

Efficiency of Nursing Care Package on Expected Outcome in Prevention of Ventilator-Associated Pneumonia among Ventilated Clients in ETCM Hospital Kolar

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Abstract

Pneumonia has accounted for approximately 15 percent of all hospital-associated infections and 27 percent and 24 percent of all infections acquired in the medical intensive-care unit (ICU) and coronary care unit, respectively. It has been the second most common hospital-associated infection after that of the urinary tract. Because of this tremendous risk, in the last two decades, most of the research on hospital-associated pneumonia has focused on ventilator-associated pneumonia. This study was aimed to assess efficiency of nursing care package on expected outcome regarding prevention of ventilator associated pneumonia among ventilated clients. A quantitative research approach with quasi experimental research design with pre-and post-test with equivalent control group design was used to carry out the study. Ventilated clients from selected hospitals who were fulfilling the inclusion criteria were selected by using non-probability convenient sampling technique. Total 40 (20 experimental and 20 control group) size sample was included in the study. In experimental group, majority (50%) had mild infection and only 15 percent had no infection in pre-test; in post-test majority (75%) had no infection and only 25 percent had mild infection and no patient had severe infection. It showed that delivery of nursing care package is effective in decreasing ventilator associated pneumonia. In control group, majority (50%) had mild infection and only 10 percent had no infection in pre-test and in post-test majority (40%) had mild infection and 60 percent had severe infection and no patient had severe infection. As nursing care package was not delivered, the infected cases increased. The efficiency of nursing care package on expected outcome regarding prevention of ventilator-associated pneumonia between experimental groups was statistically significant and in control group it was not significant. The delivered nursing care package on ventilator-associated pneumonia among ventilated clients proved its beneficial effects in controlling infection level and preventing ventilator-associated pneumonia at intensive care units. This study confirmed that nursing care package for ventilated clients can prevent infection and cut short long stay in intensive care units.

Key words: Nursing care package; expected outcome; ventilator-associated pneumonia

Pulmonary and respiratory disorders are the world's fifth greatest cause of mortality. The third largest air problem in India was chronic pulmonary obstruction, asthma, pneumonia, TB, interstitial lung illnesses, and many other ailments. In the absence of a patent airway, sufficient gas replaces or together, a patient needs more intrusive assistance with installation and automatic breathing to save a patient's life. Mechanical ventilation is a way of assisting or replacing spontaneous breathing artificially. The method is also to use a system to enhance movement between the air and the alveoli of oxygen and carbon dioxide with the

aim of strengthening the pulmonary gas exchange. The earliest description of mechanical ventilation was by Roman physician Galen. Mechanical airing is shown when the impulsive ventilation of the patient is insufficient to sustain life. It is indicated for physiological or clinical reasons. Physiological goals include promoting the exchange of cardio-pulmonary gas and raising pulmonary volume.

Pneumonia in the critical care unit is the most frequently acquired hospital infection. A ventilator-associated pneumonia (VAP) is a major cause of acquired hospital pneumonia. The accompanying fan is a leading cause of death and morbidity among mechanical long-lasting ventilation patients. Every action to avoid the onset of pneumonia linked with the ventilator should be done. Review of literature shows that the incidence of ventilator-related pneumonia

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can successfully be reduced by tracheotomy done early about 7-10 days after mechanical breathing.

Ventilator-associated pneumonia in mechanically ventilated patients is a significant ICU infection. In all incubated patients, VAP occurs in 9-27 percent. As multi-drug resistance organisms in ICUs increase their prevalence, early and precise VAP identification is a pressing problem for optimum therapy. Pneumonia-associated with the ventilator is one of the most important causes of poor outcomes in patients in the ICU worldwide and in the context of several ICUs of a tertiary care hospital in India.

Introduction of care packages for mechanically ventilated customers helps to decrease the occurrence of fan pneumonia in medical and surgical patients who developed VAP as it reduced mean ventilation time. The effect on decreasing the length of stay was seen in all ICU patients. In order to avoid the VAP, nurses are the first line of defense. In cooperation with other health care providers, the researchers found that nurses are an integral element of VAP prevention, because many treatments form part of normal care. Prevention is far more convenient than cure since it is a preventable illness in the case of VAP, and because a good strategy reduces hospitalisation, costs, morbidity and mortality.

