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TITLE

STUDY OF ANTIMICROBIAL AGENT SUSCEPTIBILITY IN PATIENTS WITH LOWER RESPIRATORY TRACT INFECTION ADMITTED IN INTENSIVE CARE UNIT OF TERTIARY HEALTHCARE HOSPITAL, AHMEDABAD.

DEPARTMENT OF GENERAL MEDICINE

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ABSTRACT

Aim - To study susceptibility of antimicrobial agents against microorganisms causinglower respiratory tract infections.

Materials & Method - Total 185 patients with symptoms & signs of lower respiratory tract infection admitted in ICU of Tertiary Healthcare hospital of Ahmedabad were taken & samples from lower respiratory tract were sent & were given antimicrobial agents for 5 days according to culture & sensitivity report.

Result - Patients with comorbidities are more likely to be admitted in ICU for management of LRTI & may require oxygen or ventilatory support. Sample from the lower respiratory tract should be sent for culture & sensitivity as early as possible. Various microorganisms, usually gram negative bacilli are isolated with variable sensitivity to antimicrobial agents.

Discussion - Patients admitted to ICU for management of LRTI should be started on empirical antimicrobial agents immediately after sending sample from the lower respiratory tract for culture & sensitivity. Majority of the patients require a shift to an antimicrobial agent of choice according to sensitivity report. Patients with requirement of ventilatory support on admission yielded more resistant microorganisms & had poor prognosis despite sensitive antimicrobial agent therapy.

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INTRODUCTION

Lower respiratory tract infection is a broad terminology which includes acute bronchitis, pneumonia, acute exacerbations of chronic emphysema / chronic bronchitis & acute exacerbationof bronchiectasis. Acute lower respiratory tract infections are one of the common clinical problems in community and hospital settings and many of the complicated patients are admitted or shifted to intensive care units for management.

Management of community-acquired pneumonia & acute exacerbations of chronicobstructive pulmonary disease may pose challenges because of diagnostic difficulty in differentiating infections caused by typical and atypical microorganisms. Beta-lactam antibiotics, macrolides, and fluoroquinolones are routinely prescribed medicines for the empirical management of these, but with time the response to these antimicrobial agents is highly varying because of the change in the sensitivity patterns of microorganisms causing lower respiratory tract infections.

AIM OF THE STUDY

Aim is to study susceptibility of antimicrobial agents against microorganisms causing Lower respiratory tract infections.

Respiratory infection is a major health problem representing over 50 million deaths per year attributed to both community-acquired and nosocomial infection.(1)

Lower respiratory tract infections (LRTI) are the most common bacterial infections among patients in intensive care units (ICUs) occurring in 10-25% of all ICU patients and resulting in high overall mortality, which may range from 22-71%. (2). The commonest LRTIs are acute bronchitis, acute trachea bronchitis, chronic bronchitis, and pneumonia, which account for 4.4% of all hospital admissions and are associated with high morbidity, mortality, and excessive health costs. (3). The etiological agents of LRTI infections vary between populations and countries, depending on the difference in geography, climate, and socioeconomic conditions, associated factors of LRTI as well as their antibiotics susceptibility(4)

The microbiological causative agents for LRTI's can be a common bacterium, an intracellular bacterial pathogen, virus, fungi or parasites; the common ones include Streptococcus pneumonia, Haemophilus influenzae, Enterococcus spp, Klebsiella pneumoniae etc (5). Critically ill patients of ICUs are at greater risk for acquiring hospital-associated infections with multidrug-resistant microorganisms. This is because of their prolonged hospital stay, immunocompromised profile, serious illness, use of invasive devices, catheters, and prolonged use of antibiotics (6). Highly resistant strains of Gram-negative bacilli (GNB) continue to spread rapidly in hospitals causing therapeutic problems in many parts of the world, especially for developing countries because isolation facilities are not enough to admit all the patients with infections due to resistant organisms[,7]. In almost all cases, eradication of causative agents requires initiation of antimicrobial therapy before obtaining culture report. However, during the last few years, the increase in antibiotic resistance has compromised the selection of empirical treatment(8). Most common bacterial agents of LRTI in the ICU are *Pseudomonas, Acinetobacter, Klebsiella, Citrobacter, Escherichia coli*.[3-5] In almost all cases, there is a need to initiate empirical antimicrobial treatment before obtaining the microbial results, but the situation is further complicated by the emergence of multiple beta lactamase producers an d multidrug resistant pathogens. In a recent report, Infectious Disease Society of America, specifically addressed three

