ORIGINAL

Role Of NIV In COPD Exacerbation – One Year Experience From A Tertiary Care Hospital

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ABSTRACT

Introduction- Non-invasive ventilation (NIV) refers to delivery of mechanical ventilation with techniques that donot need an invasive endotracheal airway. The main indications are acute exacerbation of COPD, cardiogenic pulmonary edema, pulmonary infiltrates in immune-compromised patients, and weaning of previously intubated stable patients with COPD[1]. NIV has its best indication in moderate to severe respiratory acidosis in patients with AECOPD. For this indication, studies conducted in intensive care units (ICU's), in wards, and in Accident and Emergency Departments confirmed its effectiveness in preventing endotracheal intubation and reducing mortality[2].

Objectives- To see the outcome of NIV in patients of AECOPD with respiratory acidosis

Materials and Methods- The study was conducted in Department Of Emergency Medicine, Sher-i-Kashmir Institute of Medical Sciences, Soura, Srinagar, J and K, India over a period of one year from October 2015 to September 2016 during which 153 patients of AECOPD were treated with NIV.

Results- The study included 153 patients of AECOPD who received NIV, besides standard pharmacologic treatment. 124 (81.04%) patients improved while as 29(18.96%) did not. The patients in the successful group experienced significant improvement in their HR, RR, pH, $PaCO_2$ and PaO_2 from 116.2±12.3, 32.4±4.3, 7.27±0.06, 80.7±12.5, and 52.8±10.6 at admission to 102.4±8.3, 26.4±4.4, 7.31±0.07, 70.4±16.4 and 58.6±11.5 , respectively, after 1 hour of NIV. This change in HR, RR, pH, $PaCO_2$ and PaO_2 was statistically significant.

Conclusion- The study concludes that in patients with AECOPD with moderate-severe respiratory acidosis NIV should be the first line of treatment, besides the standard pharmacologic treatment. ***JMS 2016; 19(2):e1-e10.***
Keywords- Non-invasive Ventilation (NIV), Chronic Obstructive Lung Disease (COPD), Acute Exacerbation of COPD (AECOPD), Bi-level Positive Airway Pressure (BPAP).

Introduction

Non-invasive ventilation (NIV) refers to delivery of mechanical ventilation with techniques that do not need an invasive endotracheal airway[1]. NIV has a prominent role in acute respiratory failure. By avoiding endotracheal intubation, NIV prevents complications associated with invasive ventilation like airway problems, nosocomial pneumonia and sinusitis. In addition, the patient with an intact upper airway retains the ability to eat, swallow and verbalise[3-11]. Use of NIV in appropriately selected patients of acute respiratory failure has impact on decreasing mortality, decreasing nosocomial infection, and decreasing Intubation rates[12-17]. The main indications are acute exacerbation of COPD, cardiogenic pulmonary edema, pulmonary infiltrates in immune-compromised patients, and weaning of previously intubated stable patients with COPD[1]. Patients with severe acidosis or with altered level of consciousness due to hypercapnic acute respiratory failure are exposed to high risk of NIV failure. In these patients, NIV trial may be attempted in closely monitored clinical setting where proper endotracheal intubation may be assured[2].

The interface used in NIV is a Mask of multiple tyes like Total Face Mask, Full Face Mask, Nasal Mask, Mouthpiece, Nasal Pillows And Helmet Mask.[18]

The ventilator used in NIV can be a standard ICU type ventilator or a portable one which can be run in different modes like Assist control, Pressure Support Ventilation, continuous positive airway pressure (CPAP) or bi-level airway positive pressure (BPAP). Bi-level positive airway pressure (BPAP) delivers both inspiratory positive airway pressure (IPAP) and expiratory positive airway pressure (EPAP). It is probably the most common mode used for NIV. The difference between the IPAP and EPAP is a reflection of the amount of pressure support ventilation provided to the patient, and EPAP is synonymous with positive end expiratory pressure (PEEP). [19-21]

Once a patient is selected to

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receive NIV, it should be initiated as soon as possible. Delay allows further deterioration and increase the likelihood of failure. [22,23] The procedure is first explained to the patient, appropriate size interface is applied and starting pressures are set from low levels and adjusted as per patients tolerance.[24] After NIV is initiated, the patient should be observed closely for the first eight hours to troubleshoot, provide reassurance, and monitor for deterioration. Improvement of the pH and arterial carbon dioxide tension (PaCO2) within one-half to two hours predicts success.[25-27]

Patients with COPD exacerbation and hypercapnic respiratory acidosis are the group most likely to be successfully treated with NIV. Exacerbations increase the work of breathing in these patients and may exceed the patient's ability to adequately ventilate. NIV effectively unloads the respiratory muscles, increasing the tidal volume, decreasing the respiratory rate, and decreasing the diaphragmatic work of breathing, which translates to an improvement in oxygenation, a reduction in hypercapnia, and an improvement in dyspnea.[28]

Clear cut evidence that NIV improves the outcomes in COPD exacerbations complicated by Hypercapnic respiratory acidosis.[29-32]

Meta-analysis of 14 Randomised Controlled Trials (RCT) (758 patients) compared standard medical therapy plus NIV with standard medical therapy alone.

