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Prevalence of Different Severities of Hypoxia in COVID-19 Patients Admitted in Critical Care Unit

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Abstract: In 2020 Corona Virus Disease 2019 (COVID-19) infection hit the world as pandemic. The most common and life threatening complication was various severity of respiratory failure. So we decided to conduct a study to determine the prevalence of different severities of hypoxia in COVID-19 infection. The study was a cross sectional prospective observational study on 50 participants. The study was conducted in COVID Intensive care unit (ICU) of Liaquat National Hospital and Medical College and COVID ICU of National Medical Centre Karachi, Pakistan. All patients with PO_2 to FiO_2 (PF) ratio less than 300, smokers and non-smokers were included in the study. PF ratio of 300 to 200 was considered as mild, 200 to 100 as Moderate and less than 100 considered as severe hypoxia. Admitting PO_2 from an Arterial Blood Gas (ABG) sample and FIO_2 was noted. Prevalence of hypoxia severities were graded, need of mechanical ventilation and mortality of each group was determined. 42 (84%) of patients had severe while 8 patients 16% had moderate hypoxia. None of the patient admitted in critical care had mild hypoxia. In severely hypoxic patients mortality rate was 28.6% and in moderately hypoxic group it was 50%. Severe hypoxia effected most of the COVID-19 infected patients admitted in critical care, which may be the cause of poor outcomes in critically ill COVID-19 patients.

Keywords: Hypoxia, Critical Care, COVID-19, Acute respiratory Distress Syndrome, Mechanical Ventilation

1. Introduction

COVID-19 infection hit the Wuhan city of China and it rapidly involved most of the countries of the world [1-6]. It presented with various typical and atypical presentations in different patients. In majority of patients it presented with fever, dry cough, shortness of breath, malaise, new loss of taste and sense of smell [7]. However hemiplegia as a result of cerebral venous sinus thrombosis and loose stools were also the only manifestation in various patients [8, 9].

Dyspnoea as a result of lung parenchymal involvement and in some reported autopsies as a result of thrombosis of pulmonary vessels is also noted [10]. As a cascade of dysregulated immune system, there has been presence of cytokine release syndrome, in majority of severe to critical disease [11]. Patients often required non-invasive and invasive ventilation. In most of the patients hypoxic respiratory failure was more pronounced as compared to hypercapnic respiratory failure. Ventilatory failure as result of COVID-19 pneumonia is the most common cause of mortality in such patients.

PO_2 to FiO_2 (PF) ratio is a guide for classification of severity of ARDS. It can help in guiding treatment strategy and response of treatment. We aimed to assess prevalence of different severity of hypoxic respiratory failure based on PF ratio in patients with COVID-19 infection admitted in critical care unit.

2. Material and Method

This study was a cross-sectional, prospective observational study. It was conducted in the COVID Intensive Care Unit (ICU) of Liaquat National Hospital and Medical College and COVID ICU of National Medical Centre, Karachi, Pakistan, in the month of June 2020 on first 50 participant fulfilled the inclusion and exclusion criteria. The objective of the study was to determine the prevalence of different severities of hypoxia in COVID-19 patients admitted in critical car unit. All patients were diagnosed as having COVID-19 infection through a detectable Polymerase Chain Reaction (PCR) of nasopharyngeal swab. All patients of age above 14 years and below 80 years, Requiring Invasive ventilation and non-invasive ventilation (NIV), Smokers and non-smokers were included in the study. Those having history of diagnosis of restrictive lung disease, history of thoracotomy or lobectomy, metastatic lung disease and (PF) ratio of > 300 on admission were excluded from the study. The severity of hypoxia was determined by PF ratio on admission. Participants were divided into three categories of hypoxia i.e. Mild, Moderate, and Severe depending on the PF ratio. PF ratio of 300 to 200 was considered as mild hypoxia, 200 to 100 as Moderate and less than 100 was considered as severe hypoxia. Samples were collected in a non-probability consecutive sampling. The patient's history including diagnosis, age, gender, and comorbidities were taken. PF ratio was calculated by noting admitting PO_2 from an Arterial Blood Gas (ABG) sample and FIO_2 was noted from mechanical ventilation for those patients who were intubated and it was calculated by converting litters of oxygen/minute given through NIV to percentage of oxygen/minute. Confounding variables and biasness were controlled by strictly following the inclusion and exclusion criteria. Data was recorded in pre-formed proforma.

