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PROTECTING PATIENTS FROM VENTILATOR-ASSOCIATED PNEUMONIA: CRITICAL CARE NURSES' ESSENTIAL ROLE

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Abstract:

One of the most common nosocomial infections among ventilated patients in intensive care units (ICUs) is ventilator-associated pneumonia (VAP), which is linked to an increase in ICU stay days, morbidity, and mortality. Every hospital is highly concerned about preventing it. The majority of treatments and preventative techniques are incorporated into standard nursing care. In order to avoid VAP, nurses play a variety of crucial tasks, including those of care manager, educator, coordinator, and evaluator. Following evidence-based recommendations for preventing ventilator-associated pneumonia may be hampered by nurses' ignorance about infection prevention and appropriate nursing care. In order for nurses to apply their knowledge in clinical practice, this study will assist them gain a thorough understanding of VAP and how to prevent it. Comprehending the pathophysiology, risk factors, and care package of VAP is crucial for effective prevention and management of the condition. Every ICU needs to have defined procedures, plans of action, and ongoing monitoring with reference to the care bundle.

Keywords: ICU, nurses, critical care, ventilator-associated pneumonia (VAP), risk factors.

Introduction:

The most frequent infectious consequence among patients in intensive care units (ICUs) who have received mechanical ventilation for 48 hours or more and who did not exhibit any lower respiratory infection symptoms prior to being intubated and receiving mechanical ventilation is ventilator-associated pneumonia (VAP), a subtype of nosocomial pneumonia. Consequently, there has been a significant rise in hospital expenses and patient length of stay (LOS).1–4 VAP is also linked to longer hospital and ICU stays, delayed extubation, higher rates of morbidity and death, and greater utilization of medical resources.

The primary goal of health care delivery in intensive care units is to prevent ventilator-associated pneumonia (VAP); prevention is far more economical than treatment.6 Care bundle methods are variables, precautionary actions, and the role of nurses in preventing VAP. This research will

assist nurses in gaining a thorough understanding of VAP, enabling them to utilize this information in clinical settings to prevent VAP.

A Serious Threat in Intensive Care Units (ICUs)

The second most common infection linked to healthcare, VAP accounts for 25–42% of infections that occur in intensive care units (ICUs). Intubated patients are more susceptible to VAP, and its incidence rises with the length of ventilator support.8 Patients on mechanical ventilation have a 22.8% incidence of VAP. This is common in nosocomial pneumonia, as 86% of patients receive ventilatory support.4 However, there can be fluctuation based on the research population, type of ICU, hospital resources, and diagnosis criteria.8 The estimated rate of ventilator-associated pneumonia is 1.4 to 5.8 events per 1000 intubated patients, with a downward trend since 2000.9,10 The downward trend is more pronounced in the United States, likely as a result of the use of ventilator bundles.11 The death rate from VAP is said to be between "10%" and "40%."12 Patients with VAP have longer hospital stays (2–3 times longer) and longer lengths of stay in the intensive care unit (5–7 days). The estimated hospital expenses for each case of ventilated apnea pneumonia (VAP) were $40,000.2,13 VAP development also results in an increase in ventilator days.14–16 VAP is a major concern for ventilated patients in intensive care units (ICUs), so it must be prioritized while caring for critically ill patients.7,15,17,18

PATHOPHYSIOLOGY

In order to comprehend and implement VAP prevention tactics, nurses must be knowledgeable with the pathophysiology of VAP. The duration between the start of mechanical ventilation (MV) and the onset of pneumonia determines the type of ventilator-associated pneumonia (VAP): early onset and late onset.19 Early onset occurs 48 to 96 hours after intubation and is linked to organisms that are susceptible to antibiotics, including Staphylococcus aureus, Streptococcus pneumonia, Hemophilus influenza, Proteus species, Serratia marcescens, Klebsiella pneumonia, and Escherichia coli. Antibiotic-resistant organisms such Pseudomonas aeruginosin, methicillin-resistant Staphylococcus aureus, Acinetobacter species, and Enterobacter species are linked to late-onset intubation, which typically happens 96 hours after the initial intubation.

