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AN OVERVIEW OF HYPOXIA IN COVID-19

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Abstract:

During the coronavirus disease 2019 (COVID-19) pandemic due to severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infections, patients presented with COVID-19 pneumonia of varying severity, especially to the patients who develop hypoxia condition after SARS-CoV-2 infection. Due to low oxygen saturation level, these patients are at extremely higher risk. Although the impact of hypoxia in COVID-19 patients has been distinct, in several cases, the underlying pathomechanism behind this condition is still unclear. Hypoxia in SARS-CoV-2 infected patients can be identifying with the help of a pulse oximeter, blood gas levels, and a 6-min walking test. While the doctor and researchers figure out the exact reason for this phenomenon, the patients must be under strict day-to-day monitoring. In this review, we aim to provide comprehensive perception into the underlying symptoms, mechanism, and possible factors behind the occurrence of hypoxia among COVID-19 patients.

Keywords: Coronavirus, Pneumonia, Hypoxia, COVID-19.

Introduction:

The novel corona virus pandemic caused by the SARSCoV-2 has affected people with different health conditions around the world, but patients that develop silent hypoxia due to viral pathomechanism are possibly the worst sufferers. The primary symptoms of a COVID-19 associated silent hypoxia slightly differ from that of normal hypoxia. Unlike normal hypoxic patients, patients with silent hypoxia do not face any tachypnea or dyspnea [1]. COVID-19-research is still in its growing stage. The problem associated with silent hypoxia in COVID-19 is the lack of dyspnea which also block the opportunity to study the gut microbiota-brain axis during this stage. Increased testing can help in identifying infected individuals even if they do not show any respiratory conditions and bring them under medical surveillance [2].

Patients with cardiac disease are more possible to present with silent hypoxia. The SpO2 saturation in COVID-19 may be an absolute predictor of survival. Silent hypoxia in COVID-19 patients does appear to have relation with increase in mortality [3]. Aggressive oxygen therapy to

correct hypoxia is dangerous for the successful treatment of COVID-19 patients and the reduction of mortality. However, the effectiveness of conventional mechanical ventilation as the main treatment modality has been queried due to the non-uniformity of COVID-19 compared to the conventional pulmonary failure [4]. In a patient with COVID-19, palpitation is related to poor outcome and merits attention and urgent care. However, it is important to underline that among 1712 patients with COVID-19, 64.7% (1107) did not complain of shortness of breath at admission and that 23 of them were transferred to the ICU and/or died highlighting the seriousness of this clinical presentation. In these patients, News score, LDCT of the thorax, and pulse oximeter are important method to predict death. As well, among patients without dyspnea 28.1% presented with hypoxemia/hypocapnia syndrome (happy or silent hypoxemia), which was also strongly associated with a poor outcome [5]. Smartphone-based pulse oximetry may lead to a remarkable increase in the early detection of silent hypoxia, and hence identification of the onset of COVID-19 pneumonia.

Literature review and related work

Ahsab Rahman & others [1]; reported, the novel coronavirus disease 2019 (COVID-19) has become a serious health issue, especially to the patients who develop silent hypoxia condition after SARS-CoV-2 infection. Due to the lack of dyspnoea and extremely low oxygen saturation level, these patients are at unusually higher risk. Although the prevalence of silent hypoxia in COVID-19 patients has been noticeble in several cases, the underlying pathomechanism behind this condition is still unclear. Silent hypoxia in SARSCoV- 2 infected patients can be determine with the help of a pulse oximeter, blood gas levels, and a 6-min walking test. While the clinicians and researchers figure out the perfect reason for this phenomenon, the patients must be under strict day-to-day monitoring. In this article, we aim to provide complete insights into the underlying symptoms, mechanism, and possible factors behind the occurrence of silent hypoxia among COVID-19 patients.

