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A COMPARATIVE STUDY TO EVALUATE THE EFFECTIVENESS OF PRONE VS SUPINE POSITION ON OXYGENATION IN PATIENTS WITH ACUTE RESPIRATORY DISTRESS SYNDROME ON VENTILATOR IN CRITICAL CARE UNIT AT SELECTED HOSPITALS, PANIPAT

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Abstract

The study's background: Body positioning refers to manipulating the influence of gravity on cardiopulmonary and cardiovascular function to optimise O2 transport. Positioning should be an integral component of respiratory care, particularly when prevention is the objective. Turning intensive care patients supine to lateral to prone to lateral at least hourly can make the difference between life and death. Positioning enhances gas exchange and decreases atelectasis. **The purpose of this study**: was to assess the effects of prone versus supine positions on oxygenation levels in patients with acute respiratory distress syndrome who were using ventilators in experimental groups I and II. **Methodology:** Quantitative research was used. The quasi-experimental approach assessed the effects of prone and supine positions on ventilator use in acute respiratory distress syndrome (Non –Equivalent Control Group Design). The researcher collected data from Dr. PremHospital in Panipat, Oscar Hospital in Panipat, and Gajaraj Hospital in Gohana. Convenience sampling recruited the subjects. Each group included 30 non-random samples from 60 total. Group I was prone, while Group II was supine. Modified Apache–II and an observational methodology measured physiological parameters. The experimental group was prone and the comparative group supine. Following six hours, physiological and biophysiological parameters measured post-test oxygenation (Modified Apache-II Score). Positions changed every two hours. Descriptive and inferential statistics analysed data. **Result:** Results In the experimental group, the mean post-test Level of Oxygenation score and standard deviation were 6.57 + 1.598. In the control group, the mean and standard deviation scores on the post-test were 5.67 + 1.155. The mean score difference was 0.9 The obtained independent t-test score for the 58th degree of freedom was 5.253. It was statistically significant when the value of 'p' was less than 0.001. Thus, we can conclude that the level of oxygenation differed significantly between two positions, such as prone and supine. **Conclusion:** The comparative study compared prone and supine positions on oxygenation in ventilator-dependent ARDS patients. The study found that recumbent oxygenation was better than prone. To optimise oxygenation, intensive care nurses must use positioning.

Key Words: Evaluate, certain ways to calm down, physiological parameters.

Introduction: Acute hypoxia and bilateral pulmonary infiltrates caused by pulmonary and non - pulmonary traumas are symptoms of acute respiratory distress syndrome (ARDS). 17 Hospital-acquired moderate to severe ARDS affects 1.6 to 7.7% of ICU admissions and 8 to 19.7% of ventilated patients[1] The population-based incidence of ARDS ranges from 10.1 to 86.2 instances per 100,000 person-years,19 with the most rigorous study revealing the highest occurrence. 20 Low-income countries have not reported population, hospital, or ICU ARDS incidence and outcomes.[2]

Estimating ARDS' global impact is tough. The GBD 2010 estimated mortality causes for 187 nations in 21 regions with 235 causes. It grouped deaths into three categories: communicable, maternal, neonatal, and nutritional disorders; noncommunicable diseases; and injuries. Most studies show 30%–40% ARDS mortality (Table 1) 14, 33. Only reduced tidal volume breathing reduces ARDS mortality across severity levels. Conservative fluid management decreases ICU stay and ventilation, but not death.[3]

Prone positioning lowers mortality in moderately severe ARDS (PaO2/FiO2 <150 mm Hg). Neuromuscular blockade. Several studies revealed that prone positioning (PP) improves survival in critically unwell individuals.[4] PP improves lung compliance and oxygenation. PP also reduces ventilator-induced lung injury, MV days, and ICU stay. PP may benefit ECMO patients. PP under ECMO support enhances oxygenation and lung compliance.[5] Little is known about these patients' outcomes. One survey indicated that most ICUs required 2–6 staff to turn an adult patient, even though prone ventilation had physiologic benefits and requires no special tools.

Disconnection or removal of endotracheal tubes or intravascular catheters, kinking, or secretion-induced clogging of tubes, and prone positioning of life-threatening hypoxemia patients pose substantial safety risks. Despite its physiological benefits, prone stance has not shown better clinical outcomes than supine positioning in randomised controlled trials.[6]

So, the researcher will perform a comparative 8 study to compare prone vs. supine positions on oxygenation in critical care unit patients with acute respiratory distress syndrome on ventilators.

