Use of Non Invasive Ventilation in Patients with Respiratory Failure in Nepal

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Citation

Pandey R, Chokhani R, KC NB. Use of Non Invasive Ventilation in Patients with Respiratory Failure in Nepal. *Kathmandu Univ Med J* 2011;36(4):256-59.

ABSTRACT

Background

Non-invasive ventilation (NIV) has become an integral tool in the management of acute and chronic respiratory failure. Studies have shown that use of NIV decreases the length of hospital stay, improves symptoms and also reduces the need for invasive mechanical ventilation in patients with respiratory failure. However, NIV is not used sufficiently in our country.

Objective

To find out the outcome of Non Invasive Ventilation in Respiratory failure in Nepal.

Methods

Retrospective analysis of data of 28 patients in between June 2010- November 2010 was done. All the patients selected had respiratory failure. Records were analysed for documentation of clinical diagnosis. Arterial blood gases were assessed prior to, after starting and after discontinuation of NIV. The outcome of NIV and the need for domiciliary oxygen was evaluated at discharge.

Results

Thirty four patients received NIV out of which 6 were excluded from the study due to insufficient documentation. Out of these 28 patients, 27 received bi-level and one patient received Continuous Positive Airway Pressure. Mean age of patients was 66.5 years and ranged from 42-87 years. Majority (19, 79%) were from age group 60-80 years. Most common cause for the use of bi-level ventilation was chronic obstructive pulmonary disease with type 2 respiratory failure in 19 patients (67.8%). Others included obesity hypoventilation syndrome two, acute interstitial pneumonia two, cardiogenic pulmonary oedema two, Interstitial lung disease one, bronchogenic carcinoma one, and bronchiectasis one. Arterial blood gas analysis was done on admission and 12 hours or earlier after the onset of bi-level ventilation. At the time of admission, 89.3% of the patients had type 2 respiratory failure, of which 60.6% had respiratory acidosis and 67.9% of patients had pCO2 above 60 mm Hg. Arterial blood pH prior to admission ranged from 7.19 to 7.50. Twelve hours after bi-level ventilation, only 21.3% had pH <7.35 and 42.8% had pCO2 above 60 mm Hg. Non invasive ventilation was successful in 27 patients (96.4%). All patients were advised domiciliary oxygen and all patients had respiratory follow up arranged.

Conclusions

COPD patients with type 2 respiratory failure were seen to benefit most with NIV. It is a very cost effective and safe method of treatment and should be used first in patients with COPD with type 2 respiratory failure.

KEY WORD

respiratory failure, non invasive ventilation

INTRODUCTION

Acute respiratory failure that is not responsive to conservative medical therapy often requires the intervention of mechanical ventilation via an endotracheal tube.[1] Such interventions however, pose increase risk of upper airway trauma, nosocomial pneumonia, and sinusitis. In addition, endotracheal intubation may prolong ICU and hospital stays, as additional time may be necessary for weaning from ventilation and the treatment of complications.[2] Non-invasive ventilation (NIV), which refers to the administration of ventilatory support without

using an invasive artificial airway (endotracheal tube or tracheostomy tube) has become an integral tool in the management of respiratory failure.[1] (fig 1)There has been a wide increase of its use in the last 20 years .It is proven to be beneficial in the management of acute hypercapnic respiratory failure in chronic obstructive pulmonary disease (COPD) patients, respiratory failure due to some other causes and also has its use in the management of acute cardiogenic pulmonary oedema.[2,3] It is the treatment of choice for patients with obstructive sleep apnoea syndrome (OSAS) and is increasingly being used for weaning patients off the mechanical ventilator.[4] Its use is also being studied in treatment of acute respiratory distress syndrome (ARDS).[5] The present study was done to assess the usefulness of NIV in Nepalese patients presenting with acute respiratory failure due to different causes.

METHODS

This is a retrospective study of all the patients who received NIV during the period between June 2010 to November 2010 at the Norvic International Hospital and Medical College, Thapathali, Kathmandu, Nepal.

