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A study to determine the knowledge and compliance of nursing personnel on ventilator associated pneumonia and preventive care bundle among the neonates.

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Abstract
Ventilator associated pneumonia (VAP) is the most common nosocomial infection, with the prevalence rates ranging 10 to 70% in intensive care units. It is the sub type of hospital acquired pneumonia which occurs in public who are on mechanical ventilation through an e
ndotracheal or tracheostomy tube for at least 48 hours with reported incidence of 6-20 times higher in neonates. A descriptive study was conducted to assess the knowledge and compliance of staff nurses regarding ventilator associated pneumonia and ventilator associated pneumonia preventive care bundle among the neonates admitted in Neonatal Intensive Care Units (NICU). The objectives of the study was to assess the compliance, and knowledge of staff nurses regarding VAP and to find out the association of knowledge of staff nurses regarding VAP with selected socio demographic variables like age, working experience, professional qualification. Sample size of 50 staff nurses, with convenience sampling technique was used for data collection. A structured questionnaire was used to assess the knowledge of staff nurses regarding VAP. To assess the compliance observations were done based on CDC check list.
Analysis revealed that majority (54%) of the nurses was in the age group of 31 to 40 years and higher proportion of the nurses had experience in nursing between 1-10 years.
About 80% of the staff had adequate practice to prevent ventilator associated pneumonia and only 20% had moderately adequate practice to prevent ventilator associated pneumonia. About 22% of staff nurse had adequate knowledge, and 66% had moderately adequate knowledge, and 12% had inadequate knowledge. There was no significant association between the knowledge with selected demographic variables of the nurses.
Key Words: *Ventilator Associated Pneumonia, Neonates, Neonatal Intensive care unit.*

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I. Introduction

Ventilator-associated pneumonia (VAP) develops in mechanically ventilated neonates after 48 hours on mechanical ventilation, and it is the second most common nosocomial infection in neonatal intensive care units (NICU). Overall, VAP occurs in 3-10% of the ventilated children in pediatric intensive care unit (PICU) and 6.8-32.3% of the neonates in NICUs. The incidence of VAP in neonates varies according to birth weight, and gestational age especially under 28 weeks. Low-birth weight is an important risk factor for prolonged ventilator and development of VAP. Ventilator-associated pneumonia is associated with substantially increased hospital stay and hospital costs, and also increases the use of antibiotics and ventilators thereby increasing morbidity and mortality rates.[1] It is considered to be most important cause of infection-related death in intensive care unit. The most important risk factors of VAP are prematurity, low birth weight, prolonged duration of mechanical ventilation, enteral nutrition and umbilical catheterization.

Ventilator-associated pneumonia (VAP) is a serious health care- associated infection, resulting in high morbidity and mortality. It also prolongs hospital stay and drives up hospital costs. Measures employed in preventing ventilator- associated pneumonia in developing countries are rarely reported. In this study researcher tried to assess the efficacy of designed "VAP prevention bundle" in reducing VAP rate in our neonatal intensive care unit (NICU). Prevention of VAP has been primarily achieved by the "bundle approach"; this involves the simultaneous application of several preventive strategies for all patients, often aided by tools such as checklist. In some cases there is only theoretical evidence or biologic plausibility for one or more of the elements of the bundle being effective, but application of these bundles is widely used and has been highly successful.[2]

According to data published by the NNIS (National Nosocomial Infections Surveillance) system program sponsored by the Centers for Disease Control (CDC), VAP is the second most frequent cause of nosocomial infection (20% of nosocomial infections) in Pediatric intensive care units (PICU), with rates that oscillate from 1.4 to 7 episodes per 1,000 ventilator days. In developing countries the reported rates are significantly higher, ranging from 16.1 to 89 episodes per 1,000 ventilator days.[3]

Focusing exclusively on the neonatal population accounted for, the incidence is highly influenced by gestational age and regional economic development. Hence, while in developed countries the incidence oscillates between 2.7 to 10.9 episodes per 1,000 ventilator days, in developing countries it may reach up to 37.2 cases per 1,000 ventilator days This variability could also be explained by the use of different criteria to define VAP.[4]

As neonates have different anatomy, physiology and underlying diseases, they undergo different invasive procedures compared with adults and older children hence specific studies for evaluating different "VAP bundles" efficacy in preventing VAP in NICU are needed. In Egypt and other developing countries, reports on the success of VAP intervention strategies, particularly among neonates, are scarce[5].

VAP *p*reventive bundle is part of our Quality Control Program where internal committee (registered nurses, infection control physicians) was assigned for continuous observation of adherence of our unit with monthly report about this rate.

VAP diagnosis*:* VAP was diagnosed by pediatrician and confirmed by attending neonatologist using criteria for less than one year established by *Foglia and colleagues*[6] . The clinical features of VAP are as follows.

