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PREVALENCE OF ANTIBACTERIAL RESISTANCE IN MICRO-ORGAMISMS AND THEIR ANTIBIOTIC PRESCRIBING PATTERN IN A TERTIARY CARE HOSPITAL SETTING

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ABSTRACT
Our study aimed to observe the antimicrobial-resistant patterns in the Inpatient of a tertiary care hospital setting and to observe and evaluate the antibiotics therapy management. a retrospective observational study was carried out where the data of 261 patients were collected from a Microbiology lab and MRD. The duration of cases collected for the study was for 1 year 7 months. Accordingly, the most prevalent resistant microbe was Pseudomonas aeruginosa followed by E. coli and klebsiella. The type of infection which was most common among the sample considered was urinary tract infection. We found the empirical therapy prescribed was under WHO practice guidelines for antimicrobials. In 98 percent of patients, the empirical therapy was de-escalated and escalated which resulted in a decreased duration of treatment by short duration of prognosis of the treatment and decreased risk of secondary infections, and overall decreased economic cost of treatment. Gram-negative bacteria, such as E. coli, Pseudomonas aeruginosa and Klebsiella species, were common causes of infections, in our study the resistance pattern of these species to antibiotics such as cephalosporins, beta-lactams, or lactamases and fluoroquinolones was observed. Carbapenems have been considered the most effective treatment for the serious infections resulting from such resistant bacteria. Extended-spectrum beta lactamases markers were found in E. coli (n=41), K. pneumonia (n=45), and P. aeruginosa (n=51) clinical isolates. Co-resistance to various antibiotic classes was observed in ESBL producing isolates. All of the Extended-spectrum beta lactamases isolates were found to be sensitive to imipenem and Faropenem with a low proportion of resistance. The delivery of suitable antibiotics to patients can minimize the progression of the infection. Clinical studies are required to identify risk factors for multi-drug-resistant organisms' development, as well as the economic impact of these infections, as well as the most effective antimicrobial therapies, and the duration of therapy to enhance outcomes in the treatment of multidrug-resistant infections.

1. INTRODUCTION
Antimicrobial resistance (AMR)—the ability of a microorganism (bacteria, virus, fungi, parasite) to resist the effects of a drug—is a serious, complex, and costly public health problem.[8] Culture sensitivity diagnostic testing helps a physician to figure out the infection and a causative microorganism that may affect the physiological functioning of a patient's health. It is also acknowledged that it is critical to tailor pharmacologic therapy to the organism(s) causing the illness. The use of broad-spectrum antibiotics to cover the organisms commonly associated with the infection being treated is the standard of care when starting therapy. After culture sensitivity testing, the microbial sensitive reports are available. The physician will streamline the antibacterial therapy based on sensitivity.[1]

Performing culture sensitivity testing before antibiotic administration improves the chances of identifying the infective microorganism, which aids in better patient care.

Irrational antibiotic use can result in longer hospital stays and higher costs, it also harms the patient's prognosis and increases antimicrobial resistance.[1]

Anti-bacterial resistance is classified based upon the microbe resistance to classes of antibacterial agents. There are four categories of resistance. (i) PDR-Pan drug

resistant, (ii) XDR-Extensively drug-resistant and (iii) MDR-multiple drug-resistant. Culture-sensitive testing helps in categorizing the resistant classes, which in turn enhances the physician's ability to build a better therapeutic plan for better patient health outcomes. Microbe cultivation and susceptibility testing provide data that can aid in making informed judgments. The availability of such information from laboratory testing can improve patient healthcare outcome.

1. MATERIAL AND METHODS

A Retrospective Observational study was conducted in a tertiary care hospital, Aster Prime Hospital (280 beds) in Ameerpet, Hyderabad, Telangana. during 19 months (January 2020 to July 2021). About 261 patients' data were collected from the information system center of the microbiology lab.

Inclusion criteria

Both the genders
All age groups
Only patients admitted to the hospital with an in-patient history of more than 2 days.

Exclusion criteria

- Outpatients came for consultations
- Day-care patients stayed no more than 24 hours.
- Patient refusal.

The Collected data included socio-demographic characteristics such as age, gender, past medical history, comorbidities, past antibiotics used and their duration to combat infection, the current diagnosis and current secondary infections, surgical reports, and clinical laboratory investigations such as Complete Blood Picture and Culture Sensitivity Report. Culture sensitivity testing has reported all the information on antibiotics, which were classified as antibiotics resistant to the organism, antibiotics moderately sensitive to the microorganism, and antibiotics sensitive to the microorganism.

