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General Medicine

FIRST DAY PREDICTORS OF REQUIREMENT OF MECHANICAL VENTILATION IN COPD PATIENTS WITH ACUTE EXACERBATION

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ABSTRACT

CONTEXT: Since burden of COPD vastly outnumbers the critical care facilities in India, identification on the day of admission itself of those patients with acute exacerbations of COPD will allow the physician to properly utilize these precious resources for deserving patients

AIM OF THE STUDY : To identify the first day predictors of requirement of mechanical ventilation in COPD patients with acute exacerbation.

SETTINGS AND DESIGN : Prospective study

MATERIALS AND METHODS : All the patients will undergo detailed clinical evaluation, appropriate investigations.

The demographic profile collected by questionnaire at the time of admission will include age, sex, smoking status. Patient vitals including heart rate, blood pressure and respiratory rate will be recorded. Premorbid functional status according to the modified Menzies criteria will be calculated from the patient or relatives if the patient is unable to provide the details. Arterial blood gas analysis, liver function tests, renal function tests, serum electrolytes will be done routinely for the patients. Acute Physiology and Chronic Health Evaluation II (APACHE II) score will be calculated for each patient from the following data (Age, Temperature, Mean Arterial Pressure, Heart Rate, Respiratory Rate, FiO2, Arterial pH, Serum HCO3, Serum sodium, Serum Potassium, Serum Creatinine, Packed Cell Volume, WBC count, Glasgow Coma Scale). All patients were treated with the same initial measures and intubated only if they fit into indications for mechanical ventilation. Finally the parameters were compared between those patients treated conservatively and those who eventually needed mechanical ventilation.

STATISTICAL ANALYSIS : One way ANOVA, Pearson correlation and Chi square test.

RESULTS : In our study the association between duration of cigarette smoking, high PaCO2,high APACHE II,low pH,low serum albumin, high premorbid score, low GCS and the need for mechanical ventilation was found to be significant

CONCLUSIONS : Hence, our study has found that duration of smoking in pack years, first day values of arterial blood pH, PaCO2, Glasgow Coma Scale, APACHE II score, serum albumin and premorbid functional status can be used to predict the need for mechanical ventilation in COPD patients with acute exacerbation.

KEYWORDS : COPD,mechanical ventilation,GCS

Introduction

Chronic Obstructive Pulmonary Disease (COPD) is the fourth leading cause of mortality and the 12th leading cause of disability worldwide today. The worldwide prevalence of COPD is estimated at 9/1000 men and 7/1000 women. COPD commonly affects elderly adults with a prevalence of 15%. Studies involving COPD patients with acute exacerbations discovered a combined mortality of 20.3% with prevalence of mechanical ventilation at 967%.

In view of this current scenario, identification on the first day of admission, of those COPD patients with exacerbation who may require intubation and mechanical ventilation during the course of their hospital stay, will allow prompt arrangement and appropriate utilization of these scanty critical care facilities.

MATERIALS AND METHODS:

Study Population: The present study was conducted on 200 patients from General Medicine wards of Government Rajaji Hospital, Madurai during the period of March 2016 to August 2016.

Inclusion Criteria:

All patients admitted with a primary admitting diagnosis of acute exacerbation of COPD.

All patients must have a Prior confirmed diagnosis of COPD on the basis of FEV1/FVC<0.70 and should be on regular follow up and treatment Exacerbation of COPD was diagnosed on basis of worsening of atleast one of these symptoms- dyspnea, cough, sputum production .

Exclusion Criteria. Patients with underlying COPD admitted with another primary admitting diagnosis (eg. Stroke, Acute Myocardial Infarction) were excluded from the study 2. Patients with acute respiratory failure secondary to bronchiectasis, bronchial asthma, active/inactive tuberculosis, pneumothorax, pulmonary embolism, pulmonary edema were excluded from the study

Ethical Committee Approval: Obtained.

Study Protocol: A previously designed proforma was used to collect the demographic and clinical details of the patients. All the patients were given detailed clinical evaluation, appropriate investigations.

The demographic profile collected by questionnaire at the time of admission included age, sex, smoking status. Patient vitals including heart rate, blood pressure and respiratory rate was recorded. Premorbid functional status for the last month according to the modified Menzies criteria was calculated from the patient or relatives if the patient was unable to provide the details. Arterial blood gas analysis, liver function tests, renal function tests, serum electrolytes was done routinely for the patients. Acute Physiology and Chronic Health Evaluation II (APACHE II) score was calculated for each patient from the following data (Age, Temperature, Mean Arterial Pressure, Heart Rate, Respiratory Rate, FiO2, Arterial pH, Serum HCO3, Serum sodium, Serum Potassium, Serum Creatinine, Packed Cell Volume, WBC count, Glasgow Coma Scale).

