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Peripheral oxygen measurements in suspected elderly COVID-19 patients can be an effective tool for alerting physicians

Abstract

Background: Since December 2019 the world has been facing a newly identified corona virus named SarsCov-2 which is the causative agent of COVID-19 that produces different symptoms. One of these symptoms is asymptomatic hypoxia, particularly in elderly patients. Despite the absence of signs of respiratory distress, many patients evolve to respiratory failure. The cause of this asymptomatic hypoxia remains unclear.

Objective: Our goal was to evaluate the utility of peripheral oxygen measurements using oximetry in elderly patients with suspected COVID-19 and with no apparent signs of shortness of breath, during 10 consecutive days.

Method: Every elderly patient with suspected COVID-19 who sought medical care at one of the 12 Primary Health Unit (PHU) in the South-West area of Campinas, Sao Paulo State was enrolled in the 10-days monitoring report. Each patient had the levels of oxygen saturation (SpO_2) monitored by pulse ox meter from the fifth to the tenth days after the onset of symptoms and, when possible twice a day.

Results: 1297 patients (pts) were followed during the period from August 2020 to February 2021. A total of 9023 measurements were carried out using a SpO_2 pulse ox meter. 163 (12.5%) cases were referred to the Emergency Room and 37 (3%) had to be hospitalized. The highest frequencies of symptoms occurred during the 6th and 8th day and included cough (16.8%), fatigue (12.8%), headache (9.7%), loss of taste and/or smell (6.8%). Among the patients who were hospitalized, 13 died (1%).

Conclusion: The asymptomatic hypoxia remains unclear; however, the measurement of SpO_2 levels appears to be a cheap and effective tool to be used as an alert system or further evaluation.

Keywords: asymptomatic hypoxia, sars-cov2, covid-19, primary health system

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Introduction

At the end of 2019 a newly identified corona virus named SarsCov-2 which is the causative agent of COVID-19 (corona virus disease 2019) emerged in Wuhan, China, resulting in a Pandemic that has affected countries all over the world.[1] This disease produces different symptoms including fever, cough, headache, and loss of taste, smell or appetite, shortness of breath, amongst others. One of the most important symptoms is shortness of breath due to hypoxia.[2]

Hypoxia refers to low levels of oxygen saturation (SpO_2) in the body tissues (less than 90%) whereas hypoxemia is defined as a decrease in the partial pressure of SpO_2 levels in the blood. Hypoxia can be easily diagnosed by monitoring SpO_2 with a pulse ox meter and hypoxemia is determined by a blood gas sample taken from an artery, demanding more material, time and a health technician. Therefore, a hypoxia exam appears to be a simpler and cheaper method.˝ Silent ˝ hypoxia is a condition in which the patient does not complain of dyspnea or signs of respiratory distress but presents a SpO_2 of less than 94%.

Recently, some studies have suggested asymptomatic hypoxia in COVID-19 as being associated with poor outcomes.[3,4] Furthermore; epidemiological studies have also called attention to advanced age as risk factor to COVID-19.[5] Therefore, our goal was to evaluate the utility of peripheral oxygen measurements using oximetry in elderly patients (pts) with suspected COVID-19 but with no shortness of breath by case series reports.

Method and case series

The population of the city of Campinas in the Sao Paulo State, Brazil, is 1,200,000 inhabitants. TheHealth Public System of Campinas City Hall established a weekly monitoring report of asymptomatic elderly pts with suspected COVID-19 using oximetry during six consecutive days after the onset of symptoms, in the South-West area of Campinas which has 12 Primary Health Units, during the period from August 2020 to February 2021.

Silent hypoxia was considered as a SpO_2 level between 90% and 94%, whereas hypoxia < 90%. Statistical analyses was carried out applying χ^2 tests to compare categorical data, and SPSS v.24 was used considering P-value <5% significant.

A total of 1297 elderly (≥ 60 years old) patients (pts) were followed up during six consecutive days from August 2020 to February 2021. A total of 9023 measurements were carried out using SpO_2 with a pulse ox meter; 4519 (50.1%) in the morning and 4504 (49.9%) in the

afternoon. 163 (12.5%) cases were referred to the Emergency Room and 37 (3%) had to be hospitalized. Among the patients who were hospitalized, 13 died (1%).

During some days, 1069 pts had at least SpO_2 measurements carried out twice a day (in the morning and afternoon), the measurements were grouped and compared to attain the highest measurement by period (Table 1). The highest measurements occurred during the morning after the 5th day; in 2533 (72.5%) during the morning *vs*. 961 (27.5%) during the afternoon (p=0.01). Nevertheless when this data was analyzed considering categorized saturation values, no difference was detected (Table 2).

