IMPLEMENTATION OF VENTILATOR BUNDLE APPROACH IN PREVENTION OF VENTILATOR ASSOCIATED PNEUMONIA IN GERIATRIC ICU PATIENTS

Thesis

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LIST OF ABBREVIATIONS

Abbrev	Full term
AACN	The American Association of Critical Care Nurse
ARDS	Acute Respiratory Distress Syndrome
ATS	American Thoracic Society
BAL	Broncho Alveolar Lavage
CASS	Continuous aspiration of subglottic secretion
CDC	Center for Disease Control
CFU	Colony forming unit
CLSI	Clinical and Laboratory Standard Institute
CPIS	Clinical Pulmonary Infection Score
DVT	Deep venous thrombosis
ESBL	Extended spectrum beta lactamase
ETA	Endo tracheal aspirate
ETT	Endotracheal tube
Fi O_2	Fraction of inspired oxygen
HAI	Health Care Associated infection
HCAP	Health Care Associated Pneumonia
HH	Heated humidifier
HME	Heat and Moisture Exchangers
HOB	Head of bed
ICU	Intensive Care Unit
IDSA	Infectious Diseases Society of America
IHI	Institute of health care improvement
MDR	Multi drug resistant
MRSA	Methicillin Resistant Staph Aureus
NHSN	National health care safety network
NICE	National Institute for Clinical Excellence
NNIS	National nosocomial infectious surveillance system
P_aO_2	Partial pressure of oxygen

LIST OF ABBREVIATIONS (CONT...)

Abbrev	Full term
PBS	Protected brushing specimen
SDD	Selective digestive decontamination
SEC	Squamous epithelial cells
SOD	Selective oral decontamination
VAP	Ventilator Associated Pneumonia
VRE	Vancomycin resistant enterocoli

INTRODUCTION

Ventilator-Associated Pneumonia (VAP) is a form of nosocomial pneumonia that occurs in patients receiving mechanical ventilation for longer than 48 hours. The risk of pneumonia increases 3- to 10-fold in patients receiving mechanical ventilation. Furthermore, the incidence of VAP reaches 22.8% among ventilated patients ***(Augustyn, 2007).***

The incidence of VAP varies depending on the type of Intensive Care Unit (ICU), and may range from zero to 16 per 1000 ventilator days. Highest rates were identified in traumatic ICU patients, as reported in the National Healthcare Safety Network (NHSN) report ***(Edwards et al., 2007).***

Ventilator Associated Pneumonia increases in morbidity and mortality rates, hospital length of stay, and costs. The mortality rate attributable to VAP is 27% and has been as high as 43% when the causative agent was antibiotic resistant ***(Augustyn, 2007).***

The pathophysiology of VAP involves 2 main processes: colonization of the respiratory and digestive tracts due to spread of organisms from many different sources, and microaspiration of secretions of the upper and lower parts of the airway ***(Kunis and Puntillo, 2003).***

The risk factors for VAP can be divided into 3 categories: patient related, device related, and staff related. Patient-related risk factors include preexisting conditions such as immunosuppression, chronic obstructive lung disease. Device-related risk factors include the presence of endotracheal tube, the ventilator circuit, and a nasogastric tube. Staff-related risk factor include improper infection control practices mainly hand hygiene ***(Kollef, 2004).***

Diagnosing VAP remains difficult and controversial. The diagnosis can be made on the basis of radiographic findings, clinical findings, results of microbiological tests of sputum, or invasive testing such as bronchoscopy according to the Centers for Disease Control and prevention (CDC) case definition ***(Horan et al., 2008).***

Steps for reducing the incidence of VAP are based on the CDC best-practice guidelines for patients receiving mechanical ventilation. Called the "ventilator bundle", these are the following:

- Elevation of the Head Of the Bed (HOB) to 30° to 45° unless medically contraindicated
- Continuous removal of subglottic secretions
- Change of ventilator circuit no more often than every 48 hours

- Washing of hands before and after contact with each patient ***(The American Association of Critical Care Nurse., 2006).***

The prevention of VAP could be monitored by a clinical audit which is a quality improvement process that aims at improving patient care and outcomes through systematic review of care against the standard and the implementation of change at an individual team or service level and further monitoring is used to confirm improvement in healthcare delivery especially for device related infections ***(*National Institute for Clinical Excellence*, 2002).***

AIM OF THE WORK

The aim of this study was to:

- Diagnose Ventilator Associated Pneumonia cases among mechanically ventilated patients in Geriatric ICU.
- Estimate the incidence rate of VAP per 1000 ventilation days.
- Evaluate the role of care bundle approach in prevention of Ventilator-Associated Pneumonia.
- Evaluate the role of colonization in development of VAP.

