Effects of Positioning Changes on Oxygenation Parameters among MechanicallyVentilated Patients

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Abstract

Background: Body positioning denotes to augmenting oxygen transport by influencing the effect of gravity on cardiopulmonary and cardiovascular function. Positioning should be a crucial part of respiratory care, changes in the body position of patients receiving mechanical ventilation in intensive care unit are frequent which is one of the nursing activities during care for such group of patients, also body position changes affect the peak transport of blood and oxygen. **Aim:** The study aimed to evaluate the effects of positioning changes on oxygenation parameters among mechanically ventilated patients. **Design:** A quasi-experimental design was applied in the current study. **Sample:** A purposive of 60 adult patients from both genders who were admitted during the study period on mechanical ventilation and newly admitted (less than 3 days from admission to the ICU) was selected. **Setting**: Data were collected from Chest ICU units affiliated to Ain Shams University Hospitals. **Tools**: Data was collected utilizing two designed tools (1) Patient data sheet which includes Socio demographic data for mechanically ventilated patients with lung diseases and health - relevant information (2) Oxygenation assessment scale to assess oxygenation level twice immediately and after two hours from each position which includes ABG and vital signs. **The results:** Mechanically ventilated Patients who have received change position have had oxygenation levels better than those patients who were on the routine position (fowler position). **Conclusion**: The implementation of positioning changes among the study group according to the results of basic assessment has been successful and got an effective significant improvement in oxygenation level for mechanically ventilated patients that had respiratory failure. **Recommendations:** Positioning changes of mechanically ventilated patients should be applied by all staff nurses working in ICUs as essential careneeded to improve the oxygenation level and further replication of the study is recommended on a large sample and different settings.

Key words: Mechanical Ventilation, Oxygenation, Positioning.

Introduction

Mechanical ventilation (MV) is an invasive life-support process in critical units. The major aim of ventilation is proper oxygenation and proper carbon dioxide removal. Although MV is often a life- saving intervention, it carries many prospective complications. Pulmonary hygienic cares with its two aspects, change position and suction reduces the incidence of pulmonary complications. ICU nurses play a crucial role in caring for mechanically ventilated patients in the management of patient airway in preventing complications **(Elsaman, 2017).**

Body positioning refers to augment oxygen transport, by influencing the effect of gravity on cardiopulmonary functions. Changing a patient's posture may not seem a dramatic technique, but this uncomplicated action often prevents need to more time using or tiring techniques. Positioning should be an integral part of all respiratory care, mainly when prophylaxis is the aim **(Andres et al., 2018)**. In addition positioning reduces atelectasis and advances gas exchange **(Patil and Nagarwala, 2015)**

The change in position can modify respiratory mechanics by changing challenge and/or compliance of the respiratory system and its lung and chest wall elements, and by changing static lung volume and either its components or regional distribution **(Mezidi, Yonis, & Aublanc, 2017).** Nurses working in critical units frequently change the patient's body position every two hours to prevent bed sores and other complications associated with immobility. Turning from side to side may also help slacken and drain secretions stored within the lungs. Routine lateral repositioning is a comparatively safe standardpractice **(Hodgson et al., 2020)**.

In Egypt, flow rate of patients for last six months

356 patients admitted to the ICU, 166 patients connected to mechanical ventilation **(Statistical center, Ain Shams University Hospital, 2019)**

Aim of the study:

The study was aimed to evaluate the effects of positioning changes on oxygenation parameters among mechanically ventilated patients. This aim reached through the following:

1. Assess patient's oxygenation level.
2. Implement positioning changes among the study group according to the results of basic assessment
3. Evaluate the effect of applying positioning changes on the occurrence of any changes on the study group.

Research Hypothesis:

Implementation of positioning changes among mechanically ventilated patients will positively affect the oxygenation parameters for patients with different positioning changes (supine, side lying andprone).

Significance of the study:

Bronchial drainage techniques have integrated body positioning to affect gravity-assisted mucous clearance and to improve air entry. Body positioning directly affects ventilation and perfusion matching and arterial oxygen levels. Furthermore about 39% of patients undergo mechanical ventilation for long periods which is also predicted to rise further soon.

Subjects and Methods:

Research design: A quasi-experimental design was used to achieve the aim of the study.

