

Role Of Clinical, Biochemical And Radiological Parameters And Radiological Parameters For Predicting Outcome Of Non - Invasive Ventilation In Patients With Obstructive Lung Diseases

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Abstract

INTRODUCTION

Obstructive airway diseases include Chronic obstructive airway disease, Bronchial Asthma, and Bronchiectasis. Non-Invasive ventilation is the mainstay treatment in Obstructive Lung diseases. It can reduce mortality and morbidity in patients with acute hypercapnic respiratory failure.

METHODS

Prospective cohort of 50 patients with Obstructive airway diseases, attending Respiratory Medicine department in Meenakshi Medical College either casualty or OP, satisfying the inclusion and exclusion criteria from December 2019 to June 2021 were taken for the study.

RESULTS

A total number of 50 patients were enrolled in this study out of which 15 were female and 35 were male patients which was constituted 30 and 70% respectively. In our study we compared clinical parameters like sputum consistency, smoking index with duration of NIV therapy. We compared radiological parameters like Chest X ray and Biochemical parameters like PaCO₂ with duration of NIV therapy. We also analyzed that if T2DM had any influence on NIV treatment. We compared the duration of NIV with PAH based on ECG findings.

CONCLUSION

Obstructive airway disease with acute exacerbations should be treated ICU with ventilatory support. In the past couple of years very few studies have been conducted for predicting outcome of NIV in patients with obstructive airway disease

KEYWORDS : NON INVASIVE VENTILATION, OBSTRUCTIVE AIRWAY DISEASE

INTRODUCTION:

Non-Invasive ventilation is the mainstay treatment in Obstructive Lung diseases. It can reduce mortality and morbidity in patients with acute hypercapnic respiratory failure. In our study we correlate between Clinical parameters like Sputum consistency, smoking index with NIV therapy. We also correlated radiological parameters like Chest Xray and biochemical parameters like PaCO₂ based on ABG with the duration of NIV Therapy. we analysed whether T2DM has a role in the duration of NIV therapy. We Also Compared the duration of NIV therapy with PAH based on ECG findings.

MATERIALS AND METHODS :

1. Site of Investigation: Respiratory Intensive Care Unit, Department of Respiratory Medicine, Meenakshi Medical College and Research Institute, kanchipuram, TN.
2. Study Period: December 2019 to June 2021
3. Study Design: Cross Sectional observational study
4. Statistical Analysis

Inclusion Criteria

1. Previously diagnosed cases of Obstructive Airway Disease on the basis of Spirometry with Acute exacerbation at presentation
2. GCS > 8/15
3. Age > 14years
4. ABG with pH > 7.25, PaCO₂ > 40 and < 100 mmHg
5. Patients with T2DM

Exclusion Criteria

1. Patient with acidosis (arterial pH < 7.25).
2. Patients with shock with a systolic blood pressure of < 90 mmHg despite fluid challenge or need of vasopressor agents
3. Altered conscious state (GCS < 8/15)
4. Recent myocardial infarction, unstable angina, Systemic Hypertension, Coronary Artery disease
5. Recent facial trauma.

Once the Patient got admitted in Respiratory intensive care unit, A detailed history was taken, and the patient was clinically assessed. Vitals like Respiratory rate, Pulse rate and oxygen saturation and Blood Pressure were checked. Basic routine investigation such as complete blood count, Liver profile and Renal function test. ECG was done to rule out Acute Myocardial Infarction and to check for P Pulmonale which was considered as one of the criteria to diagnose Pulmonary artery Hypertension. Arterial blood gas analysis was done to find out the pH status and to know the PaCO₂ values of the patient. Chest Xray was done to rule out signs of active Tuberculosis infection and findings like Hyperinflation, Cardiomegaly, Pneumonia were noted. All the patients were started on broad spectrum antibiotics with a additional Atypical coverage. All the patients were started on NIV therapy initially with base line setting and subsequently the patient was tapered off NIV based on their serial ABG's and Clinical condition

RESULTS

A total number of 50 patients were enrolled in this study out of which 15 were female and 35 were male patients which was constituted 30 and 70% respectively. In our study we compared clinical parameters like sputum consistency, smoking index with duration of NIV therapy. We compared radiological parameters like Chest X ray and Biochemical parameters like PaCO₂ with duration of NIV therapy. We also analyzed that if T2DM had any influence on NIV treatment. We compared the duration of NIV with PAH based on ECG findings.

