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The use of non-invasive ventilation in respiratory patients in a tertiary general hospital

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Abstract

Background: Non-Invasive Ventilation (NIV) is increasingly becoming more popular as a useful treatment modality of acute respiratory failure prior to intubation in critically ill patients. The aim of this study was to investigate the effect and outcome of treatment of patients suffering from lung disease, who were provided non-invasive ventilation (NIV) in the respiratory department of a tertiary general hospital.

Methods: In this retrospective study, a combined analysis of demographic characteristics, age, duration of hospitalization, duration of use of NIV, outcome of the disease, symptoms and treatment method was performed. Data were processed to detect factors that affect the outcome of the disease with the use of NIV.

Results: Data from 95 patients who had been hospitalized during a 2-year period in the respiratory department of a tertiary hospital were examined. Data analysis showed that the two most common diseases that led to the use of NIV was pneumonia and other respiratory infections, with no significant variation among different age groups. Comorbidities played an important role on hospitalization length and outcome.

Conclusion: In this study, the most common indication for the use of NIV was respiratory failure due to respiratory infection. Older patients with multiple comorbidities required longer hospitalization and had a worse outcome.

Key words: *NIV; CPAP; respiratory failure; pneumonia; COPD*

INTRODUCTION

Since 1960, the use of invasive mechanical ventilation following intubation has been used for the treatment of critically ill patients, especially to protect the airways and provide ventilatory support. However, in the latest decades non-invasive mechanical ventilation (NIV) is increasingly used in severely ill patients as a measure to support the respiratory system [1,2]. It has been proven effective in reducing in-hospital morbidity and mortality, reducing hospitalization time and cost. NIV is also facilitating the weaning procedure in Intensive Care Units (ICU) [3,4,5].

Non-invasive ventilation is the use of mechanical ventilation that does not require intubation [6]. It was initially used in chronic respiratory failure in respiratory patients, but it is now also used in acute respiratory failure settings (Acute respiratory failure, ARF) [7]. NIV has been used for the treatment of acute lung injury (ALI), acute respiratory distress syndrome (ARDS), acute exacerbation of chronic obstructive pulmonary disease (AE-COPD), obesity hypoventilation syndrome (OHS) and

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pulmonary oedema in patients suffering from congestive heart failure [8,9].

The main reason that NIV has been popular amongst clinicians is the fact that it can be used even outside the ICU in critically ill patients, helping to reduce the risk of intubation in certain patient groups [10]. Therefore, several major complications of invasive mechanical ventilation can be avoided. By using NIV, the airways remain intact, the normal preventive mechanisms remain active, the patient can speak, eat, and drink normally. Moreover, ventilator-associated infections can be less frequent, and the patient remains awake and co-operative. A study comparing NIV to invasive mechanical ventilation, has shown that NIV is associated with lower risk of in-hospital infection, reduced use of antibiotics, reduced ICU admission and lower mortality [11].

The aim of this study was to evaluate the use of Non-Invasive Ventilation (NIV) in critically ill patients in the Pneumology Department of a tertiary general hospital in Greece.

MATERIALS AND METHODS

This was a retrospective study that used data of 2 consecutive years (Jan 2015 - Dec 2016) from hospitalized patients in the Pneumology Department of a tertiary general hospital in Greece. As a retrospective study by design, this study did not by any means interfere with patients' treatment selection by any means. All patient information was retracted from patient case files and was subsequently processed. All collected data were anonymized and were safely stored in a dedicated database until they were analyzed.

Statistical analysis

Clinical and demographic characteristics were compared using student's t-test. All analyses were performed using the IBM SPSS software for windows (SPSS 25.0). Statistical significance level was set as usual at p-values <0.05.

RESULTS

A total of 95 patients entered this study, 55 men (57%) and 40 women (42%). Mean age was 70 years, with a range between 28 and 96 years old. 18 patients had to be excluded from analysis due to incomplete data.