Need for study: A prospective research in Nellore Medical College and General Hospital was performed to detect the prevalence of VAP, and to identify the most frequent microorganisms causing VAP in the ICU. All patients having mechanical ventilation within 24 hours are included and CPIS has been used to detect VAP. Of the 100 people studied, 29 had VAP. Of these individuals, 32 percent reported hypertension, 29 percent reported diabetes and 12 percent had both hypertension and diabetes. The investigation revealed that 89 percent of the isolates were dominated by gram-negative organisms. The other creatures have been discovered to be gram positive. The largest number of VAP infections was caused among gram-negative organisms by *Pseudomonas*, *Klebsiella* species and *E.coli*.

Incidents of VAP: There are 7.6 incidences per 1,000 patient ventilation day as shown by the National Nosocomial Infection Surveillance Program. A standard metric for the control by CDC is the number of VAP cases per 1000 aircraft days, which is defined by CDC standards. In patients with mechanical ventilation the incidence of VAP varies from 28 to 32 percent. A medical hospitalisation rate of 7 to 9 days per patient is enhanced by the presence of VAP. VAP risk is highest early in the hospital stay and is estimated at 3 percent per day for the first 5 days of ventilation, 2 percent per day for the 5-10 days and 1 percent per day beyond the day.

Hospital mortality of the VAP developed in 46 percent cases as compared to 32 percent for the

non-VAP ventilated patients. In India, the chance of death in 9-27 percent of incubated patients is doubled in comparison to similar non-VAP patients. Preventing one VAP may be expected to significantly reduce costs per patient. It has been predicted that 4,000 adult instances of VAP each year lead to around 230 fatalities, 17,000 ICU days and 46 million medical expenses. *Staphylococcus Aureus*, *Streptococcus Pneumonia*, *Pseudomonas aeruginosa*, *Escherichia Coli*, *Hemophilus Influenzae* and *Acinetobacter* species were the most frequent infections responsible for causing VAP. The present study was carried out to find out the efficiency of nursing care package on expected outcome regarding prevention of VAP among ventilated clients in ETCM Hospital Kolar.

Review of Literature

Osman et al (2020) in their article on VAP incidence in a tertiary care facility compared the pre- and post-VAP preventive bundle. Study results showed that the VAP bundle did not lower VAP in the PICU substantially.

Rafiei et al (2020) in their article on knowledge of ventilator-associated pneumonia by emergency nurses identified inadequate knowledge as prime factor. Understanding of the nurse was impacted by attending a workshop on knowledge of the guidelines associated with the ventilator. Given the relevance of this issue, the expertise of emergency nurses in this field has to be improved by conducting training.

Objectives

- To assess the incidence of ventilator-associated pneumonia among ventilated clients in experimental and control group before and after nursing care bundle.
- To compare the effectiveness of Nursing care bundle on expected outcome regarding prevention of ventilator-associated pneumonia between experimental and control group of ventilated clients.

Hypotheses

H01. There will be no significant difference in the prevalence of ventilator-associated pneumonia among ventilated clients in experimental and control group before nursing care package.

H02. There will be no significant difference in the prevalence of ventilator-associated pneumonia among ventilated clients in experimental and control group after nursing care package.

Materials and Methods

In order to achieve the objectives of the study a quantitative research approach with quasi experimental research design with equivalent pre- and post-test control group design was adopted. After approval of

institutional ethical committee data collection was carried out at ETCM Hospital Kolar, for the period of three months (September to November 2021). The independent variable is nursing care package developed by author and dependent variable is expected outcome on prevention of ventilator-associated pneumonia. By adopting non-probability convenient sampling technique, samples were selected based on inclusion criteria. A total 40 samples were randomly selected with 20 samples each in experimental and control group with following sampling criteria.

Inclusion criteria

Ventilated clients with:

- Day one on controlled mechanical ventilation
- Conditions such as: Trauma, head injury; Cardio thoracic surgery; OPC (organo phosphorus compound) poisoning
- Age group between 20-50 years
- Both gender
- Clinical pulmonary infection (CPIS) score less than 6 score on 0 daytime of ventilation

Exclusion criteria

Ventilated clients with:

- Brain death and neuro muscular blockades
- GCS<11, APACHE>29
- Pelvic injury and spinal injury
- Acute respiratory suffering condition (ARDS)
- Constant obstructive pulmonary illness (COPD)
- Heart failure and renal failure
- Hepatic failure
- Immuno-compromised patients (Cancer, HIV/AIDS)

Nursing Care Package

Nursing care package consisting of evidence-based practices to improve the outcomes of patients requiring mechanical ventilation and provided the methodology for bundle implementation and measurement of compliance. The Ventilator Bundle components are as follows:

- Elevation of patients' head of bed to 30 degree
- Changing the position of patient every 3 hourly
- Providing closed system suctioning

Purposes

Nursing care bundle is an essential procedure for reducing the VAP among ventilated patients and the purposes are

- It prevents the aspiration of gastric contents into the lungs

- It helps in drainage of pulmonary secretions
- Reduces the incidence of VAP
- It prevents the colonisation of bacteria
- To maintain a patent airway
- To improve the gas exchange

Articles needed for nursing care package: Sterile gloves; Closed suction catheters; Suction apparatus; 10 cc syringe; Face mask, goggles; Sterile normal saline solution.

