Original Article

Comparison Of Oxygen Saturation Values In Preoperative Supine And Sitting Position Above 60 Year Old Patients

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ABSTRACT:
Aims and Objective: To study the comparison of oxygen saturation values in supine and sitting position above 60 year old patients.
Background: Changes in posture affect ventilation- perfusion rates, O_2 transport and lungs volume in normal lungs.
Study Design: An observational study.
Methods: A preoperative observational study was conducted after the clearance from institutional ethical committee on 60 patients in department of Anaesthesiology, M.M.I.M.S.R, Mullana, Ambala Haryana, India. A sample of 60 elderly individuals with no heart disease, bleeding disorder, pain or anemia was included in the research. Individuals were positioned in two positions- supine and sitting. Oxygen saturation and pulse rates were then measured and recorded after the individuals held each position for ten minutes.
Results: It was found that the average SpO_2 value when measured while sitting in a chair was significantly higher than that measured when the individual was in supine body position. Hence, elderly patients, especially who have diminished cardio respiratory reserve, should be preferably made to sit rather than put in supine position for better vitals.
Conclusion: This study was conducted to analyze differences in hemodynamics viz-a-viz oxygen saturation levels, pulse rate between supine and sitting position. It was found that saturation levels were higher in patients made to sit rather than those in supine position.
Keywods: Oxygenation, elderly, anaesthesiology , pulse oximetry.

INTRODUCTION:

In a healthy individual, the normal range of oxygen saturation is (97 to 99%) measured by simple and non-invasive method in various parts of body.[1, 2] It interprets the saturation of haemoglobin with oxygen i.e. indirect estimation of arterial oxygen saturation.[3] Decrease in respiratory muscle mass, impaired diaphragmatic efficiency, electromyographic activity by as much as 50% owing to the loss of fast twitch muscle fibers (Type-II)[4] , decreased lung elastic recoil in old age results in decreased force produced by respiratory muscle activity. Chest wall compliance reduces with age due to structural changes of intercostals muscles, rib vertebral articulation and intercostaljoints.[5] Loss of muscular pharyngeal support makes the elderly susceptible to upper airway collapse leading to obstruction. A reduction in the volume of pulmonary capillary bed occurs due to increase of the

mean pulmonary artery pressure by 30%, and an increase of the pulmonary vascular resistance by up to 80%. CNS activity; ventilator response to hypoxia, hypercapnia & stress is impaired in older individuals.[11] Body positioning and its change have an effect on transports of blood and oxygen to different organs & tissue optimal positioning improves gas exchange and early recovery.[12] Opioids, benzodiazepines, anaesthetic gases during general anaesthesia have depressant effect on respiratory system which is exaggerated in older individuals.[13] Repositioning the elderly patient post anaesthesia helps in decreasing the pressure over dependent area and to increase the pressure comfort and facilitate the drainage of pulmonary secretion.[14] Right body position can increase ventilation perfusion ratio.[15] Positional changes determine the degree of gravity acting on the cardiopulmonary and cardiovascular system as well as on optimal blood circulation and oxygen transport. It is asserted that compared to recumbent position, the lung volume and capacity increase by sitting in procumbent position.[16]

METHODS:

To study the comparison of oxygen saturation values in supine and sitting position in above 60 year old patients. The study was conducted in the Department of Anesthesiology in MMIMSR. Mullana Ambala Haryana.

A written informed consent was taken during preoperative evaluation prior to surgery. All pre – anaesthetic check-up (Hb, RBC, PT/INR, ECG, chest X-ray and renal function test) was done prior to surgery. The patient was kept Nil per oral after mid night. Tablet Alprazolam 0.25 mg was given at night before surgery. SpO_2, pulse rate was recorded in the ward 10 hours and 4 hours prior to surgical procedure than patients was shifted to the preoperative room. In the morning, check the patients History when the patient was shifted to preoperative room and monitor attached to patients to record SpO_2, pulse rate vitals. The recommended oxygen saturation value is 94-98% for adults which are considered in the study (Smith et al 2012). In the elderly patients were measured for saturation of peripheral oxygen (SpO_2) and Pulse Rate (PR) and then placed in two body positions: sitting upright in a chair with feet on the ground and in the supine position, a pillow under the head of the patients. The SpO_2 and PR were recorded with a pulse oximetry at each body posture after a wait of 10 minutes. To avoid any unwanted effect on the measurements likes nail polish and full stomach which may cause change in lunge capacity and affect measurement result.

DATA COLLECTION:

To observe the hemodynamic change in supine and sitting body position. A preoperative observational study was conducted after the clearance from institutional ethical committee on 60 patients at department of anesthesiology, M.M.I.M.S.R., Mullana Ambala Haryana, India.

