Original Article

Prevalence and Antibacterial Resistance of Gram Negative Bacteria Causing Respiratory Tract Infection In Critically Ill Patients.

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Summary:

Background: Nosocomial respiratory infections in the intensive care is one of the challenging issues, competing with other major causes of morbidity and mortality, that's why it needs to be studied thoroughly.
Objectives: To assess the prevalence of colonization of respiratory tract by Gram-negative rods (GNRs) for critically ill patients in Baghdad teaching hospital, and to determine antimicrobial resistance of the isolated strains.
Patients and Methods: A cross sectional study conducted on critically patients at the ICU/Baghdad teaching hospital during the period from December 2012-june 2013. thirty four adult patients on mechanical ventilator with endontracheal intubation or trachestomy, were enrolled in this study, tracheal specimen were collected from all patients, and were cultured on various bacteriological media(blood agar, chocolate agar, macConky agar,saboroied agar) then incubated for various time. Drug resistance was examined with various antimicrobial drugs according to diagnostic microbiology guidelines.
Results: thirty four adult patient(mean age 45years), 32 patients yielded positive microbial growth on culture , infection rate= 94%, with gram negative infection show the highest rate of infection = 90% ,mainly acenitobacter baumanni about 44%,E.coli 35%, P.aeroginosa23%, K.pneumoniea20%, S.aureus11%, and monilia comprising 32% of infection. Many patients showed mixed infection pattern (more than one bacterial type). A.baumanni showed the highest resistance pattern (87%) was resistant to all types of antimicrobials and the sensitive one is only for one or two antibiotics.
Conclusion: inappropriate and incorrect administration of antimicrobial agents in empiric therapies and lack of appropriate infection control strategies are leading cause for opportunistic infection
Key words: ICU, gram negative bacteria, antibiotic resistance.

Fac Med Baghdad 2014; Vol.56, No3
Received: Jan 2014
Accepted July. 2014

Introduction:

Respiratory tract infection remaining one of the most important infectious diseases, it is the leading cause of morbidity and mortality in critically ill patients (1,2, 3).Risk factors for colonization and infection of the respiratory tract by facultative gram-negative rods include intubation and tracheostomy, severe underlying disease, especially chronic lung disease, prolonged hospitalization, prior aspiration of gastric contents, and exposure to antibiotics (4-10) . Potential colonization of respiratory support equipment has been shown as an important, yet preventable, source of this nosocomial infection. (4, 11- 13)

Respiratory infections specially in upper respiratory tract have remarkable economic impact, related not only to lost output in the workplace but also to the frequent prescription by physicians of antibiotics, even when the causative agents of infection almost certainly are not bacteria (14). On the other side, respiratory tract infections are the most common reason for primary care consultations (15).Eradication of the causative agents of respiratory tract infections is recognized as a requirement (16) ,however during the last few years, the increase in the rates of antibiotic resistance amongst the major microbial causes of the respiratory infections in the community has compromised the selection of empirical treatment for some respiratory tract infections (17).

The highly resistant gram-negative bacilli continue to disseminate in hospitals causing therapy problems in many parts of the world, particularly in developing countries (3).

Our ability to treat and prevent gram negative infection is largely hampered by antimicrobial resistance.Antibiotic resistant gram negative bacteria are more commonly identified in the ICU, and are associated with significantly longer duration of hospital stay and higher mortality rate than antibiotic susceptible gram negative infection (18). Many recent studies have found that the microorganisms associated with inappropriate antibiotic drug therapy are common group of pathogens. (18) One report determined that 20% of all ICU cases(nosocomial &community acquired infection) of

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inappropriate anti-microbial therapy were caused by resistant gram negative bacilli .The increasing frequency of antibiotic resistance has been reported first in infections at sites where penetration of the antimicrobial agent is restricted and the level of therapeutic concentrations is consequently more difficult to be achieved. It could also hinder the eradication of infections in respiratory tract infections treated using standard antibiotic therapy regimens (17). Accurate information on local epidemiology and antimicrobial resistance patterns of pathogens among the patients is essential to select a clinically effective antibiotic therapy for the infections (19).