Procedure

- Perform hand washing.
- Elevate the head of bed to 30 degree.
- Turn on suction apparatus and set the vacuum regulator to a negative pressure of 100 mmHg.
- Wear clean gloves and mask.
- Connect tubing to closed suction port.
- Advance catheter through plastic sleeve halfway down to patients (endotracheal tube without applying suction, stop if resistance is met or the patient starts coughing).
- Place the dominant thumb over the control vent of the suction port; apply continuous or intermittent suction for not more than 10 sec while withdrawing the catheter into the sterile sleeve of the closed suction device.
- Allow patients to rest 30 seconds between suction attempts and repeat steps as necessary to clear secretions.
- Withdraw suction catheter and clean it with sterile saline until clear; being careful not to instill solution into the ET tube.
- Provide right or left lateral position to the patient.
- Repeat the procedure after 3 hours.

Data collection procedure: After obtaining consent forms signed from patient's attender, each ventilated client was administered for clinical pulmonary infection to assess incidence of VAP for both experimental and control group. After pre-test assessment for expected outcome, intervention execution of nursing care package was introduced by the investigator himself on the same day for experimental group only. The nursing care package includes head elevation of 30 degree, closed system suctioning and changing the position of patient every 3 hourly. Routine care with only endotracheal suctioning was done to the control group, after test was conducted on fourth day for both experimental and control group by unchanged tool. This process continued until the researcher obtained the required sample size of 40 samples. During first month data was collected from experimental group and after 20 days control group data was collected

to prevent contamination in same hospital.

Data collection tool: The data collection tool consists of three sections, Section A – Study Population variables, Section B: Customized Clinical pulmonary illness scale to assess incidence of VAP among ventilated clients. The parameters includes Temperature, White Blood Cell count, Tracheal Secretions, Oxygenation, Pulmonary Radiograph and Culture of tracheal aspirate specimen. Section C: Physical Comfort Scale to evaluate level of physical comfort among ventilated clients regarding VAP. The parameters include Alertness, Calmness/agitation, Respiratory response, Physical movement, Blood pressure, Heart rate baseline, Muscle tone and Facial tension.

Results

The data were analysed on the basis of the study objectives, using both descriptive and inferential statistics. Findings are organised in the Tables 1-7 and Figures 1 & 2.

The obtained t value 16.5 in experimental group is statistically significant in experimental group and in control group the obtained 0.00 in not statistically significant. This shows that implementation of nursing care bundles is effective in providing physical comfort to ventilated patient.

Discussion

Demographic profile of ventilated clients showed majority 55 percent participants were in age group of 41-50 years in investigational group and in manage group 45 percent were in age group of 41-50 years. In relation to gender 70 percent participants were male and in control group 50 percent were female. Background of admission of subjects showed 50 percent participants were from medical condition and in control group 75 percent participants were also from medical condition. Reason for ventilation: majority 45 percent were due CNS diseases in experimental group and 40 percent were due trauma in control group. Type of Intubation showed majority 70 percent had endotracheal intubation in experimental group and in control group 45 percent also had endotracheal intubation. In relation to mode of ventilation, majority 35 percent were in CPAP mode and in control group 30 percent also were in CPAP mode only. Period of Intubation showed 30.0 percent in 1-5 days period and in control group also 55 percent were incubated in 1-5 days period. In comorbid condition 35 percent had chronic obstructive pulmonary

Table 1: Frequency and percentage distribution of demographic profile of ventilated clients (N=40)

