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TO ASSESS THE CORRELATION OF SPO2 ON DIFFERENT FINGERS IN PREOPERATIVE ROOM

Anaesthesiology

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ABSTRACT

Introduction: In a pre-operative room, healthcare professionals often use a pulse oximeter to monitor a patient's oxygen saturation (SPO2) levels. The pulse oximeter measures the amount of oxygen carried by red blood cells in the body. It typically clips onto a person's finger, earlobe, or another suitable body part. **Aim: -** To Study SpO2 on different fingers in the preoperative room. **Material and Method: -** A total number of 64 patients were enrolled in the study and SpO2 readings were taken from the fingers of both hands. The study was conducted to compare the differences in SpO2 reading in different fingers of both hands. SpO2 monitoring was done by using a SpO2 probe. Patients were assessed for SpO2 in all fingers of both hands in the pre-operative room and readings were tabulated and compared. **Result: -** From the study, it is clear that both hand fingers have similar readings of SpO2. Only the fifth fingers have significant results but it is infrequent to use if there were full damage to other fingers. Student t-test was applied and overall, the results were not significant at 0.05 level of significance. There is no significant difference in SpO2 reading in the fingers of the two hands and there is no significant difference in the hemodynamic parameters as well. **Conclusion: -** From the study, it is clear that there is no significant difference in SpO2 reading in the fingers of the two hands and there is no significant difference in the hemodynamic parameters as well. So, we can conclude that any finger of the hand can be used to monitor the SpO2.

KEYWORDS

SPO2, Fingers, Hemodynamic, Two Hands.

BACKGROUND

The base of pulse oximetry is the non-invasive measurement of SpO2 and pulsation in capillary blood using oximetry and plethysmography. In oximetry, the Lambert-Beer law is in effect. A microprocessor calculates SpO2 after a sensor photodiode detects the amount of red light (wavelength 660 nm) absorbed by deoxyhemoglobin and the ratio of infrared light (wavelength 940-960 nm) absorbed by oxyhemoglobin, which fluctuates with the cardiac cycle. The light source of the device is a sensor with two to three light-emitting diodes. Plethysmography can identify arterial pulse by adjusting how non-pulsating venous blood and tissue absorb light.[1,2] It is a low-cost, wireless, and portable device. The method of measurement is non-invasive, and it provides an estimate of the oxygen level in capillaries It is a low-cost, wireless, and portable device. The measurement technique is non-invasive and yields an estimate of the amount of oxygen in capillary blood.[3,4] The heart rate and tissue perfusion (measured by pulse amplitude or perfusion index) are also provided by this technique (PI).[5,6] However, there are some disadvantages to this method. Carboxyhaemoglobin and methemoglobinemia can result in erroneous SpO2 values because of the similarities in light absorption wavelength between red and infrared light, which correspond to deoxyhemoglobin and oxyhemoglobin. This study compares SpO2 measurements from various fingers on both hands to determine whether hand dominance correlates with them.

A pulse oximeter is a medical device that produces photoplethysmography by measuring changes in blood volume in the skin and indirectly measuring oxygen saturation in the blood of a patient (rather than directly measuring oxygen saturation through a blood sample). It's usually linked to a medical monitor so that caregivers can monitor a patient's oxygen levels at all times. The SpO_2 sensor calculates oxygen saturation by comparing how much red and infrared light is absorbed by the blood.

However, there might be differences between the true state determined by arterial blood gas oximetry and the oxygen saturation assessed by pulse oximetry (SpO2). SpO2 can be higher than SaO2 in the presence of high carboxyhemoglobin levels, intravascular dyes, dark skin pigmentation, motion artifacts, nail polish, optical shunting, and inadequate peripheral perfusion.[7,8]

Oxyhemoglobin saturation is measured using pulse oximeters. SpO2 is often utilized around the world, not just in operating rooms and critical care units (ICUs), but also in outpatient settings.[9] It is recommended that mechanically ventilated patients maintain a SpO_2 of around 90%.[10] According to the ARDS (acute respiratory distress syndrome) mechanical ventilation protocol summary55–80 mmHg of PaO2 or 88–95 percent SpO2 is the oxygenation target for ARDS patients. Recent oxygen therapies replace SpO2 for SaO2, therefore maintaining hypoxemia requires pulse oximeter accuracy of at least 90%; however, other research contends that SpO2 overestimates SaO2, particularly in very unwell patients.[11]

Oximetry was used to monitor patients, but the data weren't made available to clinicians until after their initial assessment. Different diagnostic procedures and treatments were almost certainly carried out at an oxygen level. There was an 89 percent saturation rate, and changes were uncommon. At lower saturations, due to the doctors' ability to detect hypoxia without the use of a machine oximeter (pulse).