ETHICAL CONSIDERATIONS:

A preoperative observational study was conducted after the clearance from institutional ethical committee on 60 patients at department of anesthesiology, M.M.I.M.S.R, Mullana, Ambala haryana, India. The written consent of the individuals agreeing to participate in the study was also obtained.

DATA ANALYSIS:

Data analysis was done with the use of SPSS-version 20. The repeated measures on t-test analysis techniques were used in the comparison of the oxygen saturation values in sitting and supine positions. A post hoc power analysis was conducted using the software package, G*Power (Faul and Erdfelder 1992). The alpha level used for this analysis was $p<0.05$ and beta was 0.20. Sample size was estimated from the result of previous study using the oxygen saturation (%) as the parameter, which is the primary outcome of our study. Our sample size came out to be 60 subjects at power of 0.95 and with an effect size of 0.36 with 10% chance of error with $\alpha = 0.05$, $\beta = 0.20$ and confidence interval of 95%.

OBSERVATION AND RESULTS:

The current study was carried out on 60 patients with range of age 60-85 years. The mean age was 65.8±5.0.

Table No.1- Distribution of age and age groups (% wise).

AGE (GROUP)	No. of cases	Percentage
60 – 64	25	41.7%
65 – 69	21	35.0%
70 – 71	1	1.7%
70 – 75	12	20.0%
76 – 85	1	1.7%
Total	60	100.0%

SpO2 %	N	Minimum	Maximum	Mean	SD
Supine Position After 10 Min	60	91.0	94.0	92.9	0.9
Sitting Position After 10 Min	60	93.0	96.0	95.1	0.8

HR (B/MIN)	N	Minimum	Maximum	Mean	SD
Supine Position After 10 Min	60	65.0	81.0	73.5	3.7
Sitting Position After 10 Min	60	72.0	87.0	80.5	3.6

SBP (mmHg)	N	Minimum	Maximum	Mean	SD
Supine Position After 10 Min	60	115.0	137.0	123.4	5.1
Sitting Position After 10 Min	60	107.0	130.0	116.3	5.3

DBP (mmHg)	N	Minimum	Maximum	Mean	SD
Supine Position After 10 Min	60	64.0	85.0	75.3	4.9
Sitting Position After 10 Min	60	68.0	88.0	78.3	5.1

Table 2- The Mean distribution of SpO_2, HR, SBP and DBP effect on position in these groups.

The overall SpO_2 for patients in supine position ranged 91.0-94.0% with mean of 92.9±0.9 and sitting position ranged 93.0-96.0%with mean 95.1±0.8 and pulse rate in supine position ranged 65.0-81.0 b/min with mean 73.5±3.7 and sitting position ranged 72.0-87.0 with mean 80.5±3.6 with statistically significant *p value is 0.001*. Whereas SBP in supine position ranged 115.0-137.0 mmHg with mean 123.4±5.1 and sitting position ranged 107.0-130.0 with mean 116.3±5.3 mmHg and DBP in supine position ranged 64.0-85.0 with mean of 75.3±4.9 and in sitting position ranged 68.0-88.0 with mean of 78.3±5.1 mmHg with statistically significant *p value is 0.001*.

	Supine Position After 10 Min		Sitting Position After 10 Min		T	p-value	Difference		95% Confidence Interval of the Difference	
	Supine Position After 10 Min	Sd	Sitting Position After 10 Min	SD			Mean	SD	Lower	Upper
SpO_2 %	92.85	0.86	95.10	0.75	-36.777	0.001	-2.25	0.47	-2.37	-2.13
HR (B/MIN)	73.45	3.72	80.53	3.64	-67.848	0.001	-7.08	0.81	-7.29	-6.87
SBP (mmHg)	123.43	5.07	116.27	5.32	54.008	0.001	7.17	1.03	6.90	7.43
DBP (mmHg)	75.25	4.86	78.30	5.06	-15.864	0.001	-3.05	1.49	-3.43	-2.67

Table 3- The Mean distribution of SpO_2, HR, SBP and DBP effect on position in these groups.

The mean SpO_2 at 10 min was 92.85±0.86 in supine position and 95.10±0.75in sitting position. The mean HR at 10 min was 73.45±3.72 in supine position and 80.53±3.64 in sitting position. The mean SBP at 10 min was 123.43±5.07 in supine position and 116.27±5.32 in sitting position. The mean DBP at 10 min was 75.25±4.86 in supine position and 78.30±5.06 in sitting position. The same *P value is 0.001(statistically significant)* is for SpO_2, HR, SBP, and DBP. There was observed significant value at 10 min in both positions.

DISCUSSION:

The study was aimed to evaluate the effect of changing body positions on oxygen saturation in old age patients.

