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Effectiveness of Suctioning with Hypertonic Saline Nebulization on Airway Clearance Among Patients at Selected Hospitals.

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Abstract: - One of the procedures that is most frequently performed in the ICU is mechanical ventilation. In addition to, a number of conditions, such as a weak cough, weak expiratory muscles and impaired mucociliary function can cause airway blockage in patients receiving manual ventilation1.

Hypertonic saline is a member of the mucolytic medication class. It's a briny concoction that says it hydrates the lung mucus first and the airway. Increasing airway hydration facilitates the extrusion of lung mucus from the respiratory tract. It facilitates increased lung mucus secretion from the respiratory tracts. This could help to maintain the health of your lungs and lower the incidence of respiratory infections4.

NEED OF STUDY:The majority of care settings, including acute care, sub-acute care, long-term care and residential settings, suction patients are done on a regular basis. When the patient is unable to clear the secretion from the respiratory system, suctioning is done. This can happen when there is an excessive amount of secretion production or insufficient clearance, which causes secretions to build up in the upper and lower respiratory system. This might result in an early obstruction of the efficient airflow. In the end, this results in decreased exchange of gases like oxygen and carbon dioxide, which are essential for ideal cellular performance11.

METHODOLOGY:The research methodology adopted for the study was quantitative research approach. The investigator used Quasi experimental, non-randomized, pre-test and post-test control group design. The study was based on the Wiedenbachs prescriptive theory. Accessible population selected for this study consisted, patients on mechanical ventilator and who are available during the study at selected hospitals. Sample size was 60 (experimental group 30 and control group 30) were selected as per inclusion criteria using non-probability convenience sampling technique.

RESULT:In experimental group, in pretest, 50% of the patients had very minimally cleared airway, 33.3% of them had minimally cleared airway and 16.7% of them had moderately cleared airway. In posttest, 13.3% of them had well cleared airway, 20%XV of them had moderately cleared airway and 66.7% of them had minimally cleared airway. In control group, in pretest, 46.7% of them the very minimally cleared airway, 20% of them had moderately cleared airway and 33.3% of them had minimally cleared airway. In posttest, 23.3% of them had moderately cleared airway, 56.7% of them had minimally cleared airway and 20% of them had very minimally cleared airway. This indicates that there is remarkably improvement in the airway clearance and ventilator associated pneumonia after the implementation of hypertonic saline nebulized suctioning.

Keywords: Hypertonic saline nebulization, suctioning, Airway clearance and observation tool.

INTRODUCTION:

Mechanical ventilation is one of the procedures that is the most commonly carried out in the ICU. In addition, airway obstruction can occur in manually ventilated patients due to a variety of issues, including an ineffective cough, frail expiratory muscles and poor mucociliary function[1].

The science of mechanical ventilation is essential for life preservation. Numerous medical conditions have an impact on the morbidity and mortality of patients receiving mechanical breathing in critical care facilities. Thus, the most rapid and efficient method of airflow was developed. Intubated patient's lung clearance has been strengthened and infection has been reduced using hypertonic salt water nebulized suctioning[2].

In comparison to a hypertonic solution, hypertonic salt water fluid has a smaller percentage of dissolved particles. An illustration of a hypertonic intravenous solution is 3% & 5% normal saline (NaCl) which dissolves the solute more readily in the intravascular region than in the cell when infused with hypotonic fluid[3].

Hypertonic saline belongs to a class of drugs called mucolytics. It is a salty solution that claims to hydrate the airway and then the lung mucus. Hydrating the airway aids in removing more lung mucus from the respiratory passages. It helps respiratory tracts to secret more mucus from the lungs. This may be helpful to keep your lungs healthy and decrease the number of respiratory infection[4].

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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[8].

NEED OF THE STUDY:

Hypertonic salt water is salty solution that aid to hydrate the airway and thin mucous in respiratory tract. Hydrating the airway helps the respiratory tract to remove the mucus from the lungs and reduce the number of respiratory infections[9].

Hypertonic saline treatment for pulmonary disease this will take about 10 minutes for the nebulizer to turn the strong salt solution into a mist that you can breathe. The nebulizer typically uses liquids with a concentration of 36 or 7%[10].

MATERIAL AND METHODS

The research methodology adopted for the study was quantitative research approach. The investigator used Quasi experimental, non-randomized, pre-test and post-test control group design. The study was based on the Wiedenbachs prescriptive theory. Accessible population selected for this study consisted, patients on mechanical ventilator and who are available during the study at selected hospitals. Sample size was 60 (experimental group 30 and control group 30) were selected as per inclusion criteria using non-probability convenience sampling technique

RESULTS:

Section I: Description of samples (patients) based on their personal characteristics.

