

PROSPECTIVE STUDY OF NON INVASIVE VENTILATION IN ACUTE EXACERBATION OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE

Dr Hemang Suthar¹

Associate Professor of medicine,

Smt NHL Medical College,Elisbridge Ahmedabad pin 380006 India

Dr Sunita Solanki²

Assistant Professor of medicine,

Smt NHL Medical College,Elisbridge Ahmedabad pin 380006 India

Dr Keyur Panasara³

3- Second year medicine resident,

,Smt NHL Medical College,Elisbridge Ahmedabad pin 380006 India

Address for Correspondence: Dr Sunita Solanki, Assistant Professor of Medicine, NHL Municipal medical college, Ahmedabad pin 380006

Abstract:

Background: Patients with chronic obstructive pulmonary disease are also prone to exacerbation with progression of their disease, which often lead to hypercapnic respiratory failure. Noninvasive ventilation has shown to have good outcomes in terms of reduction in mortality, reduction in need for intubation and mechanical ventilation and decreased duration of stay in the hospital in patients with COPD

Aims & objectives: To study the efficacy of Non Invasive Ventilation, to check demographic profile, to measure the serial arterial blood gas analysis and to monitor respiratory status in patients with acute exacerbation of chronic obstructive pulmonary disease.

Material & methods: A total of 50 patients were included in this prospective cross-sectional study. Detail history, clinical examination was done. Arterial blood gas analysis and laboratory parameters were studied before and after non-invasive ventilation.

Results: 86% of patients belonged to 46-75 years of age. 78% of patients were male. 78% of patients were addicted to tobacco in any form. Significant improvement was found in pH, pO₂, pCO₂ value in arterial blood gas analysis and SpO₂ value after four hours of noninvasive ventilation.

Conclusion: Noninvasive ventilation is well tolerated in patients with acute exacerbation of chronic obstructive pulmonary disease.

Keywords: Chronic obstructive pulmonary disease ,NIV

INTRODUCTON

Chronic obstructive pulmonary disease (COPD) is a chronic, slowly progressive disorder characterized by airway obstruction most of which is irreversible. Chronic obstructive pulmonary disease includes emphysema, anatomically defined condition characterized by destruction of lung alveoli with air space enlargement; chronic bronchitis, a clinically defined condition with chronic cough and phlegm; and small airway disease, a condition in which small bronchioles are narrowed and reduced in number¹. Patients with COPD are also prone to exacerbation with progression of their disease, which often lead to hypercapnic respiratory failure. Recently, noninvasive ventilation has shown good results in reducing mortality, intubation and hospital stay. Certain risk factors such as cigarette smoking, Dust and fumes at work, prolonged exposure to smoke produced by biomass combustion; genetic factors like *ADAM33* and macrophage elastase (*MMP12*), Severe α_1 antitrypsin deficiency have been implicated in development of COPD.

Noninvasive ventilation refers to the administration of mechanical ventilation without using an invasive artificial airway, delivered by means of positive-pressure and negative-pressure techniques. Positive pressure is applied to the airway to inflate the lungs directly, while with the latter, negative pressure is applied externally to the abdomen and thorax to draw air into the lungs through the upper airway. Noninvasive ventilation (NIV) has been shown to be an effective treatment for respiratory failure resulting from acute exacerbations of chronic obstructive pulmonary disease. There was a reduction in the need for endotracheal

intubation and mechanical ventilation leading to improving survival, reduced complication rates and length of hospital stay². Paralysis and sedation are not needed with noninvasive ventilation, hence ventilation outside the ICU is possible. Early intervention is more likely to be successful³. but even when patients present later in the natural history of their exacerbation there is still a significant role for noninvasive ventilation .

MATERIAL AND METHOD

The present prospective cross-sectional study was conducted at department of medicine in NHL municipal medical college on 50 patients with acute exacerbation of chronic obstructive pulmonary disease during the period of Jan 2014 to July 2015.

Inclusion criteria:

- Clinical diagnosis of Chronic Obstructive Pulmonary Disease
- Respiratory rate >25 breaths per minute
- Hypercapnia ($\text{PaCO}_2 > 40 \text{ mmHg}$).

Exclusion criteria:

- Impending or post-respiratory arrest
- Impaired consciousness (Glasgow Coma Scale < 8)
- Severe uncorrected hypoxia ($\text{PaO}_2 < 55 \text{ mmHg}$);
- Cardiovascular instability
- Copious secretions
- Craniofacial trauma
- Pneumothorax or pneumomediastinum.