The highest frequencies of symptoms occurred during the 6th and 8th day and comprised: cough (16.8%), fatigue (12.8%), headache (9.7%), loss of taste and/or smell (6.8%), diarrhea (3.6%) and fever (2.5%), (Table 3).

Table 1 The highest SpO_2 measurement by period

Measuring days	Morning n (%)	Afternoon n (%)	P-value
5th	227 (9)	123 (12.8)	
6th	381 (15)	140 (14.6)	
7th	441 (18)	167 (17.3)	0.016
8th	491 (19)	169 (17.6)	
9th	496 (19.5)	196 (20.5)	
10th	497 (19.5)	166 (17.2)	
Total	2533 (100)	961 (100)	3494
Only days with the measurements of both periods were considered			

Table 2 SpO_2 measurements by period of 1069 pts

SpO_2 values	Morning	Afternoon	P
≥ 95%	3130 (89.5)	3161 (90.5)	
94-90%	347 (10.0)	322 (9.2)	0.23
< 90%	17 (0.5)	10 (0.3)	
Total	3494	3494	--

Table 3 Distribution of symptoms between 5th and 10th day of SpO_2 measurements

Symptoms\day	5th	6th	7th	8th	9th	10th
Fever	23	24	**32**	27	24	15
Cough	192	**218**	199	201	209	171
Headache	102	114	**126**	114	110	77
Fatigue	122	135	**167**	151	147	139
Diarrhea	37	**47**	41	37	43	34
Loss of taste/smell	66	79	88	**89**	85	78

Discussion

Our patient cohort differs in several features compared to other published studies[7,8] that evaluate the hospitalized COVID-19 population whereas our patients were elderly, had a suspected COVID-19 and no complained. At beginning the idea was to follow these cases closely by community health agents, nurses and medical doctors, and to be alert due to silent hypoxia. However, when many cases had to be referred to emergency room and others had to be hospitalized, we realized that this monitoring could be useful. Even some researches[9] has shown a concern of physicians who discharging no severe patients with COVID-19, thinking that these cases could decompensate at home.

Although SpO_2 measurements by oximetry may seem easy, in Brazil, just healthcare professionals are habilitated for that. Hence, the Primary Health Units were responsible to call and monitor all cases. Differently of some places, for instance, Illinois in Chicago had a study where each patient received a home pulse oximeter to record their SpO_2 every 8 hours to monitor disease progression.[10]

Clearly, dyspnea in patients with COVID-19 was associated to poor outcome[3] nevertheless, as indicated by the CDC[6] and other health policies all over the world dyspnea is not a key criterion of initial severity in patients with COVID-19, and patients with a mild clinical presentation may not initially require hospitalization. Couzin-Frankel[12] raised an interesting debate regarding the treatment

of patients with low blood oxygen levels; however with no trouble breathing, highlighting that dyspnea is the sensation of shortness of breath, while hypoxia is low oxygen levels in the blood. Our data reinforced how was important to monitor the blood oxygen levels in the suspect COVID-10 cases and because of that about 13% of these cases were referred to emergency rooms. So this silent hypoxia requires further investigation, beyond laboratorial tests, to understand the reason some COVID-19 patients are able to continue with their normal daily activities despite hypoxia.[3] A satisfactory hypothesis is that silent hypoxia is the result of the differential effect of O_2 and CO_2 during gas exchange that could produce a relative preservation of the lungs' ability to excrete CO_2 despite the falling O_2 levels.[11]

In summary, peripheral oxygen measurements using oximetry in this elderly group achieved excellent results, with only a 3% of hospitalization and 1% of deaths. It is necessary to underline that all measurements were carried out by specialized healthcare professionals in the primary health units, and not only were SpO_2 measurements carried out, but also the overall exams to guarantee the general well-being of the patient. Self-monitoring of pulse oximetry by patients themselves can represent a problem, mainly due to the challenge of adequate calibration data, producing less accurate results.[12]

Conclusion

The utility of SpO_2 measurements by a health care professional can be a valuable tool to be used as an alert system for further evaluation. These results could have an important impact on the monitoring and assistance protocols for patients affected by Covid-19 in the primary health network, aiding in the active surveillance and early identification of patients with a drop in O_2 saturation. This tool could be useful topredict outcomes.

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Authors' contribution

CDS, DH and AvZ designed, collected and analyzed the data, wrote and reviewed the manuscript; ECMM performed the statistical analysis, wrote and reviewed the manuscript. MN, DM, DCPM, RS, MCF and LZ contributed substantially to the clinical protocol, training of health communitarian agents, the inclusion and control of patient outcomes. All authors performed a critical revision of the manuscript and approved the final draft.

Patient consent for publication

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Availability of data and material

All de-identified data are available upon request.

Conflicts of interest

The author declares no conflicts of interest.

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