Table 1.1: Description of samples (patients) based on their age n=30, 30

Demographic variable	**Experimental**		**Control**	
	Freq	**%**	**Freq**	**%**
Age				
31-40 years	0	0.0%	3	100.0%
41-50 years	3	100.0%	0	0.0%

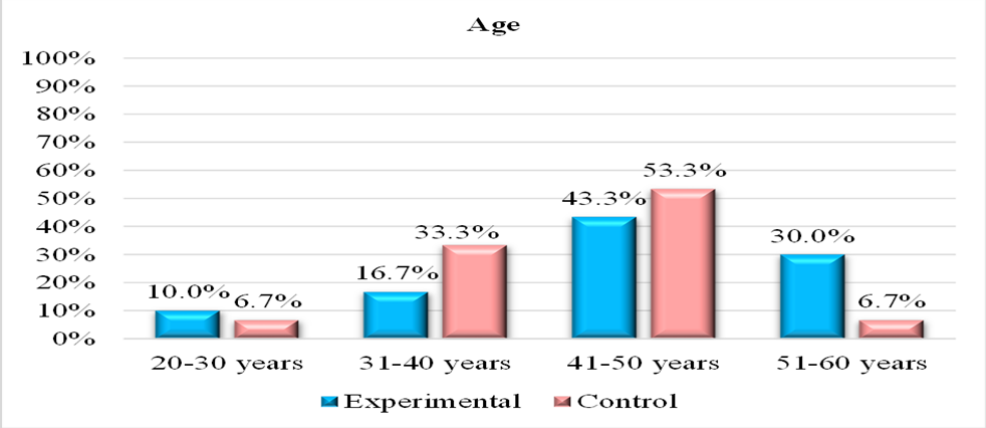

Figure No.4.1 Bar diagram showing percentage wise distribution of samples according to Age.

In the experimental group, 10% of the patients were aged 20-30 years, 16.7% of them were aged 31-40 years, 43.3% of them were aged 41-50 years and 30% of them were aged 51- 60 years. In the control group, 6.7% of the patients were aged 20-30 years, 33.3% of them were aged 31-40 years, 53.3% of them were aged 41-50 years and 6.7% of them were aged 51-60 years.

Table 1.2: Description of samples (patients) based on Gender

Demographic variable	Experimental		Control	
	Freq	%	Freq	%
Gender				
Male	2	66.70%	3	100.00%
Female	1	33.30%	0	0.00%

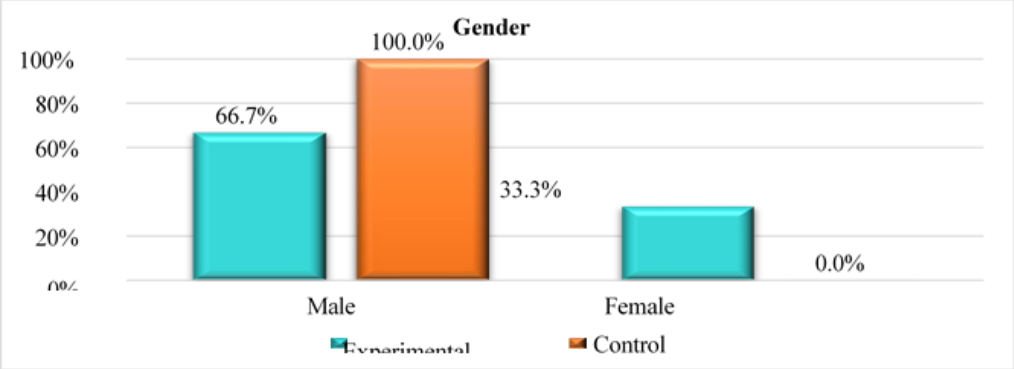

Fig No. 4.2 Bar diagram showing percentage wise distribution of sample according to gender

In experimental group, 46.7% of them were males and 53.3% of them were females. In control group, 43.3% of them were males and 56.7% of them were females.

Table 1.3: Description of samples (patients) based on Occupation

Demographic variable	Experimental		Control	
	Freq	%	Freq	%
Occupation				
Business	1	33.3%	0	0.0%
Private employee	1	33.3%	2	66.7%
Government employee	1	33.3%	1	33.3%

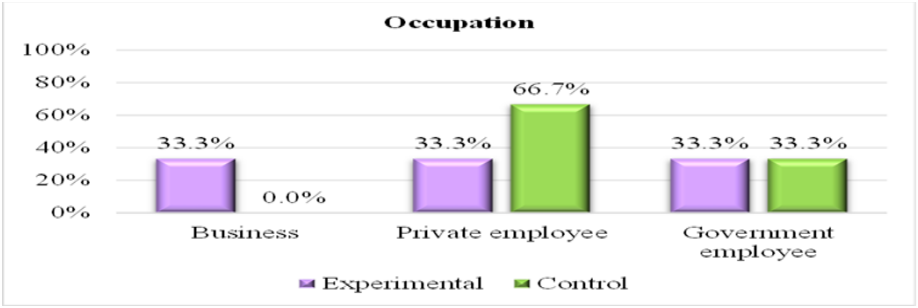

Fig no. 4.3 Bar diagram showing percentage wise distribution of samples according to occupation

In the experimental group, 23.3% of them had business, 20% of them had daily wages,10% of them were unemployed, 16.7% of them were private employees,23.3% of them were government employees and 6.7% of

them had some other occupation. In the control group, 3.3% of them had business, 16.7% of them had daily wages, 13.3% of them were unemployed, 26.7% of them were private employees, 33.3% of them were government employees and 6.7% of them had some other occupation.