In addition to hospital-grade pulse oximeters, newer and considerably more compact consumer-grade devices are swiftly gaining acceptance in the sporting, private aviation, mountaineering, and other recreational activity groups. Many individuals with chronic respiratory ailments purchase these consumer-grade models due to their compact size and low cost to titrate their medications or oxygen flow at home. The Food and Drug Administration has not approved the majority of those consumer-grade devices for diagnosing or treating diseases.[12]

Research Question

To assess the correlation between SPO_2 amongst hemodynamic variables and to check the difference in the reading of SPO2 in the right and left hand.

METHODOLOGY

A prospective and comparative clinical study will be conducted in the Department of Anesthesiology and Critical Care at SGT University, Hospital & Research Institute, Budhera, Gurugram, Haryana. After receiving written informed consent from patients and approval of the ethical committee, this study was conducted.

Sample Size: Sample size was calculated through G power software. A total of 64 patients will be included in the study to compare the differences in SpO_2 reading in different fingers of both hands. SpO_2 monitoring will be done by using a SpO_2 probe. Patients will be assessed for SpO2 in all fingers of both hands in the pre-operative room and readings will be tabulated and compared.

Inclusion Criteria

- Patients undergoing any surgical procedure of the age group of 18-40 years.
- Patients with normal hemodynamic including systolic, diastolic blood pressure and mean arterial pressure.
- ASA grade I and II.

Exclusion Criteria

- Emergency cases will be excluded
- Above 40 years and below 18 years
- ASA grade III and IV
- Anaemic patients
- Trauma patients
- Coagulation disorder

Statistical Tool

The data from the study was collected and subjected to appropriate statistical methods using SPSS version 26 (IBM SPSS Statistics Inc., Chicago, Illinois, USA). The results obtained from the study were compared by using an independent t-test for both fingers SPO_2 and Pearson correlation was used to find the relationship between SPO_2 with hemodynamic variables.

RESULTS

The results of the study data are shown in tables and graphs.

Table 1. Distribution Of Socio-demographic Variables Of The Study Participants.

Age (in Years)	
Min-Max (Median)	18-42(35.00)
Mean ± SD	32.78 ± 6.94
Weight	
Min-Max (Median)	40-88(67.00)
Mean ± SD	66.44 ± 10.77
Gender n (%)	
Female	40(62.5%)
Male	24(37.5%)
ASA n (%)	
I	21(32.8%)
II	43(67.2%)
III	0(0.0%)

In the present study, table 1 shows the demographic distribution of the data in which the mean age of the study participants was 32.78 years and had a standard deviation of 6.94 years. According to the weight of the study participants, the minimum weight was found to be 40 kgs and 88 kgs was the maximum. Similarly for gender distribution female participation was more in this study, almost 63% were females and 37% were males.

According to the ASA score, 33% were under the category of I and 67% were in II category.

Table 2. Descriptive Statistics Of Right Finger Variables Of The Study Participants.

Right	Mean	Std. Deviation
Finger 1	98.70	1.22
Finger 2	98.77	1.02
Finger 3	98.42	1.02
Finger 4	98.38	0.81
Finger 5	98.08	0.98

In this present study, table 2 shows the descriptive statistics of the right finger according to their SPO2 levels separately. Finger 1 has a 98.70 mean and 1.22 standard deviation, for the second finger it was 98.77 with a mean value and 1.02 SD, finger 3 has a 98.42 mean and 1.02 standard deviation. All fingers have almost the same readings, and the results were also not significant.