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categories of gram negative bacilli (GNB), namely extended spectrum beta lactamase (ESBL) producing *Escherichia coli*, and *Klebsiella* spp., Multidrug resistant (MDR) *Pseudomonas*, and carbapenem resistant *Acinetobacter* spp., as high priority bacterial pathogens(9). Early initiation of antibiotics has been associated with a reduction in all-cause mortality in community-acquired pneumonia, including severe pneumonia with sepsis or septic shock. Appropriate antimicrobial therapy should be initiated as early as possible in patients of CAP requiring ICU admission, preferably within the first hour after obtaining necessary microbiologic samples (10).

MATERIALS & METHODS

Study Location - The present study was carried out in intensive care unit of SMS hospital at Ahmedabad.

Study Design - Retrospective clinical study conducted from 01/06/2022 to 30/11/2023 (18 months).

Sample Size - 185 patients (100 male & 85 female)

Inclusion Criteria -

- Age > 18 years
- Patient with clinical or radiological evidence of acute lower respiratory tract infection
- Patient admitted in intensive care unit for management

Exclusion Criteria -

- Age < 18 years
- Patient who had already taken any antimicrobial agent in last 1 month
- Patients with additional active source of infection other than lower respiratory tract
- Patients with active pulmonary tuberculosis according to RNTCP
- Patients with lower respiratory tract infection but normal report of culture from lower respiratory tract sample

Method -

Total 185 newly admitted patients in the intensive care unit of SMS hospital at Ahmedabad were selected based on inclusion & exclusion criteria. Basic patient details like age, gender, comorbidities, oxygen requirement on admission were noted. Single specimen of lower respiratory tract either sputum or endotracheal tube aspiration was obtained in a sterile container according to The clinical condition of the patient. Sample was sent for culture & sensitivity testing in the Department of microbiology, SMS hospital. Reports were usually obtained in 48 hours & patients were either continued or shifted to an antimicrobial agent of choice for 5 days according to sensitivity report of microorganism/s. After 5 days of treatment by antimicrobial agent of choice, change in patient status were denoted as either improved, static or deteriorated based on clinical, laboratical or radiological evidences.

Observation & Results -

For 185 patients selected on the basis of inclusion & exclusion criteria, basic patient detailslike age, gender & co-morbidities were noted.

