg with a normal or low $PaCO_2$, or (2) Hypercapnic respiratory failure (type 2) defined by a $PaO_2$ of $<60$ mmHg or $PaO_2$ to $FiO_2$ ratio $>300$ mmHg and a $PaCO_2$ of $>45$ mmHg; (2) patient who had been on mechanical ventilation for a certain reason and need to be weaned from intubation. Furthermore, patients were divided into 7 diagnostic groups based on the condition that participate respiratory failure, see Table 1.

Criteria for excluding patients from the study include: (1) Inability of the patient to protect the airway (coma or seizure disorders) requiring an endotracheal tube or to manage secretions; (2) Systolic blood pressure less than 90 mmHg or use of vasopressors (shock); (3) Electrocardiogram instability with evidence of ischemia or ventricular arrhythmias; (4) Life-threatening hypoxemia ($O_2$ saturation $<80\%$, or $PaCO_2>60$ mmHg on a nonrebreathing face mask); (5) Agitation, lack of cooperation, facial trauma, burns, or facial surgery.

Criteria for failure and stop of NIV and exit from the study include: Development of conditions necessitating ETI, which include: (1) inability to increase or stabilize gas exchange, failure to improve agitation from hypoxemia for type 1 and/or hypercapnia for type 2 for 60 min; (2) hemodynamic or ECG instability: bradycardia (heart rate $<60$ beats/min), hypotension (systolic blood pressure $<90$ mmHg), and respiratory arrest; failure to maintain $SpO_2>88\%$, significant metabolic and/or respiratory acidosis (pH $<7.20$); (3) inability to tolerate the face mask because of discomfort; (4) failure to improve mental status within 60 min for the patient who was lethargic.

### 2.1. Procedures

The method of NIV is shown in Fig. 1. In this study, we used the two main modalities of NIV: continuous positive airway pressure (CPAP) which was used for hypoxemic respiratory failure and bi-level positive air pressure (BIPAP) which was

**Table 1** Primary indication for NIV and diagnosis at admission; the total number adds up to more than 52 as some patients had more than one diagnosis and cause for respiratory failure.

| Diagnosis at admission | No | Success (%) | Required intubation (%) | Predicted mortality (SD) | Actual mortality (%) | Duration of NIV /days (SD) |
|---|---|---|---|---|---|---|
| COPD | 8 | 6 (75) | 2 (25) | 40.7 (15) | 0 (0) | 1.8 (0.4) |
| Pneumonia (community acquired pneumonia) | 13 | 6 (46.2) | 7 (53.8) | 33.4 (21.6) | 1 (7.7) | 2.8 (1.6) |
| Cardiogenic Pulmonary edema | 15 | 11 (73.3) | 4 (26.7) | 27 (10.7) | 1 (6.7) | 1.7 (0.8) |
| Obesity/hypoventilation syndrome | 4 | 3 (75) | 1 (25) | 42.3 (19) | 0 (0) | 1.3 (0.6) |
| Weaning from intubation | 18 | 15 (83.3) | 3 (16.7) | 29 (18.7) | 0 (0) | 1.8 (0.7) |
| Neuromuscular disorders | 4 | 4 (100) | 0 (0) | 23.9 (23) | 0 (0) | 1.5 (0.6) |
| Pleural effusion | 3 | 3 (100) | 0 (0) | 27 (16.5) | 0 (0) | 1.5 (0.7) |