Akshita B Gopal & others [2]; reported, Severe serious respiratory syndrome coronavirus-2 (SARS-CoV- 2) infection has triggered the COVID-19 pandemic. Several factors induce hypoxia in COVID-19. Although being hypoxic, some SARS-CoV-2-infected individuals do not experience any respiratory distress, a phenomenon termed ‘silent (or happy) hypoxia’. Prolonged undetected hypoxia could be dangerous, sometimes leading to death. A few studies attempted to explain what causes silent hypoxia, however, the exact mechanisms are still elusive. Here, they aimed to understand how SARS-CoV-2 causes silent hypoxia.

Faisal Alhusaina & others [3]; reported, patients with COVID-19 normally present with fever and respiratory symptoms such as cough, sputum production, and dyspnea. However, they may suffer from severe hypoxemia without a clinical relation with the respiratory symptoms, also known as silent or apathetic hypoxia. The aim of the study was to check out the predictors and clinical outcomes of COVID-19 patients without dyspnea. A single-center retrospective cohort study, based on data take

out from the electronic hospital information system, with COVID-19 patients over a 10-month period in Riyadh, Saudi Arabia. Results: Of the COVID-19 patients presenting at the Emergency Department with a SpO2 < 90%, 13% had silent hypoxia. The majority of the patients required BiPAP, 34% were introduce and 60% were admitted to an intensive care unit. There was no connection between dyspnea and gender, age group, body mass index, or comorbidity. Cough, fever, and cardiac diseases were predictive for dyspnea in a regression analysis. There was equality in the clinical outcome between patients with silent dyspnea or dyspnea. Age and obesity were importantly associated with a decrease in survival, and an increase in the initial SpO2 increased survival.

B. Jiang & H. Well [4]; reported hypoxia is one of the primary causes that cause multiple organ injuries and death in COVID-19 patients. Aggressive oxygen therapy to treat the hypoxia is important in saving these patients. They have sum up the mechanisms, efficacy, and side effects of different oxygen therapy techniques and their status or the potential to treat hypoxia in COVID-19 patients. The benefit to risk ratio of each oxygen therapy technique and ploicy to use them in COVID-19 patients are enumerate. High flow nasal cannula oxygen (HFNO) should be a better choice as an early stage oxygen therapy.

Philippe Brouquia & others [5]; reported, collected data from COVID-19 patients diagnosed and cared for in Marseille, France, And selected data from patients who at admission, had a low dose CT scanner, dyspnea status, and oxygen saturation available. Blood gas was examine in a sample subset of patients. Results: Among 1712 patients with COVID-19, they report that 1107 (64.7%) do not complain of shortness of breath at admission. The low-dose computed tomography (LDCT) scan showed signs suitable with pneumonia in 757/1,107 (68.4%) of patients without dyspnea. In a subset of patients who had underwent at least one blood gas analysis (n = 161) and presented without dyspnea at admission, 28.1% (27/96) presented with a hypoxemia/hypocapnia syndrome. Asymptomatic hypoxia was related with a very poor outcome (33.3% were transferred to the ICU and 25.9% died).

Ali Lari & others [6]; reported, silent hypoxia is a structure that has been described in patients diagnosed with COVID-19. It is generally described as objective hypoxia in the absence of proportional respiratory distress. The physiological basis for this phenomenon is questionable, and its prognostic value is unclear. Author studied a case on below of a 66- year-old female presenting with serious hypoxia that was managed without mechanical ventilation. Presentation of case: A 66 year old female with multiple comorbidities initially presented with a cough, fever and an oxygen saturation of 70% on room air in the absence of respiratory pain or altered mentation. She thereafter tested positive for COVID-19 and was admitted to the intensive care unit; received oxygen via high flow nasal cannula and continuous positive pressure mask. The patient remained in the intensive care unit or 40 days under close observation and exposed multiple episodes of silent hypoxia on weaning oxygen. The patient was discharged on

room air with an oxygen saturation >90% after 56 days. The patient was not canulate during her stay.

