

# Effect of Nebulized Suctioning with 3% Hypertonic Saline for Mechanically Ventilated Patient on Airway Clearance

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## Abstract:

### ➤ Background:

Mechanical ventilation is an important life-saving technology. There are a number of related problems that contribute to the morbidity and mortality of patients receiving mechanical ventilation in intensive care unit. Therefore, it became vital to use the safest and most effective method of ventilation for the shortest possible duration. Hypertonic saline Nebulized suctioning has been used to strengthen lung clearance and reduce infection in intubated patients.

### ➤ Methods:

Quantitative evaluative approach of one group pretest posttest design was used to test the effectiveness of 3% hypertonic saline nebulized suctioning on airway clearance. Patients were selected by convenience sampling technique and sample consists of 30 mechanical ventilated patients in ICU PESIMSR at Andhra Pradesh. Semi structured interview schedule and modified bio- physiological parameters with arterial blood gas analysis scale were used. The level of airway clearance were recorded before and after administration of 3% hypertonic saline nebulized suctioning. Descriptive and Inferential statistics were used to investigate data collected in terms of policies.

### ➤ Results:

The analysis exhibits that, there was significant difference in mean value between pretest ( $7.96 \pm 2.93$ ) and posttest ( $2.74 \pm 2.93$ ). paired 't' calculated value was 8.46 greater than the table value, known to that there is an effectiveness of 3% hypertonic saline nebulisation on airway clearance among the patients connected with mechanical ventilator. The study suggests that the significant relationship between the post tests score with their selected demographic and clinical variables like gender, patient positioning during suctioning.

### ➤ Conclusion:

The study has shown that hypertonic saline nebulization is the cheap, safe, effective and easy way to maintain the airway patency of patients connected to artificial airway.

**Keywords:-** Hypertonic Saline Nebulized Suctioning, Mechanical Ventilation, Airway Clearance.

## I. INTRODUCTION

*“Prevention of disease in today is one of the most important issues in human effort.”*

Mechanical ventilation is one of the most common interventions in the ICU. It is a supportive intervention used until the basic problem of patient is resolved. A ventilator, or respirator, is a breathing machine that helps patient's breath when they are too sick to breathe on their own. The patient is connected to the ventilator via an endotracheal tube (a flexible plastic tube that is inserted into the mouth and then lowered into the trachea).

Mechanically ventilated patients may also have airway obstruction due to variety of conditions, including weakened expiratory muscles, ineffective cough, and decreased mucociliary function. This could lead to blockage of airway secretions, which may be especially tenacious due to conservative fluid management. Reducing the time of mechanical ventilation is a common ICU goal, because prolonged ventilation is associated with an increase in morbidity and mortality.

Airway management includes specific methods to validate the patent pathway between a patient's lungs and the external environment. A blocked airway means that there may be very less oxygen in the body. Humidification, nebulization and suctioning are three important steps for airway remodeling.

Airway clearance strategies (ACTs) have the potential to improve mucociliary removal through decreased mucous membranes and improve the elimination of secretions, as well as inflammatory cells and micro organ. In general; nebulization is performed using a prescribed medication to promote suctioning of secretions. However, addition of Nebulized hypertonic saline suctioning(HSS) has been shown to activate the effect of mucociliary removal with the help of reducing viscosity of mucus secretion, stimulating cilia pulse, and reducing airway edema and increasing its hydration there through secretion it's free. Hypertonic Saline Nebulized Suctioning is a concept to improve airway clearance and reduce the length of mechanical air flow, reducing the medical difficulty of an mechanically ventilated patient.

➤ *Need for the Study*

An increase in number of critically ill patients diagnosed in the year 2015 revealed that 4,312 patients were admitted in 300 intensive care units (ICUs) in 35 countries and more than half of patients 55% were mechanical ventilation during ICU admission (**Lance Patak, et al, 2015**). Therefore, it becomes the responsibility of the members of the health care team to develop a safe and patented approach for patients with mechanical ventilator to prevent complication.

