ejpmr, 2021,8(3), 304-308

SJIF Impact Factor 6.222

EUROPEAN JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH

www.ejpmr.com

Review Article

ISSN 2394-3211

EJPMR

VENTILATOR ASSOCIATED PNEUMONIA [VAP]

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Article Received on 12/01/2021 **Article Revised on 02/02/2021** **Article Accepted on 23/02/2021**

ABSTRACT

Ventilator associated pneumonia [VAP] is a serious nosocomial infectious condition. The disease diagnosis and management is an important step to avoid morbidity and mortality. These are many predisposing factors for this condition. I am going to discuss the etiology and pathogenesis, diagnosis, management and most importantly nursing interventions for ventilator associated pneumonia. The best practices of nurses for improve patient status and outcomes are commonly known as bundles of care. It includes elevation of head of bed, use of subglottic secretion drainage, oral hygiene maintenance, daily secretion interruption and assessment of readiness to extubate, endotracheal tube cuff pressure, clean pressure, clean environment, disinfection practices mainly the use of antibiotics and chest physiotherapy. We should also analyze the wrong practices and non compliance of these bundles of care. This article also suggests some important points for managing ventilator associated pneumonia patients which help in current practice.

KEYWORDS: Ventilator associated pneumonia, Endotracheal tube, Nursing Interventions, Bundles of care.

INTRODUCTION

Ventilator associated pneumonia is a serious condition associated with increased healthcare cost, morbidity and mortality. It is a nosocomial condition mainly occurs in patients who are receiving mechanical ventilation for more than 48 hours. In ventilator associated pneumonia, the invaded pathogenic organism grows in oropharyngeal secretions. The infection breeding point of VAP is oral flora, bacteraemia or both [Mietto et al, 2013]. About 20% of intensive care unit [ICU] patients are affected by VAP. So there is a need for ability to diagnose the condition and initiate the disease management.

ETIOLOGY AND PATHOGENESIS

Ventilator associated pneumonia occurs when there is oropharyngeal colonization of internal flora or by pathogens accumulated externally from the critical care environment. The infection may get exclusively from hands or garments of health care workers, contaminated respiratory equipment, hospital water or air aids the occurrence of VAP [Kallet,2015]. Intubation inhibits the body's normal defense mechanism which counter respiratory infection. Endo tracheal tube (ETT) placement disrupts body's tough reflex which protects the airways from invading pathogens. Secretion clearance through mucociliary structures is disrupted and epiglottis refluxes are delayed. These changes enhance the entry of virulent bacteria into the lower respiratory tract through the space around the ETT cuff. This infiltration causes pneumonia. The trachea is a powerful organ which is capable to stretch and expand. Its tone changes by the effect of drugs, posture and head position and the minor act of ventilation. Suit is clearly not possible to obtain a good endotracheal cuff seal in order to fully avoid micro aspiration. Futhermore, necessary ETT movements that happens routinely as part of care allows for aspiration to occur. Another contributing factor is the biofilm formation on the endotracheal tube. ETTs are made of polyvinyl chloride plastics. Bacteria easily adheres to the coating and work as appositive place for bacterial growth. Thus it causes contamination of the lower respiratory tract and development of ventilator associated pneumonia. Aspiration of potentially contaminated oropharyngeal, gastric or tracheal secretions from around the cuffed endotracheal tube into the commonly sterile lower respiratory tract results in maximum cases of endemic VAP [Kallet, 2015].

In pulmonary disease patients like with chronic obstructive pulmonary disease, the patients may be with steroid treatment and it may lower lung's host defense mechanisms. It patients are also unable to produce an effective cough. These factors also aid the risk for VAP. The patients with previous lung infections are also susceptible for ventilator associated pneumonia during hospital stays [Messilla et al,2012].

DIAGNOSIS OF VENTILATOR ASSOCIATED PNEUMONIA

The patients with VAP may present with clinical symptoms like

1) Purulent respiratory secretions
2) Increased body temperature

3) Respiratory distress conditions
4) Hypoxia
5) Cough
6) Worsening levels in lung volumes especially tidal volume.

The patients may also present with increase in inflammatory marker in body. A chest X-ray and sample culture of respiratory tract secretions also helps to identify the pathogen [Dr Felicity miller etal, 2018].

The accuracy of diagnosis of VAP is a primary factor that should be given much importance. Many pulmonary complications of ICU patients are present with similar clinical symptoms of VAP. The clinical signs of VAP is nonspecific. The medical literatures did'nt support the assumption that positive pulmonary culture and increase in pulmonary secretions are highly specific to VAP and it may mislead the diagnosed process. So proper guidelines from reliable sources along with evidence based practice is essential for diagnosis of VAP [Klompas et al, 2007].