Table 1.4: Description of samples (patients) based on Monthly Income

Demographic variable	Experimental		Control	
	Freq	%	Freq	%
Monthly Income				
Rs.21,000-40,000	2	66.7%	2	66.7%
Rs.41,000-60,000	1	33.3%	1	33.3%

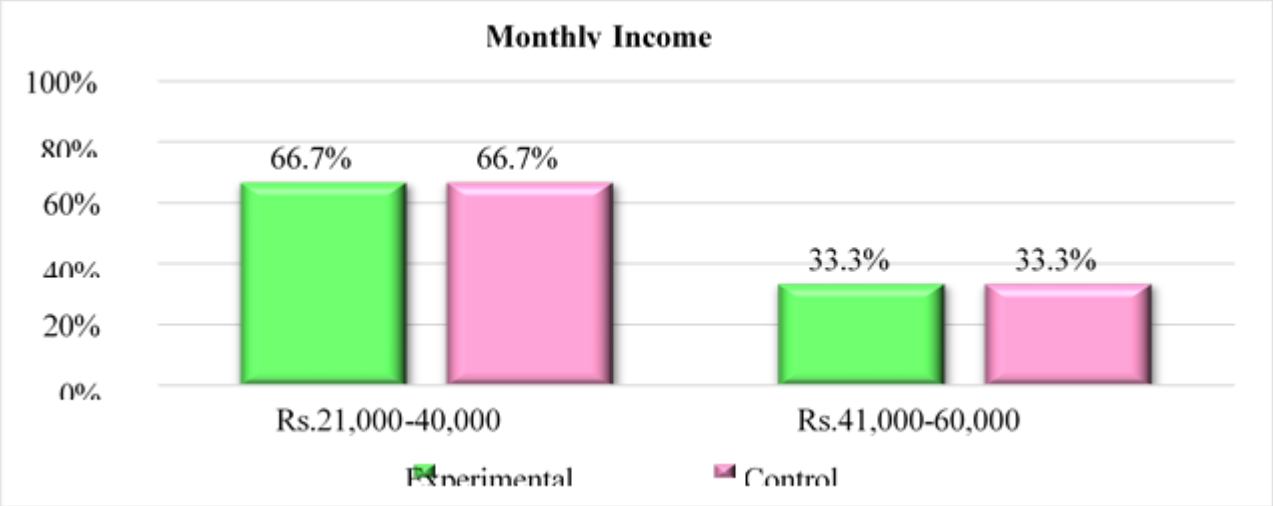

Fig No. 4.4 Bar Diagram showing percentage wise distribution of samples according to monthly income.

In the experimental group, 10% of them had monthly income up to Rs, 10000, 26.7% of them had monthly income Rs. 10001-20000, 20% of them had monthly income Rs.21000-40000, 26.7% of them had monthly income Rs. 41000-60000 and 16.7% of them had monthly income above Rs. 60000. In the control group, 6.7% of them had monthly income up to Rs, 10000, 30% of them had monthly income Rs. 10001-20000,23.3% of them had monthly income Rs. 21000-40000, 33.3% of them had monthly income Rs. 41000-60000 and 6.7% of them had monthly income above Rs. 60000.

Table 1.5: Description of samples (patients) based on Personal habits

Demographic variable	Experimental		Control	
	Freq	%	Freq	%
Personal habits				
Alcohol	1	33.30%	0	0.00%
Smoking	2	66.70%	0	0.00%
Tobacco chewing	0	0.00%	1	33.30%
Inappropriate habit	0	0.00%	1	33.30%
Others	0	0.00%	1	33.30%

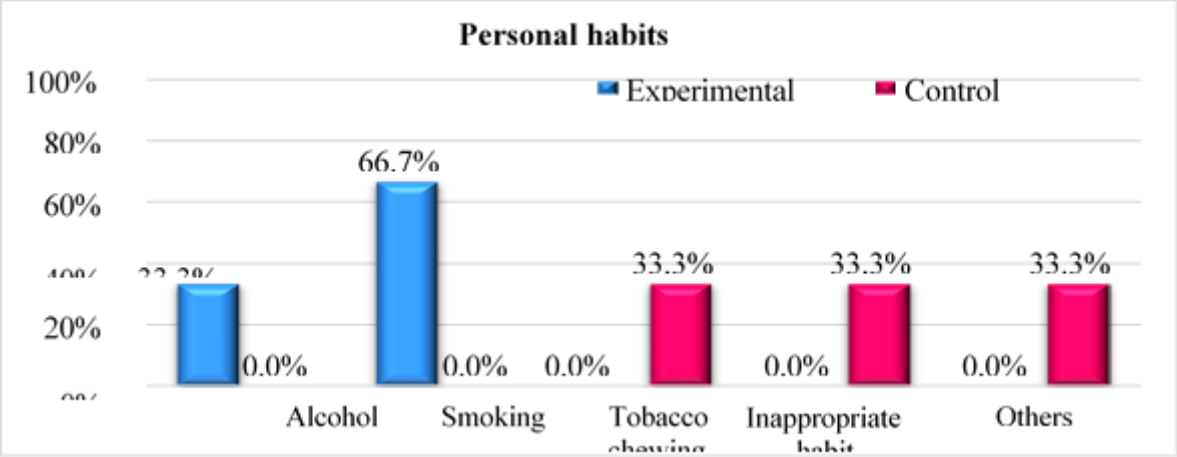

Fig. No. 4.5 bar diagram showing percentage wise distribution of samples according to personal habits

