A STUDY TO ASSESS THE EFFECTIVENESS OF VENTILATOR BUNDLE ON PREVENTION OF VENTILATOR ASSOCIATED PNEUMONIA AMONG PATIENTS ON MECHANICAL VENTILATOR AT SELECTED HOSPITALS

Mrs. Kumud Rajendrakumar Mecwan
PhD Scholar
Malwanchal University,
Department of Nursing Index city,
Nemawar Rd Indore,
Madhya Pradesh, India

ABSTRACT

Background:

The respiratory system allows for the inhalation of gases such as oxygen in the air which can then be transported by the blood around the body to supply tissues and cells, and the exhalation of waste gases such as carbon dioxide into the air. The goals of the respiration are to provide oxygen to tissues and to remove carbon dioxide. The physiology of respiration involves the following three processes: 1) ventilation, or the movement of air between the atmosphere and the alveoli 2) diffusion of oxygen and carbon dioxide between the pulmonary capillaries and the alveoli and 3) transport of oxygen and carbon dioxide in the blood to and from the 2 cells. During ventilation, the movement of air into the lungs is known as inhalation and the movement of air out of the lungs is known as exhalation.

Objectives:

1. To assess the ventilator associated pneumonia among patients on mechanical ventilator in experimental and control group.

2. To evaluate the effectiveness of ventilator bundle on prevention of ventilator associated pneumonia among patients on mechanical ventilator in experimental group and control group.

3. To associate the post test score on prevention of ventilator associated pneumonia among patients on mechanical ventilator with their selected demographic variables in experimental and control group.

Methodology:

The research approach was used for the study was quantitative evaluative approach and the research design was Quasi experimental posttest only design. 40 patients on mechanical ventilator in that 20 patients in experimental and 20 patients in control group were selected for this study by using non probability convenience sampling techniques. Data was collected with the help of semi structured interview schedule. Descriptive statistics (frequency, percentage, mean, standard deviation) and inferential statistics (chi-square test).

Major findings of the study:

The findings revealed that in experimental group 6(30%) of them were in 21- 30 years and in control group 7(35%) of them were between 51- 60 years of age. Majority of the patients in experimental 14(70%) and control 15(75%) group were male. Most of the patients in experimental 9(45%) and control group 7(35%) were ventilated due to CNS Disease problems. Most of the patients had undergone 2nd hourly suctioning in experimental group 12(60%) where as in control group 8(40%) patients had undergone 3rd hourly suctioning. Half of the patients in experimental 10(50%) and control group 11(55%) had the history of smoking habit. During the post test, in experimental group 5(25%) patients did not develop infection, 11(55%) patients had mild infection and 4(20%) patients have severe infection. In control group 7(35%) patients had mild infection and 13(65%) patients had severe infection. In experimental group the post test mean score was 1.7±1.04 and in control group the post test mean score was 2.95±1.76. The mean difference was 31. The calculated 't' value

was 5.20 which was greater than the table value 2.02, significant at p ≤ 0.05 level.

Conclusion:

Hence the research hypothesis H1 was retained. There was no association in experimental and control group on prevention of ventilator associated pneumonia with their selected demographic variables. This shows that the ventilator bundle was effective in preventing the ventilator associated pneumonia among patients on mechanical ventilator.

Key worlds:

VAP: Ventilator Associated Pneumonia , CPIS: Clinical Pulmonary Infection Score, ABG: Arterial Blood Gas, ICU: Intensive Care Unit, SICU: Surgical Intensive Care Unit, IMCU: Intensive Medical Care Unit, ARDS: Acute Respiratory Distress Syndrome, COPD: Chronic Obstructive Pulmonary Disease, ETT : Endotracheal Tube, CDC Centre for Disease Control And Prevention, WHO: World Health Organization, NHSH: National Healthcare Safety Network CNS Central Nervous System.

