Nosocomial Pneumonia in ICU – A Review article

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Abstract:

**Aim:**
The aim of the article is to review about the nosocomial pneumonia in intensive care unit.

**Objective:**
The main objective of this article is to get knowledge about nosocomial pneumonia in the intensive care unit.

**Background:**
This study is to determine incidence, clinical features, microbiological flora and prognosis of patients with nosocomial pneumonia (NP) in medical intensive care unit (ICU). Nosocomial pneumonia is associated with substantial morbidity and mortality. Patients treated with mechanical ventilation have the highest risk for developing this intensive care unit acquired pneumonia. Pneumonia is the most commonly reported nosocomial infection in ICU patients, occurring predominantly in patients whose lungs are ventilated, at a rate of 1% to 3% per day of mechanical ventilation. Substantially increased costs and mortality have been attributed to nosocomial pneumonia. It is hoped that studies based on improved diagnostic techniques, such as quantitative cultures of protected brush or bronchoalveolar lavage specimens, will provide the basis for an improved understanding of the epidemiology and prevention of this important infection in critically ill patients. Nosocomial pneumonias constitute important problem in medical ICU and are associated with high mortality. However with intensive supportive care and appropriate antibiotics many such lives can be saved.

**Reason:**
To know about nosocomial pneumonia in ICU in depth.

**Keywords:** Microorganisms, streptococcus pneumonia, infection, mortality, antimicrobial, pathogens.

**INTRODUCTION:**
Hospital-acquired pneumonia (HAP) or nosocomial pneumonia refers to any pneumonia contracted by a patient in a hospital at least 48–72 hours after being admitted. It is thus distinguished from community-acquired pneumonia. It is usually caused by a bacterial infection, rather than a virus. Nosocomial pneumonia is the most frequent hospital acquired infection and along with primary bacteremia, it is the leading cause of death from infection acquired in the hospital (1). The pathogenesis of this type of pneumonia is directly related to oropharyngeal and stomach colonization. Such colonization is more prominent in critically ill patients, and intubation increases the risk of micro aspiration by different mechanisms. In patients who require mechanical ventilation in the intensive care unit (ICU), this process frequently culminates in the development of nosocomial pneumonia. Because pathogens emerge and old pathogens develop new virulence mechanisms as fast as new antibiotics are developed, antimicrobial prophylaxis against nosocomial pneumonia may be an important strategy for prevention. The present incidence of nosocomial pneumonia in the incidence is age dependent with important morbidity, mortality, and economic cost. Bacteria are responsible for more than 90% of the pneumonias, the most common isolates being aerobic Gram-negative bacilli and S. aureus. In mechanically ventilated patients, the incidence of nosocomial pneumonia ranges from 9 to 68% in the year 2000 (2). The mortality rate has decreased in recent years, but it is still substantially high (3). Although the incidence varies with geographical location, type of ICU, patient population and local infection control practices, at any one time up to 20% of ICU patients may have a nosocomial infection (7,8). It has been suggested that a third of these infections may be preventable with effective infection control programmes (9). Increasing microbial resistance worldwide imposes an additional challenge for prevention and antimicrobial treatment (10). The institution of timely and appropriate antimicrobial therapy is crucial to decrease the complications and mortality related to pneumonia (1,3,5). One of the risk factors for nosocomial pneumonia in critically ill patients is prolonged immobilization associated with mechanical ventilation. The prevention of nosocomial pneumonia could significantly reduce morbidity, mortality and health care costs associated with critical illness. Thus, knowledge of the likely microbial etiology is extremely important to ensure the choice of an appropriate empiric antimicrobial therapy. This article will briefly review the key data and suggest approaches to the diagnosis, treatment, and prevention of nosocomial pneumonia in ICU patients.