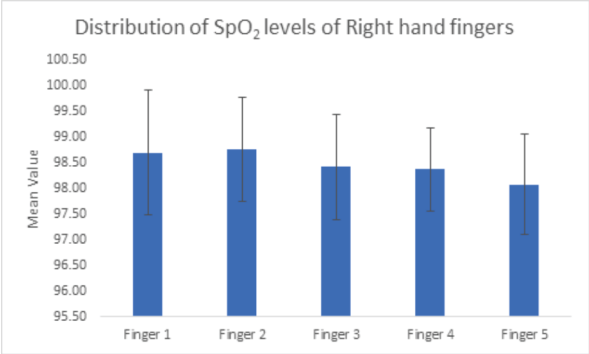


Figure 1. Distribution Of SPO2 Levels Of Right-hand Fingers

Table 3. Correlation Between Right-hand Finger With Hemodynamic Variables

Right		HEART_RATE	SBP	DBP	MAP
Finger 1	Pearson Correlation	0.036	0.029	0.002	0.011
	p-value	0.778	0.82	0.985	0.932
Finger 2	Pearson Correlation	-0.052	0.023	0.057	0.046
	p-value	0.685	0.854	0.657	0.715
Finger 3	Pearson Correlation	0.07	0.121	0.07	0.096
	p-value	0.582	0.339	0.581	0.449
Finger 4	Pearson Correlation	0.085	-0.037	0.123	0.066
	p-value	0.503	0.774	0.333	0.602
Finger 5	Pearson Correlation	0.015	0.100	0.105	0.107
	p-value	0.909	0.432	0.407	0.400

Table 3, shows the correlation between the right finger spo2 levels and with hemodynamic variable. Pearson's correlation coefficient test was applied and the results were not significant in any finger of right-handed.

Table 4. Descriptive Statistics Of Left Finger Variables Of The Study Participants.

Left	Mean	Std. Deviation
Finger 1	98.94	0.97
Finger 2	98.66	0.82
Finger 3	98.42	0.89
Finger 4	98.22	0.83
Finger 5	97.70	1.08

In this present study, table 4 shows the descriptive statistics of left-hand fingers according to their SPO2 levels separately. Finger 1 has a 98.94 mean and 0.97 standard deviations, the second finger was 98.66 with a mean value and 0.82 SD, similarly finger 3 has a 98.42 mean and 0.89 standard deviations. All fingers have almost similar readings and the results were insignificant.

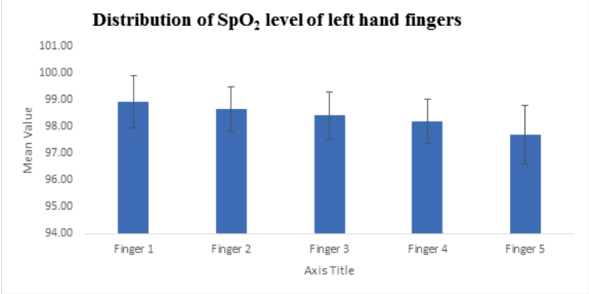


Table 5. Correlation Between Left-hand Finger With Hemodynamic Variables

Left		HEART_RATE	SBP	DBP	MAP
Finger 1	Pearson Correlation	0.255*	-0.099	-0.036	-0.059
	p-value	0.042	0.435	0.779	0.642
Finger 2	Pearson Correlation	0.147	0.196	.253*	0.242
	p-value	0.247	0.122	0.044	0.054

Finger 3	Pearson Correlation	0.256*	0.067	0.157	0.130
	p-value	0.041	0.600	0.216	0.305
Finger 4	Pearson Correlation	0.034	0.114	0.075	0.096
	p-value	0.792	0.368	0.555	0.452
Finger 5	Pearson Correlation	0.124	0.168	0.239	0.220
	p-value	0.331	0.184	0.057	0.080

Table 5, shows the correlation between the left finger spo2 level and with hemodynamic variable. Pearson's correlation coefficient test was applied and the results were significant at finger 1 versus Heart rate, finger 2 versus DBP, and finger 3 versus heart rate, the rest of the others were not significant.

