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EMPIRIC ANTIMICROBIAL TREATMENT FOR THE PATIENTS OF VENTILATOR ASSOCIATED PNEUMONIA

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Abstract

Ventilator-associated pneumonia (VAP) is characterized as pneumonia that happens 48-72 hours or from there on following endotracheal intubation, described by the nearness of another or dynamic penetrate, indications of fundamental infection (fever, adjusted white platelet check), changes in sputum qualities, and identification of a causative operator. VAP adds to approximately 50% of all instances of emergency clinic procured pneumonia. VAP is evaluated to happen in 9-27 % of all precisely ventilated patients, with the most noteworthy hazard being from the get-go over the span of hospitalization. It is the second most regular nosocomial infection in the emergency unit and the most widely recognized in precisely ventilated patients. VAP rates run from 1.2 to 8.5 per 1,000 ventilator days and are dependent on the definition utilized for conclusion [6]. Hazard for VAP is most noteworthy amid the initial 5 days of mechanical ventilation (3 %) with the mean term among intubation and advancement of VAP being 3.3 days. This hazard decreases to 2 %/day between days 5 to 10 of ventilation, and 1 %/day from that point. Prior investigations put the inferable mortality for VAP at between 33-50 %, however this rate is variable and depends intensely on the fundamental medical illness. In our paper we will discuss all about the ventilator associated pneumonia and how it is treated.

Keywords:Ventilator, associated, pneumonia, hospitals, etc.

1. INTRODUCTION

VAP is the most common ICU (intensive care unit)-acquired infection in patients requiring mechanical ventilation for over 48 hours and its estimated incidence is 10-20%. The crude ICU mortality rates for VAP range from 24 to 76%, and these patients are twice as likely to die as those patients on ventilator without pneumonia. Other than being an independent determinant of mortality; VAP is associated with longer ICU and hospital stays, prolonged mechanical ventilation, and higher costs.

In the recent past, various advancements have taken place in the management of VAP. Several studies have provided important insights into the relationship of the histology and bacteriology of VAP, various epidemiological researches have allowed the establishment of concepts for empiric antimicrobial treatment, and various updates on state-of-the-art care have been outlined[1]. However, despite these measures, a majority of issues related to the management of VAP remain unresolved and are subject to controversy. This is particularly true for the diagnostic evaluation of a patient with suspected VAP. The lack of consensus regarding the best way to diagnose VAP largely explains why the incidence rates vary so widely from one study to another — from 5 to 50% of mechanically ventilated intensive care unit (ICU) patients.

The primary task of nursing research is to contribute to the scientific base of nursing practices. Studies are needed to determine the effectiveness of nursing intervention and nursing care. Through research efforts, the science of nursing will grow and a scientifically based rationale for making changes in nursing practice will be generated. 3 As the patients' needs become more complex in the critical care setting nurses with increased expertise are needed to expand the research based knowledge and apply existing knowledge in practice setting. For example the knowledge and correct practices of suctioning is very important for nurses because improper suctioning can lead to hypoxia, cardiac arrhythmias, hypotension, increased respiratory work, unexplained cardio vascular collapse and sudden death.

2. HISTORY OF VENTILATORS

- **Early History of Ancient times**

Ancient writings by the Egyptians and Greeks described theories of respiration. In the Old testament it is mentioned that Prophet Elisha inducing pressure breathing from his mouth into the mouth of a child The Hippocratesin (460-375 BC) wrote the first description of endotracheal intubation in his book – 'Treatise on Air' here it was mentioned regarding introduction a cannula into the trachea along the jaw bone so that air can be drawn into the lungs. Later Paracelsus (1493-1541) used 'Fire Bellows' connected to a tube inserted into patient's mouth as a device for assisted ventilation. This was the first study (1550) which credited him with the first form of mechanical ventilation. Vesalius in (1543) performed ventilation via a tracheostomy in a pig. Hook (1667) used bellows via a tracheostomy in a dog. John Fathergill in 1744 reported a successful case of 'mouth to mouth' resuscitation. John Hunter developed double bellows for

resuscitation in 1775 - one for blowing air in and the other for drawing bad air out. Draeger designed an artificial breathing device "DraegerPulmoter" in 1911 that was used by fire and police units.

