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Impact of lateral positioning on oxygenation in noninvasively ventilated COVID-19 patient: A prospective observational study

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Abstract---Background: Due to the sudden outbreak of covid 19, we lost almost 6230357 deaths till date. Covid 19 causes hypoxemia. As we know, body positions can improve oxygenation by various physiological changes. Many literatures showed prone position improved oxygenation in covid19 patients. So, we want to explore whether lateral position improves oxygenation status in covid19 infected noninvasively ventilated patients during first wave of covid19 pandemic. Objectives: Aim of this prospective observational study to evaluate the impact of lateral position on oxygenation in non-invasively ventilated covid 19 patients. Methods: we enrolled non-invasively ventilated covid 19 patients from 18 years to 70 years of age and hemodynamically stable patients who were in supine position but planned to give lateral position by ICU consultant. We noted hemodynamic, oxygenation status and ABGA parameter after one hour of lateral positioning. Results: Out of 100 patients, 67 were male and 33 were female. 31 patients had Diabetes as a comorbidity, 35 patients had hypertension. Out of 3 patients, 4 had IHD and 3 had hypothyroidism. SpO2 by pulse oximetry, SO2 and PO2 from ABGA showed statistically significant increase after one hour of lateral positioning. There were no significant changes in hemodynamic parameters after lateral positioning. Conclusion: oxygenation statuses

were significantly increased after one hour of lateral positioning in non-invasively ventilated covid 19 patients without any complications.

Keywords---lateral position, COVID-19, oxygenation status.

Introduction

Covid19 is ongoing pandemic caused by SARS COV-2, Which was first found in Dec.19 in Wuhan china. We have seen that up till date, it is the deadliest pandemic in history. During 2020, sudden outbreak of covid19 patients increased within short period of time. Covid19 induced hypoxemia occurs due to loss of lung perfusion regulation and hypoxic vasoconstriction, parenchymal micro thrombi and non-cardiogenic pulmonary edema leading to severe and fatal respiratory impairment.^{[1][2]}

Body position is the integral part of the respiratory prophylactic care to improve oxygenation by changes in lung and chest wall components and by altering resistance and/or compliance. As per literature, proning is a valuable tool in improving oxygenation and decreasing respiratory effort in patients with moderate or severe COVID-19.^[3] But giving prone position is not possible every time due to reasons like patient is not willing or patient is not able to tolerate prone position. Lateral position also increases functional residual capacity, thus improves gases exchange and drainage of secretion in critically ill patients, albeit the efficacy was inconclusive.^[4]

The Lateral position is a simple technique frequently used in management of COVID19 patient in our hospital. It is also compatible with all forms of basic respiratory support. However, the efficacy of lateral position has not been reported due to limited literature. Given its potential for improving oxygenation, we conducted study with aim to observe the effect of Lateral position to improve oxygenation in noninvasively ventilated covid19 patients.

Method

Patients

After approval from institutional ethical committee (Ref: 13206/20), this prospective observational study was conducted for the period of 3 months (SEPT 2020 TO NOV 2020) in Covid ICU. In Covid ICU all noninvasively ventilated patients who were in supine position but planned to give lateral position by ICU consultant were eligible for our study. Inclusion criteria were patients of either sex, age between 18 years to 70 years, RTPCR confirmed covid19 patients and hemodynamically stable patients. We excluded Patients who were not willing to participate in this study, Patient's with impending respiratory failure, patients who required Immediate intubation ($PO_2/FiO_2 < 50$ mm Hg, altered consciousness, unable to protect airway) and patients with any condition which impeded giving lateral position (like fracture).

Lateral Position

In our ICU lateral position is given with the help of the trained medical/paramedical staff and patient is made to lie left or right lateral position with the head on their particular side as per patients' conveniences, hip and knee joint are flexed with one pillow is kept between knee joint and one pillow kept below the head.

Outcome Measure

We observed the effect on oxygenation, which was evaluated by SpO_2 from pulse oximetry and PO_2 from arterial blood gas analysis (ABGA). Primary outcome measures were change in SpO_2 from pulse-oxymetry and PO_2 from ABGA. Baseline SpO_2 and PO_2 would be the values as observed in supine position. After 1 hour of lateral position, the changes in oxygenation were noted as SpO_2 from pulse-oxymetry and PO_2 from ABGA compared with supine position. To avoid the effect of FiO_2 on PO_2 , we ensured FiO_2 remain same during observation in supine and lateral position. Secondary outcome was changes in hemodynamic parameter and occurrence of any side effects during lateral position.