Introduction:

Our body needs a constant supply of oxygen to support the body's metabolism. Respiration is one of the processes needed for survival and also provides the necessary energy for carrying on all essential life processes. It is the process by which an organism exchanges gases with its environment. The respiratory tract is the path of air from the nose to the lungs. It is divided into two sections: Upper Respiratory Tract and the Lower Respiratory Tract. Included in the upper respiratory tract are the Nostrils, Nasal Cavities, Pharynx, Epiglottis, and the Larynx. The lower respiratory tract consists of the Trachea, Bronchi, Bronchioles, and the Lungs. The organs of the respiratory system make sure that oxygen enters our bodies and carbon dioxide leaves our bodies. The respiratory system plays a vital role in the inhalation and exhalation of respiratory gases in the human body. Lung and breathing problems are common and 5th leading cause of death in world wide. In India, the respiratory disorder stands in the 3 rd place including chronic obstructive pulmonary disorders, asthma, pneumonia, tuberculosis, interstitial lung diseases etc. When a patient is unable to maintain a patent airway, adequate gas exchange or both, more invasive support with intubation and mechanical ventilation is needed to save the life of patient. Mechanical ventilation is a method to mechanically assist or replace spontaneous breathing. It is also the process of a using of an apparatus to facilitate the transport of oxygen and carbon dioxide between the atmosphere and the alveoli for the purpose of enhancing pulmonary gas exchange.

REVIEW OF LITERATURE:

M.V.Pravin Charles, et.al, 2013, A prospective study was conducted at a tertiary care teaching hospital in Mahatma Gandhi Medical College and Research 17 Institute, Pondicherry for finding out the incidence and risk factors associated with VAP. Patients who were on mechanical ventilation (MV) were monitored at frequent intervals for development of VAP using clinical pulmonary infection score. The results showed that out of the 76 patients, 18 (23.7%) developed VAP during their ICU stay. The incidence of VAP was 53.25 per 1,000 ventilator days. About 94% of VAP cases occurred within the first week of MV. Early-onset and late-onset VAP was observed in 72.2% and 27.8% cases respectively. Pseudomonas aeruginosa (33.3%) was the most common organism isolated from VAP patients. It

was followed by Klebsiella pneumoniae (20.8%), Staphylococcus aureus (8.3%), Candida albicans (8.3%), Escherichia coli (8.3%), and Acinetobacter baumannii (4.2%).

Yogesh Harde, 2013, A prospective study was done by Jawaharlal Institute of Post Graduate Medical Education and Research (JIPMER) Hospital in Pondicherry, to determine the incidence and the risk factors for development of VAP among mechanically ventilated patients. In this study the incidence of VAP was 30.67 and 15.87 in the two different ICUs and 58.3% of the cases were early -onset VAP, while 41.7% were late -onset VAP. The study identifies the risk factors for VAP include impaired consciousness, improper suctioning, tracheostomy, re-intubation, emergency intubation, and nasogastric tube feeding. The most common organism was Acinetobactor Baumanni, followed by Enterobacteracae. Early VAP was caused by Enterobacteracae and Acinetobactor causing late VAP. The study concluded that CPIS score can be a fairly good method to diagnose VAP in critically ill patients, when used reasonably and at the same time can help to restrict unnecessary antibiotic use.

Bukhari.S.Z, 2012, A prospective longitudinal study was conducted on adult intensive care unit (ICU) patients at Hera General Hospital, Makah, Kingdom of Saudi Arabia. The aim of the study was to reduce ventilator associated pneumonia (VAP) incidence rate, lessen the cost of care, and correlate Ventilator bundle compliance with VAP incidence rate. VAP prevention bundle applied was: head-of-bed elevation; daily sedation-vacation along with a readiness-to-wean assessment; closed system suctioning; and deep venous thrombosis (DVT) prophylaxis. The results showed that the VAP incidence decreases from 26.3% to 10.2%. A significant correlation was found between the VAP rate and its bundle compliance ($p \leq 0.05$). Most frequent pathogens found were Pseudomonas aeruginosa (30.8% of all isolates) 23 followed by Acinetobacter baumannii (27.7%), and methicillin-resistant Staphylococcus aureus (15.4%). The study concludes that the application of VAP prevention bundle reduced the VAP incidence rate and lowered the cost of care