There were 350 patients admitted to the respiratory unit during this six months period; of which 34 patients received NIV. Out of these, 28 were included in the study, six patients receiving NIV were excluded due to incomplete documentation. Records were analyzed for documentation of clinical diagnosis, arterial blood gases prior to, after starting and after discontinuation of NIV. Duration on NIV, the outcome of NIV and the need for domiciliary oxygen was evaluated at discharge. SPSS version 17 was used for statistical analysis of the data.

RESULTS

Out of the 28 patients in the study group, 11 were males and 17 were females. Mean age of our patients was 66.5 years and ranged from 42-87years. Majority (19) were between the age group 60-80years. Chronic Obstructive Pulmonary Disease (COPD) with type 2 respiratory failure was the most common diagnosis among the study group for which NIV was initiated. Other diagnosis included interstitial lung disease (ILD)(2), bronchogenic carcinoma(1), obesity hypoventilation syndrome(2), acute interstitial pneumonia(1), acute cardiogenic pulmonary oedema(2) and bronchiectasis(1). Out of the 28 patients, 18 patients (64.3%) were initiated on NIV outside the critical care units. Of these, eight patients (28.6%) were initiated on NIV in the medical ward and 10 patients (35.7%) in the emergency room. 10 patients (35.7%) were admitted in critical care before initiating NIV.

Arterial blood gas analysis was done on admission and 12 hours or earlier after the onset of NIV. At the time of admission, 25 patients (89.3%) had type II respiratory failure. Overall, 19 patients (67.9%) had pCO2 above 60 mm Hg (Table 1). Seventeen patients (60.6%) had respiratory acidosis (Table 2). Arterial blood pH at the time of admission ranged from 7.19 to 7.50. 12 hours after bi-level ventilation significant drops in pCO2 and improvement in acidosis was observed, with only 12 patients (42.8%) having pCO2 above 60 mm Hg and only six patients(21.3%) pH <7.35 (Table 1, 2). There was deterioration in ABG in three patients 12 hours post NIV which was attributed to ill fitting mask. Inspiratory Positive Airway Pressure (IPAP) ranged from 8 - 20 cm of H2O and Expiratory Positive Airway Pressure (EPAP) was in the range of 4 - 6 cm of H2O. Most patients were on NIV for 2-4 days. NIV was successful in 27 patients (96.4%). One patient was discharged on patient's request without significant improvement in blood gas parameters. Twenty three patients (82.1%) were discharged in a stable state off NIV, four patients(14.3%) were discharged with recommendations to use bi-level ventilator regularly at home. All the patients were advised domiciliary oxygen and all of them had respiratory follow up arranged.

Table 1. PaCO2 before and after initiation of NIV.

PaCO2(mmHg)	Frequency before NIV (%)	Frequency after NIV (%)
>100	1 (3.6)	0 (0)
81-100	7 (25)	6 (21.4)
61-80	11 (39.3)	6 (21.4)
46-60	6 (21.4)	8 (28.6)
35-45	3 (10.7)	8 (28.6)
Total	28	28

Table 2. pH before and after initiation of NIV.

pH	Frequency before NIV (%)	Frequency after NIV (%)
<7.250	5 (17.8)	0 (0)
7.250-7.300	5 (17.8)	4 (14.2)
7.301-7.349	7 (25.0)	2 (7.1)
>7.351	11 (39.2)	22 (78.6)
Total	28	28

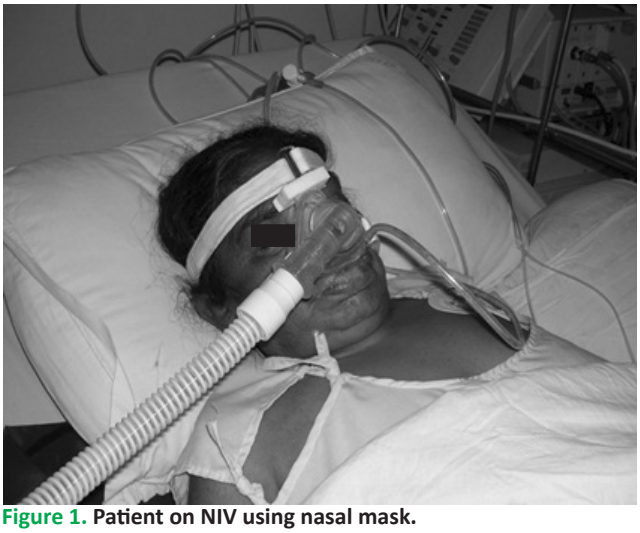

Figure 1. Patient on NIV using nasal mask.