In experimental group, 33.3% of them had habit of alcohol and 66.7% of them had habit of smoking. In control group, 33.3% of them had habit of tobacco chewing, 33.3% of them had inappropriate habit and 33.3% of them had some other habit

Table 1.6: Description of samples (patients) based on diagnosis

Demographic variable	**Experimental**		**Control**	
	Freq	**%**	**Freq**	**%**
Diagnosis				
CNS Disorder	5	16.7%	0	0.0%
Cardiac disorder	4	13.3%	2	6.7%
Renal disorder	2	6.7%	6	20.0%
Metabolic disorder	6	20.0%	10	33.3%
Others	13	43.3%	12	40.0%

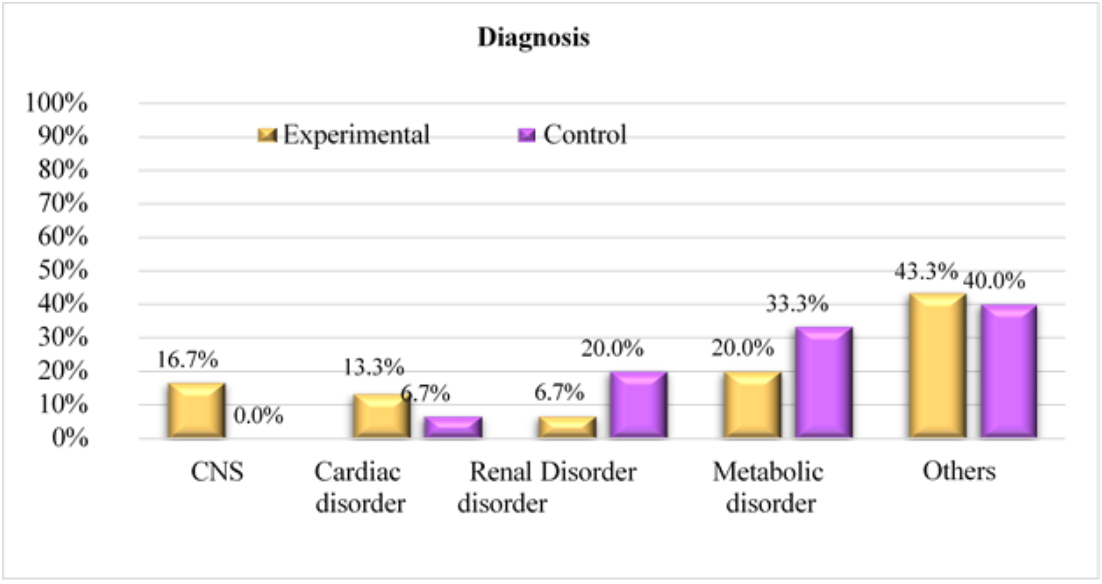

Fig. No. 4.6 Bar Diagram showing percentage wise distribution of samples according to Diagnosis.

In the experimental group, 16.7% of them had CNS disorders, 13.3% of them had cardiac disorders, 6.7% of them had renal disorders, 20% of them had metabolic disorder and 43.3% of them had some other diagnosis. In the control group, 6.7% of them had cardiac disorders, 20% of them had renal disorders, 33.3% of them had metabolic disorder and 40% of them had some other diagnosis.

Table 1.7: Description of samples (patients) based on their Frequency of suctioning,

Demographic variable	**Experimental**		**Control**	
	Freq	**%**	**Freq**	**%**
Frequency of suctioning				
Every 2 nd hourly once	12	40.0%	4	13.3%
Every 4 th hourly once	7	23.3%	15	50.0%
Every 6 th hourly once	6	20.0%	8	26.7%
Whenever required	5	16.7%	3	10.0%

