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Effectiveness of nursing care bundle on prevention of ventilator associated pneumonia

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Abstract

Background: Mechanical ventilation is a life saving therapeutic technique and frequently used treatment modality for a variety of medical diagnoses in the Intensive Care Unit (ICU). Ventilator associated pneumonia (VAP) is a common nosocomial infection occurring in 9% to 27% of mechanically ventilated patients. Nurses are the first line defense in preventing the VAP. The researcher found that together with other health care providers, nurses play a key role in preventing VAP.

Objectives: To assess the effectiveness of Nursing care bundle on prevention of ventilator associated pneumonia between experimental and control group of mechanically ventilated patients.

Design: Quasi experimental design was adopted for the study.

Setting: Dhanvantri Critical Care Center, Erode and Erode Trust Hospital.

Sample and sampling Techniques: 80 control group, 80 experimental group totally 160 patients fulfilling the inclusion criteria were selected by purposive sampling.

Methods: A Pretest was conducted by using clinical pulmonary infection score and Modified Mass Wisconsin Physical Comfort scale immediately after pretest Nursing care bundle was provided from 1st day of ventilation till 10 days for experimental group. It involves with group of nursing care activities like Position changes, Hand wash, Nebulization, Closed suction and Chlorhexidine mouth care for mechanically ventilated patients. And again Post - test was conducted to assess the effectiveness of Nursing care bundle. Collected data were analysed by using descriptive and inferential statistics.

Results: Most of the mechanically ventilated patients were in the age group of 20-30 years (53%) were female (60%), in experimental group. Most (95%) were Naso tracheally intubated in experimental group. Majority (70%) patients in VCV mode of ventilation in experimental group. (70%) subjects diagnosed as Organo Phosphorus Compound Poisoning. 38% of the subjects with Diabetes mellitus. 10 (12%) had early onset of VAP 13 (16%) and 15 (19%) respectively totally 28 patients had developed late onset of VAP in control group where as in experimental group 4 (5%) of the subjects had developed early onset, totally 11 of the subjects had developed late onset of VAP. In control group posttest I 20 (25%) experienced physical discomfort. In post test II 48 (60%) subjects were physically uncomfort. 22 (28%) were physically discomfort and 10 (12%) of the subjects experienced physical comfort. In post test III 42 (53%) of subjects were physically uncomfort. 18(22%) were physically discomfort and 20 (25%) of the subjects experienced physical comfort. In experimental group, post test I shows 58 (73%) had experienced uncomfort, 12 (15%) experienced physical discomfort and in post test I, 10 (12%) of subjects were physically comfort. In post test II 30 (37%) subjects were physically uncomfort. 28 (35%) were physically discomfort and 22 (28%) of the subjects experienced physical comfort. The overall paired t test value commensuration on clinical pulmonary infection scores evidenced distinct clinical significance ($p<0.05$) with experimental group (13.21). The overall paired t test value commensuration on clinical pulmonary infection scores evidenced distinct clinical significance ($p<0.05$) with control group (7.36). The overall paired t test value commensuration on clinical pulmonary infection scores evidenced distinct clinical significance ($p<0.05$) with experimental group (16.71). Unpaired‘t’ test shows that the overall score was 12.46 in clinical pulmonary infection score. 10.45 in physical comfort when compare to P value (1.960) it was high. It seems that there is significant difference in the level of Ventilator Associated Pneumonia and physical comfort among mechanically ventilated patients in control and experimental group after Nursing care bundle. Karl Pearson’s co-efficient of co-relation analysis between Ventilator Associated Pneumonia and Physical Comfort scores shows a significant relationship which reveals that when Ventilator Associated Pneumonia not developed and Physical Comfort level increases. Hence, there was a highly positive relationship between these variables. There is a significant effectiveness of nursing care bundle on prevention of ventilator associated pneumonia among mechanically ventilated patients in experimental than control group.