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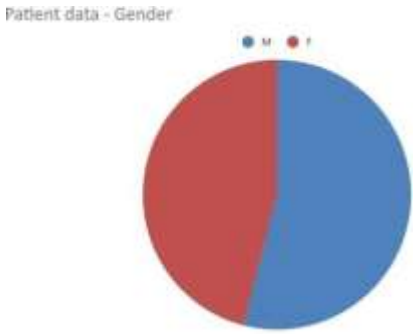
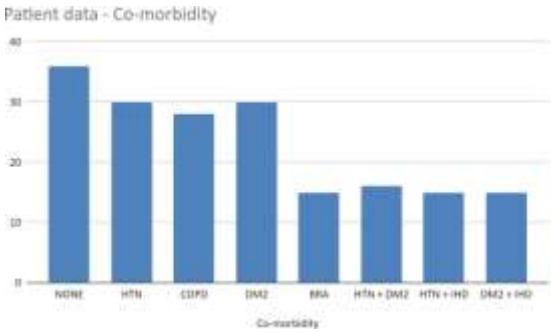
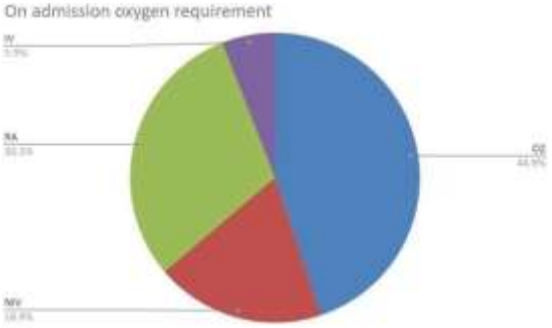
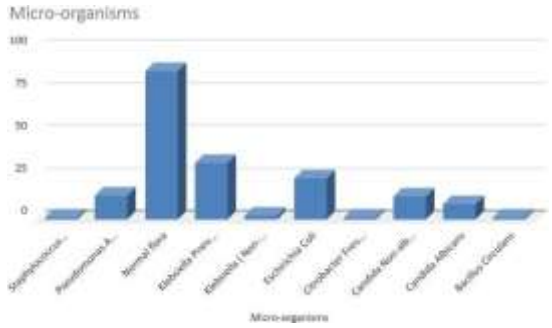




Patients were also categorised based on oxygen requirement on admission. According to clinical status of patient, sample for lower respiratory tract of patient either sputum or endotracheal aspirate was collected in a sterile container for culture & sensitivity.



Reports of culture were usually obtained within 48 hours & different microorganisms were isolated. Maximum number of isolated microorganisms were gram positive cocci which are normal respiratory flora & are usually not associated with any pathology. Maximum number of pathogenic microorganisms were gram negative bacilli like Klebsiella Pneumoniae, Eischerechia Coli, Pseudomonas Aeruginosa. A fair number of fungal microorganisms mostly Candida (Albicans & non-albicans) were also isolated.



Every patient presented to ICU, SMS hospital with provisional diagnosis of lower respiratory tract were given empirical antimicrobial agents usually Amoxicillin + Clavulanic acid or Cefoperazone +Sulbactam. Despite empirical antimicrobial therapy, various microorganisms were found whichwere resistant to various antimicrobial agents.

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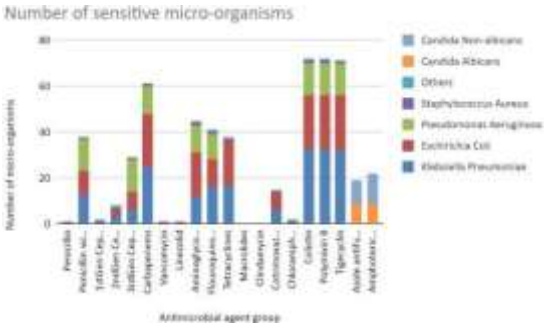
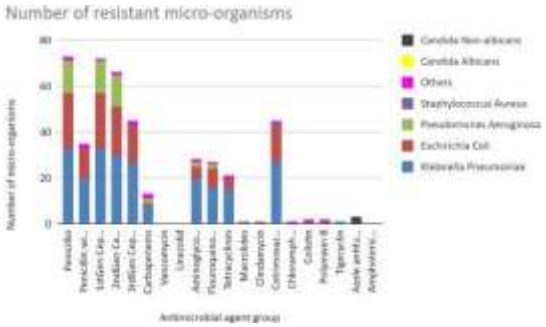
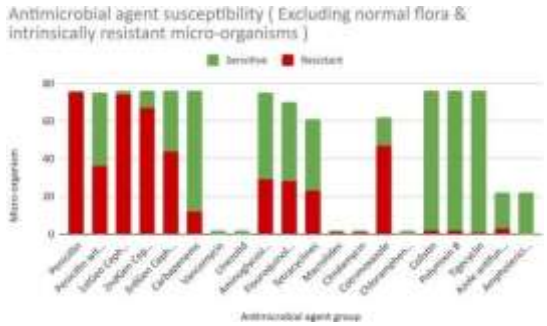
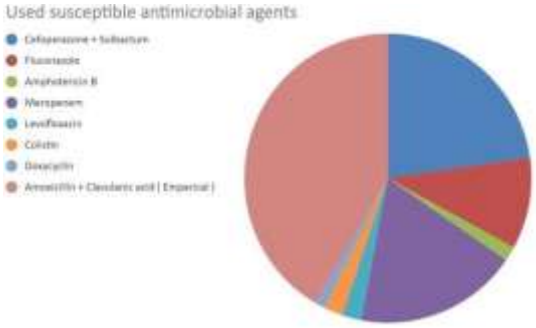