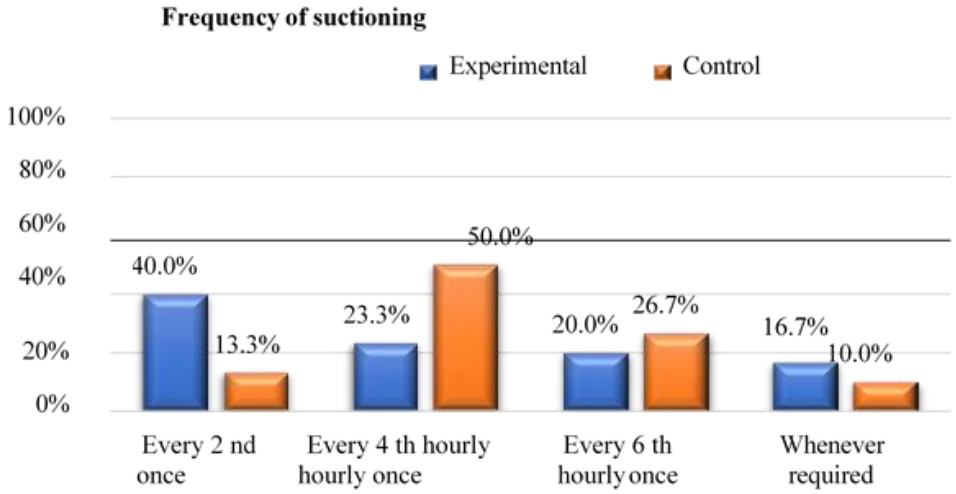

Figure No. 4.7 Bar diagram showing percentage wise distribution of samples according to Frequency of Suctioning.

In the experimental group, 40% of them had suctioning every second hour, 23.3% of them had suctioning every fourth hour, 20% of them had suctioning every sixth hour and 16.7% of them had suctioning whenever required. In the control group, 13.3% of them had suctioning every second hour, 50% of them had suctioning every fourth hour, 26.7% of them had suctioning every sixth hour and 10% of them had suctioning whenever required.

Table 1.8: Description of samples (patients) based on their Duration of Mechanical Ventilator,

Demographic variable	**Experimental**		**Control**	
	Freq	**%**	**Freq**	**%**
Duration of Mechanical Ventilator				
Less than one week	11	36.7%	16	53.3%

Less than one week	11	36.7%	16	53.3%
More than one week	7	23.3%	2	6.7%

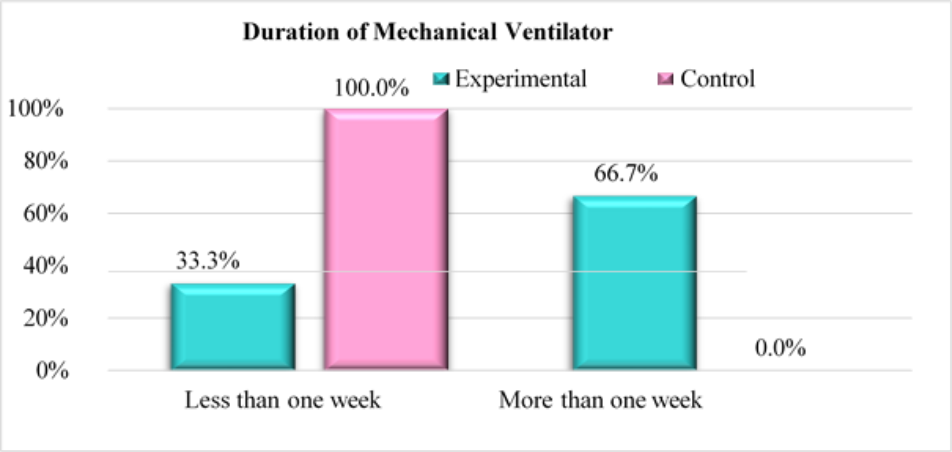

Fig. No. 4.8 Bar Diagram showing percentage wise distribution of sample duration of mechanical ventilator.

In the experimental group, 36.7% of them had mechanical ventilator for less than one week, 40% of them had mechanical ventilator for one week and 23.3% of them had mechanical ventilator for more than one week. In the control group, 53.3% of them had mechanical ventilator for less than one week, 40% of them had mechanical ventilator for one week and 6.7% of them had mechanical ventilator for more than one week.

Table1.9: Description of samples (patients) based on their Patient position during suctioning.

Demographic variable	**Experimental**		**Control**	
	Freq	**%**	**Freq**	**%**
Patient position during suctioning				
Semi -fowler position	30	100.00%	30	100.00%

In experimental and control group, all of them had semi fowler position during suctioning.

Table 1.10: Description of samples (patients) based on their Frequency of nebulization.

Demographic variable	**Experimental**		**Control**	
	Freq	**%**	**Freq**	**%**
Frequency of nebulization				
Once a day	0	0.00%	4	13.30%
Two times of day	11	36.70%	12	40.00%
Three times of day	11	36.70%	13	43.30%
Four times of day	6	20.00%	1	3.30%
More than four times a day	2	6.70%	0	0.00%