VENTILATOR-ASSOCIATED PNEUMONIA

Definition of VAP

Ventilator-associated pneumonia (VAP) is defined as pneumonia in a patient on mechanical ventilatory support (by endotracheal tube or tracheostomy) for more than 48 hours. VAP is associated with increased mortality and morbidity in critically ill patients ***(Munro et al., 2009 and Joseph et al., 2010).*** It is one of the leading causes of nosocomial infection in ICU ***(Mandell et al., 2007).***

Incidence of VAP

Ventilator-associated pneumonia is the most common ICU acquired infection ***(Andrew et al., 2011).*** The CDC and NHSN hospitals report a mean VAP rate of 3.6 per 1000 ventilator-days in medical-surgical ICUs ***(Edwards et al., 2007).*** In developing countries, the rates of VAP vary from 10 to 41.7 per 1000 ventilator-days ***(Arabi et al., 2008).***

Systematic review has determined that VAP is one of the most common hospital infections, occurring in 10% to 20% of patients who have received mechanical ventilation for 2 or more days ***(Jennifer et al., 2011).***

Morbidity and Mortality

Ventilator-associated pneumonia is a serious Health Care-Associated Infection (HCAI), resulting in high morbidity, high mortality, and high costs of treatment ***(Jaffar and Mahmoud, 2010).***

Ventilator-associated pneumonia contributes to high mortality in adult intensive care patients ***(Garrouste et al., 2008)***, with attributable mortality ranging from 15 to 70% depending on the patient population ***(Monika et al., 2011).***

Patients who develop VAP are twice as likely to die as similar patients who do not develop VAP. Rough mortality estimates from multiple studies identify rates ranging from 24% to 76% ***(Jennifer et al., 2011).***

Ventilator-associated pneumonia attributable mortality is difficult to quantify because of confounding effects of associated conditions but has been estimated to increase mortality by 30% and even twofold in critically ill patients ***(Rea-Neto et al., 2008).***

Risk group for developing VAP

Different host related factors are reported for VAP according to ***Torpy et al. (2008)*** as follows:

1. Advanced age
2. Co-morbid disease:

- Depressed level of consciousness
- Pre-existing/chronic lung disease (e.g. tuberculosis, chronic obstructive pulmonary disease, bronchiectasis)
- Colonization of the oropharyngeal cavity with hospital-acquired pathogens
- Sinus colonization or sinusitis
- Possibly gastric colonization and aspiration
- Large-volume gastric aspiration
- Immune suppression from disease (e.g. HIV) or medication (e.g. steroids)
- Malnutrition, with a decreased serum albumin level
- Sepsis
- Acute Respiratory Distress Syndrome (prolonged ventilation, devastated local airway host defenses)
- Organ failure
- Neurological/neuromuscular disease
- Burns, trauma.

Patients aged 65 years and older comprise more than one-half of all in ICU admissions; are at greater risk for nosocomial infection, sepsis, and subsequent mortality than younger patients; and have an increased chance of becoming chronically critically ill ***(Milbrandt et al., 2010).***

However indistinct clinical presentations in the older adult make pneumonia difficult to diagnose, so a high index

of suspicion is required in this population ***(Brito and Niederman, 2008).*** Also older patients may improve more slowly than younger patients, with delays in radiographic resolution common ***(Niederman and Brito, 2007).***

Also severity of illness, functional status, age-related physiologic changes, and prolonged mechanical ventilation, but not necessarily age alone, have all been implicated as factors contributing to the often-undesirable outcomes experienced by older adults ***(Wunsch et al. ,2010).***

Some of these factors disproportionately burden older adults (e.g., aspiration and poor oral health), with aspiration pneumonitis, one of the leading causes of re-hospitalization among Medicare beneficiaries ***(Boehm and Scannapieco, 2007).***

Associated risk factors for development of VAP:

Studies directed at decreasing VAP rates have identified numerous risk factors. The predominant risk factors for acquiring VAP are inadequate hand washing, supine positioning of patients, and ventilator mismanagement practices. Also placing the patient at risk is the presence of a nasogastric tube, nasogastric tube feedings, oral aspiration, and gastric alkalization ***(Tablan et al., 2010).***

At the same time other studies linked intubation with a 20-fold increase in risk of pneumonia development and identified intubation as the single most important risk factor