Table 6. Descriptive Statistics Of Hemodynamic Variables

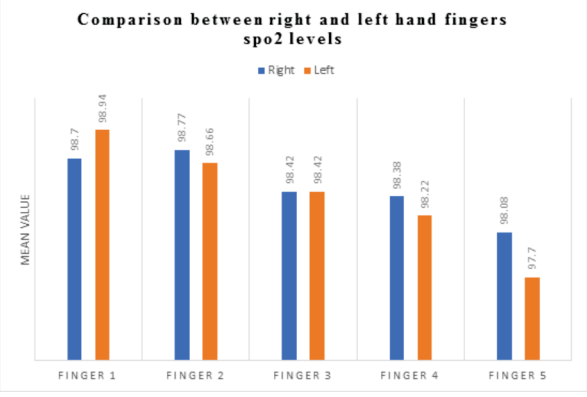
	Mean	Std. Deviation
HEART_RATE	75.91	12.76
SBP	121.70	14.98
DBP	78.02	12.74
MAP	92.56	12.88

According to a hemodynamic variable, the mean heart rate was found to be 75.91 in this study with 12.76 SD. Systolic blood pressure's mean value was 121.70 with 14.98 SD, for DBP it was 78.02 and 12.74 respectively, similarly for mean arterial pressure the mean and standard deviation values were 92.56 and 12.88 respectively.

Table 7. Comparison Between Right And Left Finger Readings By Using An Independent T-test

	Mean	Std. Deviation	t-value	p-value
Right Finger 1	98.70	1.22	1.20	0.231
Left Finger 1	98.94	0.97		
Right Finger 2	98.77	1.02	0.669	0.505
Left Finger 2	98.66	0.82		
Right Finger 3	98.42	1.02	-	-
Left Finger 3	98.42	0.89		
Right Finger 4	98.38	0.81	1.08	0.281
Left Finger 4	98.22	0.83		
Right Finger 5	98.08	0.98	2.06	.042*
Left Finger 5	97.70	1.08		
Overall Right Finger	98.47	0.72	0.675	0.501
Overall Left Finger	98.39	0.61		

In the present study, table 7 shows that the comparison of right- and left-hand fingers according to their spo2 levels. Both the hand fingers have similar readings. Only fifth fingers have significant results but it is scarce to use if there is full damage of other fingers. Student t-test was applied and overall, the results were not significant at 0.05 level of significance.



DISCUSSION

From the study, it is clear that both hand fingers have similar readings of SpO_2. Only fifth fingers have significantly lower results but it is sporadic to use unless there was full damage of other fingers. Student t-test was applied and overall, the results were not significant at 0.05 level of significance. There is no significant difference in SpO_2 reading in the fingers of the two hands and there is no significance in the hemodynamic parameters as well.

Suret. al. 2021 conducted a study for presenting a comparison of peripheral capillary blood oxygen saturation of hemoglobin (SpO_2 values) among every finger of the two arms in healthful topics with one-of-a-kind hand dominance. In this study, one hundred healthful subjects of age crew between 18 and 30 years were enrolled, of which 76 topics were right-handed and 24 were left-handed. No concern was identified as ambidextrous. After 5 minutes of rest, they have been monitored. After gathering special relevant demographic parameters such as age, sex, height, weight, non-invasive blood pressure, heart rate, body temperature, and fasting period, SpO_2 values were recorded from every finger of two arms with the identical pulse oximeter. Our result suggests that the best possible average SpO_2 values were obtained from the middle finger in both the left and right-handed subjects. There used to be no statically good-sized distinction in the SpO_2 values between the middle finger of the dominant and non-dominant hand in both the right-handed and left-handed subjects. While recording the SpO_2 through a pulse oximeter, the center fingers exhibit the perfect values accompanied by utilizing the thumbs. The lowest values are recorded from the little fingers. Again, the result depicts that there is no statically big difference in SpO_2 values between the corresponding fingers of the dominant and non-dominant hand.[13] So, our study also shows that there is no significant difference in the fingers of both the right and the left hand.

CONCLUSION

From the study, it is clear that there was no significant difference in SpO_2 reading in the fingers of the two hands except little fingers and there was no significant difference in the hemodynamic parameters as well. So, we can conclude that any finger of the hand except a little finger can be used to monitor the SpO_2.

Limitations of the Study: One of the major limitations of the study was the small sample size, and SpO_2readings only.

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