Detail history including history was taken and clinical examination was done. The patients had started on standard medical treatment and arterial blood gases measured and non invasive ventilation initiated with monitoring of pulse rate, respiratory rate, blood pressure and pulse oximetry. Arterial Blood Gases will be measured at 1 hour

and 4 hour after initiation of the non invasive ventilation therapy. The patients were followed up until discharge. Paired T square test will be used as a statistical test.

RESULTS

Table 1.

Association of various factors in patients with chronic obstructive pulmonary disease

Gender		No. of patients
	Male	39(78%)
	Female	11(22%)
	Total	50(100%)
Age		
	0-15	0
	16-30	0
	31-45	1(2%)
	46-60	21(42%)
	61-75	22(44%)
	76-90	6(12%)
Addiction		
	Tobacco	10(20%)
	Smoking	28(56%)
	Tobacco+smoking	4(8%)
	Alcohol	3(6%)
Past history		
	Hypertension	10(20 %)
	Diabetes mellitus	8(16%)
	Ischemic heart disease	8(16%)

	Old Pulmonary Kochs	14(28%)
	No Past History	10(20%)
Gold staging	Grade 0	3(6.38%)
	Grade 1	6(12.6%)
	Grade 2	21(44.68%)
	Grade 3	10(21.27%)
	Grade 4	07(14.89%)
Precipitating factors		
	LRTI	18(36 %)
	Seasonal	12(24 %)
	Off treatment	16(32 %)
	Allergic	14(28 %)
Outcome after NIV		
	Survive	44(88 %)
	Death	03(6 %)
	Intubated	03(6 %)

In present study higher chronic obstructive pulmonary disease patients 22 (44%) were in age group of 61-75 Years. Others remaining were 21 (42%) were in 46-60 years age group; 6 (12%) were in 76-90 years age group; 1 (2%) was in 31-45 years age group. Patients were higher in Male 39 (78%) as compare to Female 11 (22%). In present study 45 (90%) patients had addiction; while 5 (10%) were found no any addiction. From addiction wise 10 (20%) patients have taken Tobacco; 28 (56%) patients have taken Smoking; 4 (08%) patients have taken Tobacco + Smoking; 03 (06%) patients have taken Alcohol. Family history of COPD was present in 6(12%) of patients. Past history of pulmonary Koch's was present in 18(36%) of patients. Precipitating Factors associated with chronic obstructive pulmonary disease patients, LRTI patients were 18 (36%), seasonal factors patients were 12 (24%); off treatment factors patients were 16 (21%); allergic factors patients were 14 (28%).

In our result, In open air circulating position the mean value of Blood oxygen saturation level (SpO₂) in COPD Patients was seen as a 84.86 ± 8.50 while in Bipap position the mean value of spo₂ in COPD patients were 96.52 ± 7.45 , which is a statistically significant ($p < 0.0001$).

Table 6:

Distributions of forced expiratory volume in 1 s (FEV₁) values stratified by pack-years of smoking

Pack- Years	% of FEV ₁
0- 10	110
11-20	70.85
21-30	56
31-40	32.66
41-50	30

In present Study distributions of forced expiratory volume in 1s (FEV₁) values stratified by pack-years of smoking. Higher (110) mean value of % of FEV₁ is seen inpatients with 0-10 pack years of smoking, while lowest mean value (30) of % of FEV₁ seen in patients with 40-50 pack years of smoking.

Table 2:

Arterial blood gas analysis in patients with chronic obstructive pulmonary disease

Variables	On admission	after 4 hrs of admission	P Value
Ph	07.31 ± 0.10	07.35 ± 0.08	0.0295
PO ₂	85.22 ± 16.24	109.44 ± 22.74	<0.0001
Pco ₂	72.06 ± 29.95	53.40 ± 20.42	0.0004

HCO ₃	21.67 ± 3.33	22.34 ± 2.10	0.2317
------------------	--------------	--------------	--------

In present study results, arterial blood gas analysis before giving non-invasive ventilation and after giving non-invasive ventilation the variables as a Ph seen as (7.31 ± 0.10 vs 7.35 ± 0.08 , $p < 0.005$).