Most of the patients receiving NIV treatment belonged to the 61-80 years old age-group, followed by the 41-60 years old age-group and the 81-100 years old age-group. Only 1 patient was between 21-40 years old. The age distribution did not differ between men and women ($p = 0.348$) (Table1).

The mean hospitalization time was 24 days in these critically ill patients and the mean duration of NIV use was 9 days. The more commonly used NIV setting was continuous positive airway pressure (CPAP) in 72 patients (94%), while only 5 patients (6%) used bilevel positive airway pressure (Bi-PAP type or compatible).

The most common reason for hospitalization that required use of NIV was a respiratory infection (hypoxaemia and respiratory failure), which was present in 29 patients (31.5%). It was followed by pneumonia with chest x-ray infiltrates in 27 patients (29.3%) and AE-COPD in 19 patients (20.7%). In the pneumonia group, 20 out of the 27 cases were bacterial pneumonias with laboratory confirmation (Table 2). Finally, 6 patients fulfilled more than one indication for the use of NIV.

Hospitalization outcome was also investigated, and it was found that 65 patients had been discharged and

Table 1. *Patient characteristics and age distribution.*

Age	Male	Female	Total
21-40	1	0	**1**
41-60	9	12	**21**
61-80	21	18	**39**
91-100	11	5	**16**
Total	**42**	**35**	**77**

Table 2. *Indications for NIV use and percentages.*

Indication	No	%	Indication	No	%
Respiratory infection	29	31.5	ARDS	2	2.5
Pneumonia	27	29.3	Interstitial lung disease	1	1.2
AE-COPD	19	20.7	Rehabilitation after ICU	1	1.2
Asthma	4	5.0	Sleep apnoea	1	1.2
Acute respiratory failure	3	3.7			

12 patients had died.

The NIV indications across age groups were the following: pneumonia in the 21-40 years old age-group, AE-COPD in the 41-60 years old age-group and respiratory infection in the 61-80 years old and 81-100 years old age-groups.

Comorbidities in critically ill patients are always an issue and this was also shown in this study, with 56 patients from the study population having at least one or more comorbidities. The most common comorbidities were chronic respiratory failure, COPD, diabetes mellitus and coronary artery disease. Patients with >2 comorbidities needed more days in hospital than other patients ($p = 0,048$) (Tables 3, 4).

DISCUSSION

The use of NIV is increasingly considered as an initial alternative to mechanical ventilation in critically ill patients with acute respiratory failure with certain indications. The use of NIV in a CPAP setting and proper interface is considered a safe, easy to use and effective method of ventilation that can be used outside the ICU, in emergency department rooms and even in a hospital ward by qualified personnel.

Some of the prerequisites for its use are: 1) right indication, 2) proper interface mask, 3) co-operation of the patient and caregivers, 4) close monitoring, 5) experience of the medical and nurse team, 6) ICU back-up in case intubation is needed. Of course, in patients that fulfil criteria for early failure of NIV, all NIV procedures should be done in the ICU setting and not in a regular hospital ward.

Table 3. *Comorbidities and length of hospitalization and NIV use.*

Comorbidities	Mean length of hospitalization (days)	Mean length of NIV use (days)
1 comorbidity	20	8
2 comorbidities	17	10
>2 comorbidities	27	8

Table 4. *Comorbidities and outcome.*

Comorbidities	Discharge (n)	Death (n)
1 comorbidity	21	2
2 comorbidities	24	4
>2 comorbidities	20	6

Non-invasive ventilation use is well established in the management of respiratory failure secondary to an acute exacerbation of COPD. Randomized clinical trials have shown that NIV reduces the need for endotracheal intubation and may also improve survival [1]. The use of NIV in different clinical settings has been tested in clinical trials, with pneumonia and cardiogenic pulmonary oedema being common indications together with COPD exacerbations [2]. However, in cases of severe pneumonia (multiple lobes involved, hypotension, oxygenation index < 250 mmHg) NIV shows a high rate of failure. These patients should be carefully monitored with chest x-rays and arterial blood gas sampling, so that mechanical ventilation can be started if necessary [3].