- **Negative Pressure Ventilators**

From the mid 1800-1900s a large number of devices were invented that applied negative pressure around the body or thoracic cavity – these devices became known as negative pressure ventilators or 'iron lungs'. Two successful designs became popular; in one, the body of the patient was enclosed in an iron box or cylinder and the patient's head protruded out of the end. The second design was a box or shell that fitted over the thoracic area only (chest cuirass). Patients with chronic paralytic disorders were successfully ventilated on this type of ventilators at home for 25-30 years.

Between July-December of 1952, in Copenhagen, 2722 patients with poliomyelitis were treated in the Community Disease Hospital of which 315 patients' required ventilatory support. Many principles of Intermittent Positive Pressure ventilator (IPPV) were defined during that time –including the use of cuffed tubes, periodic sigh breaths and weaning by reduction of assisted breaths. Towards the end of the epidemic a few positive pressure ventilators were invented.

- **Present history of ventilators.**

A mechanical change of substantial importance in the late 1960's and early 1970's that shaped the present era was the introduction of Positive End Expiratory Pressure (PEEP). Two modes of ventilation Assisted Ventilation (AV) and Controlled Mechanical Ventilation (CMV) came together in a single piece of equipment and the modern era of multiple choice respiratory supports was born. The introduction of intermittent mechanical ventilator (IMV) permitted spontaneous respiration in the midst of substantial respiratory failure which paved the way for a means of weaning i.e. synchronized intermittent mechanical ventilation (SIMV), positive pressure ventilation (PSV) proved to be an addition to IMV that facilitated spontaneously breathing patients.

3. INTENSIVE CARE UNIT

An intensive care unit (ICU), also known as a critical care unit (CCU), intensive therapy unit or intensive treatment unit (ITU) is a special department of a hospital or health care facility that provides intensive

care medicine. Intensive Care Units cater to patients with the most severe and life-threatening illnesses and injuries; that require constant, close monitoring and support from specialist equipment and medication in order to maintain normal bodily functions. They are staffed by highly trained doctors and critical care nurses who specialize in caring for seriously ill patients.

- **History of Intensive care Unit**

In 1854, Florence Nightingale left for the Crimean War, where triage, used to separate seriously wounded soldiers from the less-seriously wounded, was observed., It was reported that Nightingale reduced mortality from 40% to 2% on the battlefield, her experiences during the war formed the foundation for her later discovery of the importance of sanitary conditions in hospitals, a critical component of intensive care. In 1923, Dr Walter E Dandy opened a special three-bed unit for the more critically ill postoperative neurosurgical patients at the Johns Hopkins Hospital in Baltimore, MD, USA, using specially trained nurses to help monitor and manage them. In 1930, Dr Martin Kirschner designed and built a combined postoperative recovery / intensive care ward in the surgical unit at the University of Tubingen, Germany. Other surgical units followed these examples, such that by 1960 almost all hospitals had a recovery unit attached to their operating rooms

- **Critical care at present**

Improved communication with patients and their families is now part of daily practice and the importance of involving the patient and family in decision-making, especially at the end of life, is also stressed, replacing the more paternal approach of the past . The need for a multidisciplinary approach to patient care is also recognized, and increasingly nutritionists, physiotherapists, pharmacists, infectious disease consultants, and members of other relevant specialties are regularly included in patient rounds. Large hospital-wide infection prevention schemes, focusing largely on increased awareness and improved hand-hygiene, have also been established to limit development of nosocomial infections.

4. HOW VAP HAPPENS

Different extra riskfactors have been appeared to expand the rates of VAP. These are effortlessly separated into non-modifiable and modifiable classes. Non-modifiable riskfactors incorporate male sex, expanded age (more than 60 yr.), history of ceaseless obstructive aspiratory infection, the nearness of a

tracheostomy or cranial injury, late neurologic surgery, intense respiratory pain disorder, multiorgan framework disappointment, and extreme lethargies. Possibly modifiable risk elements incorporate recumbent situating, gastric over distension, colonization of ventilator circuits, low weight in the ETT sleeve and rehashed persistent exchanges.

Pathophysiology of VAP: In solid people different factors cooperate to battle off the advancement of pneumonia; tragically the nearness of an ETT and also the run of the mill clinical conditions of ICU patients (i.e. sedation, recumbent situating, and colonization of the oropharynx with pathogenic microorganisms) meddle with these local safeguard instruments and incline intubated patients to the advancement of VAP. An unmistakable comprehension of the pathophysiology is critical to comprehend the objectives of VAP-counteractive action systems.