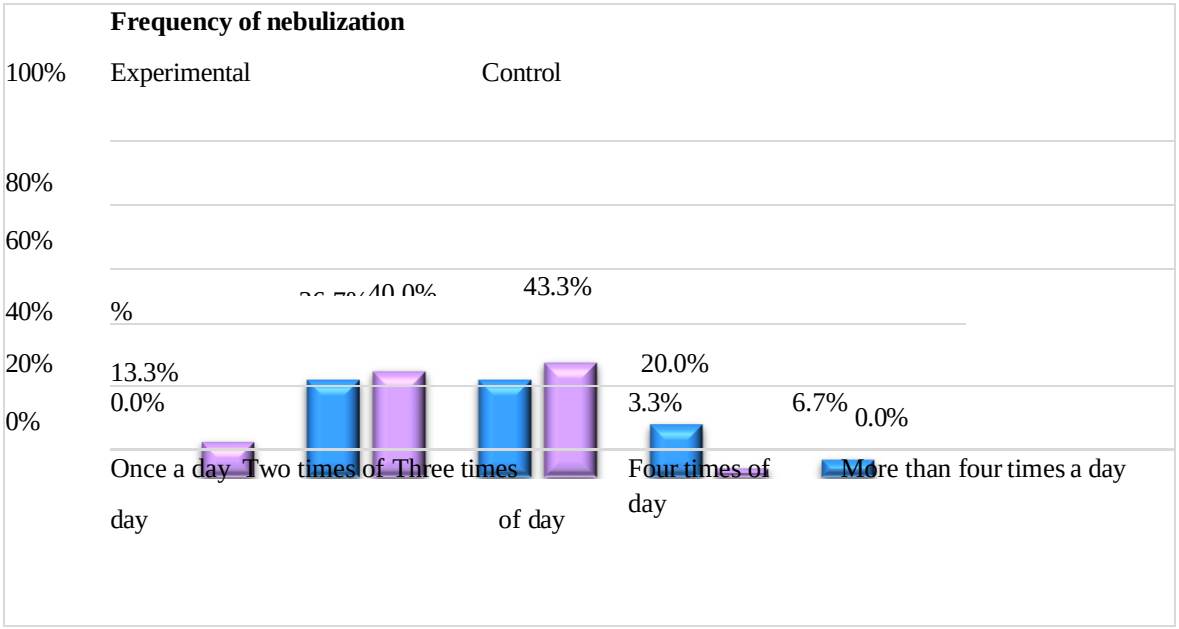

Fig No. 4.9 Bar Diagram showing percentage wise distribution of sample frequency of nebulization.

Section II: Analysis of data related to level of airway clearance among the patients on mechanical ventilator before implementation of hypertonic saline nebulized suctioning at selected hospitals.

Airway clearance	Experimental		Control	
	Freq	%	Freq	%
Well cleared	0	0.0%	0	0.0%
Moderately cleared	5	16.7%	6	20.0%
Minimally cleared	10	33.3%	10	33.3%
Very Minimally cleared	15	50.0%	14	46.7%

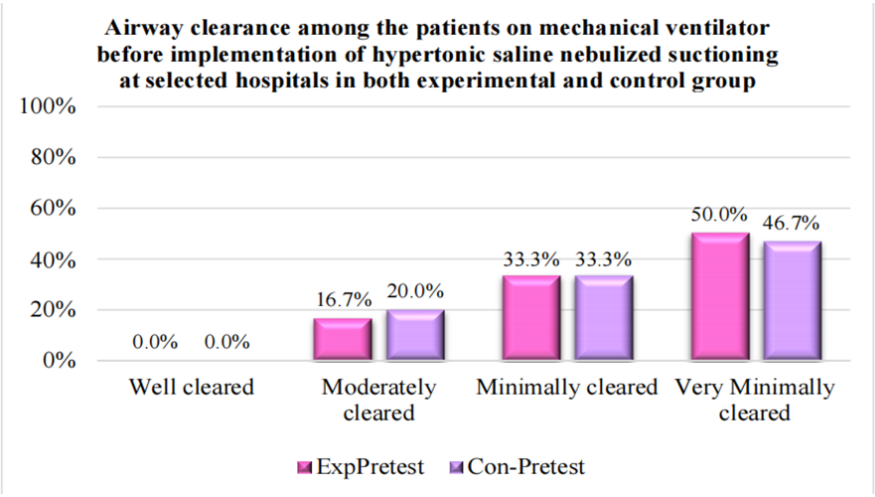

Figure No: 4.10. Bar diagram showing percentage wise distribution of airway clearance among the patients on mechanical ventilator before implementation of hypertonic saline nebulized suctioning.

In experimental group, 50% of the patients had very minimally cleared airway, 33.3% of them had minimally cleared airway and 16.7% of them had moderately cleared airway. In control group, 46.7% of them the very minimally cleared airway, 33.3% of them had minimally cleared airway and 20% of them had moderately cleared airway.

Section III: Analysis of data related to the effectiveness of suctioning with hypertonic saline nebulization on airway clearance among patients at selected hospitals.

Airway clearance	Experimental				Control			
	Pretest		Posttest		Pretest		Posttest	
	Fre q	%	Freq	%	Freq	%	Freq	%
Well cleared	0	0.0%	4	13.3%	0	0.0%	0	0.0%
Moderately cleared	5	16.7%	6	20.0%	6	20.0%	7	23.3%
Minimally cleared	10	33.3%	20	66.7%	10	33.3%	17	56.7%
Very Minimally cleared	15	50.0%	0	0.0%	14	46.7%	6	20.0%