Raquel Martinez-Reviejo & Sofia Tejada (2023), Ventilator-associated pneumonia (VAP) represents one of the most common intensive care unit (ICU)-acquired infections in patients requiring mechanical ventilation (MV) for at least 48 hrs. A systematic review and meta-analysis were performed. Randomized controlled trials and controlled observational studies of adults undergoing mechanical ventilation (MV) for at least 48 h were considered for inclusion. Outcomes of interest were the number of VAP episodes, duration of MV, hospital and intensive care unit (ICU) length of stay, and mortality. A systematic search was conducted in the MEDLINE, the Cochrane Library, and the Web of Science between 1985 and 2022. Results are reported as odds ratio (OR) or mean difference (MD) with 95% confidence intervals (CI). Thirty-six studies including 116,873 MV participants met the inclusion criteria. A total of 84,031 participants underwent care bundles for VAP prevention. The most reported component of the ventilator bundle was head-of-bed

elevation (*n*=83,146), followed by oral care (*n*=80,787). A reduction in the number of VAP episodes was observed among those receiving ventilator care bundles, compared with the non-care bundle group (OR=0.42, 95% CI: 0.33, 0.54). Additionally, the implementation of care bundles decreased the duration of MV (MD=−0.59, 95% CI: −1.03, −0.15) and hospital length of stay (MD=−1.24, 95% CI: −2.30, −0.18) in studies where educational activities were part of the bundle. The implementation of ventilator care bundles reduced the number of VAP episodes and the duration of MV in adult ICUs. Their application in combination with educational activities seemed to improve clinical outcomes.

METHODOLOGY:

The study was carried out in Be Well Hospital and Erode Emergency & Critical Care Hospital, Erode. Be Well Hospital is equipped with 100 beds and it has various departments like ICU, NICU, TRAUMA Ward, Emergency Department and IMCU. Be Well Hospital is about 15 km away from hospital. The monthly census report of patient with mechanical ventilator in ICU is 40-50, whereas Erode Emergency & Critical Care Hospital is equipped with 100 bedded multi-specialty hospital and it has various departments like Cardiac ICU, Emergency unit, Surgical ICU, NICU & Medical ICU.

Sampling:

The investigator selected these two hospitals by using non probability convenience sampling technique and also based on the availability of the sample and feasibility of the study.

Inclusion Criteria:

- Patients with age group between 20 – 60 years.
- Patients who receive mechanical ventilation.
- Both male and female patients.

Data Collection Procedure:

The data was collected for a period of 4 weeks in Be Well Hospital and Erode Emergency & Critical Care Hospital, Erode, those who fulfilled the inclusion criteria. Out of 40 patients on mechanical ventilator, 20 patients were selected from Be Well Hospital as experimental group and 20 patients were selected from Erode Emergency & Critical Care Hospital to control group by using Non probability convenience sampling techniques. Immediately after Endotracheal Intubation, ventilator bundle was provided to the patient for 3 days to the experimental group. Post test assessment was done on the 4th day for both experimental group and control group by using modified Clinical Pulmonary Infection Score (CPIS).

DATA ANALYSIS & INTERPRETATION

The collected data was tabulated, organized and analysed by using descriptive and inferential statistics.

Section- A: Distribution of patients according to their Demographic variables.