In this study the most common indications for the use of NIV were respiratory infections. The impact of multiple comorbidities on hospitalization time and final outcome was also investigated, and a positive correlation was revealed between the presence of more than 2 comorbidities and the number of days in hospital and even in-hospital mortality rates. Older patients with more comorbidities were those that required more days under treatment and demonstrated a poorer outcome.

Finally, this study shows that the use of NIV in a Pneumology Department in a tertiary general hospital in Greece was according to recommendations of the European Respiratory Society (ERS) and the British Thoracic Society (BTS) and that the outcomes were as expected according to the findings of wide-scale trials around the world.

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REFERENCES

1. Plant PK, Owen JL, Elliott MW. Early use of non-invasive ventilation for acute exacerbations of chronic obstructive pulmonary disease on general respiratory wards: a multicentre randomised controlled trial. Lancet. 2000;355(9219):1931-5.

2. Köhnlein T, Windisch W, Köhler D, Drabik A, Geiseler J, Hartl S, et al. Non-invasive positive pressure ventilation for the treatment of severe stable chronic obstructive pulmonary disease: a prospective, multicentre, randomised, controlled clinical trial. Lancet Respir Med. 2014;2(9):698-705.
3. Burns KE, Meade MO, Premji A, Adhikari NK. Noninvasive positive-pressure ventilation as a weaning strategy for intubated adults with respiratory failure. Cochrane Database Syst Rev. 2013;(12):CD004127
4. British Thoracic Society Standards of Care Committee. Non-invasive ventilation in acute respiratory failure. Thorax. 2002;57(3):192-211.
5. Elliott M, Nava S, Schönhofer B. Non-Invasive Ventilation and Weaning: Principles and Practice, Second Edition 2nd Edition. CRC Press; 2010.
6. Elliott MW, Nava S. Noninvasive ventilation for acute exacerbations of chronic obstructive pulmonary disease: "Don't think twice, it's alright!". Am J Respir Crit Care Med. 2012;185(2):121-3.
7. Carrillo A, Ferrer M, Gonzalez-Diaz G, Lopez-Martinez A, Llamas N, Alcazar M, et al. Noninvasive ventilation in acute hypercapnic respiratory failure caused by obesity hypoventilation syndrome and chronic obstructive pulmonary disease. Am J Respir Crit Care Med. 2012;186(12):1279-85.
8. Nava S, Fanfulla F. Non Invasive Artificial Ventilation, Springer –Verlag, Italia; 2014.
9. Duarte AG, Justino E, Bigler T, Grady J. Outcomes of morbidly obese patients requiring mechanical ventilation for acute respiratory failure. Crit Care Med. 2007;35(3):732-7.
10. Elliott MW, Nava S. Noninvasive ventilation for acute exacerbations of chronic obstructive pulmonary disease: "Don't think twice, it's alright!". Am J Respir Crit Care Med. 2012;185(2):121-3.
11. Appendini L, Patessio A, Zanaboni S, Carone M, Gukov B, Donner CF, et al. Physiologic effects of positive end-expiratory pressure and mask pressure support during exacerbations of chronic obstructive pulmonary disease. Am J Respir Crit Care Med. 1994;149(5):1069-76.
12. Díaz GG, Alcaraz AC, Talavera JC, et al. Noninvasive positive-pressure ventilation to treat hypercapnic coma secondary to respiratory failure. Chest. 2005;127(3):952-60.
13. British Thoracic Society Standards of Care Committee. Non-invasive ventilation in acute respiratory failure. Thorax. 2002;57(3):192-211.
14. Jolliet P, Abajo B, Pasquina P, et al. Non-invasive pressure support ventilation in severe community-acquired pneumonia. Intensive Care Med. 2001;27(5):812-21.

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