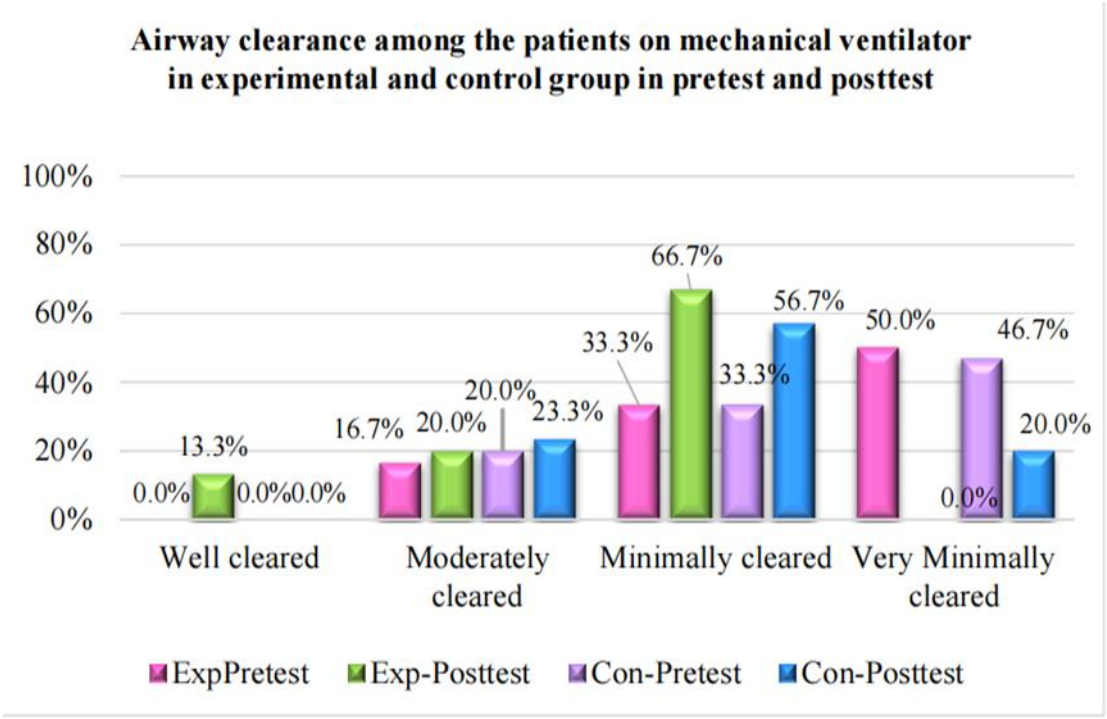

Figure No: 4.11. Bar diagram showing percentage wise distribution of Effectiveness of suctioning with hypertonic saline nebulization on airway clearance

In experimental group, in pretest, 50% of the patients had very minimally cleared airway, 33.3% of them had minimally cleared airway and 16.7% of them had moderately cleared airway. In post-test, 13.3% of them had well cleared airway, 20% of them had moderately cleared airway and 66.7% of them had minimally cleared airway. In control group, in pretest, 46.7% of them the very minimally cleared airway, 20% of them had moderately cleared airway and 33.3% of them had minimally cleared airway. In post-test, 23.3% of them had moderately cleared airway, 56.7% of them had minimally cleared airway and 20% of them had very minimally cleared airway. This

indicates that there is remarkably improvement in the airway clearance and ventilator associated pneumonia after the implementation of hypertonic saline nebulized suctioning.

Table 3.2: Paired t-test for the effectiveness of suctioning with hypertonic saline nebulization on airway clearance among patients at selected hospitals.

	Mean	SD	T	df	p-value
Pretest	16.9	3.7	21.6	29	0
Post-test	12.7	3.9			

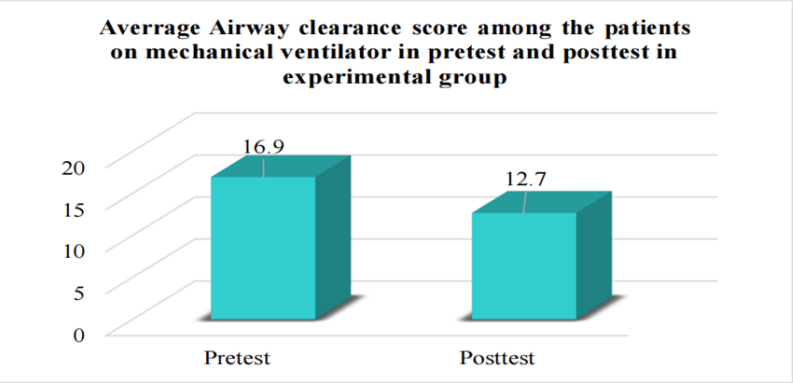

Figure no: 4.12. Bar diagram showing percentage wise distribution of average airway clearance score among the patients on mechanical ventilator in pretest and post test in experimental group

Researcher applied paired t-test for the effect of suctioning with hypertonic saline nebulization on airway clearance among patients at selected hospitals. Average airway clearance score was 16.9 in pretest which reduced to 12.7 in post-test. T-value for this test was 21.6 with 29 degrees of freedom. Corresponding p-value was small (less than 0.05), the null hypothesis is rejected. It is evident that the suctioning with hypertonic saline nebulization is significantly effective in improving the airway clearance.