Patients and methods:

A cross sectional study was conducted in ICU at Baghdad teaching hospital –Baghdad/ Iraq for period from December 2012-june 2013.

Thirty four adult patient (mean age 45years), of both gender were selected randomly to this study, all patients were on mechanical ventilator with endotracheal intubation or tracheastomy for at least five days.

Trans-tracheal sputum specimens were collected under aseptic technique for all patients. The specimens were cultured on various bacteriological media (blood agar, chocolate agar, macConky agar,saboroied agar) then incubated overnight in 37C temperature . The organism were identified as commensal or pathogen according to microbiological protocol (initially general Agar, &finalizing with specific microorganism isolating Agar) , single or mixed growth isolated from the sample were identified by observing colony character on bacteriological media. Drug resistance was examined with various antimicrobial drugs according to diagnostic microbiology guidelines (using inhibition zone criteria for identification of microorganism specific antibiotic resistance).

Results:

It was found that from 34 sputum specimens , (94%) n=32 were positive growth specimens, only two specimens(6%) showed no growth, from the 32 positive specimens, 29 cases (90%) were gram negative bacteria, 11cases (34.3%) were monilia, and five cases (15%) S.aureus gram positive bacteria.Eight specimens showed single growth, and 24 specimens showed mixed growth.

The most common gram negative bacteria in order of frequency were acenitobacter baumanni about 44%, E.coli 35%, P.aeroginosa23%, and K.pneumoniea20% (table 1)

Table 1: Number and percent of the Microorganism

Bacterial infection	No. of patient(34)*	Percent %
acenitobacter baumanni	15	44%
E.coli	12	35%
P.aeroginosa	8	23%
K.pneumoniea	7	20%
S.aureus	5	15%
monilia	11	32%

*Some patients had more than one microorganism in same specimen.

A.baumanni showed the highest resistance pattern (87%), it was resistant to all types used of antimicrobials and the sensitive two specimens are only to imipenem and tobramycin. E.coli showed least resistance to imipenem, garamycin, pipracillin, ciprofloxacin, tobramycin.

Table 2: A.Baumani infection percentage

	No. of A.baumani infected patients	Percentage
A.Baumani	15	44%
Resistance A.Baumani	2	87%