Conclusion: After implementation of Nursing care bundle found to be effective in terms of Prevention of Ventilator Associated Pneumonia. It was also revealed that no significant association between post test scores of prevention of ventilator associated pneumonia with their demographic variables. Type of intubation and mode of ventilation were associated with physical comfort among mechanically ventilated patients. Nursing Care Bundle was effective in Prevention of ventilator associated pneumonia and improves outcomes such as ICUs length of stay, duration of ventilator support and pulmonary function.

Keywords: Nursing care bundle, prevention of Ventilator associated pneumonia, mechanically ventilated patients

Introduction

Mechanical ventilation is a lifesaving therapeutic technique and frequently used treatment modality for a variety of medical diagnoses in the Intensive Care Unit (ICU) such as respiratory disorders, neurological problems, cardiac dysfunctions, metabolic conditions, poisoning, trauma, etc. It is an artificial respiratory support system, which enables the patients to breathe normally. (Wong, 2001)

Mechanical ventilation is often provided only in critical situations; therefore, it is invariably an integral part of ICU care. The patients are deprived of leading a good quality life, and are hugely dependent on the health care team for the support. Patients who undergo mechanical ventilation require a recommended care including communications, hemodynamic stability, proper airway management, prevention of infection, position changes, hand washing, Nebulization, appropriate suction, mouth care, adequate nutrition and weaning from ventilator. (Laura C. Parker 2012)

VAP is a pneumonia that occurs > 48 hours after initiation of mechanical ventilation. Early onset VAP occurs within 3 days and late onset within 4-7 days. Depending on the length of mechanical ventilation and other risk factors such as previous antibiotic exposure, the bacterial pathogens responsible for the VAP differ in virulence and antimicrobial resistance. (Kollef, *et al*, 2006**).** Ventilator associated pneumonia (VAP) is a common nosocomial infection occurring in 9% to 27% of mechanically ventilated patients. It is associated with significant morbidity including increased ventilator days, increased intensive care unit (ICU) and hospital length of stay, and increased cost. Further, the cause specific mortality rate of VAP is 20% to 40%. A study on recent approach to facilitating guideline implementation involves the use of care bundles.

The American Association of Critical care Nurses (AACN) recommended steps for reducing the incidence of VAP.

Need for the Study

Pneumonia is the second most common nosocomial infection in critically ill patients is associated with high mortality and morbidity. Incidence of HAP increases by 6-21 fold in mechanically ventilated patients, rendering VAP as the most common nosocomial infection in critically ill patients.

In 2002, an estimated 250000 health care associated pneumonias developed in hospitals and 36000 of these were associated with deaths. Patients with mechanically assisted ventilation have a high risk of developing health care associated pneumonia. For the year 2012, NHSN facilities reported more than 3957 VAPs and the incidence of various types of hospital units ranged from0.0-4.4 per1000 ventilator days.

Nurses are the first line defense in preventing the VAP. The researcher found that together with other health care providers, nurses play a key role in preventing VAP because, many of the interventions are part of routine nursing care. Prevention is better than cure is probably more appropriate as concerned to VAP because of the fact that it is a well preventable disease and proper approach decreases the hospital stay, cost, morbidity and mortality. Overall, an assessment of the efficacy of the nursing care bundle will help develop a holistic approach to the management of critical care patients on mechanical ventilation. This in the long run, will minimize the morbidity and mortality associated with VAP and will help achieve better outcomes in the critical care setting.

Statement of Problem

"Effectiveness of Nursing Care Bundle on Prevention of Ventilator Associated Pneumonia among mechanically ventilated patients admitted in selected hospitals, Erode, Tamil Nadu".

Objectives

1. To assess the incidence of ventilator associated pneumonia among mechanically ventilated patients in experimental and control group before and after nursing care bundle.
2. To compare the effectiveness of Nursing care bundle on prevention of ventilator associated pneumonia between experimental and control group of mechanically ventilated patients.
3. To correlate relationship between ventilator associated pneumonia and physical comfort among mechanically ventilated patients in experimental and control group.
4. To find out the association between the post test scores on prevention of ventilator associated pneumonia among mechanically ventilated patients in experimental and control group with their demographic variables.