➤ *Objectives of the Study*

- To assess the level of airway clearance among patients with mechanical ventilator.
- To evaluate the effectiveness of 3%hypertonic saline nebulization suctioning on airway clearance among patients connected with mechanical ventilator.
- To find out the association between post test score on 3% hypertonic saline nebulization suctioning on airway clearance between patients connected with mechanical ventilator on selected socio demographic variables and clinical variables.

## II. MATERIALS AND METHODOLOGY

Quantitative evaluative approach of one group pretest posttest design was used for the study to determine the effectiveness of 3% nebulized suctioning with hypertonic saline on airway clearance. The study was conducted in a ICU of PES Institute of Medical Science and research Kuppam,at Andhra Pradesh after obtaining necessary permits and moral clearance. Participants who completed the sampling criteria were selected by convenience sampling technique and sample contained of 30 patients with mechanically ventilated in ICU PESIMSR.

➤ *Tool Selection and Development:*

Semi structured interview schedule and modified bio-physiological parameters with arterial blood gas analysis scale was used. Tool consists of three sections.

- Section A: Contains an interview schedule for collecting socio-Demographic Variables
- Section B: Consist of interview schedule for collecting Clinical variables.
- Section C: Modified bio-physiological parameters with arterial blood gas analysis scale: The modified bio-physiological parameters with arterial blood gas analysis scale consisting of 7 items with a total score of 14.

### Scoring for the modified bio-physiological parameters with arterial blood gas analysis scale:

Score	Level of airway Interpretation
0	Normal
1-4	Mild
5-10	Moderate
11-14	Severe

Table 1

The final draft of modified bio- physiological parameters with arterial blood gas analysis scale was prepared after testing the reliability and validity.

➤ *Data collection Procedure:*

Following pretest, the experimental group received nebulization in the endotracheal tube using a nebulizer kit for 10-15 minutes with 2ml of 3% hypertonic saline, with a break of two times daily for three days. With pursued by endotracheal (ET) suctioning were performed approximately 10 to 20 seconds for a period of 2 hours at a time. Posttest was carried about 15 to 20 minutes after the procedure. Bio-physiological parameters measurements were obtained from a continuous hemodynamic monitor and reports ABG. Collected data was analyzed using descriptive (frequency distribution, mean and standard deviations) and inferential calculations (chi square test, paired test).

## III. RESULTS/DISCUSSION

With regard to demographic profile majority of data falls , on subject of age, 10(33%) of the patient age were between 41-50 years, 17(57%) patients were male, in accordance to education status 16(53%) of them had primary education, the data on education 8(27%) of them were private employee,18(60%) of them were Hindu, regarding income 12(40%) of them were earning 7000-9999 and marital status 24(80%) of them were married, In narrating the type of family, among the patients 12(40%) of them were belongs to nuclear family, 16(53%) of them were vegetarian. In addition to the distribution of clinical variable majority of data falls, distribution of patients according to history of chronic illness, 16(53%) of them had history of chronic disease and Reason for mechanical ventilation 14(46%) of them had renal disorder It is verified that to frequency of suctioning 13(43%) of them were suctioning every 2 hours and duration of mechanical ventilation 19(63%) of them were in mechanical ventilation in less than 21 days, concern to patient position during suctioning 18(60%) of them were in supine position frequency of nebulisation, among the patients 15(50%) of them were had nebulisation once a day.