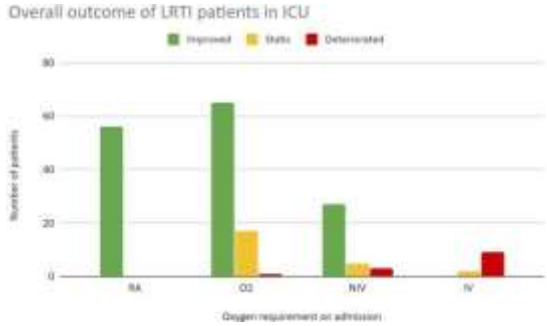


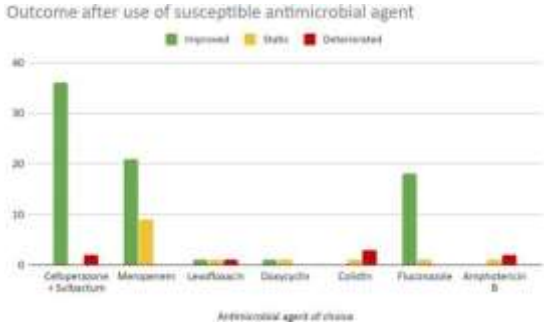
Depending upon the report of microorganism sensitivity to antimicrobial agents, patientswere either continued or shifted to antimicrobial agent of choice according to sensitivity.





After 5 days of treatment by antimicrobial agent of choice, change in patient status were denoted as either improved, static or deteriorated based on clinical, laboratical or radiological evidences.





Summary - From the above-mentioned observations, we can summarize the following…

1. Patients from both genders are admitted in ICU for management of LRTI with slight male predominance.
2. Patients with comorbidities are more likely to get admitted in ICU for management of LRTI.
3. Patients may require oxygen or ventilatory (Non-invasive or invasive) support depending on the clinical condition of the patient.
4. Many of the samples sent from the patients with LRTI yield nopathogenic microorganism, which may be related to sampling errors.
5. Maximum numbers of pathological microorganisms isolated were gram negativebacilli like Klebsiella Pneumoniae, Eschirichia Coli, Pseudomonas Aeruginosa.
6. A number of samples yielded growth of fungal microorganisms, usually Candida(Albicans or Non-albicans) which required antifungal agents.
7. Majority of microorganisms were resistant to older antimicrobial agents like penicillins, first & second generation cephalosporins.

8. Majority of microorganisms were sensitive to 3rd generation cephalosporins, carbapenems & higher antimicrobial agents like Colistin, Polymyxin B,Tigecycline.
9. Majority of patients required to switch from empirical antimicrobial agent to the antimicrobial agent of choice according to sensitivity.
10. Commonly used antimicrobial agents of choices were Cefoperazone + Sulbactam& Meropenem, while Fluconazole for fungal microorganisms.
11. Patients with requirement of ventilatory support on admission yielded more resistant microorganisms & had poor prognosis despite sensitive antimicrobial agenttherapy.
12. Antimicrobial agents like Cefoperazone + Sulbactam & Meropenem & Fluconazolehad better outcomes than higher antimicrobial agents like Colistin & Amphotericin B.