In our study, 60 elderly individuals were included. The range of age between 60-85 years (mean age was 65.8±5.0 years). In Our study, SpO_2 mean in supine position 92.85±0.86 and sitting position 95.10±0.75 with $p<0.05$ and HR mean in supine position 73.45±3.72 and sitting position 80.53±3.64 with $p<0.05$.

Table 4- Comparison of mean age in our study with another study.

	Gordon S et al [17]	Ceylan B et al [19]	Tapar H et al [23]	In our study
Mean age	73.3±5.4	33.0±13.4	30.5±5.5	65.8±5.0

As observed from the table no. 4, in our study individuals mean age was 65.8±5.0. The mean age was 73.3±5.4 in the study done by Gordon S et al [17], It mean was 33.0±13.4 in the study done by Ceylan B et al [19], it mean age was 30.5±5.5 in the study done by Tapar H et al.[23]

Table 5- Comparison of mean SpO_2 in our study with another study.

Position's	Gordon S et al[17]	Ceylan B et al[19]	Tapar H et al[23]	In our study n=60
SpO_2 supine	94.4±2.1	96.76±1.98	97.0±1.0	92.85±0.86
SpO_2 sitting	95.6±2.1	97.48±1.42	96.6±1.4	95.10±0.75

Gordon S et al took 26 elderly people above 60 years. The participant's age ranged between 62-86 year and age mean was 73.3±5.4. SpO_2 mean in supine position 94.4±2.1 and sitting position 95.6±2.1 with p- 0.001 and HR mean in supine position 61.5±9.4 and sitting position 63.1±9.2 with p- 0.095.[17]

Ceylan B et al concluded in a total of 103 health individuals, the mean age of the study participants was 33.0±13.4. SpO_2 mean in supine position 96.76±1.98 and sitting position 97.48±1.42 with as p <0.001 and PR mean in supine position 68.63±10.09 and sitting position 74.77±10.94 with p <0.001.[19]

Tapar H et al calculated the SpO_2 mean in supine position to be 97.0±1.0 and 45 degree supine-sitting position 96.6±1.4 and PR mean was in supine position 72.3±8.8 and supine-sitting position 75.6±9.4 with p<0.05.[23]

Neagley SR et al saw that all the subjects, the mean age of 68 years and range 51-87 years in this study. SaO_2 mean in supine position 94.3±0.4 and sitting position 95.0±0.3 with p<0.05 and HR mean in supine position 85±5 b/min and sitting position 87±5 b/min.[12]

All the above studies including our study reaffirm that change in the body position induces alteration in Pa,O_2, due to changes in the V/Q distribution partially linked to the direct effect of gravity, but also changes in the lungs volume and, therefore closing volume.

Dean et al stated that positional changes directly affect ventilation and perfusion matching and arterial oxygen levels. By prioritizing matching and improved lung function along with traditional goals, greater improvement in blood gases and treatment outcome may be affected. The V/Q matching can be directly manipulated by patients positioning and should be considered as treatment priority to improve respiratory gas exchange in patient with respiratory disease or in patient who may be at risk for developing pulmonary complication. The role of positioning leading to improvement in PaO_2 levels suggest that symptomatic improvement in patients with conventional postural drainage techniques may reflect improved V/Q matching in the inferior lung.[22]

Craig DB et al researched on "closing volume" and its relationship to gas exchange in sitting position and supine position. When FRC (Functional Residual Capacity) exceeded "closing volume" in both postures; it was found that supine gas exchange was better. When "closing volume" involved VT to a greater extent, gas exchange deteriorated in the supine posture. When "closing volume" was above the breathing level in both postures, (A-a) DO2, abnormally widened in the upright position.[20]

Above mentioned studies show, although the sitting position is associated with the least myocardial compression, this position is associated with the lesser O_2 consumption along with lesser gravitational stress that the heart has to overcome to support cardiac output compared with recumbent positions. The head down supine position is associated with some gravitational stress leading to greater O_2 consumption than in the horizontal positions to support cardiac output in this position.[18] More over the sitting position is associated with less myocardial compression compared to the supine position.[21]

CONCLUSION:

This study was conducted to analyze differences in hemodynamic viz-a-viz oxygen saturation levels, heart rate and blood pressures between supine and sitting position. It was found that saturation levels were higher in patients made to sit rather than those in supine position. Hence, elderly patients, especially who have diminished cardio respiratory reserve, should be preferably made to sit rather than put in supine position for better vitals. Patients in supine position lead to V/Q mismatch resulting in lower levels of O_2 saturation. This can be prevented by bed elevation of 30-45 degree in ICU to prevent fall in O_2 saturation in supine position.

LIMITATION OF STUDY:

This research was carried out on elderly individuals, with age 60-85 with no anemia. The study results cannot be generalized to encompass children and adults below 60 years of age.

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