Objectives of the study:

1. To assess the level of oxygenation among patients with acute respiratory distress syndrome on ventilator in experimental group - I and experimental group – II.
2. To compare the effectiveness of prone position Vs supine position on level of oxygenation among patients with acute respiratory distress syndrome on ventilator in experimental group - I and experimental group – II.
3. To associate the level of oxygenation among patients with acute respiratory distress syndrome on ventilator with their selected demographic variables in experimental group and experimental group – II.

Hypotheses:

All the hypothesis are tested at p value < than 0.05 level of significance.

H_1 - There will be significant difference in the level of oxygenation between prone position and supine position among patients on ventilator with acute respiratory distress syndrome in experimental group - I and experimental group – II.

H_2 - There will be significant association between the level of oxygenation among patients with acute respiratory distress syndrome on ventilator and their selected demographic variables in experimental group - I and experimental group – II.

Materials and methods:

The research approach used in the current study was based on the quantitative research approach**.** The research design adopted for this study was quasi - experimental design (Non –Equivalent Control Group Design). This study was conducted in, Dr Prem Hospital. Panipat, Oscar Hospital Dr GC Gupta hospital Panipat and Gajaraj Hospital - Gohana. All are multi –speciality hospitals with NABH Accreditation. Sample size for the present study was 60. (30 each in Experimental group and Comparison Group). The sampling technique adopted for this study was Non probability convenience sampling. Criteria for sample collection includes Patients of early, middle, late adulthood with acute respiratory distress syndrome on ventilator. Both male and female patients with acute respiratory distress syndrome on ventilator.

Development and description of the tool: The investigator prepared the tool after going through the related literature and guidance of experts in the field of Nursing and Medicine. The tool for data collection was consisted of three sections namely,

Section A: Demographic data

Section B: Peak Flow Meter and Disposable Mouth piece.

Validity and Reliability:

The tools were submitted to the experts in the field of Nursing and Medicine to

establish the content validity. Based on expert‘s suggestions, the investigator had finalized the tool for the original study. After the pilot study reliability of tool were assessed by using inter-rater reliability method. The obtained reliability score was 0.78 and it was found to be moderately reliable.

Pilot study:

The pilot study was conducted in Gajaraj Hospital, Gohana. From 01/05/2022 to 07.05/2022 With 6 subjects to determine the study feasibility. The results of the pilot study were found to be feasible.

Procedure for data collection:

From 13/05/2022 to 13/06/2022, the researcher collected data with hospital approval. The researcher chose 60 patients, 30 from Dr .Prem Hospital. Panipat were assigned as experimental group (prone) and 30 patients from Oscar Hospital and Dr GC Gupta Hospital as comparison group (supine) through nonprobability/convenience sampling. Bio physiological and physiological parameters measured both groups' pre-test oxygenation (Modified Apache-II Score). The experimental group was prone and the comparison group supine. The positions were changed every two hours, and after six hours, physiological and biophysiological parameters (Modified Apache-II Score) measured oxygenation.

Data analysis:

Descriptive and inferential statistics analysed the data. This study described mean, standard deviation, and percentage. Inferential statistics uses a one-sample t-test to determine the relationship between demographic variables and elicited problems.

Results and Interpretation:

Table – I: Frequency and Percentage Distribution of Subjects in Experimental Group – I & II (Prone Position vs Supine Position)

(N = 60)

S, No	Demographic Variables		Experimental Group		Control Group	
			Frequency (F)	Percentage (%)	Frequency (F)	Percentage (%)
1	Age (Year)	21 – 30	14	46.7	7	23.3
		31 – 40	8	26.7	6	20.0
		41 – 50	8	26.7	17	56.7
2	Sex	Male	13	43.3	19	63.3
		Female	17	56.7	11	36.7
3	Occupation	Unemployed	6	20.0	5	16.7
		House wife	6	20.0	6	20.0
		Farmer	8	26.7	5	16.7
		Laborer	4	13.3	5	16.7
		Business	2	6.7	3	10.0
		Professional	4	13.3	2	6.7
4	Smoking Habits	Yes	6	20.0	4	13.3
		No	24	80.0	10	33.3
5	Use of Alcohol	Yes	18	60.0	20	66.7
		No	12	40.0	13	43.3
6	Duration of ventilator support	1 – 3 days	3	10.0	17	56.7
		4 – 6 days	22	73.3	5	16.7
		More than 6 days	5	16.7	20	66.7
7	Modes of ventilation	Volume control mode	19	63.3	5	16.7
		Assist control mode	11	36.7	13	43.3
8	Associated conditions	Infections	4	13.3	17	56.7
		Anaemia	15	50.0	2	6.7
		Alterations in chest wall movements	5	16.7	13	43.3
		Inhalation of toxic substances	5	16.7	5	16.7
		Others	1	3.3	6	20.0