All Culture Sensitivity parameters were quantified based on the samples collected. The microbiology reports consisted of the samples of sputum, pus, urine, fecal, nasal, and tracheal culture swabs, and blood components. Anti-bacterial susceptibility testing is performed on clinically significant bacteria that have been isolated and identified from specimens.

Information about the antibiotics empirical therapy prescribed on admission into the hospital before the culture sensitivity testing and those antibiotics prescribed after the culture sensitivity reports were compared along with the duration of stay of the patient in the hospital. The duration of the patient's stay in the hospital was evaluated to know the effectiveness of the prescribed antimicrobial therapy.

The prescribed antibiotic therapy after the culture sensitivity reports were collected and evaluated to justify the rational prescribing of antimicrobials to the patients. All the information needed was collected from the Medical Record Department of the Hospital.

Data entry of the collected clinical data was entered in the Microsoft Excel sheets and further statistical analysis was done.

- Patient case history reports
- Patient case notes/discharge summary
- Medication charts
- Reports on laboratory investigations
- Microbial culture sensitivity reports
- Other diagnostic reports
- Statistical analysis

Statistical analysis was done in terms of graphical representations.

RESULTS

We have reviewed 261 in-patients' data from the microbiology lab, of which 58 patients didn't undergo culture sensitivity testing (was taken as a baseline) and 203 patients went for culture sensitivity testing, of which 51 (25.1%) isolates were of Pseudomonas aeruginosa, 45 (22.2%) isolates were of Klebsiella pneumonia, and 41 (20.2%) isolates were of E. coli.17 (8.4%) isolates of Enterobacter were found. 15 (7.1%) isolates were of Staphylococcus aureus, 10 (4.9%) Klebsiella oxytoca isolates, 7 (3.4%) isolates of Proteus vulgaris, 3 (1.5%) isolates of Proteus mirabilis, 3 (1.5%) isolates of Enterococcus pyogenes, 1 (0.4%) isolate were of Streptococcus pneumoniae, 1 (0.4%) isolate of Methicillin-resistant Staphylococcus aureus, 1 (0.4%) isolate of Serratia, and 1 (0.4%) isolate of Coagulase negative staphylococcus.

Source of infection

Clinically identified sources of infection included 22 (11%) nosocomial infections and the remaining 181 (89%) community-acquired infections. Taking into consideration 22 nosocomial infected patients, the patients had several factors which contributed to hospital infections. These were identified as immuno-compromised,[1] diabetic,[19] patients who had undergone surgery,[3] patients undergoing surgery,[17] patients on polypharmacy and steroidal therapy,[22] and comorbidity of chronic infections.[8]

Fifty-one isolates came from individuals who were recently diagnosed with urinary tract infections. Thirty-two community-acquired isolates demonstrated resistance rates of 50% or higher to tetracycline, co-trimoxazole, aminopenicillins, Nalidixic acid, ciprofloxacin, and first-generation cephalosporin. Except for co-trimoxazole, tetracycline, and amikacin, resistance rates were considerably greater in isolates from patients.

Patients' Prognosis and Antimicrobial therapy

The most common antibiotics used were piperacillin and tazobactam (13%), Linezolid (8.8%), Colistin (7%),

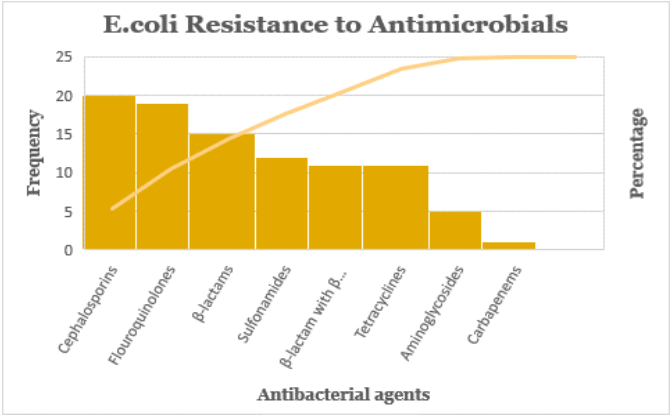
Tigecycline (6.8%), Moxifloxacin (6.4%), Faropenem (5.6%), Cefuroxime (3.2%),Vancomycin (3.2%), amoxicillin (2.7%), Amikacin (2.7%), Doxycycline (2.2%),Cefaperazone and Sulbactam (3.9%), Azithromycin (1.4%), Cefixime (0.9%), respectively. Eighty percent of the 203 patients received a combination of two or three antibiotics.

In 203 individuals with a known source of infection, the influence of the adequacy of antimicrobial therapy was evaluated. 199 patients (98%) received adequate antibiotic treatment as per the Culture Sensitivity Report and were found to have a short length of stay in the hospital, while four patients (2%) had an unsatisfactory regimen as they didn't change the therapy even after the culture sensitivity report was done.