The results suggested that 21/50 patients had mucopurulent sputum out of which all 21 patients had increased duration of NIV therapy of more than 4 days. In this study, there were 26 smoker and 24 nonsmokers. Out of 24 nonsmokers, 15 were females and remaining 9 were male 13/50

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Patients had smoking index of > 800 out of which 11/13 patients required NIV therapy for more 4 days. 14/50 patients had PAH out of which 11/14 patients required NIV therapy for more than 4 days. 14/50 patients had Type 2 DM out of which 12/14 patients required NIV therapy for more than 4 days. Biochemical Parameter like PaCo2 were compared. 17 Patients had PaCo2 more than 70, out of which 16/17 required NIV for more than 4 days. PaCo2 is an important biochemical criterion which showed strong correlation. Radiologically Chest Xray was compared. 26/50, 14/50 and 10/50 patients had X-Ray findings of hyperinflation, hyperinflation with cardiomegaly, Pneumonia respectively. Out of 14 Patients with Hyperinflation and cardiomegaly in Xray, 11/14 required NIV for more than 4 days and 3/14 required NIV for less than 4 days which was 78.6% and 21.4% of the population respectively.

TABLES

Table 4: Age statistics of people included in this study

		Frequency	Percent
Valid	LESSTHAN 60YEARS	32	64.0
	MORETHAN 60	18	36.0
	Total	50	100.0

Gender

Table 5: Gender statistics of people included in this study

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	MALE	35	70.0	70.0	70.0
	FEMALE	15	30.0	30.0	100.0
	Total	50	100.0	100.0	

Sputum

Table 6: Statistical analysis of sputum consistency included in the study

		Frequency	Percent	Valid Percent	Cumulative Percent

Valid	MUCOID	29	58.0	58.0	58.0
	MUCOPURULENT	21	42.0	42.0	100.0
	Total	50	100.0	100.0	

Table 7: Correlation between NIV and Sputum consistency

		Days of NIV			Total
		Less than 4	More then or equal to 4		
SPUTUM	MUCOID	Count	28	1	29
		% of Total	56.0%	2.0%	58.0%
	MUCOPURULENT	Count	0	21	21
		% of Total	0.0%	42.0%	42.0%
Total		Count	28	22	50
		% of Total	56.0%	44.0%	100.0%

2079

Table 8: Chi-Squared of Sputum Consistency

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	46.082	1	.000
Continuity Correction	42.246	1	.000
Likelihood Ratio	59.893	1	.000
Fisher's Exact Test			
Linear-by-Linear Association	45.160	1	.000
N of Valid Cases	50		

Table 9: Statistical analysis of smoking index included in the study

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	LESSTHAN 800	37	74.0	74.0	74.0
	MORETHANOR EQUAL TO 800	13	26.0	26.0	100.0
	Total	50	100.0	100.0	

Table 10: Chi-Squared of Smoking index

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	11.761	1	.001
Continuity Correction	9.639	1	.002
Likelihood Ratio	12.397	1	.000
Fisher's Exact Test			
Linear-by-Linear Association	11.526	1	.001
N of Valid Cases	50		

Pulmonary Artery Hypertension

2080

Table 11: Statistical analysis of PAH in this study

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO PAH	36	72.0	72.0	72.0
	PAH Present	14	28.0	28.0	100.0
	Total	50	100.0	100.0	