Table 1 shows the demographic distribution of experimental group subjects.
The experimental group – i had 14 (46.7%) subjects aged 21–30. 8 (26.7%) subjects aged 31–40 and 41–50 were evenly, distributed. Experimental group - i had 17 females (56.7%) and 13 males (43.3%). 8 (26.7%) of the experimental group - i were farmers. 6 (20.0%) were unemployed and 6 were housewives. In the experimental group - i, 24 (80.0%) did not smoke and 6 (20%) did. 18 (60.0%) of experimental group - i subjects were alcoholics. 12 (40.0%) non-drinkers 22 subjects (73.3%) in experimental group – i were ventilated for 4–6 days. 5 (16.7%) subjects were ventilated for over 6 days. The experimental group - i had 19 (63.3%) subjects in volume control mode and 11 (36.7%) in assist control mode. The experimental group - i subjects had anaemia, chest wall movement changes, and toxic substance inhalation.
The majority of experimental group - ii subjects (17 (56.7%) were 41–50 years old. 6 (20%) were 31–40-year-olds. Experimental group – ii had 19 (63.3%) males and 11 (36.7%) females. Six subjects (20%) in

experimental group - ii were housewives. 5 (16.7%) were unemployed, labourers, or farmers. In the experimental group - ii, 20 (66.7%) did not smoke and 10 (23.3%) did. 17 (56.7%) of experimental group - ii subjects were alcoholics. Non-drinkers were 13 (43.3%). 20 (66.7%) of experimental group - ii 11 subjects were ventilated for 4–6 days. Five subjects (16.7%) were ventilated for 1–3 days and more than 6 days. The experimental group – ii ventilator modes were 17 (56.7%) assist control and 13 (34.6%) volume control. In experimental group - ii, 13 (43.3%) had anaemia and 6 (20%) inhaled toxic substances.

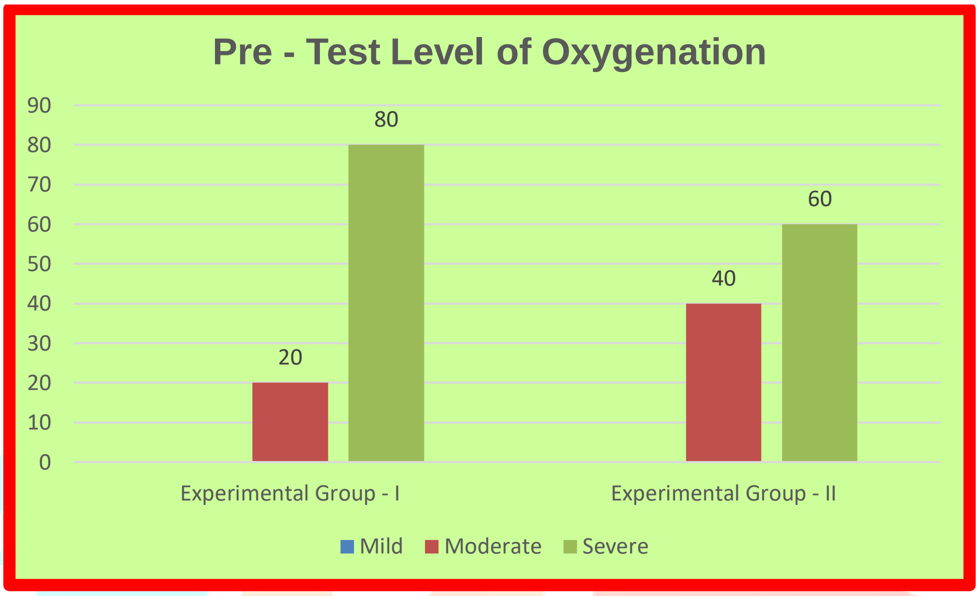

Figure – 1: Percentage Distribution of Subjects in Experimental Group-I and Experimental Group - II according to Pre-Test Level of Knowledge

Figure – 1 depicts the Percentage Distribution of Subjects in Experimental Group-I and Experimental Group - II according to Pre-Test Level of Knowledge During pre – test among the subjects who were given prone position majority 24 (80.0 %) had severe hypoxia. Moderate hypoxia was there among 6 (20.0 %) of the subjects and no one was having mild hypoxia.

