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ORIGINAL ARTICLE

Correlation of SaO_2 in patients of COVID-19 with and without COPD

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ABSTRACT

Background: The Covid-19 pandemic has wreaked havoc throughout the world, with 150 million cases to date and over 3 million lives claimed worldwide.
Aim: To explored the difference in levels of SaO_2 of COVID-19 positive patients with and without COPD.
Study design: Experimental Study.
Methodology: From May2020 to 2021 patients admitted at Aziz Bhatti Shaheed hospital were included in this studies. COVID-19 was confirmed by RT-PCR.COPD was confirmed by using GOLD standard of diagnostic criteria. SaO_2 was measured by using pulse oximeter and confirmed by blood samples measurement of SaO_2. **Statistical analysis**: SPSS version 22 was used for data analysis. Paired sample t test was performed to evaluate the hypoxia levels between three pairs among the time distribution of 1st, 3rd, and 6th, day.
Results: Levels of SaO_2 were statistically significant between COVID-19 positive patients and COVID-19 positive patients with COPD. We calculated the levels of SaO_2 at day1, 3rd, and 6th day and results were significant to show that COPD might be having some protective effect against hypoxia and that might be due to use of medications or adaptation of pulmonary cells.
Conclusion: It was concluded that levels of SaO_2 was significantly reduced in COVID-19 patients without COPD in comparison to patients without COPD.
Keywords: COVID-19, COPD and SaO_2.

INTRODUCTION

In December 2019, there was news of some novel cases of respiratory disease in Wuhan, Hubei China. Later on January 2020 it was confirmed to be a viral respiratory disease caused by novel corona virus and subsequently given the name as SARS-CoV-20[1] while the disease was termed as COVID-19. According to different studies conducted till now, all showed it is closely related to family of SARS-CoV described previously on 2002-2003 outbreak. Recently, WHO called this outbreak as pandemic. Currently there is no definite treatment, the only way to prevent the massive spread of infection is to implement strict lockdowns, avoid mass gatherings, maintain social distancing and keep hygiene by regularly washing hands[2,3].

The stricter regulations and closure of international boarders had many adverse impacts on trade, and economy worldwide specially the developing and poor countries[4]. Consequently there is fear of another economic recession and fall in major economic indices. As the number of infections, and mortalities are increasing day by day we need to further our knowledge regarding diseases prevention and limit outbreak. Despite only into a year of pandemic there are huge numbers of studies on covid-19 and observations emerging on viral genome, evolution, genetics, transcription, and human viral protein interaction[2]. This information is needed to design new therapies, vaccination and to contain viral transmission. Genomic studies are vital in understanding of novel viral behaviors, transmission modes, and to develop therapies when there is no effective vaccine available[3,4].

To date (28 June 2021), over 181 million cases of COVID-19 has been reported, and 3.9 million deaths worldwide[5]. Many countries are reporting in exponential rises in cases and fatalities during early and peak stages of pandemic. Recent studies have observed the origin of COVID- 19 to be likely natural with droplet transmission the primary source of spread. Fomite related transmission is another key source as when hands come in contact with contaminated surfaces and later used to touch eyes, nose and ears[6,7].

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Genomic studies of SARS-CoV-2 spread observed the basic reproduction rate (R_0) of 2.2 to 5.7 which is much higher than seasonal influenza. The reported (R_0) indicated the constant transmission in a given population unless containment protocol and effective measures are being taken to stop the spread of virus[6,7]. As a novel corona virus there are limited studies to reach on consensus as how it spread and factors contributing to seasonality of SARS-CoV-2. Two major factor can describe the seasonality of are environmental parameters and human behaviors[2]. Although no study till date had confirmed the seasonality of SARS-CoV-2, but observation still showed climate variables have an important role in transmission. Few studies have confirmed the stability of SARS-CoV-2 in aerosols and staying on surfaces especially on plastic, stainless steel for period of up to 72h[3,4]. Overall, recent studies are pointing towards extended aerosol and fomite spread for numerous hours and it should be addressed before the discovery of proper therapies[7].

SARS-CoV-2 belongs to family of β-coronavirus that causes SARS (severe acute respiratory syndrome) and MERS (middle east respiratory syndrome). Since late 1960 human coronavirus infections have been identified to cause mild to moderate respiratory infections followed by complete recovery[5].