**INCIDENCE:**
The incidence depends upon the age, with about 5/1000 cases in hospitalised patients aged under 35 and up to 15/1000 in those over 65 years of age. Its incidence ranges from four to 50 cases per 1,000 admissions (14,15) in community hospitals and general medical wards of teaching hospitals, and up to 120 to 220 cases per 1,000 admissions (16,17) in some intensive care units (ICU) or among patients requiring mechanical ventilation. Together with primary bacteremias, NP is the leading cause of mortality directly related to nosocomial infection (16). Death from nosocomial pneumonia in ventilated patients reaches 30±50%, with an estimated attributable mortality of 10±50% (4-6). Pneumonia may be indicated by, or defined...
clinically as, the presence of a new lung infiltrate plus evidence that the infiltrate is of an infectious origin such as the new onset of fever, purulent sputum, or leukocytosis. The relationship between nosocomial infections and in hospital mortality remains unclear. The report from the Study on the Efficacy of Nosocomial Infection Control (SENIC) project (11) estimated that at least 2.1 million nosocomial infections occurred annually among 37.7 million admissions in United States hospital, and considered 77,000 deaths to be associated with nosocomial infections (12). The highest rates of nosocomial infections are observed in intensive care units (ICUs), which are also the units in which the most severely ill patients are treated and in which the highest mortality rates are observed (13). The latter results from the acute severity of illness of ICU patients and their frequent exposure to therapeutic procedures.

CAUSES:

The development of nosocomial pneumonia represents an imbalance between normal host defences and the ability of microorganisms to colonise and then invade the lower respiratory tract. In a studies a consistent 6 organisms- staphylococcus aureus (28.0%), pseudomonas aeruginosa (21.8%), klebsiella species (9.8%), escherichia coli (6.9%) caused ~80% of episodes, with lower prevalences of serratia species, stenotrophomonas maltophilia and community-acquired pathogens, such as pneumococci and haemophilus influenzae. Inhalation, aspiration, and hematogenous spread are the 3 main mechanisms by which bacteria reach the lungs. The primary route through which organisms enter the lower airways is via aspiration of oropharyngeal secretions into the trachea in seriously ill patients. Acinetobacter species commonly colonize the respiratory tract secretions in patients in the ICU. Care must be exercised in interpretation of culture data. Streptococcus pneumoniae should be considered in early onset hospital-acquired pneumonia. This bacterium causes up to 9% of pneumonias in elderly patients in nursing homes. Haemophilus influenzae should also be considered in early onset hospital-acquired pneumonia.

### PATHOGENS ASSOCIATED WITH NOSOCOMIAL PNEUMONIA

<table>
<thead>
<tr>
<th>Low risk pathogens</th>
<th>High risk pathogens</th>
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<tr>
<td>Streptococcus pneumoniae</td>
<td>Pseudomonas aeruginosa</td>
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<tr>
<td>Haemophilus influenzae</td>
<td>Acinetobacter species</td>
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<tr>
<td>Methicillin-sensitive staphylococcus aureus (MSSA)</td>
<td>Methicillin-resistant staphylococcus aureus (MRSA)</td>
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<td>Escherichia coli</td>
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<tr>
<td>Klebsiella pneumoniae</td>
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<td>Enterobacter species</td>
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### RISK FACTORS:

Dividing patients with VAP into groups with early and late onset has been shown to be of paramount importance (21). Early onset pneumonia commonly results from aspiration of endogenous community acquired pathogens such as Staphylococcus aureus, Streptococcus pneumoniae, and Haemophilus influenzae, with endotracheal intubation and impaired consciousness being the main risk. Conversely, late onset pneumonia follows aspiration of oropharyngeal or gastric secretions containing potentially drug resistant nosocomial pathogens. Only late onset VAP is associated with an attributable excess mortality. Firstly, the starting point for early onset pneumonia has varied considerably, including time of hospital admission, admission to the ICU, or of endotracheal intubation. If the time of admission to the ICU is chosen as the starting point, patients may already have been colonised in hospital (18). One of the risk factors for nosocomial pneumonia in critically ill patients is prolonged immobilization associated with mechanical ventilation. In addition to age, sex, place of hospitalisation, chronic lung disease, roentgenographic extent of the pneumonia, white blood cell count, and the causative agent, a series of factors frequently cited in the literature (17,20) which influence the outcome of nosocomial pneumonia, were determined to be either present or absent in each episode.
Nosocomial pneumonia is a common nosocomial infection associated with ventilated patients. The organisms associated with nosocomial pneumonia and their resistance pattern varies depending on the patient group and hospital setting (22). Several investigations have addressed the efficacy of antimicrobial treatment as well as its impact on microbial resistance. The immediate administration of treatment is crucial and inappropriate treatment is associated with an increased risk of death from pneumonia. Moreover, even if the initially inappropriate antimicrobial treatment is corrected according to diagnostic results, there remains an excess mortality compared with patients treated appropriately from the beginning (27). Conversely, antimicrobial treatment is not without risk. However, if pneumonia due to high risk organisms (P. aeruginosa, A. calcoaceticus, S. marcescens, P. mirabilis and fungi) was included in the model, the presence of these high risk organisms was the only independent predictor and antimicrobial pretreatment entirely dropped out (20). Thus, antimicrobial treatment is associated with excess mortality due to pneumonia caused by drug resistant microorganisms. Furthermore, each treatment regimen exerts a specific selection pressure so that recommendations for initial empirical antimicrobial treatment must accommodate local variations in infecting organisms and their resistance patterns (28-31).

New Developments in Antimicrobial Treatment:

We suggest a change in perspective away from the individual and towards an epidemiological approach, as elaborated in the ATS guidelines (21). These include:

1. Initial antimicrobial treatment must always be empirical.

2. Empirical antimicrobial treatment can be guided by three criteria: severity of pneumonia, time of onset, and specific risk factors. All pneumonias acquired in the ICU are severe by definition in the guidelines.

3. The selection of antimicrobial agents must be adapted to local patterns of microbial resistance.

Another approach to reducing the microbial selection pressure imposed by empirical antimicrobial treatment is to reduce exposure by minimising the duration of treatment. The general framework for empirical initial antimicrobial treatment must be modified according to local requirements. Regular updates of data on potential pathogens of VAP indicating trends in microbial and resistance patterns are mandatory.

Appropriate Antibiotic Regimens:

Appropriate empiric antibiotic therapy must be directed at the most prevalent and virulent pathogens. Prevalence of particular nosocomial pathogens and prevailing antibiotic resistance levels vary from one ICU to another, depending on many factors. In most ICUs, effective empiric therapy will require activity against Gram-negative bacilli, especially Pseudomonas and Acinetobacter, as well as Gram-positive organisms. According to the guidelines of the ATS, antibiotic therapy should be based on specific risk factors that influence the spectrum of causative microorganisms in patients with NP. Substantial resources have been directed to and efforts have been made to improve and promote rational antibiotic use in ICUs. To date, no antibiotic or antibiotic regimen could be linked to a sustained better outcome in severely ill patients with VAP in terms of morbidity, mortality, and related costs. However, we have learned that there is a reduction in mortality with any regimen that is given promptly. Thus, at least initially, multi drug therapy will be required.
CONCLUSION:
Much progress has been made in the understanding of nosocomial pneumonia and this has influenced management guidelines. Nevertheless, important issues in diagnosis and treatment remain unresolved. We argue that the controversy over diagnostic tools should be closed. Instead, every effort should be made to increase our ability to make valid clinical predictions about the presence of VAP and to establish criteria to guide restricting empirical antimicrobial treatment without causing patient harm. At the same time, more emphasis must be put on local infection control measures such as routine surveillance of pathogens, definition of controlled policies of antimicrobial treatment, and effective implementation of strategies of prevention. Thus, nosocomial infections exact a heavy toll on all concerned—the patient, the medical staff, and economic resources—especially in cases of multiple infections.

REFERENCES: