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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.

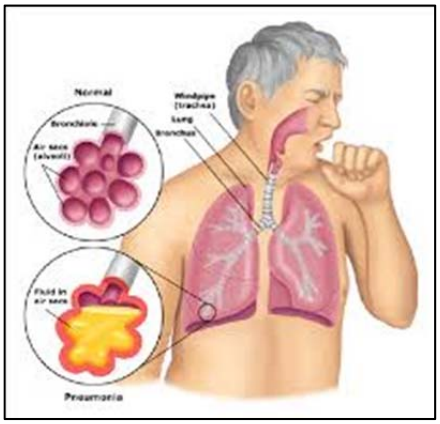
INTRODUCTION:

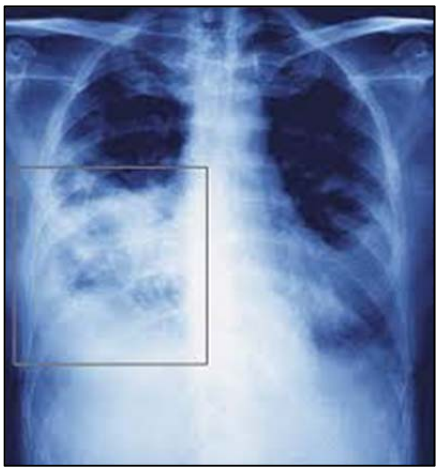
Hospital-acquired pneumonia (HAP) or nosocomial pneumonia refers to any pneumonia contracted by a patient in a hospital at least 48–72 hours after being admitted. It is thus distinguished from community-acquired pneumonia. It is usually caused by a bacterial infection, rather than a virus. Nosocomial pneumonia is the most frequent hospital acquired infection and along with primary bacteremia, it is the 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 phe 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

Low risk pathogens	High risk pathogens
Streptococcus pneumoniae	Pseudomonas aeruginosa
Haemophilus influenzae	Acinetobacter species
Methicillin-sensitive staphylococcus aureus (MSSA)	Methicillin- resistant staphylococcus aureus (MRSA)
Escherichia coli	
Klebsiella pneumoniae	
Enterobacter species	

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.

RISK FACTORS FOR NOSOCOMIAL PNEUMONIA

Impaired Host Defenses / Increased Aspiration	
Endotracheal tubes	Supine positioning
Nasogastric tubes	Impaired mental status
Enteral feeding tubes	Sedation
Large Inoculum of Organisms	
Bacterial colonization	Sinusitis
Gastric alkalinization (enteral feeds/H2)	Malnutrition
Iatrogenic (forced hand ventilation)	Contaminated respiratory equipment
Overgrowth of Virulent Organisms	
Prolonged antibiotic use	Comorbid illness
Iatrogenic (inadequate hand washing)	Frequent hospitalizations
Central venous lines	Prolonged hospital stays

ANTIMICROBIAL TREATMENT :

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:

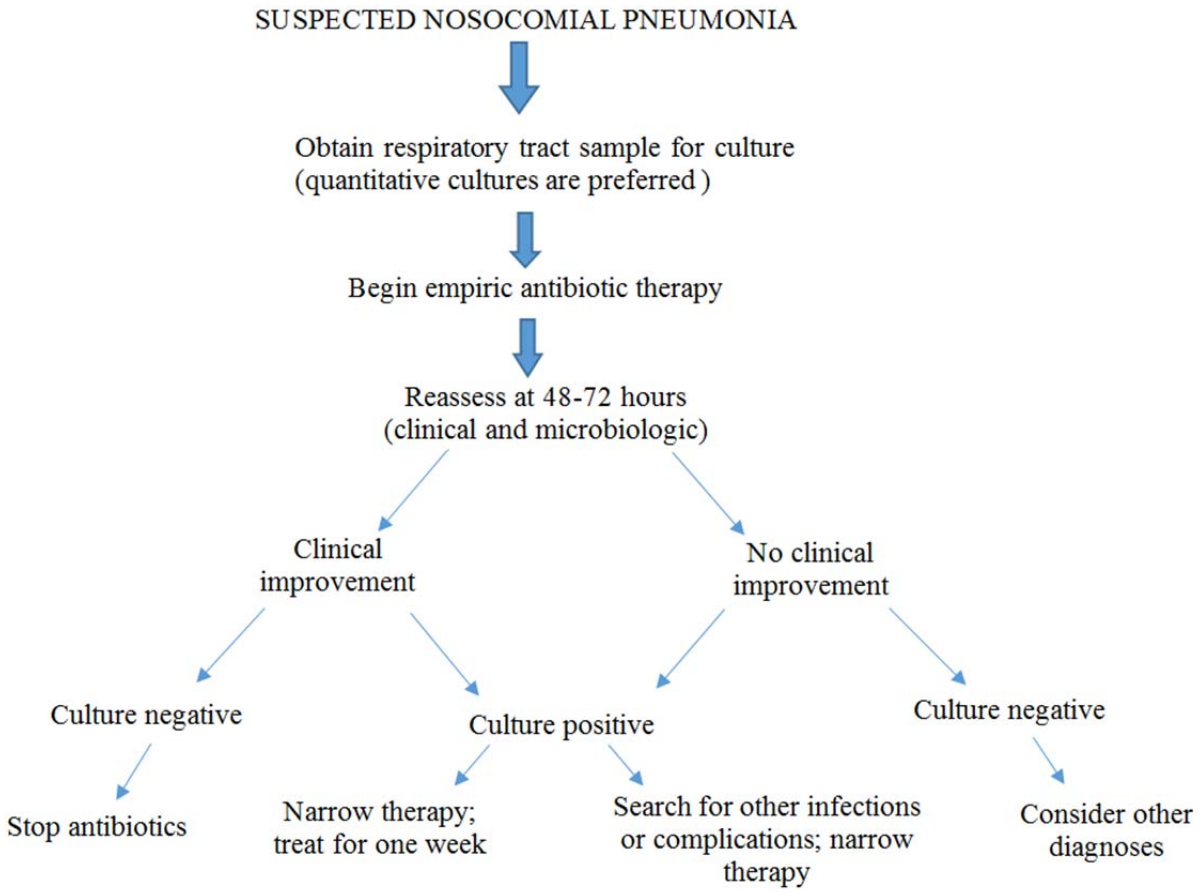
(1) Initial antimicrobial treatment must always be empirical.
(2) Empirical antimicrobial treatment can be guided by three criteria: severity of pneumonia, time of onset, and specific risk factors. All pneumonias acquired in the ICU are severe by definition in the guidelines.
(3) The selection of antimicrobial 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.

MANAGEMENT OF SUSPECTED NOSOCOMIAL PNEUMONIA :



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:

1 Celis R, Torres A, Gatell JM, et al. Nosocomial pneumonia: a multivariate analysis of risk and prognosis. Chest 1988; 93:318±324

2 Torres A, Aznar R, Gatell JM, etal. Incidence, risk, and prognostic factors of nosocomial pneumonia in mechanically ventilated patients. Am Rev Respir Dis 1990;142:523±8.

3. Alvarez-Lerma F, Palomar M, Olaechea P, Otal JJ, Insausti J, Cerda E.National Study of Control of Nosocomial Infection in Intensive Care Units. Evolutive report of the years 2003–2005. Med Intensiva 2007; 31:6–17.

4 Fagon JY, Chastre J, Vuagnat A, etal. Nosocomial pneumonia and mortality among patients in intensive care units. JAMA 1996;275:866±9.

5 Kollef MH. Ventilator-associated pneumonia. A multivariate analysis. JAMA1993;270:1965±70.

6 Papazian L, Bregeon F, Thirion X, etal. Effect of ventilator-associated pneumonia on mortality and morbidity. Am JRespir Crit Care Med 1996;154:91±7.

7 Alberti C, Brun-Buisson C, Burchardi H, et al. Epidemiology of sepsis and infection in ICU patients from an international multicentre cohort study. Intensive Care Medicine 2002; 28: 108–21.

8 Vincent JL, Bihari DJ, Suter PM, et al. The prevalence of nosocomial infection in intensive care units in Europe. Results of the European Prevalence of Infection in Intensive Care (EPIC) Study. EPIC International Advisory

9 Haley RW, Culver DH, White JW, et al. The efficacy of infection surveillance and control programs in preventing nosocomial infections in US hospitals. American Journal of Epidemiology 1985; 121: 182–205.

10 Jones RN, Pfaller MA. Bacterial resistance: a worldwide problem. Diagn Microbial InfectDis 1998;31:379±88.

11 Haley, R. W. 1985. The nationwide nosocomial infection rate: a new need for vital statistics. Am. J. Epidemiol. 121:159–163.

12. Martone, W. J., W. R. Jarvis, D. H. Culver, and R. W. Haley. 1992. Incidence and nature of endemic and epidemic nosocomial infections. In J. V. Bennett and P. S. Brachman, editors. Hospital Infections, 3rd ed. Little Brown, Boston. 577–596.

