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Research Article

Impacts of Hypoxia on Blood Pressure and Heart Rate in Covid-19 Patients

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Abstract

Background: Oxygen concentration is the percentage of hemoglobin in the blood that is saturated with oxygen. The oxygen saturation in the blood is measured by a pulse oximeter, which is measured from the finger or ear lobe. The normal amount of oxygen in the blood is from 95% to 100%. If the oxygen saturation of the blood decreases from 90%, it is called hypoxia. This means that the tissues of the body do not have enough oxygen and need treatment. It consists of respiratory diseases and high altitudes. Blood pressure, pulse rate, and PsO2 are three different medical metrics that are typically used to assess a person's condition. these are still strongly associated with the heart. In this article, our goal is the relationship between hypoxia and high blood pressure and pulse rate. **Methodology**: This cross-sectional study was carried out in the internal medicine ward of Nangarhar University's Teaching Hospital between January and December of 2023. Samples from 2191 patients suspected of having COVID-19 were gathered by the Nangarhar University Teaching Hospital's Surveillance Supportive Team (SST), and the virus was confirmed using Polymerase Chain Reaction (PCR) and Rapid Diagnostic Test (RDT). In this hospital, these tests were performed at no cost. 1518 individuals in this group tested negative for COVID-19, while 834 cases tested positive. Out of the 834 people who tested positive for COVID-19, The hospital accepted 101 patients with arterial oxygen concentrations below 90%.and we assessed the correlation between hypoxia, hypertension, and pulse rate in 101 hypoxic individuals. A sphygmomanometer was used to monitor arterial pressure, and a pulse oximeter was used to measure oxygen saturation. All 101 hypoxic COVID-19 positives with arterial oxygen saturation below 90% were included in this investigation. Additionally, hypoxia in patients with COPD, respiratory failure, and pneumonia who did not have COVID-19 was not included. Additionally, all patients, both male and female, who were over the age of eighteen and had a connection to internal medicine were included. PsO2 was the independent variable in this study, whereas blood pressure and pulse rate were the dependent variables. Statistics Calculator, SPSS, and Excel were used to analyze the data. Multiple linear regression, which characterizes the connection between a dependent and an independent variable, is how we test the independent and dependent variables in statistics. **Results:** from 2191 individuals, samples were taken due to COVID-19, of which 610 were men and 1518 were women, of which 834 (38.06%) were positive for COVID-19 and 1357 (61.95%) were negative for COVID-19.346 (41.46%) were positive for COVID-19 by polymerase chain reaction (PCR), of which 118 (14.14%) were male and 228 (27.33%) were female. And 488 (58.51%) were positive for Covid-19 by Rapid Diagnostic Test (RDT), of which 176 (21.10%) males were positive for Covid-19 and 312 (81.25%) were females for Covid-19. Among the 834 patients who tested positive for COVID-19, 101 (12.11%) had hypoxia and were admitted to the internal medical of the university teaching hospital.101 patients who had hypoxia and oxygen saturation was less than 90% participated, and we found a relationship between hypoxia and heart rate and blood pressure. The minimum age of the patients was 29 and the maximum age was 90 years. Mean confidence interval 95% CI {58.3737, 63.9828}. The standard deviation (14.2066) mean was 61.1782. Mode was 70 years. 69.30% were female and 30.69% were male. the efficiency of multiple correlation (R) equals 0.185325. This means that there is a very weak correlation between the predicted data (Y^1) and the observed data(Y).

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KEYWORDS: Arterial Oxygen Saturation, Blood Pressure, Hypoxia, Pulse Rate.