At the time of pre – test among the subjects who were provided supine position depicts, that majority 18 (60.0 %) had severe hypoxia and moderate hypoxia was present in 12 (40.0 %). No subjects were with mild hypoxia.

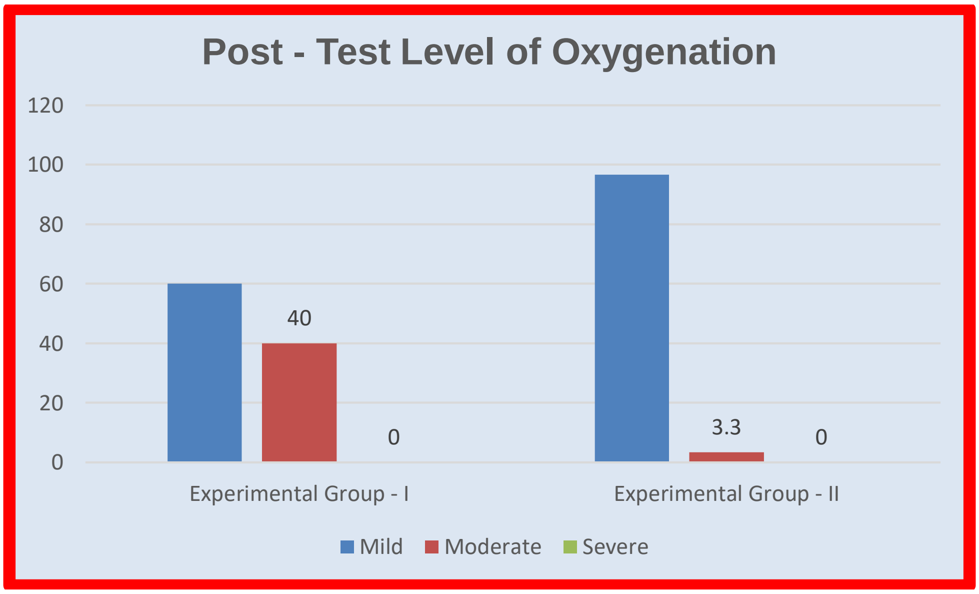

Figure – 2: Percentage Distribution of Subjects in Experimental Group-I and Experimental Group - II according to Post-Test Level of Knowledge

Figure - 2 illustrates Frequency and Percentage Distribution of Subjects in Experimental Group - I and Experimental Group - II according to Post - Test Level of Oxygenation.

During post – test among the subjects who were given prone position majority 18 (60.0 %) had mild hypoxia. Moderate hypoxia was there among 12 (40.0 %) of the subjects and no one was having severe hypoxia.

At the time of post – test among the subjects who were provided supine position depicts, that an overwhelming majority 29 (96.7 %) had mild hypoxia and moderate hypoxia was present in 1 (3.3 %). No subjects were with severe hypoxia.

Table – II Comparison of Pre-test and Post – test Level of Oxygenation of Subjects in Experimental Group – I and Experimental Group – II Using Paired 't' test

(N = 60)

Test	Mean	Mean %	Mean Difference	Standard Deviation	Paired 't' test	'P' Value
Experimental Group - I						
Pre-Test	17.00	20	9.53	1.742	26.168 (df = 29)	0.001*
Post-Test	6.57	10		1.598		
Experimental Group - II						
Pre-Test	**15.80**	**19**	9.93	1.730	33.115 (df = 29)	0.001* Significant
Post-Test	**5.67**	**8**		1.155		

Table II compares pre- and post-test oxygenation levels in experimental group 1 and experimental group II using paired "t" test.

Experimental group I had an oxygenation score of 17.00 ± 1.742 before the test. Post-test mean and standard deviation were 6.57 ± 1.598. mean difference score 9.53. The 29-degree paired "t" test score was 26.168. It was significant at 0.001.