➤ *Percentage distribution of Pre and Post test Level of airway clearance*

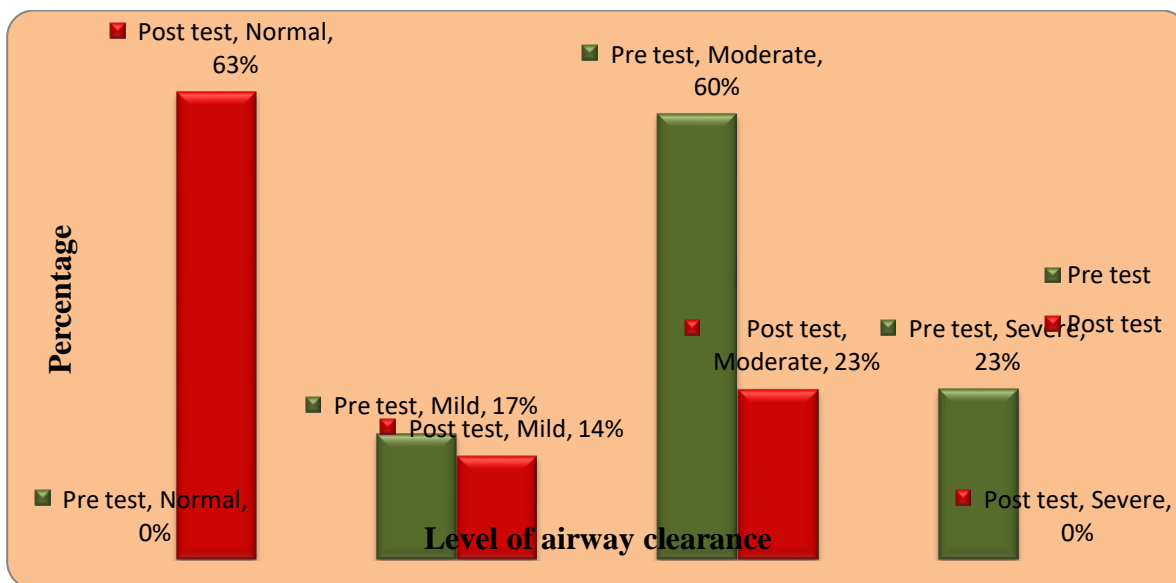


Fig 1

Figure represent the level of airway clearance, In pre(O<sub>1</sub>) and post(O<sub>2</sub>) test among 30 patient 5(17%)O<sub>1</sub>, 4(14%)O<sub>2</sub> of them had mild level, 18(60%)O<sub>1</sub>,7(23%)O<sub>2</sub> of them had moderate level, 7(23%)O<sub>1</sub>,0%O<sub>2</sub> of them had severe level and 0% O<sub>1</sub>,19(63%)O<sub>2</sub> of them in normal level.

➤ *Mean and standard deviation with pre and post test level of airway clearance among the patients connected to mechanical ventilator*

S. No.	Test	Mean	SD	't'	Table value
1	Pre test	7.96	3.34	8.46**	1.96
2	Post test	2.74	2.93		

\*\*p<0.01

Table 2

The calculated value of t was 8.46 which greater than table value, it is noted that there was a highly significant between pre and post test score.

➤ *Comparison of biophysiological parameters between pretest and post test. (N=30)*

Bio physiological parameters	Duration	Mean	SD	Paried 't' value P value
Heart rate	Pre test	110	12.354	1.734 0.092(NS)
	Post test	101	8.231	
Spo2	Pre test	97.01	1.927	2.934 0.007***
	Post test	98.83	1.654	
ETCO2	Pre test	48.91	5.320	1.018 3.122(NS)
	Post test	46.23	4.123	
ABG-pH	Pre test	8.195	0.115	1.458 0.156(NS)
	Post test	8.223	0.117	
ABG-PCO2	Pre test	49.564	5.90	1.198 0.533(NS)
	Post test	55.765	10.532	
ABG-PO2	Pre test	84.876	9.65	2.653 0.015*
	Post test	93.402	7.546	
ABG-HCO3	Pre test	21.76	6.003	0.076 0.565(NS)
	Post test	24.01	5.654	

NS=Non significant \*p<0.05\*\*p<0.01

Table 3

Data comparison within the study group showed statistically significant difference in the mean value of heart rate (pretest: 110; posttest: 101 at  $p < 0.001$ ); SpO<sub>2</sub> (pretest : 97.01; posttest : 98.83 at  $p < 0.001$ ); ABG-pH (pretest:48.91; posttest: 46.23 at  $p < 0.01$ ); Specialization of ABG-PCO<sub>2</sub>pretest: 49.564; posttest: 55.765 at  $p < 0.01$ ); Optional ABGPO<sub>2</sub> pretest:84.876; posttest:93.402 at  $p < 0.01$ );ABG-HCO<sub>3</sub>-(Pretest: 21.76; posttest: 24.01 at  $p < 0.001$ ).