Hypotheses

Level of Significance AT 0.05

- **RH_1:** There is a significant difference in the level of ventilator associated pneumonia among mechanically ventilated patients in experimental and control group before and after nursing care bundle.
- **RH_2:** There is a significant effectiveness of nursing care bundle on prevention of ventilator associated pneumonia among mechanically ventilated patients in experimental than control group.
- **RH_3:** There is a significant relationship between ventilator associated pneumonia and physical comfort among mechanically ventilated patients in experimental group and control group.
- **RH_4:** There is a significant association between post test scores on prevention of ventilator associated pneumonia among mechanically ventilated patients in experimental and control group with their demographic variables.

Chapter –Iii Methods

Research Approach

Quantitative evaluative research approach was essential to test the effectiveness of the intervention for this study.

3.2 Research Design

The research design used for the present study was Quasi experimental design where Pre and posttest with equivalent control group design.

Settings

Dhanvantri Critical Care Center, Erode Erode Trust Hospital, Erode

Variables

Independent Variable: Nursing care bundle (Position changes, Hand wash, Nebulization, Closed suction and Chlorhexidine Gluconate mouth care)

Dependent Variable: Prevention of ventilator associated pneumonia

Demographic Variables: It consists of demographic characteristics such as Age, Gender, Type of intubation, Mode of ventilation, Diagnosis of patients, Associated conditions.

Population Target Population: The population for the study was all the mechanically ventilated patients.

Accessible Population: Mechanically ventilated patients admitted in Dhanvantri Critical Care Center, Erode and Erode Trust Hospital, Erode

Sample Size
The sample size was estimated using the Power Analysis with 147 mechanically ventilated patients but additional 13 subjects were included to meet the expected attrition rate 10% (147+13 =160). The researcher included 160 samples for the study, out of which 80 were control group and 80 were experimental group.

Sampling Technique
Non- Probability Purposive sampling technique was adopted for this study.

Criteria for sample selection
Inclusion Criteria
Mechanically ventilated patients with 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 day of ventilation

Exclusion Criteria
Mechanically ventilated patients with Brain death and Neuro muscular blockades, GCS<11, APACHE>29. Pelvic injury and Spinal injury, Acute Respiratory Distress Syndrome (ARDS), Chronic Obstructive Pulmonary Disease (COPD), Heart failure and Renal failure, Hepatic failure, Immuno compromised patients (Cancer, HIV/AIDS)

Description of Tool: There are three sections tools were used.

Section A: Demographic variables. It consist of demographic characteristic of mechanically ventilated patients Age, Gender, Type of intubation, Mode of ventilation, Diagnosis of patient, Associated conditions

Section B: Clinical pulmonary infection score was used to evaluate the ventilator associated pneumonia. In this scale consists of 6 parameters i.e temperature, WBC, tracheal secretion and chest radiograph parameter was grading of 0, 1, 2 and Pao2/Fio2, Culture results score graded 0 and 2.

Scoring procedure: Less than 6 score it considers as patient does not develop ventilator associated pneumonia**.**

Section C: Modified Mass Wisconsin Physical Comfort Scale was used to evaluate the physical comfort. It consist of 6 parameters like Alertness, Calmness/ agitation, blood pressure baseline, heart rate, muscle tone. It is a 5 point rating scale. Scoring procedure
Based on the percentage scores of the level of physical comfort was graded in 3 categories. Uncomfort, discomfort and comfort.

Table 1

Level of physical comfort	Actual score	Percentage
Uncomfort	0-5	0-31%
Discomfort	6-10	32-63%
Comfort	11-16	64-100%

Content validity of the Tool
The content validity index score was 8.5 The expert's suggestion were incorporated in designing the final tool for the study in consultation with Guide, Advisory Committee members and Statistician for its appropriateness.

Reliability of the Tool
He reliability was tested Split half method used to find out the reliability of the Clinical pulmonary infection score tool was r = 0.94 and the reliability of Modified Mass Wisconsin physical comfort scale tool was r = 0.96 which showed the tool was reliable.