Setting: The study was conducted in the medical ICU units, affiliated to Ain Shams Universityhospital, Cairo - Egypt. It is critical unit which receiving the mechanically ventilated patients.

Subjects: A purposive sample of (60) adult patients from both genders who was admitted to ICU during the study period on mechanical ventilation within less than 3 days. Patients with the following disorders will be excluded: Low hemoglobin, Arrhythmia, Skeletal deformity, Obesity, Hyperthermia, Abdominal distension, Facial surgery, Head or spine injury, Carbon monoxide poisoning, Pulmonary hemorrhage, and Pulmonary abscess.

Sample size: The sample size is determined according to the power analysis formula as follow:

$$n = \frac{N}{1 + N(e)^2}$$

Where 'n' is sample size.
'N' is number of patients during the last year =250.'e' is coefficient factor = 0.05.

The minimal sample size will be =60 patients.

Tools of Data Collection:

Tool I: Patient data sheet:

It was developed by the researchers after reviewing the related literature **(Gronseth, Woodroffe & Getchuis, 2011)** and consists of thefollowing two parts:

Part 1- Socio demographic data for mechanicallyventilated: It was used to assess the socio- demographic characteristics for the studied patients, which include data about patient' age, gender, marital status, educational level, occupation.

Part 2- Clinical data for mechanically ventilated patients: It was used to assess causes related to respiratory failure, lung disease, initial assessment mode of mechanical ventilator, initial assessment Parameter of mechanical ventilator.

Tool II: Oxygenation assessment scale:

The scale developed by the researchers built on the review of the related literature **(Martinez et al., 1999)** and used to assess oxygenation level for patients through ABG (PH, Pao2, Paco2, Hco3, Spo2%) after 2hrs from change patient position, vital signs (HR, RR, BP, Temp, Spo2 by pulse oximeter). Ventilator mode and parameter (Fio2 setting, Exhaled TV, TV Setting,R.R setting, PEEP) immediately following change position and after 2hr from the same position.

Tools validity and reliability:

Validity of the proposed tools is tested by using face and content validity, through a jury of 7 expertise from medical surgical nursing department, Ain shams university (5 professors & 2 assistant professors). Testing reliability of the used tools was done by Cronbach Alpha test. In which Patient data sheet was reliable at (0.87) and Oxygenation assessment scale was reliable at (0.76).

Field Work:

Researchers explain the objectives and the nature of the study to the patient and health staff to gain their cooperation during the implementation phase of the study. Sampling was established and completed within six months from December-2020 to the end of June-2021.

Assessment phase

During this stage each patient was assessed individually, and data collection was filled by the researchers in the shifts. Patient Assessment sheet was filled for the study group by the researchers before change position it took around (5-10)minutes for each patient.

Implementation phase

Implement the positioning changes for each patient in (4) positions (fowler position degree 30- 45 routine care, left lateral position, right lateral position, prone position) every position continue for two hour that the researchers assess the patient immediately then after two hour from each position through invasive and non-invasive measurements. The data collection was done on 2 days for each patient in afternoon shifts that include 2 positionsin the first day (fowler position degree 30-45 routine care and left lateral position) then 2 positions (right lateral position, and prone position)in the second day as following:

A- First day

During this day, the researchers assess the effect of position changes on oxygenation level immediately then after 2hours from the same position, the researcher put each patient into two positions, each position around two hours fowler position degree 30-45 (routine care) and left lateral position at the first and at the end of the time for each position (vital signs, spo2, mode of ventilator, parameter of ventilator and ABG) were assessed

B- Second day

During this day, the researchers

assesses the effect of position changes on oxygenation level immediately then after 2hours from the same position, the researchers put each patient into two positions, each position around two hours right lateral position, and prone position at the first and at the end of the time for each position (vital signs, spo2, mode of ventilator, parameter of ventilator and ABG) were assessed.

Evaluation phase

The evaluation was done immediately after positioning then after the end of each position (2hrs) to evaluate the effect of applying of position changes on oxygenation level on the sample.

Administrative Design

To fulfill the study, the needed approvals were obtained from the hospital medical director and nursing director of Ain Shams University Hospitals. The official letters were issued to them from the Faculty of Nursing clarifying aim of the study to obtain the permission for data collection.