Chronic obstructive pulmonary disease (COPD) is a chronic reversible airflow limitation characterized by persistent and progressive airway obstruction along with abnormal inflammatory response of lungs[8].Recently COPD has emerged a major public health problem and it is expected to become fourth major cause of mortality in coming years. Smoking cigarette was thought to be the major cause of COPD but recently it was observed only minority of smokers develop this disease the cause of which is still under investigation, and public awareness regarding this disease is limited due to which a significant ratio of patients goes undiagnosed until later stages of COPD[9].

Thus, there have been many studies recently focused on early detection and diagnosis of COPD. Early diagnosis and treatment of COPD improves overall patient symptoms and prevents further deterioration of airways limitation through pharmacological and targeted interventions. The routine screening was not recommended, however the global initiative for obstructive lungs disease can be used for active case finding[8,9]. The

respiratory diseases have emerged as a major concern of mortality and morbidity in recent studies, and COPD as one of the major obstructive pulmonary disease there are some other pathophysiological mechanisms which occurs with progression of COPD[10]. Persistent obstruction of airways during COPD has profound effects on other organs such as cardiac functions and abnormal gas exchange and concurrent systemic effects. As discussed above COPD will be the fourth major cause of mortality by 2030 worldwide, with high prevalence in low, middle income countries. In developing countries the most common cause is smoking and exposure to smoke such as smoke during cooking[11]. occupational biomass smoke exposure, or underlying pulmonary diseases. High risk of COPD is associated with exposure to dust, harmful chemical substances, and fumes arising from fuel burning, or individuals with exposure to tobacco smoke, as well as a condition called alpha-1-antitrypsin deficiency[8,11].

Chronic smoking is the leading causes of COPD in western countries. COPD can lead to many systemic complications such as heart failure, cardiac ischemia, diabetes, lung carcinoma, depression and osteoporosis. These systemic complications are initiated due to number of upstream events on molecular and cellular levels such as higher levels of reactive oxygen species (ROS), abnormal proteases/antiproteases activity and rapid influx of leukocytes[9,10]. Many factors contribute to pathogenesis of COPD but most of studies elaborated the role of extensive pulmonary inflammation and spillover on systemic circulation, leading to increase production of inflammatory mediators such as tumor necrosis factor α (TNF-α), leukotrienes, interleukins, interferons, reactive proteins and extravasation of neutrophils. The abnormal inflammatory response leads to active recruitment of leukocytes and resultant release of free radicals and activating proteases all of which causes decrease elasticity of lungs. As lungs parenchyma elasticity decreases the distal airspaces become enlarge[12].

The objective of the study was to explored the difference in levels of SaO_2 of COVID-19 positive patients with and without COPD.

METHODOLOGY

A total of 120 COVID-19 positive patients from May 2020 to 2021 admitted to Aziz Bhatti Shaheed hospital were selected, out of which 60 were confirmed with diagnosis of COPD based on GOLD criteria, including 20 females and 40 males. Remaining 60 patients were COVID-19 positive but otherwise healthy and no previous history of any lung diseases. All subjects were sampled with pulse oximeter on the 1st, 3rd and 6th days of COVID-19 PCR positive report, using Masimo Radical – 7 pulse oximeter. Pulse oximeter readings were then compared with simultaneous blood samples to count any bias. The reference values for diagnostic criteria were SaO_2 < 90%. Sampling was performed in pair, 1st day samples of COVID-19 positive COPD patients were paired with 1st day samples of COVID-19 positive with no COPD, and so on 3rd and 6th day.

Statistical analysis: All data were analyzed by SPSS 25.0 statistical software. Paired sample t test was performed to evaluate the hypoxia levels between three pairs among the time distribution of 1st, 3rd, and 6th, day. Statistical significance was indicated by a *p*-value<0.05. Results were expressed as mean, t, df, and P values.

RESULTS

A total of 120 Covid-19 positive patients out of which 60 patients are COPD free are detected to have hypoxia starting from day-1, whereas COPD patients were having mild hypoxia after 6th day.

