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Case Report

COVID-19 pandemic: Surgical face mask and its effect on cardiopulmonary system in pregnancy: A short report

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ABSTRACT

The COVID-19 pandemic has reawakened the necessity of wearing a face mask in public places in several countries including Nigeria. The effect of prolonged use of face mask on pregnant women is not yet evaluated. The objective of this study was to assess the impact of wearing a surgical face mask on the cardiopulmonary functions of pregnant women. A prospective and case-control study was conducted among 85 healthy pregnant women at gestational ages between 20 weeks and 37 weeks. Equal number of age and parity-matched healthy non-pregnant women were recruited as controls. Their baseline S_PO_2 and arterial pulse were measured. The participants were then instructed to wear surgical face masks and remain at a resting position for 1 h; thereafter, the S_PO_2 and pulse rates were measured using a mobile electronic pulse oximeter. Data analysis was done using SPSS version 23. The level of significance was set at 0.05. There was no significant difference in their mean SpO_2 (97.44% ± 3.365) and (98.86% ± 1.014) for the pregnant women and the controls, respectively (P= 0.146). However, the mean pulse rate of the pregnant women was significantly higher than that of the controls (97. 58b/m ± 10.731 and 93.17b/m ± 8.850; P = 0.012). The incidence of hypoxemia (S_PO_2 < 90%) was very low (2.35%) in the pregnant women but non among the non-pregnant control. The incidence of hypoxia-related symptoms was also very low (1.8%). There was a weak negative correlation between the S_PO_2 and pulse rate (r = −0.0881; P = 0.464 in the pregnant group compared to the controls (r = −0.309; P = 0.004). A vast majority of healthy pregnant women can safely wear a surgical face mask for a long time.

Keywords: Hypoxeimia, Tachycardia, Surgical face mask, Prolonged use, Pulse oximeter

INTRODUCTION

With the outbreak of the novel Severe Acute Respiratory Syndrome virus (SARS-2/COVID-19) infection in Wuhan, China, in December 2019; the world is facing the worst pandemic in over 100 years. Social distancing, regular hand washing with soap under running water, use of alcohol-based hand sanitizer, and face masks are major preventive ways to control the spread of coronavirus infection.[1-4]

There has been wide concern about the potential face mask-induced maternal hypoxia and the risks to the fetus. Reduced oxygen intake may trigger acute respiratory distress syndrome in pregnancy, especially in pregnant women with asthma or cardiac disease.[5] Pregnancy-related disorders such as pre-eclampsia may get worse in the face of reduced oxygen intake.[6,7] Chronic hypoxia has been a known cause of intra-uterine growth restriction, oligohydramnios, abnormal non-stress test, placental abruption, preterm labor, and increased risk of operative delivery.[8,9]

While there is a conflicting report on the use of face masks on the disease transmission and health of the users, attention has not been given to some specified groups of people such as pregnant women. Hence, the need for this study, as the findings may help us establish the safety or otherwise of prolonged use of face masks by pregnant women.

CASE REPORT

This was a prospective and case-controlled study conducted at the University of Calabar Teaching Hospital (UCTH) and Calabar Women and Children **Hospita**l (CWCH) both situated in Calabar metropolis, Southern Nigeria, from May 1, 2020, to August 31, 2020. Eighty-five healthy pregnant women between ages 18 and 49 years attending the antenatal clinic with a singleton pregnancy of 20–37 weeks gestational ages were recruited **by systematic sampling method** into the study arm. The controlled arm comprised 85 healthy non-pregnant women of similar age, body mass index, and parity. Participants were instructed to wear a nose mask for at least 1 h in a resting position. The mask was examined for proper application to ensure that the nostrils are covered [Figure 1]. Their bases-line SpO_2 and pulse rates were measured. Those with SpO_2 below 97 and arterial pulse rates <90 b/m were excluded from the study. Their body mass index was calculated and maternal obesity (high BMI) was described as a BMI of 30 kg/m^2 and greater. Advanced maternal age was described as maternal age of 35 years and above.

Figure 1: SpO_2 and pulse rate of a pregnant woman measured by a nurse with mobile pulse oximeter in a consulting room.

Data analysis

Data analysis was done using SPSS version 22. The level of significance was set at $P \leq 0.05$.

Ethical issues

Approval was obtained from the UCTH Health Research Ethics Committee (protocol assigned number UCTH/HREC/33/563). Approval was also obtained from the management of CWCH. Participation was voluntary. Written informed consent was obtained from every woman before enrollment. Confidentiality was maintained. When a participant was noticed to have respiratory problems, she was offered the needed care. Permission was obtained for the picture as shown in [Figure 1].

RESULTS

The mean SpO_2 among the participants in both groups was above 95%. There was no statistical difference in the mean SpO_2 in the two arms ($P = 0.146$). Only two subjects (2.35%) in the study group experienced hypoxemia ($S_PO_2 < 90\%$). The mean maternal pulse rate among the pregnant women was significantly higher when compared to that of the non-pregnant control ($P = 0.012$). Only 3 (1.8%) of the pregnant women experienced mild dizziness. [Table 1] compares the means.

Correlation between SpO_2, Pulse Rate, and maternal BMI

Among the pregnant women, the study showed a week negative correlation between S_PO_2 and pulse rate (r = 0.0881

Table 1: The mean age, SpO_2, and pulse rates of the participants.