1. INTRODUCTION

The proportion of oxygen-saturated hemoglobin in the blood is known as the oxygen concentration. A pulse oximeter, which is taken from the finger or ear lobe, measures the blood's oxygen saturation. Blood oxygen levels typically range between 95% and 100%. Hypoxia occurs when the blood's oxygen saturation falls below 90%. This indicates that the body's tissues require care because they are not receiving adequate oxygen. It includes high altitudes and respiratory conditions. psO2 (peripheral capillary oxygen saturation) measures the amount of oxygen in the blood. psO2 is the percentage of oxygenated hemoglobin. Hemoglobin is a protein that transports oxygen in the blood. The necessity was because most of the COVID-19 patients who had shortness of breath and the oxygen concentration of their arterial blood was below 90%, their blood pressure was high and had tachycardia, and the research in this connection had not yet been carried out in Nangarhar University Teaching Hospital, and so we felt it necessary to investigate the relationship between hypoxia and hypertension and heart rate to see if hypertension and tachycardia are related to hypoxia or not. Hemoglobin is in red blood and determines the color of blood. If the blood has good oxygen, the muscles perform their tasks well. When the blood oxygen level drops below 90%, it is a dangerous sign called hypoxia. https://www.cablesandsensors.com › pages › is-spo2-sam...

Blood pressure is defined as the force required by the blood to travel through the arteries. Your arteries are forced to fill with oxygen-rich blood by the force generated by the heart's pumping action. Hypertension, or high blood pressure, is the term used to describe situations in which your blood pressure is higher than normal. Your blood pressure fluctuates based on your daily activities. If your blood pressure is regularly higher than usual, you may develop hypertension, or high blood pressure. Elevated blood pressure is linked to a higher risk of developing further health issues, including heart disease, heart attack, and stroke. https://www.cablesandsensors.com › pages › is-spo2-sam...

It is also thought that hypoxia during sleep chronically increases blood pressure, the reason for this is not yet known, but it is thought to be the overactivity of the sympathetic nerve**.** **(**Leuenberger.,2001). Blood pressure rose in tandem with the rise in hematocrit during hypoxia, reaching its peak on day 24. Blood pressure stayed high for the duration of the observation period even when normal hematocrit, erythrocyte mass, and blood volume returned following the restoration of normoxia (Vaziri.,1996). Chronic hypoxia increases blood pressure and noradrenaline overflow in healthy humans (Calbet .,2003). SpO2 and blood pressure are two medical measurements that determine the health status of a person. All of them are closely related to the heart, which is one of the most important vital organs of the human being. https://www.cablesandsensors.com › pages › is-spo2-sam...

Over the course of 28 nights, chronic intermittent hypoxia in humans increased blood pressure and sympathetic muscle activity (Gilmartin.,2010). The hypertension(HTN) risk is increased by mild sleep apnea. Ninety-nine percent of pediatric patients (18–35 years old) with HTN who do not have secondary etiology have underlying OSA. For the diagnosis of OSA, formal polysomnography is not inferior to home sleep investigations. The degree of HTN is positively connected with the nocturnal oxygen desaturation rate (Seetho IW.,2013). Since Nangarhar University Teaching Hospital has not yet conducted a study in this area, we were compelled to look into the connection between hypoxia heart rate, and hypertension to determine whether or not tachycardia and hypertension are related to hypoxia.

2. METHODOLOGY

Between January and December of 2023, this cross-sectional study was conducted at the internal medicine ward of the Teaching Hospital at Nangarhar University. The Surveillance Supportive Team (SST) at Nangarhar University Teaching Hospital collected samples from 2191 individuals who were suspected of having Covid-19. The Rapid Diagnostic Test (RDT) and Polymerase Chain Reaction (PCR) were used to confirm the virus. These tests were conducted at no cost in this facility. In this study, 834 patients tested positive for COVID-19, whereas 1518 people tested negative. 101 patients with arterial oxygen values below 90% were admitted to the hospital out of the 834 individuals who tested positive for COVID-19 we evaluated the relationship between pulse rate, hypertension, and hypoxia in 101 hypoxic people. A pulse oximeter was used to assess oxygen saturation, and a sphygmomanometer was utilized to track arterial pressure. This study included all 101 hypoxic COVID-19 positives whose arterial oxygen saturation was less than 90%. Furthermore, hypoxia in non-COVID-19 patients with pneumonia, respiratory failure, and COPD was excluded. Furthermore, all patients (male and female) with a relationship to internal medicine who were older than eighteen were included. In statistics, this is how we test the independent and dependent variables. In this study, blood pressure and pulse rate were the dependent variables, while PSO2 was the independent variable. The data was analyzed using Excel, SPSS, and Statistics Calculator. In statistics, we assess the independent and dependent variables using multiple linear regression, which describes the relationship between a dependent and an independent variable.