Table 12: Correlation between NIV and PAH

			DAYSOFNIV		Total
			LESSTHAN N 4	MORETHAN MOREQUAL TO 4	
PAH	NO PAH	Count	25	11	36
		% of Total	50.0%	22.0%	72.0%
PAH Present	PAH Present	Count	3	11	14
		% of Total	6.0%	22.0%	28.0%
Total		Count	28	22	50
		% of Total	56.0%	44.0%	100.0%

Table 13: Chi-squared of PAH

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	9.432 ^a	1	.002
Continuity Correction	7.584	1	.006
Likelihood Ratio	9.729	1	.002
Fisher's Exact Test			
Linear-by-Linear Association	9.243	1	.002
N of Valid Cases	50		

2081

Diabetes Mellites

Table 14: Statistical analysis of DM in this study

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	36	72.0	72.0	72.0
	YES	14	28.0	28.0	100.0
	Total	50	100.0	100.0	

Table 15: Chi-squared of DM

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	13.732 ^a	1	.000
Continuity Correction	11.481	1	.001
Likelihood Ratio	14.569	1	.000
Fisher's Exact Test			
Linear-by-Linear Association	13.457	1	.000
N of Valid Cases	50		

PaCO₂:

PaCO₂

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Paco2 lessthan 70	33	66.0	66.0	66.0
Valid PaCo2 morethan 70	17	34.0	34.0	100.0
Total	50	100.0	100.0	

PaCO₂ * days Crosstabulation

		days		Total
		Less than 4 days	More than or equal to 4 days	
Paco2 lessthan 70	Count	27	6	33
	% within Paco2	81.8%	18.2%	100.0%
	% within days	96.4%	27.3%	66.0%
	Count	1	16	17
PaCo2 morethan 70	% within Paco2	5.9%	94.1%	100.0%
	% within days	3.6%	72.7%	34.0%
	Count	28	22	50
	Total			

	% within Paco2	56.0%	44.0%	100.0%
	% within days	100.0%	100.0%	100.0%

Xray:

X-Ray

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid hyperinflation	26	52.0	52.0	52.0
Valid hyperinflation +	14	28.0	28.0	80.0
Valid cardiomegaly	10	20.0	20.0	100.0
Valid pneumonia	10	20.0	20.0	100.0
Total	50	100.0	100.0	

		days		Total	
		Less than 4 days	More than or equal to 4 days		
xray	hyperinflation	Count	18	8	26
		% withinxray	69.2%	30.8%	100.0%
		% within days	64.3%	36.4%	52.0%
	hyperinflation + cardiomegaly	Count	3	11	14
		% withinxray	21.4%	78.6%	100.0%
		% within days	10.7%	50.0%	28.0%
pneumonia	Count	7	3	10	
	% withinxray	70.0%	30.0%	100.0%	
	% within days	25.0%	13.6%	20.0%	
Total	Count	28	22	50	
	% withinxray	56.0%	44.0%	100.0%	
	% within days	100.0%	100.0%	100.0%	

DISCUSSION

This is a prospective observational study in which a total of 50 patients were included. The Patients included in this study were previously diagnosed as Obstructive airway diseases based on their spirometric reports and who have come with an acute exacerbation. An obstructive airway disease includes Chronic obstructive Pulmonary disease, Bronchial asthma, bronchiectasis. Patients were not sub grouped in this study.

In this study 70% were males and remaining 30% were female patients. Maximum age of the patient was 74 and minimum age of the patient was 26. Mean age of the patient was 53.

Clinical parameters

Sputum consistency

Out of 21 patients with mucopurulent sputum, all the 21 patients required NIV for more than 4 days. 29 Patients with mucoid sputum, only 1 required NIV for more than 4 days. This study shows that all the patients with mucopurulent sputum required Non-Invasive ventilation for longer days. Infections being the most common cause for an acute exacerbation.