Observations and Results

Table 1 Demographic profile of study participants(N:100)
we enrolled total 100 eligible covid19 patients in our study

Variable	
Mean Age [in year] [mean + SD]	56.54+10.75
Gender	
➤ Male	67[67%]
➤ Female	33[33%]

Figure 1: Medical history of patients (N=100)

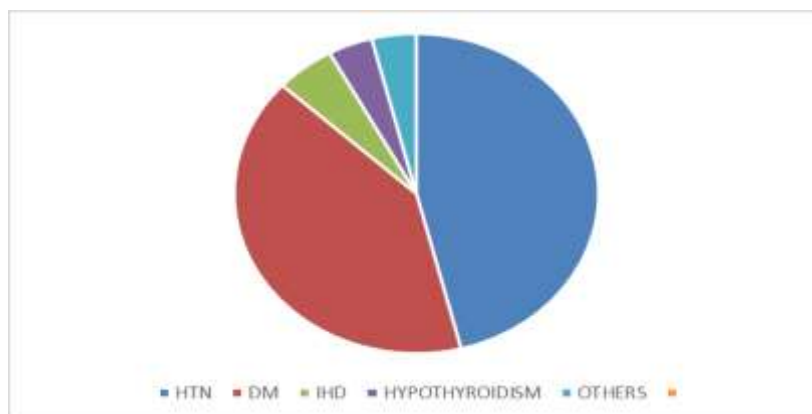


Figure 2: change in oxygen saturations at 1 hour after lateral position [n=100]

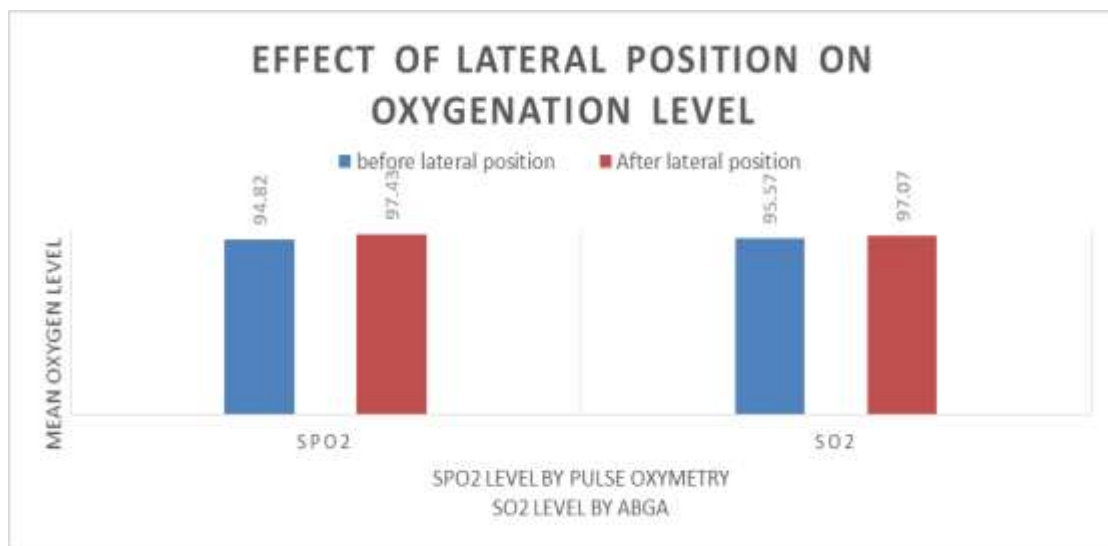


Table 2: ABGA parameter at 1 hour after lateral position [n=100]

Variable	Before lateral position	After lateral position	P value
PH	7.410±0.5	7.420±0.5	0.225
PO ₂	102.24± 45.76	110.85± 46.90	0.000
PCO ₂	37.29±6.90	36.03±6.91	0.015
HCO ₃	24.22±3.66	26.39±18.53	0.252
SO ₂	95.57±2.81	97.07±2.16	0.000