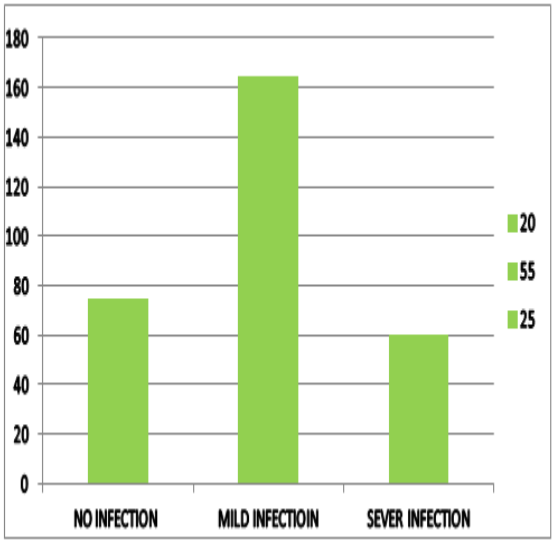
Section-B: a. Distribution of patients according to the post test score on prevention of Ventilator Associated Pneumonia in Experimental group. b.

Distribution of patients according to post test score on prevention of Ventilator Associated Pneumonia in Control group.

Section-C: a. Comparison of post test score on prevention of Ventilator Associated Pneumonia among patients on mechanical ventilator in experimental and control group. b. Mean, Standard Deviation and Mean difference on prevention of Ventilator Associated Pneumonia among patients on mechanical ventilator in experimental & control group

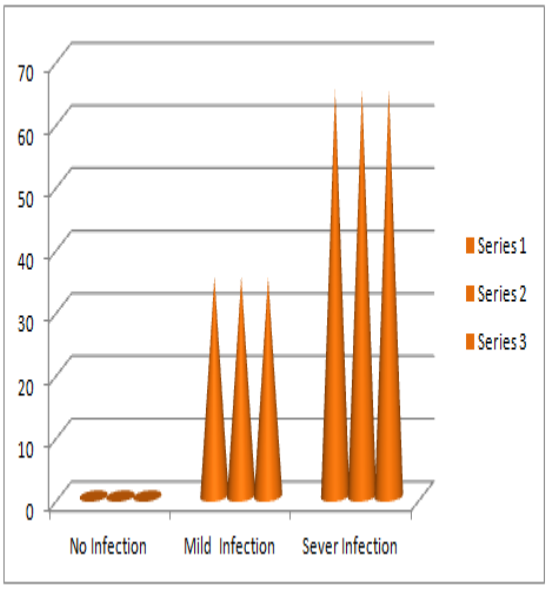
Section-D: a. Effectiveness of Ventilator bundle on prevention of Ventilator Associated Pneumonia among patients on mechanical ventilator in experimental group. b. Association between prevention of Ventilator Associated Pneumonia among patients on mechanical ventilator in experimental & control group with their selected Demographic variables.

Distribution of patients according to Post Test Score on prevention of Ventilator Associated Pneumonia in Experimental group.



Percentage distribution of patients according to post test score on prevention of Ventilator Associated Pneumonia in Experimental group. The above bar diagram shows that in experimental group 5(25%) patients on mechanical ventilator have no infection, 11(55%) patients on mechanical ventilator have mild infection and 4(20%) patients on mechanical ventilator have severe infection.

Distribution of patients according to Post Test Score on prevention of Ventilator Associated Pneumonia in Control group.



Percentage distribution of patients according to post test score on prevention of Ventilator Associated Pneumonia in Control group. The above bar diagram shows that in control group 7(35%) patients on mechanical ventilator have mild infection and 13(65%) patients on mechanical ventilator have severe infection.

Mean, Standard Deviation and Mean percentage of Post test Score on Prevention of Ventilator Associated Pneumonia among Patients on Mechanical Ventilator in Experimental and Control group.

Groups	Maximum Score	Post test			Difference in Mean%
		Mean	SD	Mean%	
Experimental group	5	1.7	1.04	28	31
Control group	5	2.95	1.76	59	

shows that in experimental group the post test mean score is 1.7±1.04 and the mean percentage is 28. In control group the post test mean score is 2.95±1.76 and mean percentage is 59. The difference in mean percentage is 31. The mean difference shows that, the ventilator bundle reduces the development of ventilator associated pneumonia in experimental group.

prevention of ventilator associated pneumonia among patients on mechanical ventilator with their selected demographic variables. The 't' test is used to evaluate the effectiveness of ventilator bundle on prevention of ventilator associated pneumonia among patients on mechanical ventilator. The chi- square test is used to find out the association between the post test score on prevention of ventilator associated pneumonia with their selected demographic variables. The result shows that ventilator bundle is effective in preventing ventilator associated pneumonia among patients on mechanical ventilator.