Ethical considerations:

- An official permission was obtained before conduction of the study.
- The aim of the study was described to the patients and health staff to obtain their cooperation.
- Oral consent was attained from the patients to ensure willingness to participate in the study, by speaking with loud voice to ensure the desire of the patients to participate. .
- The researchers maintain the privacy and confidentiality of subjects' data.
- Patients were permitted to choose to participate or not and they were informed that they have the right to withdraw from the study at any time without giving any reason.

Statistical Design

The collected data were organized, categorized, tabulated, and statistically analyzed using the Statistical Package for Social Science (SPSS) version (12) to evaluate the studied patients' changes throughout the study phases (pre & post) to evaluate the differences between the groups under study as regards the various parameters. The statistical analysis includes percentage (%), and Chi-Square (X^2), P value, and alpha Cronbach test. Significant (S) statistical difference obtained at p<

0.05. Highly significant (HS) statistical difference obtained at p<0.01.

Results

Table (1): shows that; the mean age of the patients with bilateral lung disease in the present study were 47.11±5.64 while the patients with right lung disease were 50.27±4.29 and the patients with left lung disease were 47.68±5.08, Respectively 65% of them were male majority of them 65% were married, 26.7 from them were widow and 8.3 from them were divorced. As well as one third of sample 35 % of the studied subjects had illiterate. As the other third of sample 31.7% had secondary. Also, shows that; approximately 30% from patients had bronchial asthma related to respiratory failure, 23.3% of patients had ARDS, 28.3 % of patients were pneumonia, 11.7 % of patients were Intra pulmonary fibrosis and 6.7 % of patients were other disease.

Table (2): shows that; the all patients were normal temperature .As pulse 1.7% patients were bradycardia , 41.7 % of patients were between 60 and less than 80 b /m, 36.7 % of patients werebetween 80 and less than 100 b /m and 20 % of patients were tachycardia between above 100 b /m. As well as respiratory rate 10% subjects were between 12 and less than 16 , 40 % of patients werebetween 16 and less than 20, 40 % of patients were between 20 and less than 24 c /m and 10 % of 3 patients were between above 24 c /m meanwhile, blood pressure 35% patients were hypotension,43.3 % of patients were normal , 21.7% of patients were hypertension. Also, regarding mode of mechanical ventilator 35% were on mode SIMV while 18.3% patients were on mode CMV and 46.7% of patients were on mode A/C.

Table (3): shows improvement in PH with different positions in right & left lung disease is highly significant at (p value≤ 0.001), also it isnon-significant in bilateral lung disease at (p= 0.105). Moreover, there is highly statistically significant improvement in PaCo2 with differentpositions in right & left lung at (p value≤ 0.001), and there is non- significant improvement in PaCo2 with bilateral lung disease at (p value= 0.121). Also, it showed improvement in HCO3 with right lung disease is highly significant at (p value≤ 0.001), while it is non-significant in left lung disease at (p value= 0.204) and there is non- significant in HCO3 with bilateral lung disease, at (p value= 0.105). Finally, it showed significant improvement in SPO2 in ABG in right lung disease, left Lung disease, and bilateral lung disease at (p value≤ 0.001).

Figure (1): shows an elevation in percentage of PaO2 in ABG with right lung disease in left position, also it showed elevation in percentage of PaO2 in ABG with left lung disease in right position, and there is elevation in percentage of PaO2 in ABG with bilateral lung disease in prone position.

Table (4): shows a non- significant relation in FiO2 setting, PEEP setting, RR setting and tidal volume setting in bilateral, right and left lung disease (p=1.000).

Table (5): shows enhancement of SPo2 by pulse oximeter immediately and after 2hrs in patients with bilateral lung disease in prone position, also it showed enhancement of SPo2 by pulse oximeter immediately and after 2hrs in patients with Right Lung disease in left position, moreover it showed improvement in SPo2 by pulse oximeter immediately in patients with left lung disease in prone position and there is enhancement in SPo2 by pulse oximeter After 2hrs in patients with left lung disease in right position with a highly significant difference at (p value<0.001).