Figure 3: oxygenation status after 1 hour of lateral position

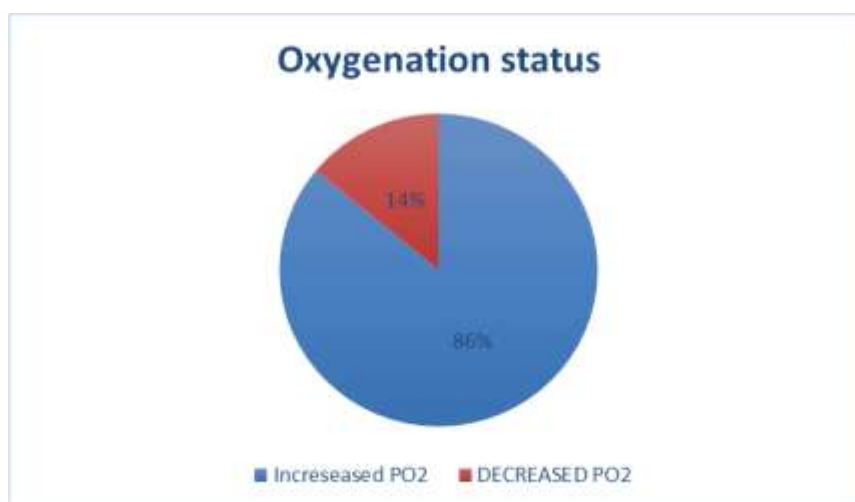


Table 3 : Hemodynaemic Parametre At 1 Hour (N=100)

Parameter	Baseline mean±SD	at 1 hr mean±SD	p value
PR (min)	84.9 ± 14.3	81.4 ± 13.4	0.5190
SBP (mmhg)	127.14±14.6	121.4±14.9	0.8400
DBP (mmHg)	80.7±7.7	76.7±7.7	0.9999
MBP (mmHg)	96.2±9.3	91.6±9.2	0.9146
RR (min)	23.6±2.9	22.7±2.3	0.9999
SPO ₂ (%)	94.8±2.8	97.4±1.6	<0.0001

All vital parameters pulse, blood pressure, respiratory rate were not statistically significant ($P>0.05$). While oxygen saturation was statistically highly significant ($p<0.0001$) after one hour of lateral position. No side effects were noted during one hour of lateral positions.

Discussion

Our study was aimed to know efficacy of lateral position to improve oxygenation in Covid19 patients. In supine position baseline SpO₂ and PO₂ was 94.82± 2.82 and 102.24± 45.76 respectively. After 1 hour of lateral position SpO₂ and PO₂ was 97.43±1.57 ($P<0.0001$) and 110.85±46.90($P=0.000$) respectively, which is statistically significant. [Figure 2] In supine position, posterior alveoli get compressed due to gravitational effect, shape of chest wall and compressive effect of heart and diaphragm.^[5] During lateral position, diaphragm is free from abdominal pressure compared with supine position resulting in improvement of gas exchange as well as it reduces work of breathing.

Retucci et al^[6], in 2020 studied 25 patients suffering from covid19 disease and observed improvement of pO₂ (100.8(20.4)) after 1 hour of lateral position (pO₂ 88.4(15.5) in supine position), which is statistically significant($P=0.04$), which is similar to our study. While Study of lateral position on oxygenation in 18 patients of ARDS by Tongyoo S et al^[7] found mean PaO₂ increased (84.6±20.4 vs 90.3±29, $P=0.23$) after turning patients from supine to right lateral position ,which is not statistically significant which is opposite to our findings.

Covid19 affects various zone of the lung asymmetrically and in patchy manners causing acute respiratory distress syndrome. In our study 14% patients did not show any improvement in fact showed slight fall in PO₂(Eleven patients had decreased PO₂ <10mmHg than supine position and four patients had fall more than 10mmHg) and 86% showed an increased in PO₂. [Figure 3] The most likely explanation for this fall may be the disease was in the active initial peak stage during our observation, Although ARDS is bilateral but may be the disease was more extensive on one site or extensive bilateral involvement. And in our study, choice of lateral position (right or left) was entirely at patient's discretion. According to Hewitt N et al, In unilateral lung disease, dependent lung more betterly ventilated when diseased lung remains on nondependent site during lateral position.^[4] As per many literature, lateral position favors the dependent lung in ventilation and perfusion and maintained V/Q matching ^[8] but needs monitoring.

Present study showed beneficial effect of lateral position over supine position in terms of oxygenation level which is supported by Patil PS et al.^[9] There was no change in other ABGA parameter except PCO_2 and SO_2 [Table 2], it suggests that improvement of oxygenation depends on beneficial effect of ventilation. Hemodynamic parameter were not statistically significant which is similar to the study of Tongyoo S et al.^[7] None of our patients had hypoxemia, hypertension, although it was bit low but statistically not significant. [Table:3] Few limitations as this observational study were conducted during pandemic, we observed the patient at one particular time of disease, during that time patient could be in acute phase, recovery phase or peak phase, we did not note. We did not enroll as per radiological finding, we only considered clinical presentation of patients.

Conclusion

From our study we conclude that lateral position improves oxygenation status in non-invasively ventilated covid19 patients.

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