A patient with VAP may have raised body temperature, leukopenia, apnea, tachypnea, nasal flaring with retraction of the chest wall or grunting, wheezing, rales, rhonchi, and cough, according to the CDCP.9 The pathogenesis of VAP is unknown. colonization of the digestive and respiratory systems as well as microaspiration of secretions from the upper and lower airways are characteristics of VAP. Bacteria colonizing a patient's lower respiratory tract or pulmonary parenchyma while they are on mechanical ventilation causes ventilator-associated pneumonia (VAP). The spread of organisms through the oropharynx, sinus cavities, nares, dental plaque, gastrointestinal tract, patient-to-patient contact, and ventilator circuit can cause aspiration

of secretions or the use of contaminated equipment.2,20,21 Inhaling colonized bacteria from these sources can trigger an active host response, leading to ventilator circuit contamination and bacterial colonization of the lungs.

A Double-Edged Sword in Ventilation and a Gateway for VAP

The lower respiratory tract might be directly penetrated by colonized germs due to the endotracheal tube's presence. Oral secretions and upper airway secretions collect above the tube's cuff. Large amounts of bacteria form a pool that lines the tube and forms a biofilm. These bacteria can be transferred to the lungs through ventilator-induced breaths, which can be dislodged by adding saline to the tube, suctioning, coughing, or repositioning the tube.21,22 Endotracheal tubes create an unusual interruption between the upper and lower airways, giving bacteria a direct path into the lower airway and avoiding the upper airway.21 The body's capacity to filter and humidify air will decline due to the presence of bacteria in the lower airway.22 The presence of such tubes can also reduce or eliminate the cough reflex and impair mucociliary clearance. Additionally, an endotracheal tube gives bacteria a place to attach themselves to the trachea, which increases mucus production and secretion.23 This impairs the host's natural defense mechanisms, raising the risk of bacterial colonization and the aspiration of the colonized organisms.

Aspiration of gastric contents can be another possible cause of VAP, as the stomach may act as a reservoir for bacteria.14 Micro or macro aspirations of oropharyngeal or gastric fluids are a crucial step in the development of VAP. For enteral feedings, medicine delivery, or stomach decompression, patients on mechanical ventilation typically receive nasogastric or orogastric tubes. The gastro-esophageal sphincter is disrupted by the presence of a nasogastric or orogastric tube, which increases gastrointestinal reflux and gives germs a path to move from the stomach to the oropharynx and colonize the upper airway. Enteral feedings raise the pH and volume of the stomach, which raises the possibility of bacterial colonization and aspiration, which could lead to an infection.24

Diagnosis

Because every intubated patient receiving ventilatory assistance is at risk, accurate identification and treatment of ventilator-associated pneumonia (VAP) are difficult and contentious.25 The diagnosis of ventilator-dependent pneumonia (VAP) is based on radiographic findings, clinical findings, and the results of microbiological tests of sputum, such as culture and sensitivity, or invasive testing, such as bronchoscopy.26 Results on chest radiographs are not repeatable and should not be used alone for the diagnosis of VAP, as pulmonary infiltrates seen on chest radiographs of patients receiving mechanical ventilation may be caused by atelectasis, aspiration, pulmonary embolism, pulmonary edema, alveolar hemorrhage, pulmonary infarction, and acute respiratory distress syndrome.2 Five of the most common signs of VAP include significant heavy growth reported in the culture of tracheal

aspirates, body temperature greater than or less than 350 C, development of progressive new infiltrate on X-ray, and leukocytocyto Any two of the aforementioned indicators could be regarded as a VAP diagnosis.

RISK ELEMENTS

VAP can happen to any intubated patient receiving ventilatory support. Three categories—related to hosts, related to devices, and related to personnel—are used to group various risk factors.

Preexisting illnesses include immunosuppression, chronic obstructive pulmonary disease, and acute respiratory distress syndrome are examples of host-related risk factors. A patient's body positioning, advanced age, degree of consciousness, number of intubations, blood transfusion, and medications, such as antibiotics and sedatives, are additional host-related factors.2,27 A patient's decreased level of consciousness increases the risk of aspiration and ventilator-associated pneumonia (VAP).

Risk factors associated with the device include the ventilator circuit, the endotracheal tube, and the existence of an orogastric or nasogastric tube. Secretions accumulate above the endotracheal tube's cuff and pulmonary aspiration rises in supine patients. Such pools may cause microaspiration, or the leaking of microorganisms surrounding the cuff into the trachea, under low cuff pressure. Furthermore, the gastro-esophageal sphincter is also disrupted by nasogastric and orogastric tubes, which increases the risk of VAP and reflux.2,29

One of the risk factors associated with personnel is inappropriate hand washing. not wearing personal protective equipment when antibiotic-resistant germs have been identified, and not changing gloves between patient interactions. If medical personnel don't wash their hands properly before doing procedures like suctioning or adjusting an intubated patient's ventilator circuit

Thus, the possibility of patient-to-patient cross-contamination will raise the risk of VAP. An increased incidence of VAP has also been linked to neglecting to wash hands and change gloves between contaminated patients.30 In addition, when antibiotic-resistant organisms have been identified, patients are more likely to cross-contaminate one another when appropriate personal protective equipment is not worn.

OVERSIGHT

The VAP management task is a crucial and demanding one for the ICU's medical staff. It is dependent upon how the antimicrobial medication, the host reaction, and the infectious pathogen interact. The infection may move to the lungs and cause a pulmonary infection. But a rigorous method to managing VAP has emerged, one that updates local epidemiology, evaluates VAP and

diagnostic tools daily, and uses clinical and biochemical indicators to assess host response. Etiologic diagnostic testing and the prompt start of antibiotics are the two crucial steps that are advised for the treatment of a patient with VAP.31 Antibiotic Management: As part of the initial management of VAP, suitable antibiotics should be chosen for each patient based on their unique risk factors for multidrug-resistant pathogens and the time that the disease first manifested. In addition, it is important to thoroughly examine the antimicrobial spectrum of activity, effective dosages, pharmacokinetic profiles, and side effects of individual antimicrobials.32

Patients with early-onset VAP who do not have a risk factor for multidrug-resistant (MDR) pathogens are advised to start with initial empirical antibiotics, which currently include ceftriaxone, fluoroquinolones, ampicillin-sulbactam, and ertapenem. Initial antibiotic therapy for patients with late-onset VAP or those with risk factors for multidrug resistance (MDR) pathogens may include one of the following options: beta-lactam/beta-lactamase inhibitors (piperacillin-tazobactam) combined with an antipseudomonal fluoroquinolone (ciprofloxacin) or aminoglycoside plus linezolid or vancomycin (if risk factors for methicillin-resistant Staphylococcus aureus are present) or antipseudomonal cephalosporins (such as cefepime, ceftazidime), antipseudomonal carbapenems (imipenem or meropenem), or beta-lactam/beta-lactamase inhibitors (piperacillin-tazobactam).33 Telavancin is indicated for HABP/VAP caused by susceptible isolates of Staphylococcus aureus, including methicillin-susceptible and resistant isolates, when alternative treatments are not appropriate.

ACTION AVOIDANCE

Implementing care bundles in clinical practice for mechanically ventilated patients admitted to ICUs 34 and active surveillance 28 is associated with a reduced risk of ventilator-associated pneumonia (VAP). A care bundle is a collection of essential interventions derived from evidence-based guidelines that are expected to improve patients' health outcomes by facilitating, promoting changes in patient care, and encouraging guideline compliance.34–36 It is based on the pathophysiology and etiology of pneumonia, mode of mechanical ventilation, and duration of ventilation, which provides prompt and consistent preventive strategies.

In order to prevent and reduce ventilator-associated pneumonia (VAP), appropriate multidisciplinary approaches and interventions should be implemented in intensive care units (ICUs). These should start at the time of intubation, or earlier if feasible, and continue until extubation.2,37 The main goals of these interventions should be to prevent microaspiration of subglottic secretions, prevent oropharyngeal colonization, and prevent ventilator equipment contamination.38 Numerous strategies and guidelines have been developed and proposed. The application of evidence-based guidelines for VAP in clinical practice, however, varies and is negatively impacted by a number of factors, including inadequate infection control programs, a lack of training, and a lack of awareness of these guidelines among healthcare professionals.