NURSING INTERVENTIONS FOR VENTILATOR ASSOCIATED PNEUMONIA

Nurses can implement evidence base practices together which can improve patient outcomes which are commonly known as Bundles of care.

1) ELEVATION OF HEAD OF BED [30°-45°]

In VAP, the contents of oropharynx and GIT may aspirate. Nursing the mechanically ventilated patients in a semi recumbent position aims to present aspiration of gastric content. In an observational study in which the aspiration was measured using the help as technetium [TC] -99m labeled sulphur colloid placed into the stomach, patients who were nursed supine in comparison to patients nursed at 45° had significantly more evidence of aspiration. Many randomized trials in UK shows VAP is associated with nursing the patient in supine position. The elevation of bed to 45° had shown to reduce VAP. Even the exact degree of elevation needed is not clear the elevation of atleast 30° is recommended [Hellyer et al, 2016].

2) USE OF SUBGLOTTIC SECRETION DRAINAGE

Secretions have a potential ability to bypass endotracheal tube cuff, especially when it is deflated. Secretions that pool above the endotracheal tube but below the vocal cords are a potential source of pathogens that could cause VAP. Since conventional secretion methods cannot access this area, endotracheal tubes that have a designed section catheter for this space allows this pods to be drained [Hellyer et al, 2016].

Meta analysis studies showed the benefits of Subglottic Secretion Drainage [SSD] with a consistent signal of reduction in VAP. A relative risk reduction of 0.51 [95% CI 0.37-0.71] was demonstrated by dezflulion etal.The studies shows subglottic secretion drainage reduces the duration of mechanical ventilation by 2 days[95% CI 1.7-2.3] and length of ICU stay by 3 days [95% CI 2.1-3.9] [Hellyer et al,2016] [Dezfulion et al, 2005].

3) ORAL HYGIENE MAINTENANCE

Oral hygiene maintenance plays an important role in controlling microorganisms gathering in oral cavity. Randomized studies in ICUs with use of mechanical teeth brushing as standard care then added two hourly mouth rinsing with sterile water, bicarbonate mouth wash and chlorhexidine demonstrated the effectiveness of tooth brushing to clear dental plaques and control respiratory pathogen[Berry et al 2011].

4) DAILY SEDATION INTERRUPTION AND ASSESSMENT OF READINESS TO EXTUBATE

Sedation of endotracheally intubated patients is universal to ensure patient comfort. Continuous sedation can lead to accumulation of sedatives and over sedation and is mainly associated with increased duration of mechanical ventilation [Arvoliga etal,2005][Hellyer etal,2016].So we assessed mechanical ventilation and intubation as predisposing factors to VAP. Two strategies that have been used by health practioner (especially nurses) to reduce mechanical ventilation are spontaneous breathing trails [SBT] and daily sedation interpretation [DSI] [Hellyer e tal, 2010].

5) ENDOTRACHEAL TUBE CUFF PRESSURE

Endotracheal tube cuff pressure is an important matters in preventing ventilator associated pneumonia as the secretions leak into the lungs through the area around the ETT cuff [Vottier et al 2016]. Mainly a pressure of tracheal tube with a pressure of > 20 cm H2O is recommended to be beneficial [Dr.Felicity Miller et al, 2018].

6) CLEAN ENVIRONMENT, DISINFECTION AND USE OF ANTIBIOTICS

Hospital acquired infections directly affect patient care and is another expense as the health care system. Emphasis should be given to the cleanliness of the environment, disinfection of items used within health care facility and hand hygiene.[Fernando et al 2017]. Adhere to proper hand hygiene measure specifically five months of hand hygiene is the most valuable practice in avoiding nosocomial infections specially ventilator associated pneumonia[Koff etal, 2011]. Another core component is reducing the antimicrobial resistance [AMR] by reducing over usage of antibiotics [Ferando et al, 2017]. So campaigns for hand hygiene, safe and clean environment of hospital and proper use of antibiotic is important.

7) AVOIDANCE OF SCHEDULED VENTILATOR CIRCUIT CHANGES

Humidified gases condense in the ventilator circuit and are at rich of becoming contaminated. Frequent changes of the circuit are a risk factor for the development of

ventilator associated pneumonia [Craven OE et al, 1986]. This may be due to the entry of contaminated secretions to bronchial tree via endotracheal tube lumen due to manipulation of ventilator tubing. The study by Kollef mit et al,1995, suggest that frequency circuit changes are associated with increased incidence of ventilator associated pneumonia, probably due to the excessive manipulation of the ventilator circuit. Changing the ventilator circuit only when clinically indicated such as visible soiling or when faulty results in significant cost saving compared to routine changing of circuit and decrease the incidence of ventilator associated pneumonia [Hellyer et al, 2016].