- Mortality (11% Vs 21%)
- Intubation (16% Vs 33%)
- Length of Hospital stay(4.5 days)[33]

The benefit is most pronounced in patients with severe COPD exacerbation (pH<7.3).

- Mortality (12% less)
- Intubation (34% less)
- Length of Hospital stay (5.59 days less)[34].

Aims and Objectives

To study the role and outcome of NIV in patients with AECOPD with respiratory acidosis.

Materials and Methods

The study was conducted in the Department of Emergency Medicine, Sher-i-Kashmir Institute of Medical Sciences, Srinagar, Jammu and Kashmir, India over a period of one year from October 2015 to September 2016 during which 153 patients of AECOPD with respiratory acidosis were treated with NIV.

Inclusion criteria

COPD patients with acute worsening of breathlessness with any one of the following

- Respiratory Rate (RR) >25 breaths per minute
- pH<7.35
- $PaCO_2$ >45 mm Hg
- PaO_2 <60 mm Hg
- SpO_2 < 92%

Exclusion Criteria

- Cardiac arrest
- Respiratory arrest
- Upper Gastrointestinal Bleed
- Shock
- Glasgow Coma Scale (GCS) <8/15
- Recent Myocardial infarction
- Copious respiratory secretions

Method

Once a patient fulfilled criteria for NIV, a baseline Heart Rate (HR), Respiratory Rate (RR), and Arterial Blood Gas (ABG) analysis were taken, procedure explained to the patient and consent taken, NIV was administered by portable ventilator (Philips Respironics Triology 100) via Full face mask of appropriate size in BPAP mode in sitting position. Starting pressures were kept at IPAP 8 and EPAP 4 which were gradually titrated as per patient parameters. Patient would be observed throughout. ABG analysis repeated at 1 hour. If there was improvement in patients condition (clinical and laboratory parameters) NIV was continued. Weaning was considered when patient had persistent improvement. In case of worsening of patient's condition (lab or clinical), NIV was terminated and endotracheal intubation was considered.

Results

In our study, the mean age of the patients was 65.4 years. 32 (20.92%) patients were in <60 years age group while as 121 (79.08%) patients belonged to the >60 years age group. Out of the 153 patients, 131 (85.6%) were males and 22 (14.4%) were females. NIV was successful in 124 (81.04%) patients and failed in 29 (18.96%) patients. Among the patients in successful group, HR, RR, pH, PCO2 and PO2 at admission were 116.2±12.3, 32.4±4.3, 7.27±0.06, 80.7±12.5 and 52.8±10.6 and changed to 102.4±8.3, 26.4±4.4, 7.31±0.07, 70.4±16.4 and 58.6±11.5 with 1 hour of NIV, respectively. This change in HR, RR, pH, PCO2 and PO2 was statistically significant with p-value < 0.05. And, in the same group of patients, at discharge, HR, RR, pH, PCO2 and PO2 were 84.1±6.2, 21.4±4.5, 7.39±0.05, 58.2±10.8 and 66.4±14.2 respectively. While as, among the patients in the failed group, HR, RR, pH, PCO_2 and PO_2 were 120.4±8.5, 36.6±6.5, 7.25±0.05, 88.4±14.4 and 49.5±12.4 at admission and after 1 hour of NIV changed to 116.2±7.2, 30.1±4.3, 7.25±0.06, 83.5±11.7 and 53.5±12.3, respectively. This was not statistically significant. 10 (6.5%) patients developed mucosal dryness as complication.