Variables	MEAN±SD	*P*-value	95% CI	
			Lower Bound	Upper Bound
Age (years)				
Study arm (*n*=85)	29.35±5.329	0.361	−1.232	1.891
Control arm (*n*=85)	29.02±4.978			
SpO_2 (%)				
Study arm (*n*=85)	97.44±3.365	0.146	−2.176	−0.671
Control arm (*n*=85)	98.86±1.014			
Pulse rate (b/m)				
Study arm (*n*=85)	97.58±10.731	0.012	1.427	7.384
Control arm (*n*=85)	93.17±8.850			

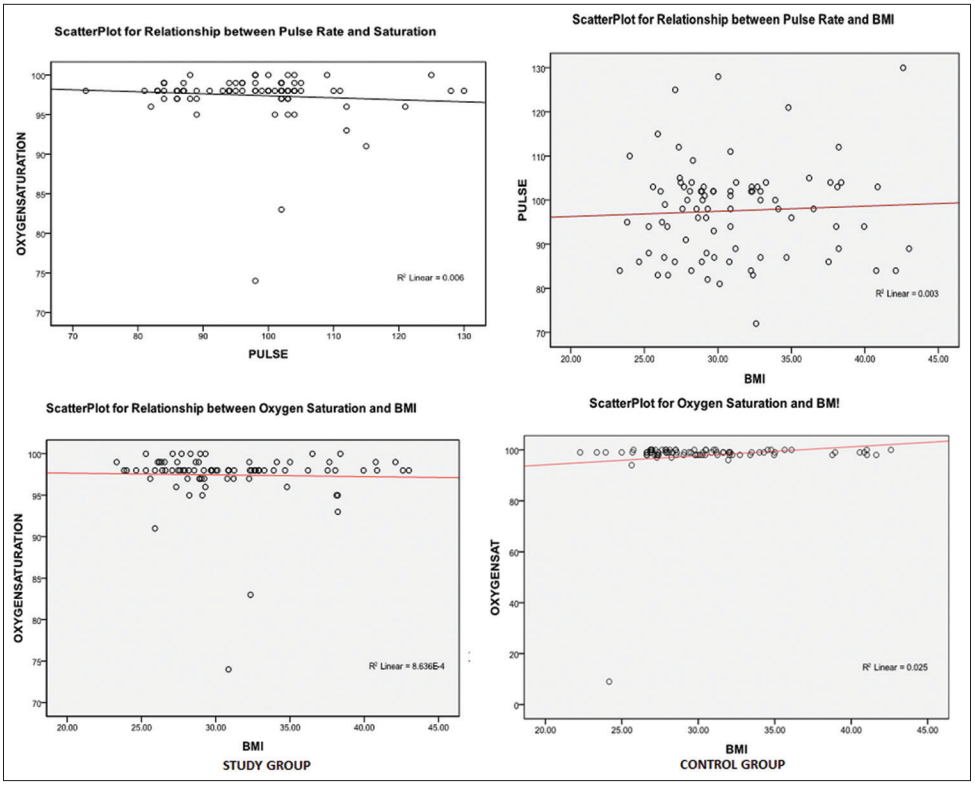

Figure 2: Scattered diagrams showing the correlations.

and $P = 0.464$). [Figure 2] shows that as the O_2 saturation decreases, the arterial pulse increases.

There was also a weak negative correlation between S_PO_2 and maternal BMI (r = −0.029 and the $P = 0.789$). Furthermore, a weak positive relationship between maternal pulse rates and BMI was observed (r = 0.051; $P = 0.642$) indicating that women with higher BMI slightly tends toward having higher pulse rates compared to those with normal weight.

DISCUSSION/CONCLUSION

The COVID-19 pandemic has necessitated behavioral and lifestyle adjustments globally, especially where vaccination coverage is low. This study found that a vast majority of healthy pregnant women can wear surgical face masks consistently for a long period without experiencing dangerously low oxygen levels. In this study, there was no significant difference in the mean SpO_2 between pregnant and non-pregnant controls ($P = 0.146$) while the mean maternal arterial pulse rate in the study group was significantly higher than that of the control (97.58± 10.731 vs. 93.17± 8.850; $P = 0.012$). In normal pregnancy, the mean maternal heart rate usually increases by an average of 10–20 beats/min.[10] As such, this was more likely a normal physiological adaptation in pregnancy.

The slight increase in pulse rate is likely as a result of changes in cardiac rhythm in response to decease SpO_2. This is a compensatory mechanism to enhance rapid gaseous exchange to prevent tissue hypoxia.[11] The cardiac output in pregnancy increases by 30–50%. Pulse rate is one of the determinants of cardiac output. Heart rate variability is a biomarker for autonomic nervous system functions and adaptation to different physiological and pathological conditions.[12,13]

Face mask remains one of the most effective modalities of preventing COVID-19 among pregnant women. Data on the safety of COVID-19 vaccination in pregnancy are not conclusive with some studies suggesting adverse reactions in pregnant women. The infection in pregnancy is associated with a severe disease that may cause maternal and perinatal mortality and morbidity.[5,10,14]

The findings in this study are reassuring that prolonged and proper use of surgical face masks in pregnancy is not harmful to the cardiopulmonary system of pregnant women. This finding is contrary to the widespread perception that wearing a face mask is associated with a harmful effect on maternal health during the viral pandemic. A previous, clinical, and controlled study reported that breathing through an N95-type mask significantly reduced mean tidal volume and minute ventilation among pregnant women.[15] Hence, we strongly recommend surgical face masks for pregnant women where applicable.

A multi-center study comparing the effects of different types of face mask on pregnant women is necessary.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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