Patients were promptly intubated if NIV was contraindicated or not responding to NIV, if they had severe dyspnea and increased work of breathing, if acute respiratory acidosis wih pH <7.25 and PaCO2> 60 mmHg was present, if respiratory rate was >35 or if PaO2 was <40mmHg. Labinvestigationslike Hb, urea, creatinine, GCS, arterial pH were done.

STATISTICAL ANALYSIS: The information collected regarding all the selected cases were recorded in a master chart. Data analysis was done with the help of computer by using SPSS 16 software and Sigma Stat 3.5 version (2012).

Using this software mean, standard deviation and „p" value were calculated through One way ANOVA, Chi square test and P value of< 0.05 was taken as significant.

RESULTS: Of the 200 patients included in the study, 44 belonged to the age group (< 50 years) {22%}, whereas 156 patients {78%} were over 50 years of age. Of the total 200 COPD patients used in the study,

Males were 153 (76.5%) Females were 47 (23.5%) none of the 55 cases who had smoked for 1-10 pack years eventually required mechanical ventilation 10 of the 54 cases (18.5%) with pack years11-20 needed mechanical ventilation 23 of the 28 (82.14%) with pack years 21-30 needed mechanical ventilation 9 of the 13 cases (69.2%) with pack years >30 needed mechanical ventilation Grade 1 CAN compared to controls Of the total 200 COPD patients, 34 had a pH of ≤7.2, of whom 33 eventually needed mechanical ventilation (97.05%), whereas only 36 of 166 patients with pH >7.2 eventually needed mechanical ventilation (19.14%).

PaCO2 (mm Hg)	No Of Cases	MV	No MV
<60	51	1	50
>60	149	46	103
Total	200	47	153
Mean		73.64	63.76
SD		5.27	6.19
P'Value		<0.001	

P value of <0.001 obtained by our study clearly indicates that pH ≤7.2 is an independent predictor for mechanical ventilation in COPD patients.

Of the total 200 COPD patients, 32 had a GCS < 13 , of whom 30 (93.75%) eventually needed mechanical ventilation (97.05%), whereas only 17 of 168 patients with GCS >13 (10.11%) eventually needed mechanical ventilation.

P value of <0.03 obtained by our study clearly indicates that GCS< 13 is an independent predictor for need for mechanical ventilation in COPD patients.

Of the total 200 patients, 137 had an APACHE II score of < 15 on the day of admission, of which 7 {5.1%} eventually needed mechanical ventilation, whereas 63 patients had APACHE II score > 15 on the day of admission of whom 40 {63.4%} needed mechanical ventilation.

P value <0.001 obtained by our study indicates that APACHE II score >15 on the day of admission is an independent predictor of need for mechanical ventilation.

APACHE II SCORE VERSUS NEED FOR MECHANICAL VENTILATION:-

APACHE II	No Of Cases	MV	No MV
<15	137	7	130
>15	63	40	23
Total	200	47	153
Mean		18.81	11.88
SD		3.34	2.84
P value	<0.001		

PaCO2 VERSUS NEED FOR MECHANICAL VENTILATION:

DISCUSSION:

In our study, majority (78%) of patients were over 50 years of age. We already know COPD is a disease more affecting elderly persons. The findings of this study are similar to our earlier knowledge.

In our study, majority (76.5%) of patients were males. The prevalence of COPD, as we already know, is much more in males than females, probably due to higher prevalence of smoking in males. Our study also follows the same prevalence pattern.

In our study, smokers comprised 150 (75%) of the total 200 cases. As we already know, the major etiological factor in COPD is cigarette smoking, hence our finding was in line with previous studies.

Madkour et al have earlier described smoking duration in pack years as a predictor of need for mechanical ventilation. In our study, P value of <0.001 shows that the association between duration of smoking and the need for mechanical ventilation is significant. Hence our findings follow the same trend as previous studies and COPD patients with long duration of smoking as measured by pack years are more likely to require mechanical ventilation in case of acute exacerbations.