8) CHEST PHYSIOTHERAPY TO REDUCE PULMONARY INFECTION RATE

Chest physiotherapy helps to reduce pulmonary infection rate and length of mechanically ventilator period. Physiotherapy input in ICU is related to length of hospitalization as early weaning of mechanically ventilation and mobilization reduces the period of hospital stay [Castro et al,2013].

MANAGEMENT OF VENTILATOR ASSOCIATED PNEUMONIA PATIENTS

The type of organism that causes VAP usually depends on the duration of mechanical ventilation. Generally early ventilator associated pneumonia is mainly caused by pathogens that are sensitive to antibiotics, whereas the late onset ventilator associated pneumonia is caused by drug resistant and more difficult to treat bacteria. However this is by no means a rule and merely a guide to inhale antibiotic therapy until further detailed clinical information is available [Kalanuria et al, critical care, 2014].

Assessment of duration of mechanical ventilation is a key factor in selection of appropriate antibiotics. Early onset VAP [≤4 days] are mainly treated primarily with limited spectrum antibiotics whereas we choose broad spectrum antibiotics for late onset VAP [≥ 4 days].

A bacteriological pattern and susceptibility based antibiogram helps to selection of optimally dosed empiric therapy. [Kalanuria et al, critical care, 2014]. Thus the selection of antibiotics is very crucial in determining clinical outcome. Owing to high rate of resistance to monotherapy observed with Pseudomonas aeruginosa combination therapy is always recommended. The usual duration of treatment for early onset of VAP is 8 days and longer duration of treatment is needed in case of late onset ventilator associated pneumonia or if drug resistant organisms are suspected or identified [Kalanuria et al critical care, 2014].

ANALYSIS AND SUGGESTIONS TO CURRENT PRACTICE

To achieve an establishment management of ventilator associated pneumonia, various factors are to be addressed. The management of VAP in various ICUs via various health practioners varies with the level of knowledge and training acquired by them [Safdar et al, 2016]. Critical care nursing interventions play an important role in the prevention of ventilator associated pneumonia, quantitative surveys done in the past shown the critical care nurses awareness about evidence based practice in preventing VAP is limited. Lack of knowledge is a barrier towards the adherence of evidence based practice. So it is vital to assess the critical care nurses knowledge, attitude and opinions about evidence based practice in VAP prevention to guide towards existing practice improvement. Lack of resources and heavy work load of nurses and inability to translate research finding into bedside practice also acts as a barrier and needs strategies for improvement [Jansson et al, 2013].

The introduction of team resources managements [TRM] to the reduction of VAP is ICU is an effective method. This idea includes education sessions for health care staff regarding prevention and management of VAP, encouraging reminder regarding sputum gathering, promoting the maintenance of head of the bed elevated, reinforcing importance of hand hygiene and regular change of respiratory devices and tubing [ching –wei et al, 2015].

Bundles of care have an important aspect in nursing practice to improve patient status, regular subglottic secretion drainage, endotracheal tube cuff pressure maintenance, regular hand hygiene, oral hygiene to avoid respiratory pathogens, disinfection and safer ICU environment for patient which will help to promote better patient care.

Reviewed meta-analysis conducted in the past suggested measures to prevent VAP and reduce mortality rates in ICUs is concluded into three methods –digestive prophylactic methods, circuit prophylactic methods and oropharyngeal prophylactic interventions. In detail these preventive measures explained as digestive decontamination [SDD], making gastric content more acidic, early introduction of enteral nutrition, avoids gastric content aspiration. On second part is circuit prophylactic measures, encourage use of closed inline devices for invasion ventilation, early tracheostomy if prediction of long term mechanical ventilation in need, aerosolized antimicrobials, strict use of humidification for invasive circuit & regular secretion clearance. The third suggestion factor is oropharyngeal prophylaxis which consist of selective oropharyngeal decontamination[SOD], correct patient positioning, strict subglottic secretion clearance, ETT cuff pressure maintenance [G.Nair et al, 2015].

CONCLUSION

In conclusion, ventilator associated pneumonia is a most common nosocomial infection from intensive care unit with patient who require an invasive mechanical ventilation for more than 48 hours via endotracheal tube

or tracheostomy. Nursing interventions are very crucial to reduce hospital stays of patients and control the infection. To adhere to better practices by nursing staff they need proper training and better knowledge. VAP education is critical care unit department helps to improve knowledge and skills of staff. Along with nurses intervention we need appropriate antimicrobial therapy according to the culture and sensitivity results. Long term use of broad spectrum antibiotics therapy should be monitored and withdrawn if not necessary to avoid antimicrobial resistance. Bundles of care with proper knowledge along with a suitable antimicrobial therapy are necessary for better treatment outcome for ventilator associated pneumonia.

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