Conclusion -

From the above-mentioned study it can be concluded that patients with comorbidities are more likely to be admitted in intensive care unit for management of lower respiratory tract infection & may require oxygen or ventilatory (Non-invasive or invasive) support depending on the clinical condition.Empirical antimicrobial therapy should be started for patients with lower respiratory tract infections immediately after sending specimen for culture & sensitivity. Various microorganisms usually gram negative bacilli are isolated with variable sensitivity to antimicrobial agents, thus patients should be immediately shifted to antimicrobial agent of choice according to sensitivity report. Patients with requirement of ventilatory support on admission yielded more resistant microorganisms & had poor prognosis despite sensitive antimicrobial agent therapy.

References –

1. Ahmed SMA, Abdelrahman SS, Saad DM, Osman IS, Osman MG, Khalil EAG. Etiological Trends and Patterns of Antimicrobial Resistance in Respiratory Infections. Open Microbiol J. 2018 Mar 30;12:34-40. doi: 10.2174/1874285801812010034. PMID: 29785214; PMCID: PMC5897982.

2. Goel N, Chaudhary U, Aggarwal R, Bala K. Antibiotic sensitivity pattern of gram negative bacilli isolated from the lower respiratory tract of ventilated patients in the intensive care unit.

3. Santella, B.; Serretiello, E.; De Filippis, A.; Veronica, F.; Iervolino, D.; Dell'Annunziata, F.; Manente, R.; Valitutti, F.; Santoro, E.; Pagliano, P.; et al. Lower Respiratory Tract Pathogens and Their Antimicrobial Susceptibility Pattern: A 5-Year Study. Antibiotics 2021, 10, 851. https://doi.org/10.3390/antibiotics10070851

.

4.Gebre, A.B., Begashaw, T.A. & Ormago, M.D. Bacterial profile and drug susceptibility among adult patients with community acquired lower respiratory tract infection at tertiary hospital, Southern Ethiopia. *BMC Infect Dis* **21**, 440 (2021). https://doi.org/10.1186/s12879-021-06151-2.

5.Maduakor Uzoamaka, Onyemelukwe Ngozi, Ogboi Sonny Johnbull and Ohanu Martin, Current trends on Bacterial etiology of Lower Respiratory Tract Infection and their Antimicrobial Susceptibility

in Enugu, The American Journal of the Medical Sciences, http://dx.doi.org/10.1016/j.amjms.2017.06.025

6. Priyanka Gohel, Bhavin Prajapati, Hiral Shah, Kaival Kothari, Jayshri Pethani. BACTERIOLOGICAL PROFILE AND ANTIBIOTIC SUSCEPTIBILITY PATTERN OF TRACHEAL SECRETIONS ISOLATES AMONG ICU PATIENTS At TERTIARY CARE HOSPITAL. J Evid Based Med Healthc 2022;9(01):1-7.

7.Behera B, Sahu KK, Bhoi P, Mohanty JN. Prevalence and antimicrobial susceptibility patterns of bacteria in ICU patients with lower respiratory tract infection: A cross-sectional study. J Acute Dis 2020; 9(4): 157-160.

8.Bajpai T, Shrivastava G, Bhatambare GS, Deshmukh AB, Chitnis V. Microbiological profile of lower respiratory tract infections in neurological intensive care unit of a tertiary care center from Central India. J Basic Clin Pharm. 2013 Jun;4(3):51-5. doi: 10.4103/0976-0105.118789. PMID: 24808671; PMCID: PMC3979271.

9. Chaudhary U, Aggarwal R. Antibiotic sensitivity pattern of gram negative bacilli isolated from the lower respiratory tract of ventilated patients in the intensive care unit. Indian J Crit Care Med 2009; 13 (3):148-151.

10.Khilnani GC, Zirpe K, Hadda V, Mehta Y, Madan K, Kulkarni A, Mohan A, Dixit S, Guleria R, Bhattacharya P. Guidelines for Antibiotic Prescription in Intensive Care Unit. Indian Journal of Critical Care Medicine 2019;23 (Suppl 1):1-63.