Smoking index:

Smoking is one of the important risk factors. Smoking affects lung in many ways, and it is responsible for multiple respiratory disease. One among them is Chronic obstructive pulmonary disease. Smoking is the most common habit seen in male. Although, the trend of smoking has been changed recently as Men and women are smoking on a regular basis. smoking is more commonly associated with COPD than Cigarette smoking. Those patients had emphysematous lung and multiple bullae in their lung, which affects gaseous exchange which results in hypoxemia and eventually respiratory failure. These patients required Non invasive ventilation with high pressure. Ultimately these patients required NIV for more days, hence smoking cessation should be advised for those patients.

Diabetes :

Diabetes is one of the most common co morbid condition seen in old age group. In this study, we have excluded all other Co morbid conditions like Systemic hypertension , coronary artery disease.. Patient who had diabetes has more chance of developing secondary infection. Even fungal infection are very common in patients with diabetes. These patients must be treated for secondary infections with higher antibiotics and their sugars has to be controlled. All these factors lead to use of NIV for longer days.

Pulmonary Artery Hypertension:

Pulmonary artery hypertension is one of the important complications seen in COPD and bronchiectasis patient. PAH occurs in patient who had persistent hypoxemia. PAH has multiple complication. One among them is Cor pulmonale. Patient with severe PAH needs to be treated symptomatically with diuretics and Anti Hypertensives. All these factors altogether affected the duration of NIV. Few patients ended in hemodynamic instability and ended in mechanical ventilation. So, before initiating a patient on NIV, all the factors must be kept in mind. Prolonged duration of NIV, results in stay in hospital for more days. This will affect the patient mentally. Our study concludes that parameters like Sputum consistency, diabetic and smoking are positively correlated with NIV

BIOCHEMICAL PARAMETER:

PaCo₂:

Nowadays Arterial Blood Gases was considered as one of the routine investigations for patients presenting with acute exacerbations.

We followed British thoracic guidelines and initiated NIV for all the Patients with PaCo₂ of more than 40mmHg and less than 100mmHg. This study shows that patient with High PaCo₂ values on NIV support needs a close monitoring. This study also shows that patients with high PaCo₂ required NIV with higher pressure to decrease their PaCo₂ level. When NIV is combined with standard medical treatment, recovery from the illness is faster.

Radiological Parameters:

Chest Xray:

Any patient coming with an respiratory exacerbations, chest X-Ray will be initial investigation to done. Chest X-Ray findings like hyperinflation, flattening of both hemidiaphragms, cardiomegaly were noted. Overall patients with hyperinflation, hyperinflation with cardiomegaly required NIV for longer days. Patients with bronchiectasis have more chances of stasis of secretions which becomes as source of infection in the future. When NIV is combined with Chest physiotherapy, recovery from the illness will be faster.

I would like to highlight a few important parameters and their significance with the duration of NIV therapy from this study.

Sputum Consistency – patients with Mucopurulent sputum had longer duration of NIV therapy compared to patients with mucoid therapy, and these patients with mucopurulent sputum also received concomitant antibiotic therapy.

Smoking Index – patient with longer duration of smoking are more affected. We observed that duration of treatment were increased for these patients.

PaCo₂ - Patients with Raised PaCo₂ needs close monitoring and higher pressures at the earliest of the treatment.

Chest Xray – Patients with findings in their CXR needs close observation. Along with NIV, chest physiotherapy, proper antibiotics are required.

CONCLUSION

Obstructive airway disease with acute exacerbations should be treated in ICU with ventilatory support. In the past couple of years very few studies have been conducted for predicting outcome of NIV in patients with obstructive airway disease. From our study we can conclude that patients with mucopurulent sputum, smoking index of >800, PAH, and T2DM required NIV for more than 4 days. Patients with Higher PaCo₂ levels required high pressures and longer days of NIV therapy to decrease the PaCo₂ levels. Patient with Xray findings like Pneumonia, cardiomegaly required NIV support for a longer duration of time. Patients with such conditions should be given prompt treatment and carefully monitored as they required prolonged therapy as well as longer stay in the ICU. NIV along with Proper antibiotics and supportive care were needed for these patients to prevent the requirement of Mechanical ventilation.

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