Variable	Investigational group		Control Group	
	Frequency	Percent	Frequency	Percent
1. Age in years				
20-30 years	5	25.0	8	40.0
31-40 years	4	20.0	3	15.0
41-50 years	11	55.0	9	45.0
2. Gender				
Male	14	70.0	10	50.0
Female	6	30.0	10	50.0
3. Background of admission				
Medical condition	10	50.0	15	75.0
Surgical condition	4	20.0	2	10.0
Trauma	6	30.0	3	15.0
4. Reason for ventilation				
CNS Diseases	9	45.0	5	25.0
Cardiac diseases	5	25.0	3	15.0
Respiratory diseases	1	5.0	1	5.0
Poisoning	1	5.0	1	5.0
Trauma	1	5.0	8	40.0
Others	3	15.0	2	10.0
5. Type of intubation				
Endotracheal intubation	14	70.0	9	45.0
Naso gastric intubation	-	-	6	30.0
Tracheotomy intubation	6	30.0	5	25.0
6. Mode of ventilation				
ACV	5	25.0	3	15.0
PCV	1	5.0	2	10.0
SIMV-VC	2	10.0	2	10.0
SIMV-PC	5	25.0	4	20.0
PS	0	0.0	3	15.0
CPAP	7	35.0	6	30.0
7. Period of intubation				
1-5 days	6	30.0	11	55.0
6-10 days	5	25.0	3	15.0
11-15 days	6	30.0	4	20.0
21-25 days	3	15.0	2	10.0
8. Co morbid condition				
Chronic obstructive pulmonary disease	7	35.0	12	60.0
Cardiomyopathy	4	20.0	2	10.0
Chronic renal Failure	3	15.0	3	15.0
Others	6	30.0	3	15.0
9. Frequency of suctioning				
2nd hourly	4	20.0	3	15.0
3rd hourly	15	75.0	12	60.0
4th hourly	1	5.0	5	25.0
10. History of smoking				
Yes	14	70.0	9	45.0
No	6	30.0	11	55.0

disease and in control group 60 percent had chronic obstructive pulmonary disease. Frequency of suctioning: 75 percent underwent 3rd hourly suction and in control group also 60 percent underwent 3rd hourly suction. History of Smoking: majority (70%) had history of smoking and in managed group 55 percent had no history of smoking.

In experimental group, majority (50%) had mild infection and only 15 percent had no infection in pre-test. In post-test majority (75%) had no infection and only 25 percent had mild infection and no patient had severe infection. It shows that delivery of nursing care package is effective in decreasing ventilator-associated pneumonia.

In control group, majority (50%) had mild infection and only 10 percent had no infection in pre-test and in post-test majority (40%) had mild infection and 60 percent had severe infection and no patient had severe infection. Here nursing care package were not delivered so number of infected cases was increased. The efficiency of Nursing care package on expected outcome regarding avoidance of respirator connected pneumonia between experimental group was statistically significant and in control group it was not statistically significant. The hypothesis H01 that there will be no significant difference in the prevalence of ventilator-associated pneumonia among ventilated clients in experimental and control group before administration of nursing care package is rejected and hypothesis H02 that there will be no significant difference in the prevalence of ventilator-associated pneumonia among ventilated clients in experimental and control group after administration nursing care package is accepted.

This study is consistent with Munro & Ruggiero (2014), who conducted study on pneumonia bundle linked to the care: optimum care repair. The VAP bundle is a priority in many healthcare facilities, according to the research. Several hospitals are making procedural improvements in order to boost VAP rates by using a package. This bundle, however, is controversial in the literature because there is limited evidence for VAP intervention. Surveillance criteria can also interpreted differently from clinical diagnostic standards. Health care institutions are under pressure to reduce VAP rates, yet correctly diagnosing VAP can be challenging.

Recommendations

1. The Nursing care bundle Package was an effective intervention in health facilities for VAP prevention.
2. The introduction of the Veneered Care Bundle on the day of admission the morbidity, mortality due to pneumonia associated with the ventilator can be reduced.

Table 2: Level of Physical Comfort in experimental group before and after administration of nursing care package (N= 20)

Overall physical comfort level	Pre-test		Post-test	
	Frequency	Percent	Frequency	Percent
Un comfort	20	100.0	5	25.0
Discomfort	0	0.0	15	75.0
Comfort	0	0.0	0	0.0
Total	20	100	20	100

Table 3: Level of physical comfort in control group before and after administration of routine care (N=20)

Overall physical comfort level	Pre-test		Post-test	
	Frequency	Percent	Frequency	Percent
Un comfort	20	100.0	20	100.0
Discomfort	0	0.0	0	0.0
Comfort	0	0.0	0	0.0
Total	20	100	20	100