Table (6): shows enhancement in HR immediately in patients with bilateral lung disease with highly statistically difference at (p value≤ 0.001), also statistically significant enhancement in HR immediately in patients with right lung disease at (p= 0.003), and there is statistically significant improvement in HR immediately in patients with left lung at (p value=0.014). Moreover there is highly statistically significant difference improvement in HR after 2hrs in patients with bilateral, right and left lung disease at (p value≤ 0.001).

Table (7): shows enhancement in RR on monitor immediately and after 2hrs in patients with bilateral, right and left lung disease with highlysignificant difference at (p value ≤0.001).

Table (1): Distribution of studied patients related their characteristics (N=60).

Characteristics	Bilateral Lung disease		Right Lung disease		Left Lung disease		Total	
Age	N	%	N	%	N	%	N	%
20<30	1	3.0	0	0.0	0	0.0	1	1.7
30<40	10	30.3	3	15.8	3	37.5	16	26.7
40<50	3	9.1	1	5.3	1	12.5	5	8.3
>50	19	57.6	15	78.9	4	50.0	38	63.3
Mean±SD	47.11±5.64		50.27±4.29		47.68±5.08		48.34±4.6	
Gender								
Male	21	63.6	12	63.2	6	75.0	39	65.0
Female	12	36.4	7	36.8	2	25.0	21	35.0
Marital status								
Married	21	63.6	14	73.7	4	50.0	39	65.0
Widow	10	30.3	3	15.8	3	37.5	16	26.7
Divorced	2	6.1	2	10.5	1	12.5	5	8.3
Educational level								
Illiterate	12	36.3	7	36.8	2	25.0	21	35.0
Primary	5	15.2	4	21.1	2	25.0	11	18.3
Secondary	11	33.3	6	31.6	2	25.0	19	31.7
High education	5	15.2	2	10.5	2	25.0	9	15.0
Causes of respiratory failure								
ARDS	14	42.4	0	0.0	0	0.0	14	23.3
Bronchial asthma	10	30.3	5	26.3	3	37.5	18	30.0
Pneumonia	2	6.1	12	63.2	3	37.5	17	28.3
Pulmonary fibrosis	7	21.2	0	0.0	0	0.0	7	11.7
Other	0	0.0	2	10.5	2	25.0	4	6.7

Table (2): Initial assessment of vital signs & mode of mechanical ventilator among mechanically ventilatedpatients with lung diseases (N=60).

Vital signs	Bilateral Lung disease		Right Lung disease		Left Lung disease		Total	
	N	%	N	%	N	%	N	%
Temperature								
36.5<37.5	33	100	19	100	8	100	60	100
Pulse								
40<60	0	0.0	0	0.0	1	12.5	1	1.7
60<80	20	60.6	4	21.1	1	12.5	25	41.7
80<100	11	33.3	7	36.8	4	50.0	22	36.6
>100	2	6.1	8	42.1	2	25.0	12	20.0
Respiratory rate								
12<16	3	9.1	3	15.8	0	0.0	6	10.0
16<20	15	45.5	7	36.8	2	25.0	24	40.0
20<24	13	39.3	6	31.6	5	62.5	24	40.0
>24	2	6.1	3	15.8	1	12.5	6	10.0
Blood pressure								
Normal	11	33.3	12	63.2	3	37.5	26	43.3
Hypotension	12	36.4	5	26.3	4	50.0	21	35.0
Hypertension	10	30.3	2	10.5	1	12.5	13	21.7
Mode of mechanical ventilator								
CMV	4	12.1	5	26.3	2	25.0	11	18.3
A/C	16	48.5	10	52.6	2	25.0	28	46.7
SIMV	13	39.4	4	21.1	4	50.0	21	35.0

Table (3): Comparison between effect of routine position (Fowler position) and other positions on the oxygenation level for mechanically ventilated patients with lung diseases through ABG parameters (PH, Paco2 and HCO3 after 2 hours from same position) (N=60).