The COPD Patients, after giving NIV the survive patients were 44 (88%); while 03 (6%) were death and 03(6%) were intubated. In present Study, on follow up of patients of chronic obstructive pulmonary disease patients after treatment, 21 (44.68%) patients had grade II, 10 (21.27%) patients had grade III, 07 (14.89%) patients had grade IV, 06 (12.76%) patients had grade I, and 03 (06.38%) patients had Grade 0.

DISCUSSION

The incidence of Chronic Obstructive Pulmonary Disease has been increasing in recent years in India. In the present study, we have studied demographic profile, and characteristics of patients with chronic obstructive pulmonary disease on noninvasive ventilation at our institute.

Various national and international studies have projected an increase in the incidence of Chronic Obstructive Pulmonary Disease. The mean age of present study was 63 ± 9.62 years which is consistent with those described in other studies with a range of 61-75 years, compare to L. Brochard *et al*⁴ in which mean age found 71 ± 9 years with range of 65-80 years. In present study, higher chronic obstructive pulmonary disease was found among males (39 cases, 78%) than females (11 cases, 22%) which was contradict the study done by PK Plantet *et al*⁵ in which incidence female (55%) was high among male (45%). Spada *et al*⁶ analyzed the SpO₂ and demonstrated that greater SpO₂ was associated with no invasive ventilation success which is similar to our study 84% to 96% of oxygen saturation.

In present study, arterial blood gas analysis was compared on admission and after treatment of NIV. The significant value ($p < 0.005$) defined in ph value ($p < 0.05$); pO₂ ($p < 0.001$), pCo₂ ($p < 0.05$), while in there no significant in HCO₃ ($p > 0.005$). Similar results were performed

in JS Balami *et al*⁷ In addition, hypocapnia decreases myocardial oxygen delivery during increasing oxygen demand and increased systemic vascular resistance. The initial Ph and PaCO₂ can be used clinically to stratify patients according to their risk of meeting criteria for intubation. Changes in PaCO₂ and PaO₂ are not associated with either a positive or an adverse outcome and should not be the focus of monitoring. NIV have several disadvantages like slower correction of gases abnormality, aspiration , facial skin necrosis , gastric distention , air leakage , transient hypoxemia from accidental removal , eye irritation.

CONCLUSION

Noninvasive ventilation is well tolerated in patients with acute exacerbation of COPD. A decrease in intubation and mortality rates and decrease in long term hospital stay are the advantages of NIV. This study shows NIV can be successfully used as an alternative to endotracheal intubation and mechanical ventilation in patients with chronic obstructive pulmonary disease. Patients with hypercapnic respiratory acidosis may derive the greatest benefit from noninvasive ventilation.

NIV has been shown to be cheaper and easier to implement in clinical practice and in emergency department setting. Non-invasive ventilation had a better outcome compared to immediate invasive ventilation in COPD patients in need of ventilator support admitted to the ICU in our observational study.

BIBLIOGRAPHY :

1. Edwin K Silverman , James D Crepo et al , Chronic obstructive pulmonary disease chapter 286 page from 1990 to 1999 Harrison's Principles of Internal Medicine , 20th edition.
2. Josephine V Lightowler-Non-invasive positive pressure ventilation to treat respiratory failure resulting from exacerbations of chronic obstructive pulmonary disease: Cochrane systematic review and meta-analysis .British Medical journal-2003;326:185(25 January)

3. Hillas G, Perlikos F, Tsiligianni I, Tanais N. Managing comorbidities in COPD. International journal of Chronic Obstructive Pulmonary Disease. 2015 ;10:95-109. Doi:10.2147/COPD.S544773.
4. Brochard L, Mancebo J, Wysocki M, et al. Noninvasive ventilation for acute exacerbations of chronic obstructive pulmonary disease. N Engl J Med 1995;333:817-22
5. P K Plant et al – Non-invasive ventilation in acute exacerbations of chronic obstructive pulmonary disease long term survival and predictors of in hospital outcome Thorax in 2001;56:708-712 (September)
6. Spada C et al – Oxygen saturation/fraction of inspired oxygen ratio is a simple predictor of noninvasive positive pressure ventilation failure in critically ill patients. J Crit Care. 2011;26(5):510-6
7. Balami JS, Packham SM, Gosney MA. Non invasive ventilation for respiratory failure due to acute exacerbation of chronic obstructive pulmonary disease in older patients. Age Ageing 2006;35:75-9