➤ Association between Post test Level of Airway Clearance with Selected Demographic & Clinical Variables among the Patients Connected to Mechanical Ventilator

S. No.	Demographic variables / Clinical variable	N	Level of airway interpretation			Chi square
			Normal	Mild	Moderate	
1	<b>age in years</b>					6.11 Df=6,NS
	(1.1) 21 -30 yrs	4	2	1	1	
	(1.2) 31 -40 Yrs	8	4	2	2	
	(1.3) 41 – 50 Yrs	10	9	1	-	
2	(1.4) 51 – 60 Yrs	8	1	-	4	
	<b>Gender</b>					6.46 Df=2,S
	(2.1) Male	17	8	2	7	
	(2.2) Female	13	11	2	-	
3	<b>Occupational status</b>					8.56 Df=6,NS
	(3.1)Business	5	4	1	-	
	(3.2)Daily wages	8	3	2	3	
	(3.3) Unemployed	6	3	1	2	
	(3.4) Private	8	6	-	2	
4	(3.5)Government	3	3	-	-	
	<b>Income</b>					6.53 Df=8,NS
	(4.1)Rs. < 1,000	-	-	-	-	
	(4.2)Rs.1000 –Rs. 3999	2	1	1	-	
	(4.3)Rs.4000 –Rs. 6999	8	6	2	-	
(4.4)Rs.7000 –Rs. 9999	12	6	1	5		
5	(4.5)Rs. >10000	8	6	-	2	
	<b>Type of family</b>					6.74 Df=4,NS
	(5.1) Nuclear family	12	6	1	5	
	(5.2) Joint family	10	5	3	2	
(5.3) Extended family	8	8	-	-		
6	<b>Dietary pattern</b>					6.784 Df=4,NS
	(6.1) Vegetarian	16	10	4	2	
7	(6.2) Non vegetarian	14	9	-	5	
	<b>Personal habits</b>					8.43 Df=8 NS
	(7.1) Alcohol	2	1	-	1	
	(7.2) Smoking	10	5	3	2	
(7.3) Tobacco chewing	-s	-	-	-		
8	(7.4) No bad habits	18	13	1	4	
	<b>13) Reason for mechanical ventilation</b>					6.53 Df=8,NS
	(8.1) CNS Disorder	6	3	1	2	
	(8.2) Cardiac Disorder	8	5	2	1	
(8.3) Renal Disorder	14	11	-	3		
9	(8.4) Metabolic disorder	2	-	1	1	
	<b>14) Frequency of suctioning</b>					4.56 Df=4,NS
	(9.1)Every 2 <sup>nd</sup> hourly once	13	8	3	2	
(9.2) Every 4 <sup>th</sup> hourly once	8	5	1	2		
10	(9.3) Every 6 <sup>th</sup> hourly once	9	6	-	3	
	<b>15) Duration of mechanical ventilation</b>					3.14 Df=2,NS
	(10.1) One week	3	2	1	-	
(10.2) One month	22	16	2	4		
	(10.3) More than one month	5	1	1	3	

11	<b>16) Patient Position during suctioning</b> (11.1) supine <i>position</i> (11.2) semi-Fowler's <i>position</i>	18 12	11 8	3 1	4 3	6.57 Df=2,S
12	<b>Frequency of 533ebulization</b> (12.1) once a day (12.2) two times a day (12.3) three times a day (12.4) four times a day	15 6 9 -	10 3 6 -	2 1 1 -	3 2 2 -	8.53 Df=6,NS
13	<b>Type of mucous secretion</b> (13.1) thickening secretion (13.2) mild secretion (13.3) clear secretion	.14 13 3	12 7 -	2 1 1	- 5 2	8.74 Df=6,NS

Table 4

The study elicit that the significant association between the post tests score with their selected demographic and clinical variables like gender, patient positioning during suctioning.

❖ *Outcome:*

From the above findings, it is clear that the oxygen levels are enhanced by the intervention of Nebulized hypertonic saline suctioning to mechanically ventilated patient.

#### RECOMMENDATION ON THE STUDY

- A comparative study can be conducted.
- The research can be repeated in a larger sample to add to the findings.
- The study can be performed using 5% of hypertonic saline nebulized extracts among patients connected to a mechanical ventilator.

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