Arterial Blood pH on the day of admission has been earlier studied by other groups. Khilnani et al have found pH <7.26 to be significant with respect to need for mechanical ventilation. Hoo et al have also identified pH< 7.25 to be significant, with maximum rate of intubation with pH< 7.20. Kumar et al have found pH < 7.20 to be a significant predictor. In our study, a similar trend was found with 97.05% of patients with pH <7.2 on the first day eventually going for mechanical ventilation. Ventilation-perfusion mismatch, alveolar hypoventilation and respiratory muscle fatigue are reasons for acidosis in severe acute exacerbations.

Glasgow Coma Scale <9 has been identified by Ucgun et al as a significant predictor of mechanical ventilation. Our study has indicated a GCS < 13 to be significant. The lower threshold for our study is probably due to higher rates of intubation and relatively low availability of noninvasive ventilation.

APACHE II score> 22 has been described by Vitacca et al as significant in predicting need for mechanical ventilation. APACHE II > 23 was found significant by Ucgun et al while Kumar et al have identified an APACHE II score > 11.5 as independent predictor of intubation. Our study had a pattern more similar to the latter, with 63.4% of patients with APACHE >15 eventually needing mechanical ventilation.

Serum Albumin< 3.5 g/dl has earlier been found significant in predicting mechanical ventilation by Khilnani et al. Whereas in their study, Vitacca et al found albumin to have no significant relationship with mechanical ventilation. Our study has paralleled the findings of Khilnani et al and indicates serum albumin < 3 g/dl to be significant predictor of intubation as 66.07% of patients with albumin <3g/dl on the first day needed mechanical ventilation. Serum Albumin is a proven marker of nutritional status of patients. COPD patients who are malnourished are more likely to go in for intubation and mechanical ventilation during an acute insult like an exacerbation. This explains the reason for the predictive ability of low serum albumin.

PaCO2 > 68 mm Hg has been described by Kumar et al as a significant predictor of mechanical ventilation. In our study, first day PaCO2 > 60 mm Hg has been found to be significant as 30.8% of patients with PaCO2 > 60 mm Hg needed mechanical ventilation during the course of their hospital stay. Ventilationperfusion mismatch, alveolar hypoventilation and respiratory muscle fatigue are reasons for increased PaCO2 in severe acute exacerbations.

Premorbid functional status shows the severity of COPD as well as associated underlying comorbid conditions. Menzies et al have shown that premorbid status is the most significant factor in predicting outcome. Kumar et al showed that worse premorbid status can predict need for mechanical ventilation. In our study, 86.8% of patients with worse (Grade III and Grade IV) premorbid functional status according to modified Menzies score eventually required mechanical ventilation. Hence the finding in our study parallels the previous studies.

Hence, our study has found that duration of smoking in pack years, first day values of arterial blood pH, PaCO2, Glasgow Coma Scale, APACHE II score, serum albumin and premorbid functional status can be used to predict the need for mechanical ventilation in COPD patients with acute exacerbation.

CONCLUSION

Males comprise the majority of COPD cases, probably due to increased prevalence of smoking habit among males.

Majority of cases are over 50 years of age, hence COPD is a disease affecting the elderly more.

Majority of cases are smokers, which is in line with previous knowledge that smoking is the major causative factor for COPD.

Long duration of smoking (as measured in pack years) is a significant predictor of need for mechanical ventilation in COPD patients with acute exacerbation.

Low arterial blood pH on the day of admission (<7.2) is a significant predictor of need for mechanical ventilation in COPD patients with acute exacerbation.

Altered sensorium on the day of admission (as measured by a low Glasgow Coma Scale {<13}) is a significant predictor of need for

mechanical ventilation in COPD patients with acute exacerbation.
A high APACHE II score on the day of admission (>15) is a significant predictor of need for mechanical ventilation in COPD patients with acute exacerbation.

Low serum albumin on the day of admission (<3.5 g/dl) is a significant predictor of need for mechanical ventilation in COPD patients with acute exacerbation.

High PaCO2 (>60mm Hg) on the day of admission is a significant predictor of need for mechanical ventilation in COPD patients with acute exacerbation.

Worse premorbid functional status (as measured by Grade III or IV on the modified Menzies score) is a significant predictor of need for mechanical ventilation in COPD patients with acute exacerbation.

Hence, using these above mentioned variables, it is possible to classify according to severity and identify on the day of admission itself, those COPD patients with acute exacerbation who may, during their hospital stay, require mechanical ventilation.

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