Experimental group II had an oxygenation score of 15.80 ± 1.730 before testing. Post-test mean and standard deviation were 5.67 ± 1.155. mean difference score 9.33. The 29-degree paired "t" test score was 33.115. It was significant at 0.001.

Table – III: Comparison of Level of Oxygenation of subjects in experimental group – I and experimental group - II using independent 't' test

(N = 60)

Post-Test	Mean	Mean %	Mean Difference	Standard Deviation	Independent 't' test	'P' Value
Experimental Group - I	6.57	10	0.9	1.598	5.253 (df = 58)	0.001 Significant
Experimental Group - II	5.67	8		1.155		

Table III compares pre- and post-test oxygenation levels in experimental group I and II using independent "t" test. Post-test mean and standard deviation Level of Oxygenation score was 6.57 ± 1.598 in experimental group. Control group post-test mean and standard deviation were 5.67 ± 1.155. mean difference score 0.9 The 58-degree independent "t" test score was 5.253. It was significant at 0.001. Thus, prone and supine positions differed in oxygenation.

Table – IV: Level of association between post – test level of oxygenation score with demographic variables of the subjects in experimental group – I

(n = 30)

S. No	Demographic Variables		Post – Test Level of Oxygenation Mild	Moderate	χ^2 Value		'P' value
1	**Age (Year)**	21 – 30	9	5	0.46	2	0.794 Not Significant
		31 – 40	4	4			
		41 – 50	5	3			
2	**Sex**	Male	6	7	1.833	1	0.164 Not Significant
		Female	12	5			
3	**Occupation**	Unemployed	4	2	4.132	5	0.531 Not Significant
		House wife	3	3			
		Farmer	3	5			
		Laborer	3	1			
		Business	2	0			
		Professional	3	1			
4	**Smoking Habits**	Yes	3	3	0.312	1	0.455 Not Significant
		No	15	9			
5	**Use of Alcohol**	Yes	13	5	2.801	1	0.098 Not Significant
		No	5	7			
6	**Duration of ventilator support**	1 – 3 days	1	2	2.336	2	0.311 Not Significant
		4 – 6 days	15	7			
		More than 6 days	2	3			
7	**Modes of ventilation**	Volume control mode	11	8	0.096	1	0.534 Not Significant
		Assist control mode	7	4			
8	**Associated conditions**	Infections	2	2	1.944	4	0.746 Not Significant
		Anaemia	10	5			
		Alterations in chest wall movements	3	2			
		Inhalation of toxic substances	2	3			
		Others	1	0			

Table IV: Demographic variables and post-test oxygenation score association in experimental group I. The above table showed that demographic variables like age, sex, occupation, smoking habits, alcohol use, duration of ventilator support, modes of ventilation, and associated conditions did not significantly affect post test oxygenation in experimental group I.

Table – V: Level of association between post – test level of oxygenation score with demographic variables of the subjects in experimental group – II

(n = 30)

S. No	Demographic Variables		Post – Test Level of Oxygenation: Mild	Post – Test Level of Oxygenation: Moderate	χ2 Value	df	'P' value
1	Age (Year)	21 – 30	7	0	0.791	2	0.673 Not Significant
		31 – 40	6	0			
		41 – 50	16	1			
2	Sex	Male	19	0	0.1787	1	0.367 Not Significant
		Female	10	1			
3	Occupation	Unemployed	5	0	4.138	6	0.658 Not Significant
		House wife	5	1			
		Farmer	5	0			
		Laborer	5	0			
		Clerical	3	0			
		Business	2	0			
		Professional	4	0			
4	Smoking Habits	Yes	10	0	0.517	1	0.667 Not Significant
		No	19	1			
5	Use of Alcohol	Yes	13	0	0.791	1	0.567 Not Significant
		No	16	1			
6	Duration of ventilator support	1 – 3 days	5	0	5.172	2	0.075 Not Significant
		4 – 6 days	20	0			
		More than 6 days	4	1			
7	Modes of ventilation	Volume control mode	13	0	0.791	1	0.567 Not Significant
		Assist control mode	16	1			
8	Associated conditions	Infections	2	0	0.842	4	0.887 Not Significant
		Anaemia	13	0			
		Alterations in chest wall movements	5	0			
		Inhalation of toxic substances	6	0			
		Others	3	1			

Table V: Demographic variables and post-test oxygenation score association in experimental group II. The above table showed that demographic variables like age, sex, occupation, smoking habits, alcohol use, duration of ventilator support, modes of ventilation, and associated conditions did not affect post-test oxygenation in experimental group II.