13. Vincent, J. L., D. J. Bihari, P. M. Suter, H. A. Bruining, J. White, M. H. Nicolas-Chanoin, M. Wolff, R.C. Spencer, M. Hemmer, for the EPIC International Advisory Committee. 1995. The prevalence of nosocomial infection in intensive care units in Europe: results of the EPIC study. J.A.M.A. 274:639–644.

14. Center for Disease Control. Nosocomial infection surveillance, 1984. In: Surveillance summaries (published four times a year). 1986;35 (No. 1SS):17-29

15. Barrett FF, Casey JI, Finland M. Infections and antibiotic use among patients at Boston City Hospital-February 1967. N EngI Med 1968; 278:5-9
16. Johanson WG, Pierce AK, Sanford JP, Thomas GD. Nosocomial respiratory infections with grain negative bacilli: the significance of colonization of the respiratory tract. Ann Intern Med 1972; 77:701-06
17. Stevens RM, Teres D, Skillman JJ, Feingold DS. Pneumonia in an intensive care unit. Arch Intern Med 1974; 134:106-11
18. Akca O, Koltka K, Uzel S, etal. Risk factors for early-onset, ventilator-associated pneumonia in critical care patients: selected multiresistant versus nonresistant bacteria. Anesthesiology 2000;93:638±45.
19. MacIntyre N, Helms M, Wunderink R, Schmidt G, Sahn SA: Automated rotational therapy for the prevention of respiratory complications during mechanical ventilation. Respiratory Care 1999, 44:1447-1451.
20. Gross PA, Neu HC, Aswapokee P, Van Antwerpen C, Aswapokee N. Deaths from nosocomial infection: experience in a university and community hospital. Am J Med 1980; 68:23
21. American Thoracic Society. Hospital-acquired pneumonia in adults; diagnosis, assessment, initial severity, and prevention. A consensus statement. AmJRespirCritCareMed1996;153:1711±25.
22. Rello J, Ausina V, Castella J, etal. Nosocomial respiratory tract infections in multiple trauma patients. Influence of level of consciousness with implications for therapy. Chest 1992;102:525±9.
23. Ewig S, Torres A, El-Ebiary M, etal. Bacterial colonization patterns in mechanically ventilated patients with traumatic and medical head injury. Incidence, risk factors, and association with ventilator-associated pneumonia. AmJRespirCritCareMed1999;159:188±98.
24. Rello J, Ausina V, Ricart M, etal. Impact of previous antimicrobial therapy on the etiology and outcome of ventilator-associated pneumonia. Chest 1993;104:1230±5.
25. Kollef M. Inadequate antimicrobial treatment: an important determinant of outcome for hospitalized patients. ClinInfectDis 2000;31(Suppl 4): S131±8.
26. Kollef M, Ward S, Sherman G, etal. Inadequate treatment of nosocomial infections is associated with certain empiric antibiotic choices. CritCareMed2000;28:3456±64.
27. Luna C, Vujachich P, Niederman MS, etal. Impact of BAL data on the therapy and outcome of ventilator-associated pneumonia. Chest 1997;111:676±87.
28 Rello J, Sa-Borges M, Correa H, etal. Variations in etiology of ventilator-associated pneumonia across four treatment sites: implications for antimicrobial prescribing practices. AmJRespirCritCareMed 1999;160:608±13.
29. Kolleff MH, Vlasnik J, Sharpless L, etal. Scheduled change of antibiotic classes: a strategy to decrease the incidence of ventilator-associated pneumonia. AmJRespirCritCareMed1997;156:1040±8.
30 Gruson D, Hilbert G, Vargas F, etal. Rotation and restricted use of antibiotics in a medical intensive care unit. Impact on the incidence of ventilator-associated pneumonia caused by antibiotic-resistant gram-negative bacteria. AmJRespirCritCareMed2000;162:8378± 43.
31 Walger P, Post K, Mayershofer R, etal. Initial antimicrobial policies in the ICU should be based on surveillance rather than on crop rotation. Abstractsof the40thInterscienceConferenceonAntimicrobialAgents andChemotherapy, 401, abstract 89.
32. Niederman MS. An approach to empiric therapy of nosocomial pneumonia.MedClinNorthAm1994;78:1123±41
33. Alvarez-Lerma F. Modification of empiric antibiotic treatment in patients with pneumonia acquired in the intensive care unit. ICU-Acquired Pneumonia Study Group. IntensiveCareMed1996;22:387±94.
34. Rello J, Gallego M, Mariscal D, etal. The value of routine microbial investigation in ventilator-associated pneumonia. AmJRespirCritCare Med1997;156:196±200.
35. Kollef MH, Ward S. The influence of mini-BAL cultures on patient outcomes: implications for the antibiotic management of ventilator-associated pneumonia. Chest 1998;113:412±20.