Data was analysed by using IBM Statistical Package for the Social Sciences (SPSS) version 20, United States of America, New York. Mean was calculated for age. Frequency and percentage were calculated for qualitative variables, i.e. gender, Severity of hypoxia, smokers, non-smokers, mechanical ventilation and non-invasive ventilation, mortality or survival.

3. Result

In our patients, minimum age was 32 years and the maximum age was 77 years with a mean of 61.36±10.536 years.

Out of 50 patients, 42 (84%) of patients were in category of severe hypoxia with a PF ratio of less than 100. Minimum value of PF ratio was 44. Only 8 patients that is 16% had a moderate hypoxia while none of the patient admitted in critical care had mild grade of hypoxia. Maximum recorded PF ratio in our participants was 185.

In 42 (84%) of patients with severe hypoxia, 30 (71.4%) patients were male and 12 (28.6%) were female. In moderate hypoxia category all of the patients were male.

Amongst severely hypoxic patients 4 (9.5%) patients were smoker and 38 (90.5%) were non-smoker. While in moderately hypoxic group all patients were non-smokers.

34 (81%) of severely hypoxic patients intubated and mechanically ventilated while 8 (19%) were managed via a non-invasive ways of ventilation. All patients with moderate hypoxia received only non-invasive ventilation.

In severe hypoxic patients 12 (28.6%) had mortalities and 30 (71.4%) patients survived. In moderate hypoxia group mortality and survival rate was 50% each.

4. Discussion

Hypoxic respiratory failure is a complication of many medical conditions from acute pulmonary edema, pneumonia to pulmonary embolism [12-15]. Different ventilator strategies from non-invasive ventilation to mechanical ventilation are needed to treat the condition, depending upon severity of hypoxia [16-19]. In COVID-19 infection, the greatest challenge observed by clinician was to maintain the optimal saturation level and a terminology of happy hypoxia came into existence due to better tolerance of hypoxia by patients [20-22].

In our study we observed that patients who admitted in critical care with a diagnosis of COVID-19 infection were mostly presented as severe hypoxemic respiratory failure. Few of the patients had moderate severity of hypoxia. We observed that in our study all patients were either having moderate or severe hypoxia and no patient had mild category of hypoxia. This supports the better tolerance of hypoxia as mildly hypoxic patients with PF ratio of 300 to 200 were not needed to be admitted in critical care.

Advanced age group patients were more seriously affected and required critical care admissions as in our study the mean age of patients was 61%. This is in accordance with other study which shows that advance age group is a risk factor of having a severe disease [23].

4 out of 50 of our patients were smoker and they all presented as severe hypoxemic respiratory failure. This may conclude that smoking is a risk factor of having severe form of COVID-19 infection [24]. This conclusion is also supported by another study [25].

In our study most of the severely hypoxic patients required mechanical ventilation while some of them were still manageable on non-invasive ways of ventilation. All of our patients with moderate degree of hypoxia were managed on non-invasive ventilation. In severe hypoxic patients survival rate was 71.4%, but on contrary to this in moderately hypoxic patients the survival and mortality rates were same.

5. Conclusion

Our study concluded that in critical care settings, patients presented with COVID-19 infection were more commonly effected by severe hypoxic respiratory failure which may explain the need of mechanical ventilation in this category. Some of them had moderate hypoxia and none of the patient was in mild hypoxia category. Overall severe hypoxia in critically ill COVID-19 patient may explain need of prolonged ICU stay and significant mortality.

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