ABG parameters	Routine (Fowler position)		Left		Right		Prone		ANOVA	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	F	P-value
PH										
Bilateral	7.37	0.12	7.37	0.04	7.40	.03	7.40	0.03	2.08	0.105
Right Lung	7.34	0.02	7.36	0.02	7.34	.02	7.36	0.02	6.13	<0.001**
Left Lung	7.34	0.01	7.32	0.02	7.37	.02	7.39	0.01	28.6	<0.001**
Paco2										
Bilateral	40.73	5.01	41.70	4.41	42.42	2.3	40.55	1.23	1.97	0.121
Right Lung	37.11	2.49	38.74	2.00	35.84	2.5	39.32	2.36	8.56	<0.001**
Left Lung	34.50	3.12	35.38	4.37	38.38	1.6	39.13	0.99	4.96	0.007*
HCO3										
Bilateral	23.30	3.21	23.33	3.02	24.12	1.6	24.52	0.91	2.08	0.105
Right Lung	20.68	0.67	22.63	0.83	20.42	1.07	22.05	1.35	20.949	<0.001**
Left Lung	19.75	1.16	34.25	27.0	23.88	1.3	24.88	1.36	1.63	0.204
Spo2										
Bilateral	92.21	1.45	93.39	1.85	97.15	1.5	99.45	0.71	175.338	<0.001**
Right Lung	94.05	1.72	98.79	0.79	91.05	1.2	94.58	1.71	95.2	<0.001**
Left Lung	95.75	2.19	89.00	1.20	99.25	0.7	98.75	1.67	75.0	<0.001**

Non-Significant >0.05 Significant <0.05* High Significant <0.001**

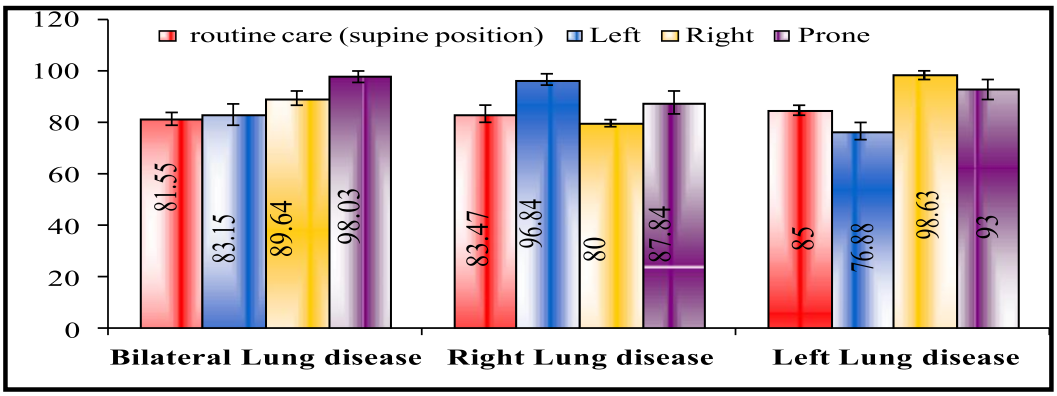

Figure (1): Comparison between effect of routine position (Fowler position) and other positions on the oxygenation level for mechanically ventilated patients with lung diseases through invasive measurement (Pao2 after 2 hours from same position) (N=60).

Table (4): Comparison between effect of routine position (Fowler position) and other positions on the oxygenation for mechanically ventilated patients with lung diseases through noninvasive measurement **(**FiO2 Setting, tidal volume setting, PEEP setting and RR setting) (N=60)

Ventilator Parameters	(Fowler position)		Left		Right		Prone		ANOVA	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	F	P-value
FiO2										
Bilateral	52.42	10.91	52.42	10.91	52.42	10.91	52.42	10.91	0.00	1.00
Right lung	50.00	9.86	50.00	9.86	50.00	9.86	50.00	9.86	0.00	1.00
Left lung	47.50	8.86	47.50	8.86	47.50	8.86	47.50	8.86	0.00	1.00
Tidal volume										
Bilateral	402.2	148.5	515.8	685.17	402.28	148.5	402.2	148.5	0.77	0.51
Right	413.9	61.84	413.9	61.84	413.95	61.84	413.9	61.84	0.00	1.00
Left Lung	397.5	30.59	397.5	30.59	397.5	30.59	397.5	30.59	0.00	1.00
PEEP										
Bilateral	7.73	2.27	7.48	2.33	7.48	2.33	7.48	2.33	0.09	0.96
Right	5.63	0.68	5.63	0.68	5.63	0.68	5.63	0.68	0.00	1.00
Left lung	5.38	0.74	5.38	0.74	5.38	0.74	5.38	0.74	0.00	1.00
RR setting										
Bilateral	15.48	3.61	15.48	3.61	15.48	3.61	15.48	3.61	0.00	1.00
Right lung	17.37	1.61	17.37	1.61	17.37	1.61	17.37	1.61	0.00	1.00
Left lung	15.38	0.92	15.38	0.92	15.38	0.92	15.38	0.92	0.00	1.00