The gold standard for diagnosis of VAP is lung biopsy, however it is an invasive procedure. Since it is difficult to make a definite diagnosis of VAP in children and adults, centers for disease control and prevention (CDC) has recommended the following criteria for diagnosis of VAP in children under one year of age:

Worsening of gas exchange (e.g. O_2 desaturations [e.g. pulse oximetry < 94%], increased oxygen requirements, or increased ventilator demand) and at least three of the following:

• Temperature instability
• Leukopenia (< 4,000 WBC/mm^3) or leukocytosis (> 15,000 WBC/mm^3) and left shift (> 10% band forms)
• New onset of purulent sputum or change in character of sputum, or increased respiratory secretions, or increased suctioning requirements
• Apnea, tachypnea, nasal flaring with retraction of chest wall or grunting
• Wheezing, rales, or rhonchi
• Cough
• Bradycardia (< 100 beats/min) or tachycardia (> 170 beats/min)

For VAP prevention, the concept of bundle of care was defined. It enabled great successes in VAP prevention; however, the insufficient compliance observed in clinical practice needs to be addressed in order to define easier-to-apply procedures. Unfortunately, few studies have focused on neonates, particularly those with a low or very low birth weight. The incidence of neonatal VAP is difficult to be correctly determined, because it is difficult to differentiate between new or progressive radiographic infiltrates due to neonatal pneumonia or due to exacerbation of bronchopulmonary dysplasia and frequent episodes of atelectasis. Designed VAP bundle is composed of: [7]

- Head-of-bed elevation 30^0-45^0.
- Re-enforcement of hand hygiene practice.
- Sterile suction and handling of respiratory equipment.
- Intubation, re-intubation and endotracheal tube (ETT) suction as strictly indicated by unit protocol (document).
- Change ventilator circuit if visibly soiled or mechanically malfunctioning (document)[8]
- Proper timed mouth care with normal saline and suction of oro-pharyngeal secretion.
- Daily evaluation for readiness for extubation to nasal continuous airway pressure (NCPAP) at morning round, and sedation vacation for sedated patient.

Written protocols were performed for strict indications of intubation, re-intubation, suctioning of ET and change of the ventilator circuit. Documentation is needed in the patient flow sheet.

The aim of the present work is to assess the effectiveness of our proposed "VAP prevention bundle" in decreasing rates of neonatal VAP.

Objectives

1) To determine the Knowledge of the nursing personnel on neonatal ventilator associated pneumonia preventive care bundle.
2) To assess the Compliance of the nursing personnel in using neonatal ventilator associated pneumonia preventive care bundle for newborn.
3) To find the association between the knowledge with selected demographic variables of the nursing personnel.

Methods

Study Design

A descriptive study was conducted**.**

Setting of the study

NICU of Christian Medical College, Vellore. It is a tertiary center for providing multi specialty health care and has a bed capacity of 2957 with patients coming from all over India and abroad. The NICU has 71 beds and caters care for all the sick neonates inborn and out born.

Population

The population consists of newborn connected on invasive ventilator and staff nurses working in neonatal unit of CMC, Vellore.

Sample

The sample consists of observations made on the newborn connected to invasive ventilator and the staff nurses working in neonatal unit who fulfilled the inclusion criteria.

Sample size

Knowledge assessment – About 50 staff nurses were taken

Compliance assessment - Event sampling - Samples of 100 observations were made on newborn that fulfilled inclusion criteria.

Sampling method

Convenience sampling method was used.

Criteria for sample selection

Inclusion criteria

1. Newborn connected on invasive ventilator
2. Nursing personnel working in the neonatal unit more than one year
3. Nursing personnel with GNM / B.SC / P.B. BSC qualification.

Exclusion criteria

1) Nursing personnel who is on long leave
2) Multipurpose health workers

Sample size

The proportion is taken as 60% based on

- Formula is n = 4pq/ d2
  4X 60X40/10^2
  n= 96

100 Observations on compliance were made.

- 50 nurses working in neonatal unit (knowledge)

Variables:

Independent variable- Knowledge and compliance on VAP preventive care bundle.

Dependent variable- Ventilator associated pneumonia in neonate.

Data collection Instrument and Scoring:

PART A - *Socio demographic variables* such as: age, experience (in years), professional qualification, working area.

PART B -*Structured self- administered questionnaire* consisted of 15 questions each question has 4 options and one question carry 1mark. Each correct answer is given score of 1, and wrong answer is given 0.

- Total maximum mark was 15
- Total minimum mark was 0

PART C - *Ventilator associated pneumonia check list*

Ventilator associated pneumonia preventive care bundle check list consists of 10 items. Each correct step was given, YES and score of 1 was given.

Each incorrect step was given NO and score of 0 was given.

If steps not required was marked as NA and no score was given.