3. RESULTS

Samples were collected from 2191 people because of COVID-19, 610 of whom were men and 1518 of whom were women. Of them, 834 (38.06%) tested positive for COVID-19, while 1357 (61.95%) tested negative. By polymerase chain reaction (PCR), 346 (41.46%) tested positive for COVID-19, with 228 (27.33%) being female and 118 (14.14%) being male. According to the Rapid Diagnostic Test (RDT), 488 (58.51%) tested positive for COVID-19, with 176 (21.10%) males and 312 (81.25%) females.101 (12.11%) of the 834 individuals who tested positive for COVID-19 experienced hypoxia and were hospitalized to the university teaching hospital's internal medical unit. Participants were 101 patients with hypoxia whose oxygen saturation was below 90%. We discovered a correlation between hypoxia and blood pressure and heart rate. Patients ranged in age from 29 at the youngest to 90 at the oldest. 95% CI for the mean is {58.3737, 63.9828}. The mean standard deviation was 61.1782 (14.2066).

Seventy years was the mode. 30.69% were men and 69.30% were women. the coefficient of multiple correlation (R) equals 0.185325. it means that there is a very weak relation between the predicted data (in the dependent variable (PSO2) (Y^1) and the observed data dependent variables such as blood pressure and pulse rate (Y). Y and X relationship: R square (R^2) equals 0.0343454, it whitens that the predictors (X) explain 3.4% of the variance of Overall regression right-tailed F (1.96) =3.485566, P-value=0. 0648955. since P-value≥α (0.05), we accept the H0. The data from the COVID-19 testing results at the teaching hospital in 2023 provides a comprehensive overview of testing outcomes.

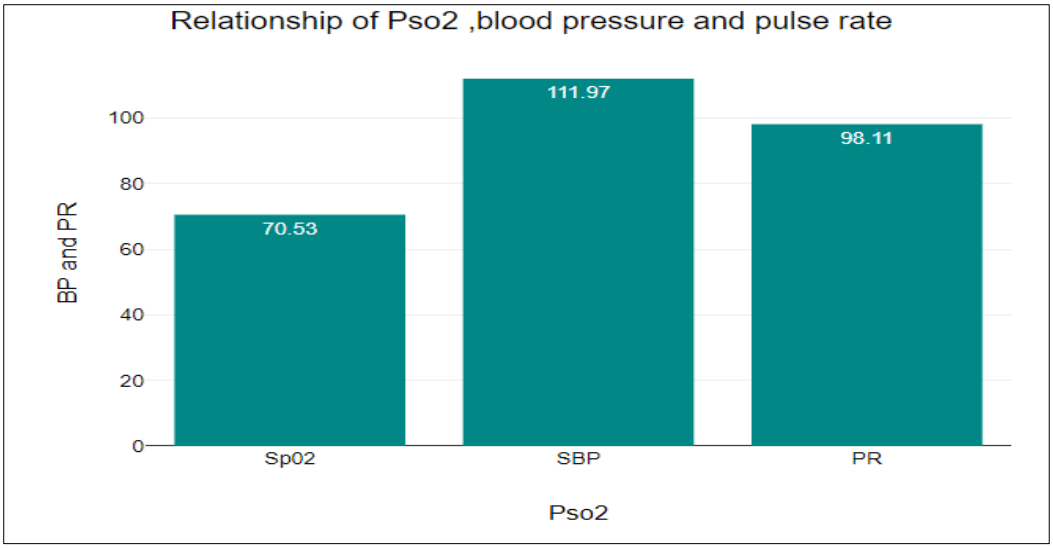
Here's a summary of the key findings:

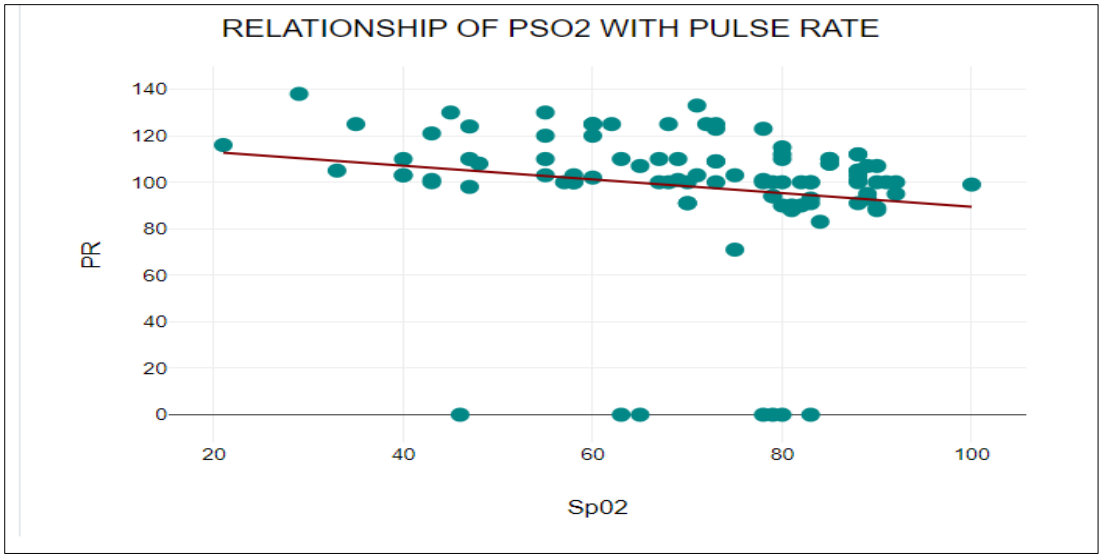
Table 1: Total Samples Taken: 2,191. **Total Positive Cases**: 834 (38. 06%). **Total Negative Cases**: 1,357 (61.95%)			
Gender	**Total Positive Cases of covid-19:** 834 (38.06%)		Total Negative Cases of covid-19: 1,357 (61.95%)
	Positive by PCR	**Positive by RDT**	
F	228 (65.89%	312 (63.95%	
M	118 (34.11%	176 (36.05%	
Total Positives	346 (15.78%)	488 (22.24%)	
PsO2 less than 90%	**101 (12.11%)**		

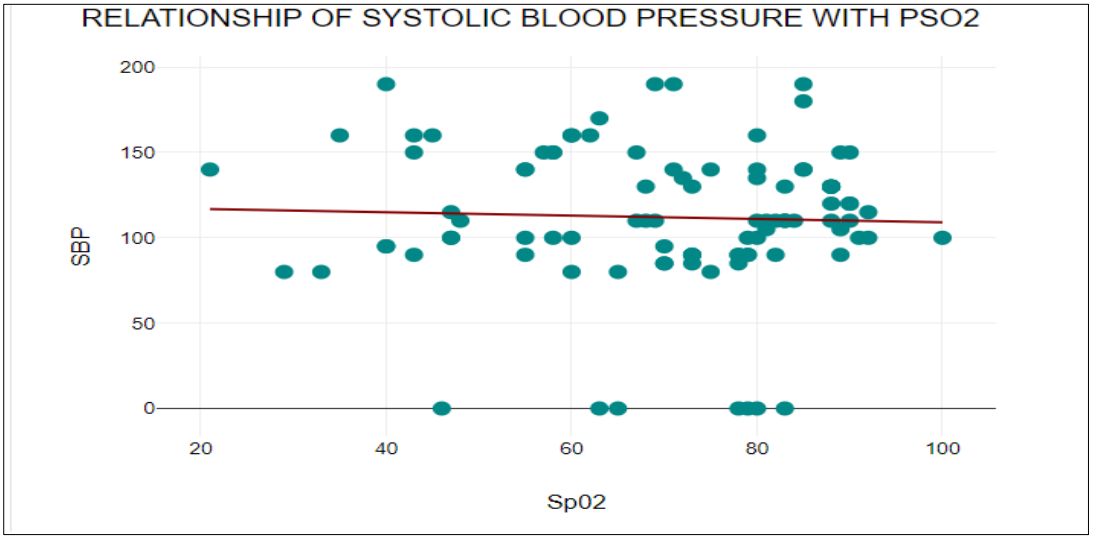
Key Observations:

1. The overall positive case rate for COVID-19 is 38.06%.
2. In RDT results, a higher proportion of positive cases is observed in females (63.95%) compared to males (36.05%).
3. PCR results show a more balanced gender distribution, with females accounting for 65.89% and males for 34.11% of positive cases. These findings highlight gender differences in test results, particularly the higher positive rate among females in the RDT category, while the PCR results indicate a more equitable distribution between genders.

Groups	**Age**
Number of observations	101
Minimum	29
Maximum	90
Range	61
Mean (xl,,)	61.1782
Mode	70 (appears 10 times)
Mean Confidence Interval	95% CI [58.3737, 63.9828]
Standard Deviation (S)	14.2066
SD Confidence Interval	95% CI [12.4811, 16.4901]
Standard Deviation (Ĭ*f*)	14.1361
Q1	50
Median	62
Q3	70
IQR	20
Skewness	-0.2363
Excess kurtosis	-0.6066







4. DISCUSSION

In this research, our goal is to find the relationship between hypoxia (decreased arterial oxygen saturation) with blood pressure and pulse rate. The importance of this research is that many COVID-19 patients who come to the hospital have low arterial oxygen saturation and high blood pressure and pulse rate, so we felt it necessary to evaluate the relationship between low arterial oxygen saturation and blood pressure and pulse rate. The coefficient of multiple correlations (R) equals 0.185325. it means that there is a very weak correlation between the predicted data (in the dependent variable(psO2) (Y^1) and the observed data (dependent variables such as blood pressure and pulse rate (Y). overall regression: right-tailed F (1.96) =3.485566, P-value=0. 0648955. Since P-value≥α (0.05), we accept the H0. There was no special limitation in this research because all vital monitoring examinations of every patient are in the ICU, intervention is not necessary, and all monitoring is necessary for every patient in a free form. Taking care of any underlying problems that may cause your oxygen levels to drop is the best method to lessen your risk of hypoxia. Discuss your concerns as well as specific methods to reduce your risk with your physician if you have a heart or lung disease. Intermittent chronic hypoxia causes sympathetic nerve stimulation, which leads to changes in vasculature, which causes hypertension. (Sunderram.,2012). Repeated attacks of sleep apnea cause hypertension, the main cause of which is an increase in sympathetic outflow. (Fletcher.,2000). Obstructive sleep apnea patients are exposed to chronic intermittent hypoxia; such people are at risk of hypertension and cardiovascular diseases (Foster.,2010). Patients suffering from sleep apnea with periods of hypoxemia are prone to hypertension. (Fox., 2006). Frequent hypoxia causes hypertension(Leke.,1997). Acute hypoxia increases heart rate, cardiac output, peripheral vascular resistance, and systemic blood pressure through sympathetic hyperactivity. (Serebrovskaya.,2008).

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Authors Contributions: Dr. Saifullah did the analysis, selection, collection of data, and writing of the research.
Dr. Naqibullah Hadi cooperated with me in the analysis of the research.

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