Table (5): Comparison between effect of routine position (Fowler position) and other positions on the oxygenation level for mechanically ventilated patients with lung diseases through noninvasive measurement **(**SPo2 by pulse oximeter immediately of position then after 2 hours from same position) (N=60).

SPo2 by pulse oximeter	Routine		Left		Right		Prone		ANOVA	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	F	P-value
<u>Immediately</u>										
Bilateral Lung	92.30	1.07	92.88	1.62	96.18	1.70	98.52	1.12	141.682	<0.001**
Right Lung	92.95	1.68	96.00	2.16	93.63	1.12	93.16	1.74	12.773	<0.001**
Left Lung	94.25	2.12	93.38	2.50	91.88	1.25	98.50	1.77	16.705	<0.001**
<u>After 2hr</u>										
Bilateral Lung	92.27	1.51	93.58	2.22	97.15	1.54	99.45	0.71	141.363	<0.001**
Right Lung	94.16	1.68	98.89	0.57	91.05	1.27	94.68	1.57	109.950	<0.001**
Left Lung	95.88	2.36	89.00	1.20	99.25	0.71	98.75	1.67	69.420	<0.001**

Non-Significant >0.05 Significant <0.05* High Significant <0.001**

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Table (6): Comparison between effect of routine position (Fowler position) and other positions on the oxygenation level for mechanically ventilated patients with lung diseases through noninvasive measurement (HR immediately of position then after 2 hour from same position) (N=60).

HR	Routine		Left		Right		Prone		ANOVA	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	f	P-value
Immediately										
Bilateral Lung disease	75.48	10.56	83.52	12.19	90.42	23.04	91.68	6.09	8.307	<0.001**
Right Lung disease	88.95	11.44	88.00	8.55	96.74	12.62	97.58	4.59	5.026	0.003*
Left Lung disease	99.75	10.61	104.1	8.49	101.5	3.51	92.00	3.34	4.184	0.014*
After 2 hrs										
Bilateral Lung disease	78.45	10.22	83.35	11.46	90.77	5.85	92.26	6.38	16.731	<0.001**
Right Lung disease	89.89	10.89	86.21	8.35	98.74	10.04	97.26	4.42	8.767	<0.001**
Left Lung disease	98.75	8.40	118.6	7.13	91.25	1.04	92.00	3.85	37.992	<0.001**

Table (7): Comparison between effect of routine position (Fowler position) and other positions on the oxygenation level for mechanically ventilated patients with lung diseases through noninvasive measurement (RR on monitor immediately of position then after 2 hour from same position) (N=60).

RR on monitor	Routine		Left		Right		Prone		ANOVA	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	F	P-value
Immediately										
Bilateral Lung disease	19.74	2.39	19.29	1.10	17.61	0.80	17.10	1.37	21.393	<0.001**
Right Lung disease	19.47	1.17	16.37	1.26	19.63	1.07	18.63	1.07	32.923	<0.001**
Left Lung disease	20.25	2.71	21.63	2.07	19.88	1.25	16.00	0.00	14.126	<0.001**
After 2hrs										
Bilateral Lung disease	19.29	1.81	19.61	1.76	17.19	1.08	17.03	1.02	26.647	<0.001**
Right Lung disease	18.89	2.75	15.79	1.40	21.26	1.37	18.79	1.32	29.175	<0.001**
Left Lung disease	19.00	2.56	24.38	1.41	15.38	0.92	15.38	0.92	56.599	<0.001**

Discussion

Positioning is important to break through the routine monotonic delivery of mechanical ventilation and to support the clearance of respiratory secretions, the prevention of pressure sores and ventilator acquired pneumonia, and the improvement in lung volume and oxygenation. In the acute respiratory distress syndrome (ARDS) the early and prolonged prone positioning has been realized to increase survival in those patients

studied Timing of noninvasive ventilation failure: causes, risk factors, clarified that the mean age of all the studied patients was 58.47 ± 8.2 years, majority were males and resident in rural areas and most of them had a positive smoking history.