Correlation between COPD and hypoxia: There was statistically significant (P < 0.05) difference in hypoxia between COPD Covid-19 positive patients and otherwise healthy group with no COPD. The mean Sao_2 in otherwise healthy group were 86.2%, 88.15%, 90.2% measured at 1st, 3rd, and 6th day respectively. Whereas mean Sao_2 in COPD COVID -19 positive patient were 91.61%, 92.7%, 93.51% at 1st , 3rd, and 6th, day respectively as shown in table-1.

Table 1: Mean SaO_2 & SD among Two Groups and Statistical Significance

Group name	Sao_2 at day 1 Mean ± SD	Sao_2 at 3rd day Mean ± SD	Sao_2 at 6th day Mean ± SD
COPD COVID-19 group	91.6 ± 0.30	92.7±0.21	93.5±0.30
Non COPD Covid-19 group	86.2± 0.3	88.1 ± 0.21	90.2± 0.25

Correlation of hypoxia between COPD and COPD free pairs: There was statically significant difference (P <0.05) between 3 pairs. The mean of pair 1 was -3.262, the mean of pair 2 was -4.55 and third pair mean was calculated to be -5.308. All these values correspond to increasing level of hypoxia in patients with COVID-19 but more increase in hypoxia were observed in patient with no COPD COVID-19 compared with COPD Covid-19 patients. Pair t test and results were presented in table-2.

Table-2: Paired sample t test among three pairs having statistical significance

Pair name	Mean	t	df	P-value
COPD COVID-19 and non COPD COVID 19 at day1	-3.26	-57.9	57	0.000*
COPD COVID-19 and non COPD COVID-19 at 3rd day	-4.5	-110.9	57	0.000*
COPD COVID -19 and non COPD COVID-19 at 6th day	-5.3	-89.8	57	0.000*

*Statistically Significant

DISCUSSION

The current standard to assess the association between airflow limitation and $\dot{V}_A/\dot{Q}$ is to estimate gas exchange disturbance across all GOLD classes of COPOD. It had explored the three major findings and extend previous investigations. First $\dot{V}_A/\dot{Q}$ abnormality followed by inappropriate gaseous exchange assessed by $AaPo_2$ way before FEV_1 decline. Lately all spirometry variables will become abnormal[13].

During second phase arterial blood gases and $\dot{V}_A/\dot{Q}$ rapidly decline not correlating with phase 1. Thirdly the mismatch of $\dot{V}_A/\dot{Q}$ starting from phase 1 to phase 4 and by the time it reaches phase 4 the values are nowhere near the values observed in acute and severe conditions. As noted above there is steady decline in gaseous exchange disturbance spread across the classes of GOLD criteria of COPD. Past studies are failed to determine any correlation between spirometry and abnormal gaseous exchange. The factors which contributed to failure to find the above correlation are probably the very small change in $\dot{V}_A/\dot{Q}$ indexes across all Gold classes[13].

We found out a remarkable statistically significance exist between Sao_2 of COVID-19 infected COPD patients and non COPD COVID-19 patients. It could be due to reason of using bronchodilators as a therapeutic intervention in patient of COPD. Hypoxia during progression of COVID-19 is the main pathophysiological feature and cause of mortality. COVID-19 associated hypoxia has all systemic, organ and cellular levels determinant and overlapping of all these determinants to cause death in patients of COVID-19. Many studies had depicted severe COVID-19 can lead to organ failure due to progression of mild hypoxia to ADRS[14].

ARDS can be clinically identified by respiratory distress and reduced lung compliance to gaseous exchange due to lung injury and decrease PaO_2:FiO_2 ratio. The radiological findings of ARDS are bilateral infiltrates. However the hypoxia in COVID-19 differ from ARDS in having a good lungs compliance with other system and organs involvement. Despite the global efforts to try and tackle the pandemic of COVID-19 the challenge to understand the basic pathophysiology of cellular and molecular mechanisms still remains a mystery. Therefore current therapeutic strategies are limited to treat covid-19 related hypoxia. Recently, many studies

had discovered the activation of HIF-1α pathway during first few days of COVID-19 induced mild hypoxia would decrease ACE2 and increase levels of ADAM17 on alveolar surface which leads to decrease binding and invasion of SARS-CoV-2. Therefore mild hypoxia during first few days of COVID-19 infection, if treated well can increase chances of decrease mortality due to hypoxia[15].

