
بسم الله الرحمن الرحيم

Nosocomial Pneumonia

Incidence and Associated Burden

- Nosocomial pneumonia is the second most common nosocomial infection and the leading cause of death from nosocomial infections among critically ill patients.

- Incidence ranges from 5 to more than 20 cases per 1000 hospital admissions, with the highest rates in immunocompromised, surgical, and elderly patients.

- Approximately one-third of nosocomial pneumonias are acquired in the ICU, with VAP being the majority of these ICU-acquired pneumonias.

- Cook et al. estimated that the risk of VAP is 3% during the first 5 days on MV, 2% from the 5th to the 10th days, and 1% for subsequent days.

- Nosocomial pneumonia, and particularly VAP, increases the duration of hospitalization and healthcare costs.

Mortality

- The crude mortality from nosocomial pneumonia may be as high as 30% to 70%.

- Several reports have estimated that one-third to one-half of all VAP-related deaths are the direct result of the infection, with a higher mortality rate in cases caused by Pseudomonas aeruginosa and Acinetobacter spp.

- Attributable VAP mortality has been defined as the percentage of deaths that would not have occurred in the absence of the infection.

- The most recent studies reported an attributable mortality associated with VAP of 10%, with surgical patients and patients with mid-range severity of illness at the highest associated risk.

PATHOGENESIS

- Pathogens must first gain access to the airways to cause pneumonia, and intubated patients are at high risk for aspiration of colonized oropharyngeal secretions.

- In healthy, nonintubated patients, when bacteria gain access to the respiratory tract, colonization is prevented through defense mechanisms, such as a cough, mucus clearance, and cellular and humoral immune responses.

- Critically ill and intubated patients are already at a high risk for infection because of underlying illness, comorbidities, malnutrition, and invasive devices or procedures.

- Pulmonary aspiration of the colonized oropharyngeal secretions across the endotracheal tube (ETT) cuff is the main pathogenic mechanism for the development of VAP.

- The most commonly used ETT for longterm mechanically ventilated patients comprises a high-volume, low-pressure (HVLP) cuff.

- The diameter of the HVLP cuff is two to three times larger than the tracheal diameter.

- When the ETT cuff is inflated within the trachea, folds invariably form along the cuff surface, causing consistent aspiration of oropharyngeal secretions.

- Bacteria easily adhere to the ETT internal surface to form a structure called a biofilm.
- Biofilm is composed of sessile bacteria embedded within a selfproduced exopolysaccharide matrix.
- Indeed, sessile bacteria are difficult to eradicate by the host's immune response or antibiotics.
- During MV, biofilm particles may dislodge into the airways as a result of the inspiratory airflow and invasive medical interventions, such as tracheal aspiration.

Sources of Colonization

- Patients are colonized exogenously by contaminated respiratory equipment, the ICU environment, and the hands of the ICU staff.

- Several reports have described ICU outbreaks due to colonized bronchoscopes water supply, respiratory equipment, humidifiers, ventilator temperature sensors, respiratory nebulizers, and the contaminated ICU environment.

- Endogenous colonization is the primary pathogenic mechanism for VAP development.

- In patients undergoing MV; the oropharynx is the first site to be colonized by pathogens (36 hours), followed by the stomach (36-60 hours), the lower respiratory tract (60-84 hours), and the ETT thereafter (60-96 hours).

- In ICU patients, several oropharyngeal defense mechanisms are dramatically altered.

❖alcohol abuse

❖Diabetes

❖COPD

❖the extensive use of antibiotics in critical care settings

❖the antimicrobial effectiveness of saliva is highly impaired due to a dramatic reduction in the salivary flow

- Bacteria that colonize the oropharynx also produce a large variety of hydrolases that lead to increased expression of key receptors for bacteria adhesion.

- sinusitis increased the risk of nosocomial pneumonia.

- According to the gastropulmonary hypothesis of colonization, the stomach of ICU patients is colonized by pathogens due to gastric alkalinization associated with enteral nutrition and drugs for prevention of gastrointestinal bleeding.

- Continuous gastroesophageal reflux facilitates translocation of microbes into the oropharynx, which is then aspirated across the ETT cuff.

- Early studies have shown that in tracheally intubated patients, gastric pH higher than 4 was consistently associated with gastric colonization.

- Several studies have not found a relationship with bacteria causing VAP as first originating in the stomach.

- Tracheal intubation prevents the closure of the glottis. Hence, it hinders cough; moreover, intubated patients are often sedated and unable to generate high expiratory flows.

Etiologic Agents for Nosocomial Pneumonia

- Microorganisms responsible for nosocomial pneumonia differ according to the ICU population, the duration of hospital and ICU stays, and the specific diagnostic method(s) used.
- VAP is commonly caused by aerobic pathogens, often MDR, including P. aeruginosa, Acinetobacter species, carbapenemase-containing Klebsiella pneumoniae, and MRSA.
- It seems that in ICU-acquired pneumonia, the overall frequency of MDR pathogens and MRSA is sufficiently high to warrant the use of broad empirical therapy.

- Patients with COPD are at increased risk for Haemophilus influenzae, Moraxella catarrhalis, P. aeruginosa, or S. pneumoniae infections.

- Patients with acute respiratory distress syndrome (ARDS) are at higher risk for developing VAP caused by S. aureus, P. aeruginosa, and Acinetobacter baumannii, and often in these patients, VAP is caused by multiple pathogens.

- Trauma and neurologic patients are at increased risk for S. aureus, Haemophilus, and S. pneumoniae infections.

- Legionella pneumophila as the cause of nosocomial pneumonia should be considered, particularly in immunocompromised patients. Often, the source of legionellosis outbreaks within the hospital is a water system that has become colonized by the microorganism.

- Candida spp. and Aspergillus fumigatus are the most commonly isolated fungi, predominantly in immunocompromised patients.

- Candida promotes the development of pneumonia by creating biofilms that facilitate bacterial colonization.

- Viruses may also cause VAP. Herpes simplex virus type-1 (HSV-1) nosocomial pneumonia is more frequently reported in immunocompromised patients and patients with ARDS, major surgery, or extensive burns.


THANK YOU