Original Research Paper

Volume - 12 | Issue - 11 | November - 2022 | PRINT ISSN No. 2249 - 555X | DOI : 10.36106/ijar

Community Medicine

CORRELATION BETWEEN OXYGEN SATURATION OF BLOOD AND FRONTAL TEMPERATURE IN SCREENING FOR COVID-19 IN A TERTIARY HEALTH CARE CENTRE

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ABSTRACT As the COVID19 cases with new variants are on the rise, methods to screen individuals before entering a hospital or public areas have become pivotal for the control of its spread. For these cases noncontact frontal temperature readings by infrared thermometers are widely used in many places. But the accuracy and reliability of these are questionable due to the environmental interractions, which were corrected by the use of pulse oximeters. Pulse oximeters transcutaneously measure the functional oxygen saturation of arterial blood (PaO2). This is simply a reflection of oxygen saturation curve. In patients with a baseline SO2 of 91% at body temperature of 370C, an increase in body temperature to 400C is anticipated to cause a 5% decrease in SO21. This decrease has major potential implication concerning diagnosis.

KEYWORDS : COVID-19, pulse oxymeter, infrared thermometer

INTRODUCTION

As screening and testing for COVID 19 cases are on the hike and face masks have become a new normal of everyday life, a small diagnostic tool that clips to the tip of your finger is fast becoming a must have gadget in the fight against the coronavirus. The pulse oximeter has revolutionized modern medicine with its ability to transcutaneously monitor the functional oxygen saturation of hemoglobin in arterial blood (SpO2). The routine use of infrared thermometer in the screening of COVID suspects has increased.

The pulse oximeter measures your blood oxygen saturation and heart rate by Beer-Lambert law which states that the concentration of unknown solute (hemoglobin) dissolved in a known solvent (blood) can be determined by the light absorption of the solute. It estimates arterial blood saturation by sensing the absorption spectrum of oxyhemoglobin and deoxyhemoglobin. Two photodiodes, typically housed in a finger probe, which produce light at 660 nanometers (red) and 900nm to 940nm (infrared) are used.

Oxygenated blood cells are bright red and deoxygenated cells are dark red. The pulse oximeter compares the number of bright red cells to dark red cells to calculate oxygen saturation as a percentage. So, for example, a reading of 99% means only 1% of the blood cells in your bloodstream have been depleted of oxygen. A normal pulse oximeter oxygen level reading is between 95% and 100%, and anything less than 90% is considered dangerously low, or hypoxic. Some doctors have reported COVID-19 patients entering the hospital with oxygen levels at 50% or below. Goldberg et al had suggested that the influence of pyrexia in children with low-normal oxygen saturation is expected to be much higher because of the non-linear shape of the oxygen dissociation curve2. Tozzetti C et al suggested that non-invasive measurements of hemoglobin oxygen saturation (SaO2) by pulse oximetry (SpO2) have become routine in emergency settings, and SpO2 has been labeled the fifth vital sign3. Kiekkas P et al noted that an increased median temperature from 38.1°C to 39.0 °C was accompanied by a decrease in SpO2 from 98.0 to 97.6%4.

Ruskin KJ stated that the pulse oximeter detects the amount of oxyhemoglobin and deoxygenated hemoglobin in arterial blood and shows it as Oxyhemoglobin saturation (SpO2) which is an indirect estimation of arterial oxygen saturation (SaO2). The normal amount of SpO2 in healthy individuals is 97% to 99%5. Schutz SL et al suggested that the SpO2 of earlobe probes, as due to lesser mean difference, more limited confidence level and higher agreement ration with SaO2 resulted by arterial blood gas (ABG) analysis had higher accuracy6.

Infrared thermometers help in the detection of frontal temperature without contacting the patients. They can be used as part of an initial check at entry points to identify people who may have elevated temperatures. Liu et al had suggested that measuring the auditory meatus temperature is a more reliable screening for fever than measuring the forehead body surface temperature using the same infrared body thermometer in out- door conditions7. This could be due to more prominent effects of outdoor environmental factors on forehead body surface temperature.

The drawbacks of non-contact temperature assessment devices include: infections without a fever, use of fever-reducing drugs, other infections or conditions that may cause elevated temperatures, devices failing to identify elevated temperatures, or misreading normal temperatures as elevated. To counteract the disadvantages of infrared thermometers, pulse oximeters can be used along with them, for screening COVID 19 in outpatients.

To date limited studies have been done in the analyzing the proportion of patients with blood oxygen saturation below 95% attending a screening OP in tertiary dental care centres with normal frontal temperature in regard with assessing silent hypoxia. Studies on association of SpO2 and temperature change with use of pulse oximeter and infrared thermometer respectively in the screening OP patients during COVID spread are also limited. The results of this study can be used in the betterment of screening of patients using these instruments.

The objective of this study was to evaluate the correlation between blood oxygen saturation as measured with pulse oximeter and frontal temperature as measured with infrared thermometer among patients reported to screening OP of Govt dental college Thrissur and also to assess the proportion of patients with blood oxygen saturation level below 95% as measured using pulse oximeter with normal frontal temperature.

METHODOLOGY

In this cross-sectional study, patients reporting to the screening OP of Govt dental college, Thrissur within the inclusion criteria of age above 18 yrs and consulting time within 9am to 11am were measured for their frontal temperature using infrared thermometer. Patients not consented to participate, with respiratory problems and other contributing medical conditions and patients who had taken antipyretic medicines on the same day were excluded. Oxygen saturation of blood and pulse rate using pulse oximeter were also noted. Sample size of 200 was obtained after the pilot study. The age, gender and pulse rate were considered as the covariables.

RESULTS

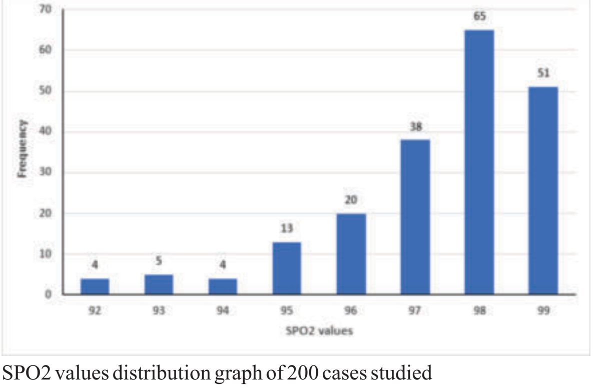
200 patients were assessed for their frontal temperature and SPO2

levels. According to SPO2 values distribution graph it was found that 98 SPO2 value was seen in 65%cases. A low oxygen saturation level of 95 and below was seen in 26%cases, with lowest level of 92 in 4% cases.

As pulse rate of patients was assessed a range of 70-100 in 62% of cases. A low pulse rate of below 70 was seen in13% cases. A high pulse rate of above 100 was seen in 35%.

On frontal temperature analysis, a raised temperature of above 37 is seen in 7% cases. Most othe patients were having 36-37 degrees temperature range (88%)

69% of the patients were in 30 – 60 age range with males and females of almost same percentage. Frontal temperature vs SPO2 shows a negative correlation of -0.330 while doing Pearson Correlation analysis and the correlation is statistically significant at the 0.01 level (p- value< 0.05)



SPO2 values distribution graph of 200 cases studied

Frontal temperature distribution graph of 101 females and 99 males

Frontal Temperature (in degree Celsius)	Frequency	Percentage
32-33	2	1
35-36	9	4
36-37	176	88
37-38	11	6
Above 38	2	1

Correlation analysis

Frontal temperature vs SPO2 shows a negative correlation of -0.330 while doing Pearson Correlation analysis and the correlation is statistically significant at the 0.01 level (p- value< 0.05)

Correlations

		VAR00003	VAR00004
VAR00003	Pearson Correlation	1.000	-.330**
	Sig. (2-tailed)	.	.000
	N	200	200
VAR00004	Pearson Correlation	-.330**	1.000
	Sig. (2-tailed)	.000	.
	N	200	200

**. Correlation is significant at the 0.01 level (2-tailed).

DISCUSSION

This study helps in the better interpretation of pulse oximeter and infrared thermometer values, when used for the screening of COVID -19. COVID-19 had claimed more than 6 million lives worldwide till date. This situation has put forward many research findings and system learning which can be used efficiently to reduce the impact of this pandemic. One of the important aspect of management is the accurate detection and timely management of hypoxia. Home oximetry and screening using infrared thermometer had saved many lives by enabling patients requiring hospitalisation to be identified earlier, while also conserving hospital beds and reducing the risk of nosocomial infection.

In April 2020, an emergency room doctor observed COVID-19 patients without visible signs of dyspnea and a SpO2 below 90%. He noticed that these patients had a form of oxygen deprivation, which is difficult to detect, called "silent hypoxia," despite the patients feeling alert and breathing normally8.

Asymptomatic hypoxia (AH) or silent hypoxia is becoming more prevalent in the COVID-19 literature and is associated with extremely poor outcomes9. In a study from prehospital first responder data, a higher discrepancy was found between oxygen saturation (SpO2) and respiratory rates in COVID-19 Acute Respiratory Failure (ARF) patients compared to earlier non-COVID-19 ARF patients10. Healthcare providers must remain attentive while checking for a 3–5% drop in SPO2 after mild activity/ambulation, room air, and the presence of hypoxemia without tachypnea8,11.

In this study frontal temperature vs SPO2 shows a negative correlation of -0.330 while doing Pearson Correlation analysis and the correlation is statistically significant at the 0.01 level (p- value< 0.05). Frontal temperature vs pulse rate shows a small positive correlation of 0.183 while doing Pearson Correlation analysis and the correlation is statistically significant at the 0.01 level (p- value< 0.05).

As screening tests currently available remain inadequate, the temperature evaluation remains primary test for COVID-19. Due to physiological changes in older people and difference in clinical presentations, the current treatment protocols and assessment should be reconsidered. Symptom-based screening for COVID-19 has proven to be inefficient. The data being collected during screening, explains that temperature and self-report of exposure and/or symptoms are missing in more than 50% of infected individuals. Further research is essential in this area to determine the most appropriate screening assessments and the cohorts exhibiting variations from standard physiological norms.

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