Taken together we would propose to further investigate the causes of hypoxia and difference in level of Sao_2 in patients with COPD and non COPD COVID-19 positive patients. We have hypothesized the difference in hypoxia could be due to use of certain medication by COPD patients which might have some protective effect.

Limitations: Limitations included limited time frame, resources and financial constraints.

CONCLUSION

It was concluded levels of SaO_2 was significantly reduced in COVID-19 patients without COPD in comparison to patients without COPD. Hence, $Sa0_2$ can be an helpful tool in predicting COVID-19 prognosis among COPD patients.

Author's contribution: AF& MUQ: Conceptualized the study, analyzed the data, and formulated the initial draft, **SS&MA:** Contributed to the proof reading, **RM&MZ:** Collected data, **ZUS&TL:** Contributed to the proofreading the manuscript for intellectual content.

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REFERENCES

1. Ashour H, Elkhatib W, Rahman M, Elshabrawy H. Insights into the Recent 2019 Novel Coronavirus (SARS-CoV-2) in Light of Past Human Coronavirus Outbreaks. Pathogens. 2020;9(3):186.
2. WHO Director-General's opening remarks at the media briefing on COVID-19 - 11 March 2020 [Internet]. Who.int. 2021 [cited 10 November 2021]. Available from: https://www.who.int/dg/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---11-march-2020

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3. Zhou Y, Hou Y, Shen J, Huang Y, Martin W, Cheng F. Network-based drug repurposing for novel coronavirus 2019-nCoV/SARS-CoV-2. Cell Discovery. 2020;6(1).
4. Uddin M, Mustafa F, Rizvi T, Loney T, Al Suwaidi H, Al-Marzouqi A et al. SARS-CoV-2/COVID-19: Viral Genomics, Epidemiology, Vaccines, and Therapeutic Interventions. Viruses. 2020;12(5):526.
5. Yang X, Yu Y, Xu J, Shu H, Xia J, Liu H et al. Clinical course and outcomes of critically ill patients with SARS-CoV-2 pneumonia in Wuhan, China: a single-centered, retrospective, observational study. The Lancet Respiratory Medicine. 2020;8(5):475-481.
6. Early Epidemiological and Clinical Characteristics of 28 Cases of Coronavirus Disease in South Korea. Osong Public Health and Research Perspectives. 2020;11(1):8-14.
7. Singh S, Khan A. Clinical Characteristics and Outcomes of Coronavirus Disease 2019 Among Patients With Preexisting Liver Disease in the United States: A Multicenter Research Network Study. Gastroenterology. 2020;159(2):768-771.e3.
8. Global Strategy for the Diagnosis, Management, and Prevention of Chronic Obstructive Pulmonary Disease: GOLD Executive Summary Updated 2003. COPD: Journal of Chronic Obstructive Pulmonary Disease. 2004;1(1):105-141.
9. Mun S, Hwang Y, Kim J, Park S, Jang S, Seo J et al. Awareness of chronic obstructive pulmonary disease in current smokers: a nationwide survey. The Korean Journal of Internal Medicine. 2015;30(2):191.
10. Bhatt S, Kim Y, Wells J, Bailey W, Ramsdell J, Foreman M et al. FEV1/FEV6to Diagnose Airflow Obstruction. Comparisons with Computed Tomography and Morbidity Indices. Annals of the American Thoracic Society. 2014;11(3):335-341.
11. BG U. Chronic Obstructive Pulmonary Disease (COPD). Virology & Immunology Journal. 2017;1(4).
12. Churg A, Cosio M, Wright J. Mechanisms of cigarette smoke-induced COPD: insights from animal models. American Journal of Physiology-Lung Cellular and Molecular Physiology. 2008;294(4):L612-L631.
13. Marini J, Gattinoni L. Management of COVID-19 Respiratory Distress. JAMA. 2020;323(22):2329.
14. Liu Y, Lv J, Liu J, Li M, Xie J, Lv Q et al. Mucus production stimulated by IFN-AhR signaling triggers hypoxia of COVID-19. Cell Research. 2020;30(12):1078-1087.
15. Dhont S, Derom E, Van Braeckel E, Depuydt P, Lambrecht B. The pathophysiology of 'happy' hypoxemia in COVID-19. Respiratory Research. 2020;21(1).