Every ICU should have protocols for non-invasive mechanical ventilation (NIMV) in acute exacerbations of chronic obstructive pulmonary disease (COPD), weaning, and sedation that promotes lower infusion doses or its daily interruption.19,39,40 Strategies should be developed to integrate evidence-based practices into the daily care given to patients receiving mechanical ventilation.41 Weaning protocols and daily assessments of readiness to wean are very important because the longer a patient is on mechanical ventilation, the higher the risk of developing ventilator-associated pneumonia (VAP) development.40,42,43 A well-implemented VAP bundle will reduce ventilator days, length of stay (LOS), and ultimately the rates of VAP.15

The aspiration of stomach contents is avoided by reducing the use of sedatives and opioids. Prophylaxis to minimize peptic ulcer disease (PUD) and deep-vein thrombosis (DVT) is an important part of the VAP bundle. Other suggested strategies to prevent gastric excess distention include monitoring gastric residual volumes and providing medications to promote stomach motility. Sedation is administered to patients receiving mechanical ventilation. Therefore, antiembolism stockings and antithrombotic medicines are used as part of DVT prevention. Histamine2 blockers, for example, raise the pH of stomach contents and shield the airway from acidic contents as part of PUD prophylaxis 46.

The Nurse's Crucial Role in VAP Prevention: From Daily Evaluations to Evidence-Based Practices

Because the presence of an endotracheal tube predisposes patients to VAP, patients should be evaluated daily for potential weaning and extubation from mechanical ventilation. This can be achieved by using techniques like T-piece trials, weaning intermittent mandatory ventilation, and pressure-support ventilation.15, 53 Daily evaluation of the patient with an interruption in sedation and a spontaneous breathing trial for patient's readiness to be weaned from mechanical ventilation can reduce its duration, preventing VAP.47 The key components of the VAP prevention bundle discussed above are outlined below.
The Nurse's Role in VAP Prevention

Every hospital's everyday task for nurses is to prevent infections. This also holds true for the critical unit, where nurses have a leading role in preventing infections, whether they are VAP or not. They take charge of nursing care, establish and maintain a safe environment, and are essential in preventing nosocomial infections.

In order to shield patients from infection, nurses guide other medical professionals in the use of preventative techniques. Thus, following evidence-based recommendations for preventing infections may be hampered by a lack of understanding of infection prevention and appropriate nursing care.
pneumonia brought on by a ventilator. The incidence of ventilator-associated pneumonia (VAP) is closely linked to the lack of experienced nurses, inadequate knowledge and comprehension of the pathophysiology and risk factors for the development and prevention strategies of VAP.2,54

This is because ICU nurses provide nursing care in close proximity to patients, handle the majority of mechanical ventilation procedures, and mentor other healthcare providers, students, and visitors. Additionally, they ought to be correlated with knowledge, competence, and accountability when providing nursing care to the patient. Nurses should adhere to the nursing process, which consists of assessment, planning, implementation, and evaluation, from the moment a patient is admitted. In addition to alerting the doctor by reporting the patient's response and progress, nurses identify patients who are at a high risk of infection. Using universal precautions like environmental hygiene, nurses should focus on infection control in order to safeguard both themselves and their patients.
Since nurses carry out the majority of mechanical breathing operations, they should be knowledgeable with aspiration, daily weaning trials, sedation holidays, and non-invasive positive pressure ventilation.
prevention, ET tube cuff pressure, head of bed elevation, and subglottic suctioning of endotracheal tubes. To lower the risk of VAP, this knowledge should be appropriately utilized in practice.43,55 Nurses should maintain accurate records and reports, oversee in-service instruction for nursing staff addressing infection control, and provide visitors with appropriate health education counseling.

Conclusion:

Nurses are in charge of the patient's entire care from the time of admission until the patient is discharged. They play a crucial part in preventing VAP because they are one of the members of the health team who spends the most of their time tending to patients. But knowledge alone is not enough; you also need to apply it when and where it matters most by giving patients comprehensive nursing care that is tailored to their individual needs. The primary function that critical care nurses play in preventing VAP is because of this.
VAP, a prevalent infection complication among intensive care unit (ICU) patients receiving mechanical ventilation for a minimum of 48 hours, is a significant factor leading to elevated rates of morbidity, death, hospital expenses, and length of stay (LOS). Healthcare systems have a significant impact on the prevention of VAP by creating policies and procedures and enforcing them. All healthcare providers should receive information on the risk factors and preventive methods of ventilator-associated pneumonia (VAP) in order to prevent and reduce the incidence of VAP. Successful interdisciplinary approaches should be used in intensive care units. Routine nursing care includes the majority of interventions and prevention techniques, which nurses deliver by assuming a variety of roles, including coordinator, educator, manager, care giver, and evaluator.

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