The present study illustrated that causes relatedto respiratory failure were near quarter of the studiedsubjects were ARDS, while less than one third of them were bronchial asthma, more than one quarter of them were pneumonia and minimum of them were Intra pulmonary fibrosis and other disease**.** This wasin the same line with **Zamzam et al., (2015)** who reported that most prevalent causes were related to respiratory failure, COPD followed by interstitial lung disease, bronchial asthma and the lowest were obesity hypoventilation. Also, **Kubler et al., (2013)** who studied the mechanical ventilation in ICU, reported that multi-center point-prevalence study showed the commonest etiology of respiratory failure leading to mechanical ventilators was chronic obstructive pulmonary disease followed by ARDS, pneumonia, and cardiogenic pulmonary edema.

Initial assessment of vital signs, all subjects were normal. Pulse in most of studied subject was normal. Also respiratory rate in most of them were normal between 16 and less than 20. Bloodpressure about less than half of them was normal. In this respect **Elsaman(2017)** who revealed a comparison between the control and study groups as related to cardiac parameters including HR and MAP (Mean airway pressure) and respiratory parameters including RR and TV(Tidal volume). The results displayed that there was **(Mezidi & Guérin, 2018).**

Regarding patients' sociodemographic characteristics results showed that, most of studied subjects were in age group more than 50 yrs. According the gender two thirds of sample was malesand married. According level of education, also it’s showed that one third of the sample of the studied subjects was Illiterate. Regarding occupation one half of sample was workers and one quadrant was unemployed**.** These findings were in accordance with **Ozyilma, Ugurlu and Nava (2014)** who no significant statistical variance between the two groups with normal range for majority of studied groups. On the same line **Hammash et al., (2015)** emphasized that, Patient’s temperature for mechanical ventilated patients range between 96.2- 101.8.f. Considering initial assessment modes of mechanical ventilator as less than half of studied subjects were on mode A/C**.** In this respect a study by **Kubler et al., (2013)** emphasized that a multi-center point-prevalence study showed that more than half of the patients in IMV group received IPPV as an initial mode while 45% received SIMV.

The current results revealed that there is highly significant difference enhancement in PH with right lung disease in left position, highly statistically significant enhancement in PH with left lung disease in right position and non-significant in bilateral lung disease. This result was inconsistent with **Banasik and Emerson (2017)** who confirmed that each patient was passively turned to each of the three positions (right and left 45° lateral and supine) according to a computer-generated, randomized positioning sequence.

According PaCo2 a highly significant enhancement in PaCo2 with right lung disease, there is statistically significant improvement in PaCo2 with left lung disease and there is non-significant improvement in PaCo2 with bilateral lung disease**.** This result disagreed with **Wu et al., (2015)** who showed that PaCO2 in both groups (Dorsal Position and Alternate Position Groups) were not considerably different, which was not statistically significant.

Also, a highly significant improvement in SPO2 in ABG with right lung disease in left position, highly statistically significant improvement in SPO2 in ABG with left lung disease in right position and highly significant difference progress in SPO2 in ABG with bilateral lung disease in prone position. From the researchers viewpoint when lung pathology is bilateral, arterial blood gases are improved, when patients lie on the right side compared with the left. This can be explained by the greater size of the right lung and reduced compression of the height on lung in this position compared with left lying. Thus, increased regional ventilation under the influence of gravity with an overall improvement in ventilation/ perfusion ratio appears to be main mechanism of position induced improvement in oxygenation according to **Patil and Nagarwala (2015).** In the opinion of the present researchers that these mechanisms may contribute to the improved oxygenation but that a smaller amount of lung tissue will be collapsed in the prone position and that this might be a more important cause ofthe improved gas exchange.

In this respect **Mezidi and Guérin, (2018**) who confirmed that oxygen saturation did not differ significantly when the zero degree and 60-degree positions were compared. On the same line **Guerin,Reignier & Richard (2013)** who showed in his study that the semi recumbent position appears to cause significant falls in saturation of central venous oxygen (ScvO2). This means that body position is an important determinant of gas exchange.