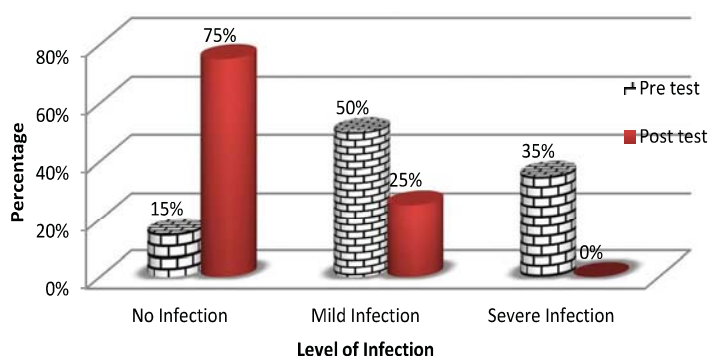


Fig 1: Prevalence of clinical pulmonary infection in experimental group before and after administration of nursing care package (N=20).

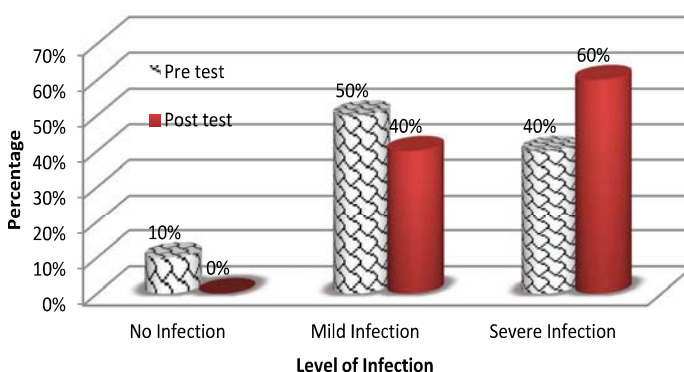


Fig 2: Prevalence of clinical pulmonary infection in control group before and after administration of routine care (N=20).

3. The VAP accounts for a considerable number of ICU-infections and is linked to extensive ICU antibiotic use and significant morbidity, death and expenditures.

Table 4: Mean, mean percentage and SD of clinical pulmonary infection scores in experimental and control group (N=40)

Groups	No. of items	Max score	Pre-test			Post-test		
			Mean	Mean %	SD	Mean	Mean %	SD
Experimental group	6	12	8.75	72.91	1.83	5.55	46.25	1.93
Control group	6	12	9.0	75.0	1.68	9.8	81.66	1.10

Table 5: Mean, mean percent and SD of before test and after test physical comfort scores in experimental and control group (N=40)

Groups	No. of items	Max score	Pre-test			Post-test		
			Mean	Mean %	SD	Mean	Mean %	SD
Experimental group	8	32	10.10	31.56	2.82	26.15	81.71	2.25
Control group	8	32	11.0	34.37	2.40	11.0	34.37	2.40

4. A similar study can be conducted with large group.
5. A comparative study can be done to determine the effectiveness of (a) closed suctioning system versus open suctioning system on preventing the ventilator-associated pneumonia or (b) qualitative and quantitative aspiration of tracheal secretion on ventilator-associated pneumonia.

Nursing Implications

In order to strengthen the nursing skills of the future, the modification and upgrading of nursing curriculum is essential. Student nurses claim fulfillment with their undergraduate courses in the contents of infection control and the teaching techniques. Increasing attention should also be paid to clinical training to enhance students' acquisition and retention of knowledge on prevention of nosocomial infection.

Table 6: Comparison of pre-and post-test CPI scores in experimental and control group (N=40)

Groups	Pre-test		Post-test		Mean difference	t Value	Df	Inference
	Mean	SD	Mean	SD				
Experimental group	8.75	1.83	5.55	1.93	3.2	6.39	19	S
Control group	9.0	1.68	9.8	1.10	0.8	2.99	19	S

The obtained t value 6.39 in experimental group is statistically significant in experimental group and in control group the obtained 2.99 is also statically significant.

Table 7: Comparison of pre-test and post-test PCS scores in experimental and control group (N=40)

Groups	Pre-test		Post-test		Mean difference	t Value	Df	Inference
	Mean	SD	Mean	SD				
Experimental group	10.10	2.8	26.1	2.25	16.05	16.3	19	S
Control group	11.0	2.4	11.0	2.40	0	0.0	19	NS

Conclusion

The delivered nursing care package to ventilated clients proved its beneficial effects in terms of expected outcomes in controlling infection level and preventing ventilator-associated pneumonia at intensive care units. This study confirmed that nursing care package for ventilated clients can cut short long stay in intensive care units.

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