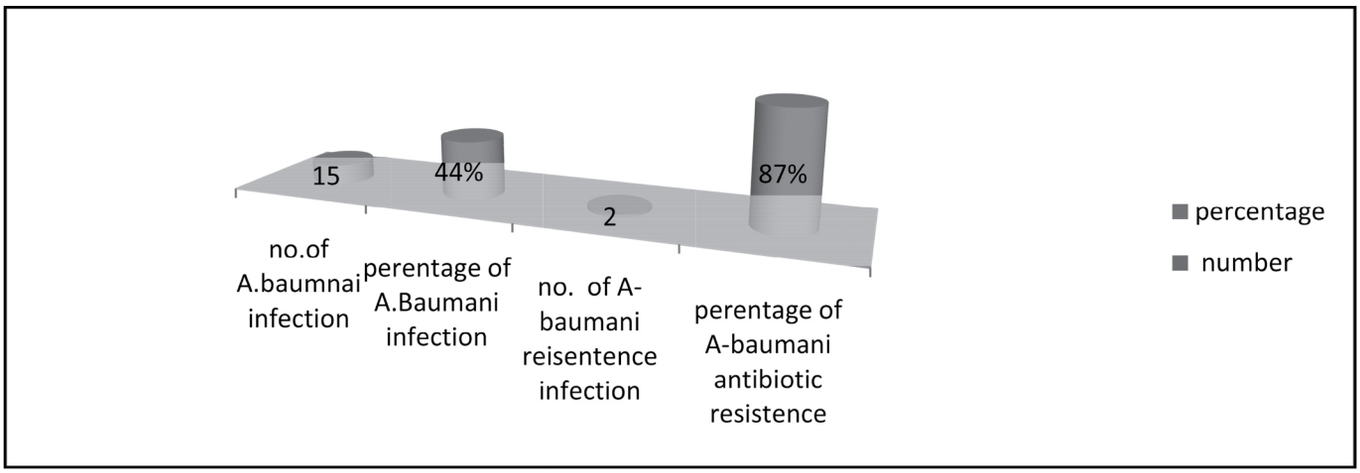

Figure 1: Number & Percentage of A.Bauman infection and antibiotic resistance

Table 3: percent of e-coli sensitivity

	No.of Ecoli infected patients	Percentage
E-coli percentage	12	35%
E-Coli Sensitivity	11	91%

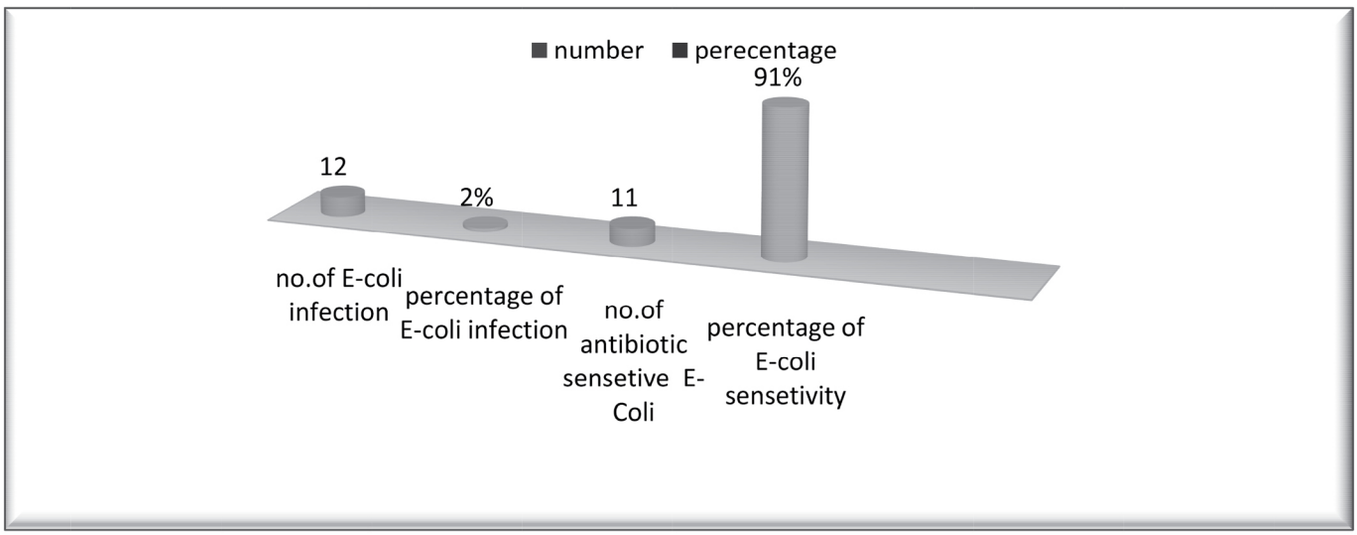

Figure 2: No. & percentage of E.coli infection and antibiotic sensitivity

Table 4: Percent of monilia infection

	No.of monilia infected patients	percentage
Monilia	11	32%

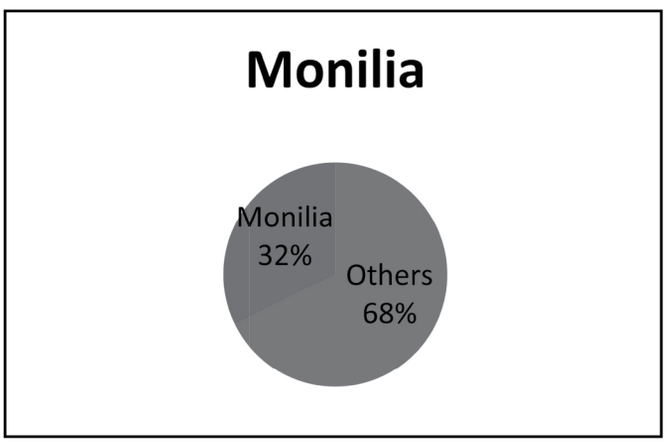

Figure 3: Moninlia percent

Discussion:

Nosocomial infection and mortality in ICUs are more prevalent than in other wards of the hospital (20,21) Pneumonia accounts for approximately 10 to 15% of hospital-acquired infections, and mortality rates range from 15 to 50% (4, 10, 22, 23,24) Respiratory tract infection among ICU patients is frequently polymicrobial , with multidrug resistant gram negative bacilli are the most common pathogen.These organism isolated in 40 to 60% of respiratory infections (4, 6, 22, 23, 25). In our study we found high overall rates of nosocomial infection (94%). From the point view of ICU-AIs, comparisons between hospitals can not be appropriate for the reason of different conditions of ICUs and surveillance methods applied.

In a study done by Erbay et al.(26) P. Aeruginosa (22.6%), Staphylococcus aureus (22.2%) and Acinetobacter spp. (11.9%) were found the most responsible agents in ICUs acquired infections, and, Esen and Leblebicioğlu (27) declared The most frequently reported isolates were P. Aeruginosa (20.8%), S. aureus (18.2%), Acinetobacter spp. (18.2%) and Klebsiella spp. (16.1%). In our ICU, the most isolated agent was Acinetobacter spp. (44%), Escherichia coli (33%). Pseudomonas spp. (23%), S. aureus (11.%), K.pneumoniea20%, and monilia comprising 32% and it was attracted to attention that the role of Candida spp. is increasing in our ICU, this due to irrational excessive use of antibiotics and lower slandered of hygiene in our health institute. In new guidelines the culture sensitivity specimen for monitoring can be withdrawn even the patient is on antibiotic treatment.

In a study on the epidemiology of respiratory tract bacterial pathogens, P.aeruginosa has been reported as the most prevalent organism (24%) followed by S. pyogenes (18%), S. aureus (17%) and K. pneumoniae (8%) (28).In an Indian study (3) on bacterial isolates from respiratory tract of ICU patients, the percentage isolation rate for P. aeruginosa, Klebsiella spp., Enterobacter spp. have been reported 21.5, 19, 8 and 6.2%, respectively.

We observed the microorganisms were multidrug resistant.

The highest resistance (87%)showed by A.baumanni except 2 cases which showed sensitivity to imipenem and tobramycin which is consistent with the results obtained from Indian study by Nidhi Goel et al(2009) (29) . E.coli showed least resistance to imipenem, garamysin, pipracillin, ciprofloxacin, tobramycin. Among the 5 S. aureus isolates, all were sensitive to vancomycin.P.aeroginosa isolates (8 cases)showed very good sensitivity to most of drugs but not 3rd generation cephalosporins.Monilia (32% of cases)raise in mind the need for addition of antifungal treatment in ICU patients and the study of its sensitivity to antifungal treatment.In another Indian study on antibiotic resistance pattern of gram-negative bacterial isolates of lower respiratory tract secretions, the highest and lowest mean resistance among predominant gram negative bacteria in tracheal aspirate has been noted to ampicillin (96.6%) and amikacin (28%), respectively (1). Compared to previous report from Iran, an increased rate of antibiotic resistance was observed in Acinetobacter spp. (30) and P. aeruginosa against some tested antibiotics (31).
We concluded most of the isolates are opportunistic . There are many possible reasons for this alarming phenomenon, including inappropriate and incorrect administration of antimicrobial agents in empiric therapies and lack of appropriate infection control strategies.

Author contributions:
Dr.Faez and Dr.Ali have made the study conception,design,data collection and interpretation,data analysis.
Dr.Hassan had made the critical revision.

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