Method of Data Collection
Prior to the collection of the data, permission was obtained. Formal consent from the patient relatives was obtained and confidentiality was maintained. Pilot study was conducted. Pretest was conducted with Clinical Pulmonary Infection (CPIS) Score and Modified Mass Wisconsin Physical Comfort Scale in experimental and control group to assess the VAP and physical comfort among mechanically ventilated patients. Experimental group received the Nursing care bundle, Nursing care bundle was given from 1st day of ventilation to 10 days. Three post tests were done on 3rd day, 7th day, 10th day for both experimental and control group.

Data Analysis and Results

Table 2: Frequency and percentage distribution of pre and post test scores on ventilator associated pneumonia among mechanically ventilated patients in Control group N1=80

Level on Prevention of ventilator associated pneumonia	Pre test score		Post test score I		Post test score II		Post test score III	
	F	%	F	%	F	%	F	%
No development of Ventilator Associated Pneumonia	80	100	70	88	67	84	65	81
Development of Ventilator Associated Pneumonia	-	-	10	12	13	16	15	19

Table 3: Frequency and percentage distribution of pre and post test scores on ventilator associated pneumonia among mechanically ventilated patients in experimental group N=80

Level on Prevention of ventilator associated Pneumonia	Pre test score		Post test score I		Post test score II		Post test score III	
	F	%	F	%	F	%	F	%
No development of Ventilator Associated Pneumonia	80	100	76	95	74	92	73	91
Development of Ventilator Associated Pneumonia	-	-	4	5	6	8	7	9

Table 4: Frequency and percentage distribution of control group pre and post test scores on physical comfort among mechanically ventilated patients (N1=80)

Physical comfort	Pre test		Post test 1		Post test 2		Post test 3	
	F	%	F	%	F	%	F	%
Uncomfort	80	100	60	75	48	60	42	53
Discomfort	-	-	20	25	22	28	18	22
Comfort	-	-	-	-	10	12	20	25

Table 5: Frequency and percentage distribution of experimental group pre and post test scores on physical comfort among mechanically ventilated patients (N2=80)

Physical comfort	Pre test		Post test 1		Post test 2		Post test 3	
	F	%	F	%	F	%	F	%
Uncomfort	80	100	58	73	30	37	-	-
Discomfort	-	-	12	15	28	35	21	26
Comfort	-	-	10	12	22	28	59	74

Table 6: Area wise comparison of mean, SD, and mean percentage of control group and experimental group 3rd post test scores on ventilator associated pneumonia

Clinical Pulmonary Infection Score Parameters	Maximum scores	Post test scores III					
		Control group			Experimental group		
		Mean	SD	Mean (%)	Mean	SD	Mean (%)
Temperature	2	0.7	0.31	35	0.73	0.84	37
WBC	2	0.84	0.75	42	0.89	1.01	45
Tracheal Secretions	2	0.96	0.61	48	0.89	1.57	45
PaO2/FiO2	2	0.45	0.81	23	0	1.52	0
Chest Radiograph	2	0.71	1.95	36	0.98	1.63	49
Culture results	2	0.3	1.55	15	0.7	1.80	35
TOTAL	12	5.53	0.28	46	3.5	2.04	29

Table 7: Unpaired t test value of Posttest scores 3rd on prevention of ventilator associated pneumonia and Physical comfort in control group and experimental gr

Mechanically ventilated patients	Post test scores 3	Level of Significance(P)
Prevention of ventilator associated pneumonia		
Temperature	10.01	P< 0.05 Significant
WBC	8.39	P< 0.05 Significant
Tracheal Secretions	9.45	P< 0.05 Significant
PaO2/FiO2	11.58	P< 0.05 Significant
Chest Radiograph	9.02	P< 0.05 Significant
Culture results	10.39	P< 0.05 Significant
Total	12.46	P< 0.05 Significant
Physical comfort parameters		
Calmness/Agitation	7.32	P< 0.05 Significant
Blood pressure baseline	7.04	P< 0.05 Significant
Heart rate baseline	7.58	P< 0.05 Significant
Muscle tone	8.12	P< 0.05 Significant
Total	10.45	P< 0.05 Significant