Jason Teo [7]; reported, that it is still probable to perform this early detection of silent hypoxia in COVID-19 patients using smartphones. It has been shown that oxygen saturation readings measured using smartphones match up highly with readings obtained using medical-grade pulse oximeters. Also, smartphone-based pulse oximetry has been found to be particularly accurate when the oxygen saturation levels in the users are above 90%. Oxygen saturation in healthy patients range from 95-100%, so the general public could use their smartphones to regularly take their own measurements quickly at home and contact their health. This form of smartphone-based pulse oximetry may lead to a remarkable increase in the early detection of hypoxia, and hence recognition of the onset of COVID-19 pneumonia.

Table No. 1 An overview of hypoxia in COVID-19

Sr. No	Title of research paper and year of publication	Name of Author	Remarks
1.	Silent hypoxia in COVID-19: pathomechanism and possible management strategy (2021)	Ahsab Rahman, Tahani,Tabassum, Yusha Araf, et,al.	Author suggested, Based on the current knowledge, it is still unsure why silent hypoxia occurs in a COVID-19 patient. The available piece of evidence suggest that the virus may be affecting the brain and nervous system, or there might be a lack of hypoxic vasoconstriction in such patients.
2.	Silent hypoxia in COVID-19: a gut microbiota connection (2021)	Akshita B Gopal, Soumyadeep Chakraborty, Pratyush K Padhan, Alok Barik, et,al.	Author reported, the problem associated with silent hypoxia in COVID-19 is the lack of dyspnea which also block the opportunity to study the gut microbiota-brain axis during this stage. Increased testing can help in identifying infected individuals even if they do not show any signs.
3.	Predictors and clinical outcomes of silent hypoxia in COVID-19 patients, a single-center retrospective cohort study (2021)	Faisal Alhusaina, Azam Alromaih, Ali Alqobaisi, Talal Alaboodi, Majid Alsalamah	Author reported, patients with cardiac disease are more likely to present with silent hypoxia. The SpO2 saturation in COVID-19 may be an only predictor of survival. Silent hypoxia in COVID-19 patients does not appear to have an connection with increase in mortality.
4.	Oxygen therapy strategies and techniques to treat hypoxia in COVID-19 patients (2020)	B. Jiang & H. Well	Author reported, aggressive oxygen therapy to correct hypoxia is analytical for the successful treatment of COVID-19 patients and the reduction of mortality. However, the effectiveness of conventional mechanical ventilation as the main treatment modality has been queried due to the non-uniformity of COVID-19 compared to the conventional pulmonary failure.
5.	Asymptomatichypoxia	Philippe	Author concluded: The absence of shortness

	inCOVID-19 is associated with pooroutcome (2020)	Brouquia, Sophie Amranea, Sébastien Cortaredonab, Philippe Parolab, et,al.	of breath in an old patient with comorbidity merit medical attention and should not be considered as a good sign of safety. In these patients, pulse oximetry is an important matter to predict the outcome along with news score and LDCT scanner.
6.	Caution against precaution: A case report on silent hypoxia in COVID-19 (2020)	Ali Lari, Mohammad Alherz, Abdullah Nouri, Lotfi Botras, Salah Taqi	Author reported clinicians face a clinical dilemma on even if to canulation a "silently hypoxemic" patient, who displays hypoxia out of proportion to clinical examination. A recent paradigm shift that suggests delaying intubation further displays the need for clearer analysis of the situation. This case demonstrates a favorable outcome of the latter approach, yet emphasizes a case-by-case approach until clearer recommendations are available.
7.	Early Detection of Silent Hypoxia in Covid-19 Pneumonia Using Smartphone Pulse Oximetry (2020)	Jason Teo	Author reported, smartphone-based pulse oximetry may lead to a remarkable increase in the early detection of silent hypoxia, and hence identification of the onset of COVID-19 pneumonia. This would almost certainly reduce intensive care admissions, intubations, and the mortality rate of COVID-19.

Conclusion:-

This review has highlighted that clinicians who are managing patients with COVID-19 pneumonia need to be observant for the presence of silent hypoxia. Thus, signs and symptoms of shortness of breath in patients with severe COVID-19 pneumonia should alert the clinician to the possibility of hypoxia. Clinical evaluation should be improve such that the diagnosis of hypoxia is not delayed or missed.

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