DISCUSSION

NIV was first reported to be successful in acute respiratory failure by using continuous positive airway pressure (CPAP) in 1976.[1] Its usefulness was realised in 1981 following report of successful reversing of obstructive sleep apnoea through the nares by CPAP.[2] Subsequently, more and more reports recognized its benefits in managing acute respiratory failure particularly COPD.[3-5] Over the last fifteen years, the use of NIV has increased dramatically due to progressive improvements in mask interfaces, increased appreciation of role of ventilator muscles in both acute and chronic ventilatory failures, desire to avoid complications related with intubation and invasive mechanical ventilation and to reduce the duration of hospitalisation and costs.

The most studied application of NIV is for acute exacerbations of COPD. Just over a dozen years ago, Brochard et al showed that pressure support ventilation, administered via a face mask, significantly reduced the need for intubation, the duration of mechanical ventilation, and ICU length of stay compared to historically matched control subjects.[3,6] In the largest randomized trial, Plant et al treated 236 patients with acute exacerbations of COPD with standard medical therapy with or without NIV in general medical respiratory wards and found more rapid improvements in arterial pH, respiratory rate, and breathlessness in the NIV group compared to the control group.[7] It has also been found to be useful in the management of acute severe asthma with hypercapnic respiratory failure.[8] It has also been reported to be useful in respiratory failure due to pneumonia9 ARDS, cardiogenic pulmonary oedema and trauma.[9-12] NIV has also been found to be useful in restrictive lung diseases, hypercapnic respiratory failure due to chest wall abnormality or neuromuscular disorder and weaning from tracheal intubation.[13-15] NIV in acute respiratory failure especially COPD has also shown to reduce mortality and need for subsequent mechanical ventilation.[16] Noninvasive ventilation works by decreasing the work of breathing, reducing the transdiaphragmatic pressures and improving the oxygenation with reduction in hypercapnia. The widespread use of NIV and its advantage lies in the fact that it is easier to use, avoidance of invasive ventilation and more comfortable to the patients.

In our study, patients with COPD were the most common group of patients who received NIV. COPD with hypercapnic respiratory failure has been reported to be one of the most common indications for NIV with success as discussed above. 65.1% of the patients were managed outside the intensive care units most of whom would have otherwise been in intensive care unit. This decreases the cost for the patient and avoids the complications related with admission in critical care units. The present study highlights this point that NIV can easily be given anywhere including at home. Study by Plant et al also highlighted the same.[7] In the present study 89.3% of the patients had type II respiratory failure and 67.9% of the patients had PaCO2 above 60 mm of Hg at the time of admission. Within twelve hours of starting NIV, significant improvements in terms of drop in PaCO2 and increase in pH was observed in majority of the patients suggesting the success of this intervention. Repeat assessment of blood gases was done only after 12 hours of treatment to save on the costs for frequent analysis. Clinical improvements, however, were noted in many patients within two hours of starting treatment.

NIV is contraindicated if patient is in coma, has had a cardiac or respiratory arrest or has any condition which requires immediate intubation. It is also contraindicated if there is cardiac instability due to shock and need for pressor support, ventricular dysrhythmias and complicated acute myocardial infarction; GI bleeding - intractable emesis and/or uncontrollable bleeding; inability to protect airway due to impaired cough or swallowing, poor clearance of secretions and depressed sensorium and lethargy; status epilepticus and if there is potential for upper airway obstruction due to extensive head and neck tumors, any other tumor with extrinsic airway compression and angioedema or anaphylaxis causing airway compromise.

CONCLUSION

Our study clearly shows that NIV is effective in Nepalese patients with respiratory failure due to various causes most notably COPD. Limitations of our study are the relatively small sample size and that this was an observational study. The findings of our study support the current recommendations on the use of NIV.

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