The present study showed non-significant difference in FiO2 setting, PEEP (Positive end expiratory pressure) setting, RR setting and tidal volume setting in bilateral, right and left lung disease with fowler, left, right and prone positions. The previous result was consistent with **Thornton (2018)** who studied Prone Positioning in Acute Respiratory Distress Syndrome Patients, USA,reported that, FiO2 data provided evidence that prone positioning improves patient oxygenation compared to traditional supine positioning. Prone position patient's oxygenation surpassed that of the supine positioned patients at least 48 hours after prone positioning was implemented. Also, **Wu et al., (2015)** emphasized that, the dynamic compliance and tidal volume in alternate position group could also be improved compared to dorsal position group, and the difference was statistically significant.

Relating HR, there is a highly significant progress in HR immediately in patients with bilateral lung disease, there is significant difference improvement in HR immediately in patients with right lung disease and left lung disease. From the researcher view, the body position can influence the number of times the heart beats per minute. When patient is lying down and especially when the patient is lying in a lateral position the heart beats fewer times per minute than when he is sitting or standing. When the patient is lying down, the effect of gravity on the body is reduced, allowing more blood to flow back to the heart through the veins. Because more blood returns to the heart, the body is able to pump more blood per beat, which means that less beats per minute are required to satisfy the body's demand for blood, oxygen and nutrients according to **Martin Hughes (2017).**

In this respect **Rad et al., (2018**) who confirmed in his study that, Heart rate variability was slightly lower in the prone position than the other (supine and lateral) two positions, but this difference was not significant. The results also showed that the mean of heart rate was not significant between the supine and left lateral positions. Also, **Bloomfield et al., (2015)** reporting that arrhythmias was reduced with prone position with statistically significant relations.

There is a highly statistically significant enhancement in RR on monitor immediately and after 2hrs in patients with bilateral, right and left lung disease**.** These findings were contradicted with**Bloomfield et al., (2015)** who reported that, when patients were turned to prone position, Spao2 and RR were decreased markedly among adult patients with respiratory failure, but findings were not statistically significant. Also, **Mezidi and Guérin (2018)** which studied the impact of prone position on respiratory rate is complex, but the increase in chest wall elastance is a central mechanism. This evidence that sitting position and prone position are providing positive impact on respiratory mechanics of mechanically ventilated patients compared to supine position.

There is a highly significant enhancement in SPo2 after 2hrs in patients with bilateral lung disease in prone position, while there is highly significant enhancement in SPo2 after 2hrs in patients with right lung disease in left position and with left lung disease in prone position and there is a highly statistically improvement in SPo2 after 2hrs in patients with left lung disease in right position.

From the researchers opinion, lung expansion is more beneficial in prone than in supine because the heart is supported by sternum and there is less parenchymal distortion which help in opening previously deflated lung, oxygenation may improve to such an extent that PEEP and FiO2 can be reduced according to **Patil and Nagarwala, (2015).** The previous result agreed with **Mezidi and Guérin, (2018)** who reported that supine position (lying flat) or lateral positions do not seem beneficial for critically ill patients in terms of respiratory mechanics. The sitting position (with thorax angulation >30° from the horizontal plane) is associated with improvement of oxygenation (SPo2) and reduction of work of breathing with statistically Significant improvement SPo2 both sitting and prone positions.

Conclusion

The researchers concluded that, mechanically ventilated patients with bilateral lung disease have significant enhancement in oxygenation parameters in prone position and side lying position as compared to Fowler position. But this enhancement is highly significant in prone position as compared to side lying. As well as patients with left lung disease will have significant enhancement in oxygenation parameters in right position and prone position as compared to fowler position. But this enhancement is highly significant in right position as compared to prone position and patients with right lung disease will have significant improvement in oxygenation parameters in left position and prone position as compared to fowler position. But this enhancement is highly significant in left position ascompared to prone position.

Recommendations

Implication for Nursing Practice

- Conducting continues in-service program to improve nurse's performance in caring for such patients on mechanical ventilation.

- Positioning changes of mechanically ventilated patients should be applied by all staff nurses working in ICUs as essential care needed to improve the oxygenation parameters.

Implication for Future Research

- Further studies on a large sample and different settings should be implicated.

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