Table 8: Co-rrelation between the pre test scores and post test scores of Ventilator Associated Pneumonia and Physical Comfort among mechanically ventilated patients

Ventilator Associated Pneumonia and Physical Comfort	'r' value	Level of significance
Pre test	**0.5**	**P < 0.05 significant**
Post test I	0.66	P < 0.05 significant
Post test II	0.78	P < 0.05 significant
Post test III	**0.89**	**P < 0.05 significant**

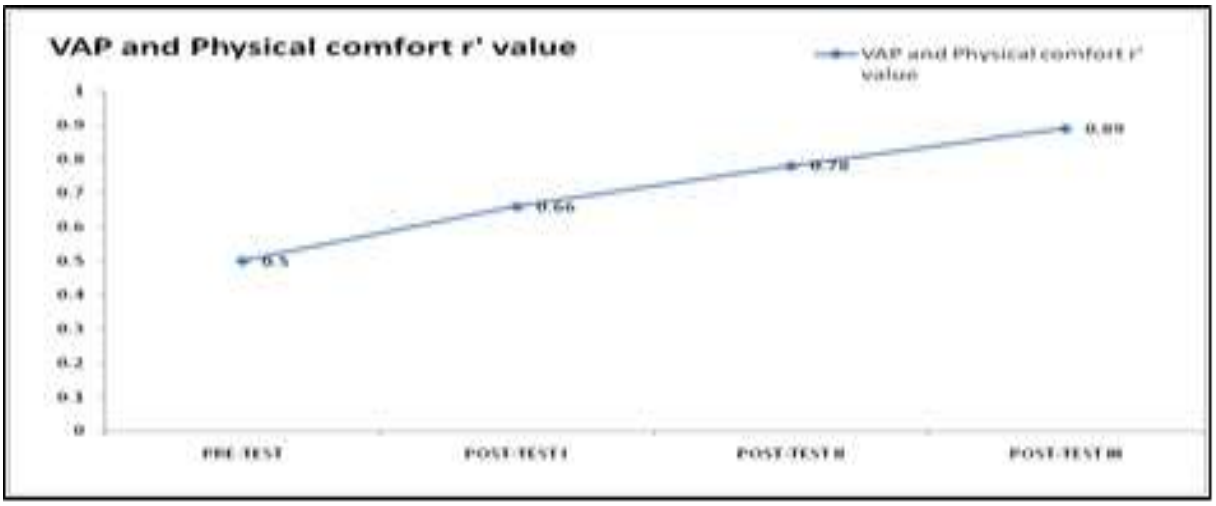

Table 9: Association between control group posttest scores and demographic variables of ventilator associated pneumonia and physical comfort among mechanically ventilated patients.

Sl. No.	Variables	DF	x^2		Table value	Level of Significant
			VAP	Physical comfort		
1	Age (in years)	1	0.80	0.32	3.84	P>0.05 Not significant
2	Gender	1	0.45	0.07	3.84	P>0.05 Not significant
3	Type of intubation	1	0.02	0.61	3.84	P>0.05 Not significant
4	Mode of ventilation	1	0.49	0.01	3.84	P>0.05 Not significant
5	Diagnosis of the patient	1	0.42	0.08	3.84	P>0.05 Not significant
6	Associated condition	1	0.61	0.94	3.84	P>0.05 Not significant

S No	Variables	DF	x^2		Table value	Level of Significant
			VAP	Physical comfort		
1	Age (in years)	1	0.25	0.19	3.84	**P>0.05 Not significant**
2	Gender	1	0.36	1.24	3.84	**P>0.05 Not significant**
3	Type of intubation	1	0.06	8.54	3.84	**P<0.05 significant**
4	Mode of ventilation	1	1.87	8.54	3.84	**P<0.05 significant**
5	Diagnosis of the patient	1	0.96	0.01	3.84	**P>0.05 Not significant**
6	Associated condition	1	0.04	0.67	3.84	**P>0.05 Not significant**

Chapter V-Discussion

The major findings of the study were Most of the mechanically ventilated patients were 20-30 years of Age, Female, Majority were Naso tracheally intubated. In Mode of ventilation, majority of patients in VCV mode, most of them were diagnosed as Organo Phosphorus Compound Poisoning, With Associated condition of Diabetes mellitus.