Validity and Reliability of the Instrument-

Content validity was done by experts in the OG and Neonatal unit. The score is -0.8 was obtained. Reliability of the instrument was assessed during pilot study

Data collection procedure

Data was collected among staff nurses working in neonatal unit using convenience sampling method. Written informed consent was obtained; a structured questionnaire is prepared and was used to collect the data among neonatal staff nurses. The investigator administered knowledge questionnaire to assess the knowledge, the compliance of the nursing personnel was observed using VAP preventive care bundle check list. When baby is connected on ventilator the investigator used to observe the compliance based on the check list by non participating observation method from 8 am to 4 pm.

Data Analysis plan

- The demographic variables analyzed using frequency and percentage.
- Mean, and frequency used to analyzing the compliance of VAP bundle.
- The association between knowledge and compliance of VAP bundle was assessed by Chi- square test

Protection of human subjects

Permission was sought from the Head of OG Nursing Department**.** The research proposal was approved by the research committee prior to conducting the pilot study and the main study. Confidentiality was maintained throughout the study. Written consent was taken before the study from the participants.

Data analysis and study findings

The knowledge was assessed on 50 staff nurses and compliance was assessed by 100 observations in Level III neonatal unit of CMC, Vellore.Descriptive statistics and chi-square were used to analyze the data using statistical package for social sciences (SPSS) P value of <0.05 was considered significant and P value of <0.001 was considered highly significance

Table 1
Distribution of the nurses based on Demographic variables

S.No		No	%
1.	Age (in Years)		
	20-30	19	38
	31-40	27	54
	41-50	3	6
	51-60	1	2
2.	Experience in nursing (in Years)		
	1-10	30	60
	11- 20	19	38
	21-30	0	0
	31-40	1	2

Majorities (54%) of the nurses were in the age group of 31 to 40 years and higher proportion of the nurses had experience in nursing between 1-10 years.

Figure 1: Distribution of the samples based on knowledge on ventilator associated pneumonia

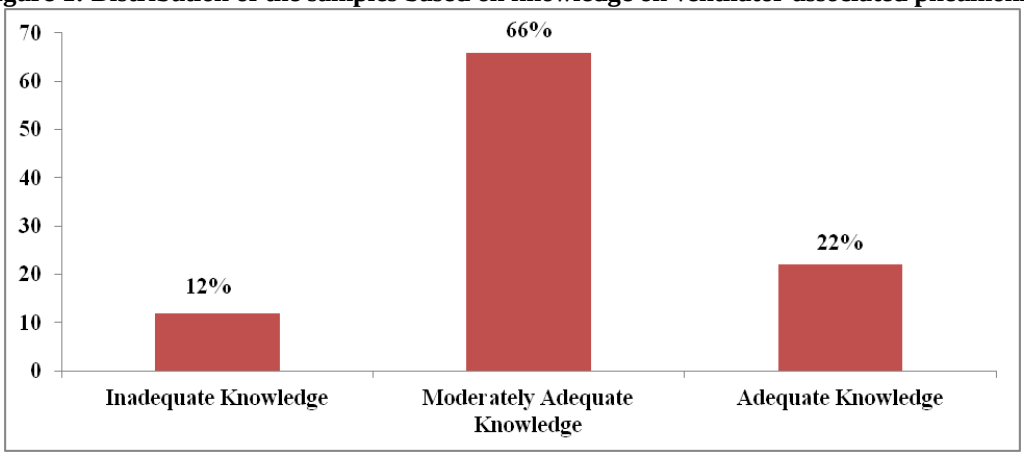

Figure 1 revealed that majority (66%) of the nurses had moderately adequate knowledge and 22% had adequate knowledge and remaining 12% had inadequate knowledge on ventilator associated pneumonia.

Figure 2: Distribution of the samples based on practice of care bundle to prevent ventilator associated pneumonia among the neonates.