Age Profile	
< 60 years	> 60 years
32 (20.92%)	121 (79.08%)

Gender Profile	
Men	Women
131 (85.6%)	22 (14.4%)

Outcome of NIV	
Success	124 (81.04 %)
Failed	29 (18.96%)
Total	153

Outcome of NIV					
	Successful Group (n=124)			Failed Group (29)	
	At admission	1 hour	At discharge	At admission	1 hour
HR	116.2±12.3	102.4±8.3	84.1±6.2	120.4±8.5	116.2±7.2
RR	32.4±4.3	26.4±4.4	21.4±4.5	36.6±6.5	30.1±4.3
pH	7.27±0.06	7.31±0.07	7.39±0.05	7.25±0.05	7.25±0.06
$PaCO_2$	80.7±12.5	70.4±16.4	58.2±10.8	88.4±14.4	83.5±11.7
PaO_2	52.8±10.6	58.6±11.5	66.4±14.2	49.5±12.4	53.5±12.3

Successful group(n=124)			
	At admission	1 hour	p value
HR	116.2±12.3	102.4±8.3	<0.001
RR	32.4±4.3	26.4±4.4	<0.001
pH	7.27±0.06	7.31±0.07	<0.001
$PaCO_2$	80.7±12.5	70.4±16.4	<0.001
PaO_2	52.8±10.6	58.6±11.5	<0.001

Failed Group (n=29)			
HR	At admission	1 hour	p value
RR	120.4±8.5	116.2±7.2	
pH	36.6±6.5	30.1±4.3	
$PaCO_2$	7.25±0.05	7.25±0.06	
PaO_2	88.4±14.4	83.5±11.7	
HR	49.5±12.4	53.5±12.3	

Complications	
Mucosal dryness	10 (6.5%)

Discussion

In the present study, mean age of the patients was 65.4 years which is similar to other studies.[35,36] Lt. Col S P Rai et al observed the mean age 68.32 years.

Gender distribution of the patients in the present study showed male predominance with 131 (85.6%) males as against 22 (14.4%) females which is consistent with other studies.[36,37,38] In the study of Lt. Col S P Rai et al, males outnumbered the females.

Out of 153 patients in the study group, 124 (81.04%) patients improved with NIV, while as 29 (18.96%) patients failed to improve with NIV. Studies regarding NIV in AECOPD reveal around 90% success rate. Verma et al[39] reported a success rate of 90% with NIV in patients with AECOPD. In our study, the success rate is 81% which is less than that reported in the literature. We believe that the patients included in our study were more sick than the patients in other studies. The mean pH and $PaCO_2$ of the patients in successful group in this study was 7.27±0.06 and 80.7±12.5 as against 7.33±0.08 and 66.48±18.88, respectively, in the study done by verma et al[39].

In this study, the patients in the successful group experienced significant improvement in their HR, RR, pH, $PaCO_2$ and PaO_2 from 116.2±12.3, 32.4±4.3, 7.27±0.06, 80.7±12.5, and 52.8±10.6 at admission to 102.4±8.3, 26.4±4.4, 7.31±0.07, 70.4±16.4 and 58.6±11.5, respectively, after 1 hour of NIV. This change in HR, RR, pH, $PaCO_2$ and PaO_2 was statistically significant. This observation is consistent with other studies. Brochad et al[29] found that RR and pH changed from 35±7 to 25±8 and 7.27±0.1 to 7.31±0.09, respectively, after 1 hour of NIV while as PCO_2 change took 4 hours.

In our study, the patients in the successful group had their HR, RR, pH, PCO_2 and PO_2 improved from 116.2±12.3, 32.4±4.3, 7.27±0.06, 80.7±12.5, and 52.8±10.6 at admission to 84.1±6.2, 21.4±4.5, 7.39±0.05, 58.2±10.8 and 66.4±14.2 at discharge, respectively. These results match with the results obtained by Verma et al[39].

The patients of the failed group, in the present study, did not experience much improvement in their HR, RR, pH, PCO_2 and PO_2 with 1 hour trial of NIV. Their HR, RR, pH, PCO_2 and PO_2 were 120.4±8.5, 36.6±6.5, 7.25±0.05, 88.4±14.4 and 49.5±12.4 at admission and after 1 hour of NIV changed to 116.2±7.2, 30.1±4.3, 7.25±0.06, 83.5±11.7 and 53.5±12.3, respectively. This change in HR, RR, pH, $PaCO_2$ and PaO_2 was not statistically significant. Garpestard et al[40] had pointed out that patients not having a favourable initial response to NIV should be considered for intubation without delay. Following the failure to respond to NIV, they were considered for intubation.

In the present study, the mean duration of NIV use was 7.91 days which is comparable to other studies. Verma et al[39] found the mean duration of NIV use in patients of AECOPD 8.35 days.

In the present study, 10 (6.5%) patients developed mucosal dryness (mouth and nose) as a complication related to NIV. This is comparable to other studies[41].

Conclusion

From the present study, we conclude that in patients of AECOPD with hypercapnic respiratory acidosis, NIV should be the first line of treatment, besides the standard pharmacologic treatment. However, NIV is not the panacea for all the AECOPD patients; if patient improves, don't stop to monitor; and if NIV fails, don't delay intubation.

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