Hypothesis 1: There is a significant difference in the level of ventilator associated pneumonia among mechanically ventilated patients in experimental and control group before and after nursing care bundle. So this hypothesis was accepted.

In control group (VAP) In pre test mean was (5.01± 0.97) In post test III mean was (5.53±0.28) Difference in mean percentage 4%. The paired t test value was 6.83. Physical Comfort In pre test mean was (3.92 ± 1.00) In post test III, mean was (12.31 ±0.37) Difference in mean percentage 52%. The paired t test value was 7.36

In experimental group VAP In pre test mean was (8.02 ±1.95) In post test III mean was ((3.5 ±2.04) Difference in mean percentage 38%. The paired t test value was 13.21. Physical Comfort In pre test mean was (5.16 ± 0.38) In post test III, mean was (14.81 ±0.13) Difference in mean percentage 61. The paired t test value was 16.71. Unpaired 't' value of VAP was 12.46. So the hypothesis 2 was accepted.

Karl Pearson's co-efficient of co-relation analysis between Ventilator Associated Pneumonia and Physical Comfort scores shows a significant relationship which reveals that when Ventilator Associated Pneumonia not developed and Physical Comfort level increases. Hence, there was a highly positive relationship between these variables. So the hypothesis 3 was accepted. Chi-Square was calculated to find out the association between post test scores of ventilator associated pneumonia and demographic variables of mechanically ventilated patients in control group reveals that there was no significant association. Thus, the null hypothesis was accepted. So the hypothesis 4 was rejected.

The overall paired t test value clinical significance ($p<0.001$) with control group was 6.83, 7.36 and whereas in experimental group was 13.21 16.71 respectively. Significant difference was observed between pre and posttest scores in experimental group and control group. Unpaired't' test overall score between experimental and control group was 12.46 and 10.45 respectively which is statistically significant ($p<0.001$).

Conclusion

The study concluded that Nursing care bundle was effective in reducing prevalence of Ventilated associated pneumonia and improves physical comfort among physiological and psychological symptoms among mechanically ventilated patients. The constant encouragement and direction of guides, co-operation of respondents to participate in the study contributed to the fruitful completion of the study.

References

1. Michetti CP, Fakhry SM, Ferguson, AAST Ventilator-Associated Pneumonia, Investigators (May 2012). "VAP rates at major trauma centers compared with a national benchmark: a multi-institutional study of the AAST". The journal of trauma and acute care surgery,2012:72(5):1165-73.
2. Cook D. "Ventilator associated pneumonia: perspectives on the burden of illness". IntensiveCare Medicine,2000:26 Suppl1:S31-7.
3. Koenig Steven M, Truwit Jonathon D. (October 2006). "VAP: Diagnosis, Treatment, and Prevention". Clin Microbiol Rev,2000:19(4):637-657.
4. Lung Bacterial Population Diversity in CAP, VAP and Health using 16S rDNA Sequencing. Research Gate. Retrieved,2016-04-19.
5. Nolan TJ, Gadsby N. (2016-04-12). "Low-pathogenicity Mycoplasma spp. are highly prevalent among patients with VAP". Thorax, 2016, 71: thoraxjnl–2015–208050.
6. Conway Morris, Andrew; (2009-07-01). "Peripheral Blood Neutrophil Dysfunction ". American Journal of Respiratory and Critical Care Medicine,2009:180(1):19–28.
7. Morris, Andrew Conway; Brittan, Mairi; Wilkinson, (2011-05-12). "C5a. Blood,2011:117(19):5178-5188.