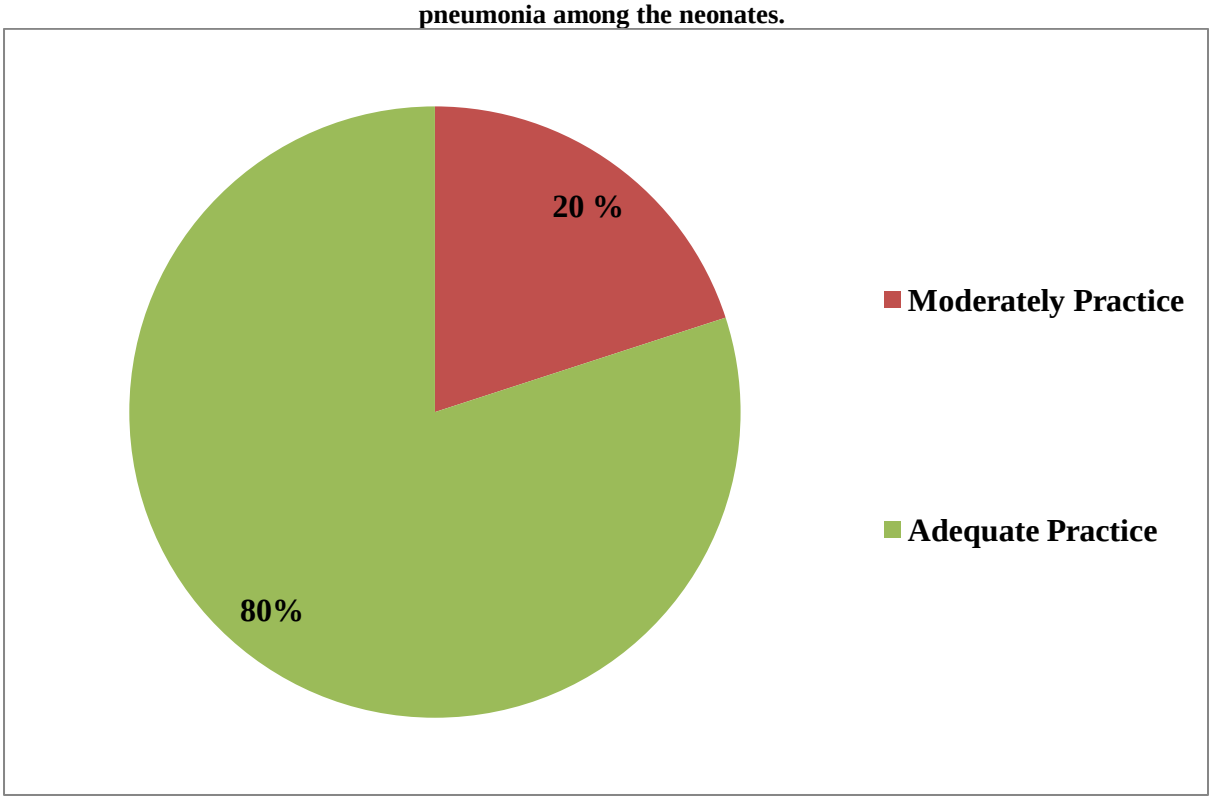

Figure 2 revealed that 80% of the staff nurses had been compliance to prevent ventilator associated pneumonia and only 20% of the staff nurses had been partial compliance to prevent ventilator associated pneumonia

Table 2: Association between Knowledge of staff and selected demographic variables

S.No	Demographic Variables	Knowledge							
		Inadequate		Moderately Adequate		Adequate		χ^2	p-value
		No.	%	No	%	No	%		
1.	Age (in Years)								
	21-30	3	15.8	15	78.9	1	5.3		
	31-40	3	11.1	16	59.3	8	29.6	8.128	.229
	41-50	0	0	1	33.3	2	66.7		
	51-60								
2.	Experience in nursing (in Years)								
	1-10	5	16.7	20	66.7	5	16.7		
	11- 20	1	5.3	12	63.2	6	31.6	2.984	.561
	21-30	0	0	0	0	0	0		
	31-40	0	0	1	100	0	0		

Table 2 revealed that there was no significant association between knowledge with selected demographic variables of the nurses.

II. Discussion

The first objective of the study was to determine the knowledge of the nursing personnel regarding VAP, a total of 50 nursing personnel was selected and knowledge on VAP was assessed. This showed that 22% had adequate knowledge 66% had moderately adequate knowledge and 12% had in adequate knowledge. The above finding is supported by Ankit Sharma (2019)[9] who reported that the knowledge of the nursing personnel regarding VAP was adequate for 6% and 28% had moderately adequate knowledge and 66% had inadequate knowledge among a sample size of 50 staff nurses.

The second objective was to assess the compliance of staff nurses of VAP bundle among neonates. The study findings revealed that 80% of staff nurses had adequate compliance to VAP bundle and 20% of staff nurse had partially adequate compliance to VAP bundle. This is supported by Neema John (2017)[10] who inferred that 80% had compliance towards VAP bundle.

The third objective was to find the association between the knowledge and the selected demographic variables. However there was no significant association between other background characteristics like age, professional qualification, and total years of experience of staff nurse with the knowledge.

III. Conclusion

VAP is associated with an increase of 7.6 days of ventilation, an increase of 8.7 days in intensive care, and an increase in total stay of 11.5 days. It also plays a role in 6–30% of additional deaths in these critically ill patients. A good number of these unfortunate outcomes are the result of system failures that could have been avoided. Prevent VAP with VAP bundles, evidence-based practices that, when implemented together, should result in dramatic reductions in the incidence of VAP. Compliance with the VAP bundle CDC protocol is followed in the neonatal unit in order to prevent VAP among neonates staff nurses were able to adhere the protocols.

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