Result:

In experimental group 6(30%) patients were between the age group of 20 – 30 years and in control group 7(35%) patients were between the age group of 51 – 60 years. ϖ Majority of the patients in experimental 14(70%) group and in control 15(75%) group were male. ϖ In experimental and control group 9(45%) and 7(35%) patients were ventilated due to CNS Disease problems respectively. Most of the patients had undergone 2nd hourly suctioning in experimental group 12(60%) and in control group 8(40%) patients had undergone 3rd hourly suctioning. ϖ Half of the patients in experimental group 10(50%) and in control group 11(55%) had the history of smoking habit. In experimental group 5(25%) patients had no infection, 11(55%) patients had mild infection and 4(20%) had severe infection. In control group 7(35%) had mild infection and 13(65%) patients had severe infection. ϖ In experimental group mean score was 1.7 ± 1.04 and in control group mean score was 2.95 ± 1.76, the mean percentage of experimental group was 28% and control group was 59%. The mean difference was 31. ϖ In experimental and control group the mean score was 1.7 ± 1.04 and 2.95 ± 1.76 respectively. The 't' value was 5.20 which is significant, at $p \leq 0.05$ level. Hence H1 was retained. Thus, it become evident that ventilator bundle was effective in preventing the ventilator associated pneumonia. ϖ There was no association in experimental and control group on prevention of ventilator associated pneumonia with their selected demographic variables 50 such as age, sex, reason for mechanical ventilation, frequency of suctioning, and history of smoking. Hence H2 was rejected among patients on mechanical ventilator with their selected demographic variables at $p \geq 0.05$ level.

Conclusion:

The study was done to evaluate the effectiveness of ventilator bundle on prevention of ventilator associated pneumonia among patients on mechanical ventilator at selected hospitals, Erode. The result of this study showed that ventilator bundle was effective in preventing the ventilator associated pneumonia among patients on mechanical ventilator in experimental group. There was no association found between the prevention of ventilator associated pneumonia with the selected demographic variables in experimental and control group. Hence research hypothesis H2 was rejected at $p \geq 0.05$ level.

Recommendations:

- *A similar study can be conducted with large group. ϖ A similar study can be conducted in various settings to identify the factors influencing ventilator associated pneumonia.*
- *A comparative study can be done to determine the effectiveness of closed suctioning system versus open suctioning system on preventing the ventilator associated pneumonia.*
- *A comparative study can be done to determine the effectiveness of closed system suctioning versus supraglottic suctioning of endotracheal tube on prevention of ventilator associated pneumonia.*
- *A comparative study can be done to determine the effectiveness of qualitative and quantitative aspiration of tracheal secretion on ventilator associated pneumonia.*

BIBLIOGRAPHY

- *Arlene, L, Polaski. (2010). "Core principle and practice of Medical Surgical Nursing". (2nd edition). Haryna: Elsevier Publication.*
- *Barbara, K, Timby. Nancy, E. Smith. (2007). "Introduction to Medical Surgical Nursing". (9th edition). Philadelphia: Lippincott Williams and Wilkin.*
- *Black Joyce M. & Jane Hokanson Hawks. (2005). "Medical Surgical Nursing". (7 th edition). Philadelphia: W.B.Saunders Company.*
- *Brunner and Suddarth. (2013). "Medical surgical Nursing". (12th edition). Philadelphia: Lippincott Williams and Wilkins.*
- *Asoka Gunaratne. (2010). "An audit on ventilator associated pneumonia in the Intensive Care Unit". International Journal of Anesthesia, Pain & Intensive care, 47, 128-132.*
- *Cook, et al. (2008). Endotracheal Suction: A systemic Review. Volume 14.124- 136. http://www.actamedcolomb.org.co*