Discussion:

Here, we talk about the study's results and the literature that supports them, based on the study's goals.

The first objective of the study was to assess the level of oxygenation among patients with Acute Respiratory Distress Syndrome on ventilator in experimental group - I and experimental group – II.

Pre-test prone patients exhibited severe hypoxia in 80.0%. No one had mild hypoxia and 20% had moderate hypoxia. At pre-test, 18 (60.0%) of supine patients had severe hypoxia, whereas 12 (40.0%) had moderate hypoxia. None had moderate hypoxia. Most prone subjects (60.0%) showed mild hypoxia during post-test. None had severe hypoxia, although 40% had moderate hypoxia.At post-test, 96.7 % of supine patients had mild hypoxia, while 1.3% had moderate hypoxia. None had significant hypoxia.

Bajwa, AA, et al. (2010) studied automated prone positioning and axial rotation in critically sick, non-trauma patients with acute respiratory distress syndrome. Automated prone positioning and kinetic treatment were given to 17 acute respiratory distress syndrome patients. The mean ratio of PaO2 to FiO2 before prone positioning was 89.33 and rose to 224.92 after at least 30 minutes ($p < 0.05$), indicating that automated prone positioning using kinetic therapy is safe and effective for improving oxygenation in critically ill patients with acute respiratory distress syndrome. Hence, prone position improves oxygenation in ventilated ARDS patients more than supine position.[7]

Second objective of the study was to compare the effectiveness of prone position Vs supine position on level of oxygenation among patients with acute respiratory distress syndrome on ventilator in experimental group - I and experimental group – II.

Post-test mean and standard deviation Level of Oxygenation score was 6.57 + 1.598 in experimental group. Control group post-test mean and standard deviation were 5.67 + 1.155. mean difference score 0.9 The 58-degree independent "t" test score was 5.253. It was significant at 0.001. The following studies supported this investigation. **Chua, Ee; Zahir, Syed; Ng, Ka; Teoh, Wan; Hasan, Mohd; Ruslan, Shairil; Abosamak, Mohammed. (2021).** Compared prone and supine positions in COVID-19 patients: Oxygenation parameters—PaO2/FiO2, PaCO2, SpO2—were the main outcomes. Intubation and death were secondary outcomes. Results This review comprised 35 trials (1712 patients). Prone position significantly improved PaO2/FiO2 ratio and SpO2 compared to the supine group (study = 13, patients = 1002, MD 52.15, 95% CI 37.08 to 67.22; $p < 0.00001$). Prone position reduced mortality (studies = 5, patients = 688, Odd ratio, OR 0.44, 95% CI 0.24 to 0.80; $p = 0.007$). The supine and prone groups had similar intubation rates (studies = 5, patients = 626, OR 1.20, 95% CI 0.77 to 1.86; $p = 0.42$). Conclusion Prone position enhanced PaO2/FiO2 ratio and SpO2 in COVID-19 patients.[8]

Third objective of the present study was to associate the level of oxygenation among patients with acute respiratory distress syndrome on ventilator with their selected demographic variables in experimental group and experimental group – II.

In this investigation, age, sex, occupation, smoking habits, alcohol usage, duration of ventilator support, types of ventilation, and concomitant factors were not associated with post-test oxygenation in experimental group I and II.

This research did not support the previous findings. **Kalpana K (2011)** examined the effects of prone and supine positions on oxygenation in patients with acute respiratory distress syndrome on ventilators at selected hospitals in Salem. In experimental Group-I, oxygenation is related with smoking, alcoholism, and other conditions (prone). So, study hypothesis H2 is sustained, but experimental group-II shows no correlation between oxygenation and other conditions.[9]

Conclusion:

The study compared prone and supine positions for oxygenation in ventilated ARDS patients. The study found that supine improved oxygenation more than prone. To optimise oxygenation, critical care nurses must use positioning.

Source of Funding – Self

Ethical Permission – Obtained from Research Ethical Committee of Ved Nursing College – Panipat.

Conflict of Interest - Not a single possible or actual conflict of interest exists.

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