Table:3.3. Two sample t-test for the comparison of change in airway clearance score in experimental and control group

Group	Mean	SD	T	df	p-value
Experimental	4.3	1.1	11.2	58	0.000
Control	1.2	1.0			

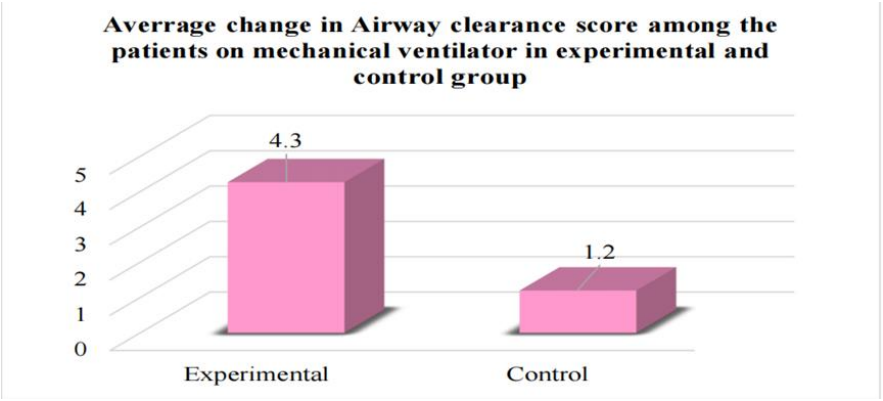

Figure no: 4.13. Bar diagram showing percentage wise distribution of average change in airway clearance score among the patient on mechanical ventilator in experimental and control group.

Researcher applied Two sample t-test for the comparison of change in airway clearance score in experimental and control group. Average change in airway clearance score was 4.3 in experimental group which was 1.2 in control group. T-value for this test was 11.2. with 58 degrees of freedom. Corresponding p-value was small (less than 0.05), the null hypothesis is rejected. It is evident that the suctioning with hypertonic saline nebulization is significantly effective in improving the airway clearance among the patients on mechanical ventilator.

Section IV

Analysis of data related to the association of airway clearance with selected demographic variables

Demographic variable		**Airway clearance**			**p-value**
		Minimally cleared	**Moderately cleared**	**Very minimally cleared**	
Age	20-30 years	1	4	0	**0.000**
	31-40 years	5	7	3	
	41-50 years	13	0	16	
	51-60 years	1	0	10	
Gender	Male	10	7	10	**0.231**
	Female	10	4	19	
Occupation	Business	3	0	5	**0.064**
	Daily wages	5	3	3	
	Unemployed	2	3	2	
	Private	4	4	5	
	Government employee	4	0	13	
	Other	2	1	1	
Monthly Income	Rs. < 1,0000	1	3	1	**0.001**
	Rs.10001- 20,000	7	7	3	
	Rs. 21,000-40,000	6	1	6	
	Rs.41,000-60,000	5	0	13	
	> Rs. 60,000	1	0	6	

Personal habits	Alcohol	0	0	2	**0.012**
	Smoking	5	1	9	
	Tobacco chewing	3	0	6	
	Inappropriate habit	4	0	7	
	Others	8	10	5	
Diagnosis	CNS Disorder	1	1	3	**0.000**
	Cardiac disorder	1	0	5	
	Renal disorder	4	2	2	
	Metabolic disorder	1	0	15	
	Others	13	8	4	
Frequency of suctioning	Every 2 nd hourly once	6	1	9	0.026
	Every 4 th hourly once	6	2	14	
	Every 6 th hourly once	7	5	2	
	Whenever required	1	3	4	
	One week	10	9	8	0.042
Duration of Mechanica l Ventilator	One month	7	2	15	
	More than one week	3	0	6	
Frequency of nebulizatio n	Once a day	0	4	0	0.000
	Two times of day	13	6	4	
	Three times of day	6	1	17	
	Four times of day	1	0	6	
	More than four times a day	0	0	2	

Fisher's exact test is used to find an association between study findings of airway with demographic variables.

Since p-values corresponding to age, monthly income, personal habits, diagnosis, frequency of suctioning, duration of mechanical ventilator and frequency of nebulization were small (less than 0.05), hence found to have significant association with the airway clearance.

DISCUSSION:

Any research study cannot be considered complete till the research findings have been propagated among concerned fraternity and other significant people. This chapter deals with summary of findings, discussion, conclusion, implications, and recommendations of the study. The study was conducted with the purpose to Effectiveness of suctioning with hypertonic saline nebulization on airway clearance among patients at selected hospitals. At the starting of the data collection, the study was discussed with samples. Samples were selected according to the inclusion criteria and exclusion criteria. Explained the purpose of the study and assured about confidentiality of the information between the investigator and the respondent. Before Data Collection the consent was taken from the patients. Data was collected from 60 samples from selected hospitals of city.

CONCLUSION

The aim of the study was to assess the Effectiveness of suctioning with hypertonic saline nebulization on airway clearance among patients at selected hospitals. The study made use of Quasi experimental, pretest posttest control group research design. The study population consisted of patients on mechanical ventilator at selected hospitals. Total 60 samples were taken with non-probability convenience sampling technique. For generating necessary data, Content validation was done by 13 experts from different field.

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