Similarly, as with any pneumonia, VAP happens when the microscopic organisms are brought into the regularly sterile lower respiratory tract and overpower the host's ordinary safeguard instruments against disease. Two factors have been portrayed for the passage of infection bringing about creatures into the lower respiratory tract: most noteworthy is small scale desire of pathogenic living beings from the upper respiratory tract/gastrointestinal tract around the ETT and the second is biofilm generation on the ETT itself.

The upper respiratory tract of the greater part of the mechanically-ventilated patient is colonized with conceivably pathogenic microorganisms. This was first settled in a review in 1969 that detailed the nearness of enteric gram-negative microbes in the oropharynx of 75 for every penny of fundamentally sick patients[7]. A proposed clarification is a bacterial abundance of the upper gastrointestinal tract and retrograde development.

The desire of discharges containing these pathogens gives a way to disease of the clean bronchial tree. Another review distributed in 2007 affirmed the nearness of comparative pathogenic microorganisms in the lower respiratory tract of intubated patients by looking at DNA tests from microbes on the tongue and acquired from bronchoalveolar lavage (BAL). The second potential wellspring of presentation of microorganisms into the lower respiratory tract can be ascribed to the ETT itself.

5. VAP PREVENTION: INFECTION CONTROL IN THE ICU

The goal of infection control is to prevent cross transmission of pathogens, which has been shown to play an important role in the development of nosocomial infections including VAP. An effective strategy should target infection control from several vantage points: education of the medical team, universal hand hygiene, use of personal protective equipment and a protocol for microbiological surveillance36.

All healthcare providers involved in the care of patients requiring mechanical ventilation should be educated about and take an active role in VAP prevention, as multidisciplinary teams, who are well educated about infection control measures, are more successful in VAP prevention37,38. However, the translation of decades of research showing the effectiveness of VAP-prevention strategies into clinical practice has proven to be challenging. Studies conducted amongst ICU physicians and nurses reveal that only 37 and 22.3 per cent of these care providers respectively follow published recommendations for prevention of VAP39,40. Care bundles have been proposed to address this gap in implementation of guidelines but studies to date have been inconclusive.

Ventilated-associated pneumonia (VAP) is a major concern for hospitals and a major problem for ventilated patients in the intensive care unit. Included in the basics are hand hygiene, wearing gloves, endotracheal tube suctioning, head of bed at 30°, stress ulcer prophylaxis, turning patient side to side at least every two hours, and giving the patient a sedation vacation each morning. Beyond the basics included here are oral hygiene, oral suctioning, endotracheal tube cuff pressure, artificial humidification, the difference in practice between registered nurses and respiratory therapists, using the beach chair position and early mobilization, and the VAP bundle. The prevention of VAP becomes the focus for both nurses and respiratory therapists working with patients who are ventilated.

6. STRENGTH AND BARRIERS OF VAP PREVENTION BUNDLES

A Nation-wide application of VAP prevention bundles requires an organizational structure, which is participatory and transversal, including regional and national healthcare organizations, scientific societies, hospital management, infection control staff, physician and nurse leaders in ICUs, and the collaboration of all HCW working in the ICU. The greater the implication of each category in the pyramid of liabilities, the bigger is the chance of success. The main barrier to implementation is uncoordinated activity of participants. Involved parties need to work in coordination, unconditionally and avoiding egos. Some units argued that the need for additional resources to apply the recommendations

and to collect the data needed for calculation of rates is a barrier for participation in the National Projects and for implementing the bundles.

The training of HCW in charge of the critically ill in applying the VAP bundle is associated with conveying the concept of patient safety and the use of tools like identification of errors, communication, meetings with hospital management and establishing targets for improvement. In India, the bundles for the prevention of CRBSI and VAP have been key to facilitate the dissemination of a culture of critically ill patient safety.

Most studies show that the application of VAP bundles is associated with significant reductions in VAP rates. This impact grows as a function of time and adherence. The low VAP rates reached have persisted, as indicators of national and international registries of this infection reveal. As a consequence, quality reference standards for VAP rates have been adapted. In the Calgary Health Region (Canada), ICUs reduced their VAP rate goal in 2008 from 9.9 to 7.4 cases per 1,000 ventilator-days after incorporating a prevention bundle. In India, SEMICYUC has reduced the reference standard quality indicator for VAP from 18 episodes in 2005 to 12 in 2011 and to 7 in 2017 per 1,000 days of mechanical ventilation, after "Neumonía Zero".

Local and national VAP prevention bundles have shown to be efficient in transferring knowledge to clinical practice in ICUs. The strategies used most frequently for implementation of VAP bundles have been education, posters, audits of adherence, and feedback of results. Most initiatives have accomplished significant reduction in VAP rates, in spite of considerable heterogeneity of recommendations, ways of implementation, auditioning of adherence and registry of VAP rates.

7. VAP PREVENTION: REDUCING THE TIME AT RISK

As talked about over, any intubated patient is at risk for the advancement of VAP and the more extended the length of mechanical ventilation, the higher the risk. Therefore, the counteractive action of VAP must start with maintaining a strategic distance from or restricting the time of mechanical ventilation at whatever point conceivable. A few methodologies have been portrayed to accomplish this objective: non-intrusive positive weight ventilation (NPPV), sedation occasions, weaning trials, keeping away from re-intubation, and early tracheostomy have all been considered as techniques to diminishing time of mechanical ventilation and hence, diminish the danger of VAP. Non-invasive positive weight ventilation:

The utilization of NPPV has been appeared to fundamentally bring down the danger of VAP and has likewise shown mortality advantage in randomized reviews led utilizing patients with an assortment of ailments. A meta-investigation including 12 investigations of more than 800 patients, affirmed these discoveries. Furthermore, earlier reviews have demonstrated that NPPV is especially valuable in patients with intense worsening of incessant obstructive pneumonia malady and patients with aspirator oedema[8]. Along these lines, it is suggested that NPPV is utilized when conceivable to avoid endotracheal intubation. Day by day weaning trials and sedation occasions: When the choice is made to intubate a patient, a methodology to free the patient from mechanical ventilation should likewise be considered. Day by day weaning trials and sedation occasions have been more than once depicted and approved as systems that utmost the season of mechanical ventilation. As the danger of VAP is identified with the length of mechanical ventilation, restricting this term bodes well; however, no randomized trials have demonstrated an advantage concerning the decrease in VAP rates.

Re-intubation: Re-intubation is associated with a higher danger of VAP because of higher rates of the goal. Satisfactory ICU staffing ought to be kept up to limit spontaneous extubations requiring re-intubation, and arranged extubations ought to be painstakingly considered. As clinicians propose weaning, they should be aware of and adjust the dangers associated with re-intubation and the total time of mechanical ventilation. Early tracheostomy: It was already suspected that early tracheostomy may prompt better results. Nonetheless, an as of late distributed meta-examination of studies contrasting early tracheostomy (performed within 7 days of intubation) and either drawn out endotracheal intubation or delayed endotracheal intubation taken after by tracheostomy found that the planning of tracheostomy was not associated with a critical diminishment in here and now mortality, long haul mortality, the rate of VAP, length of mechanical ventilation, term of sedation, span of ICU or healing centre stay, or different difficulties. Avoidance of colonization of the upper aviation route and gastrointestinal tracts has additionally been focused as a way to anticipate VAP. Here we talk about the relative utility of oral cleaning, specific stomach associated sterilization, and the utilization of probiotics. Specific stomach associated track purification: Selective stomach associated tract sterilization (SDD) and particular oropharyngeal disinfecting (SOD) are measured in which anti-microbial treatment is utilized to annihilate conceivably pathogenic microorganisms in oral, gastric, and intestinal greenery. Anti-infection agents are regularly non-absorbable, topical arrangements of anti-infection agents with expansive range movement

controlled either orally, enter partner and additionally in conjunction with parenteral antimicrobials. These strategies have been examined for a considerable length of time and have been the subjects of audits and meta-investigation indicating humble diminishments in mortality.

8. CONCLUSION

VAP is a typical infection and certain mediations may influence the occurrence of VAP. ICU clinicians ought to know about the hazard factors for VAP, which could demonstrate helpful in distinguishing patients at high hazard for VAP and adjusting patient consideration to limit the danger of VAP, for example, maintaining a strategic distance from superfluous bronchoscopy or balancing enteral bolstering. VAP keeps on being a regularly experienced test among fundamentally sick patients and worries about noteworthy concerns of dreariness, antibiotic usage and cost. Concentrates on counteractive action methodologies coordinated towards the pathophysiologic systems of VAP have indicated variable achievement.

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