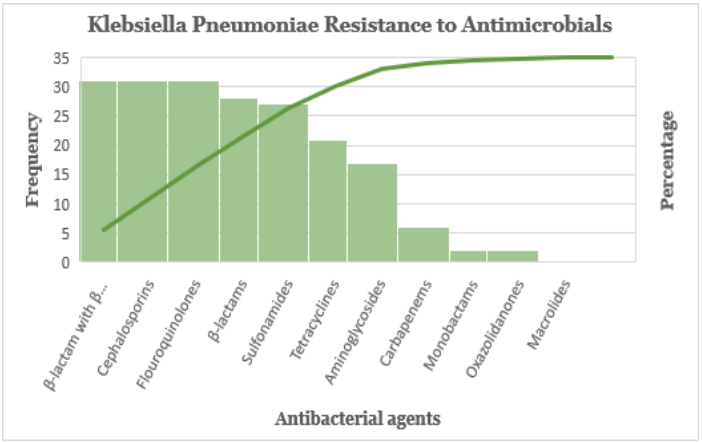
Extended-spectrum beta lactamases markers were found in E. coli (n=41), K. pneumonia (n=45), and P. aeruginosa (n=51) clinical isolates. Co-resistance to various antibiotic classes was observed in ESBL producing isolates. All of the Extended-spectrum beta lactamases isolates were found to be sensitive to imipenem and Faropenem with a low proportion of resistance.

The Impact of the Culture Sensitivity Report on Prescribing Pattern of Antibacterial

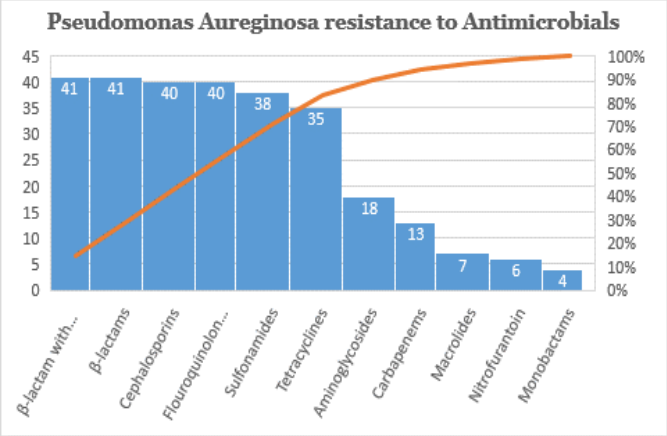
Isolates from the patients were sent for culture sensitivity testing immediately and, depending on the culture sensitivity report, the antimicrobials which were given changed if there was a presence of resistance against the antimicrobial was found. If the antimicrobials were found to be intermediate sensitive or sensitive, they were continued in treatment. On careful examination of the prescriptions, we found that the culture sensitivity report has influenced a significant change in the antimicrobials that were prescribed before the culture sensitivity report. According to the culture sensitivity report, we found about 80% of the prescribed antimicrobials were replaced by escalating or de-escalating the antimicrobials, and 12% of the prescribed treatment continued as the primarily given antimicrobial was found to be sensitive in the culture sensitivity report. In the patients in whom the culture sensitivity testing was performed in them about 2% of the prescribed treatments were not given in accordance with the culture sensitivity report, and these prescriptions did not experience any change even though the culture sensitivity report suggested that the antimicrobials should be changed as the organism found was resistant to the antimicrobial prescribed.



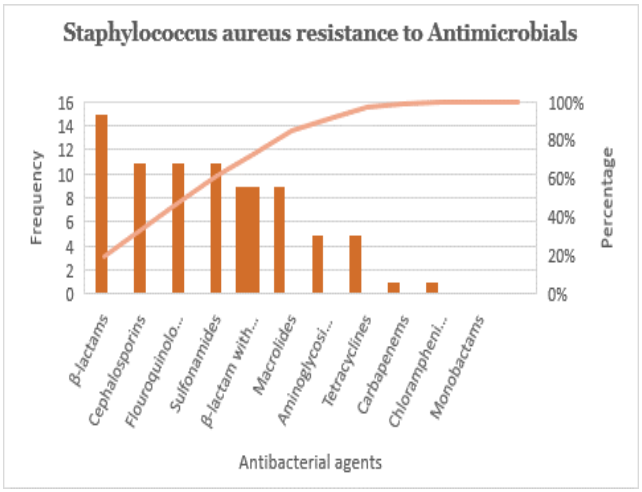
Graphical representation 1



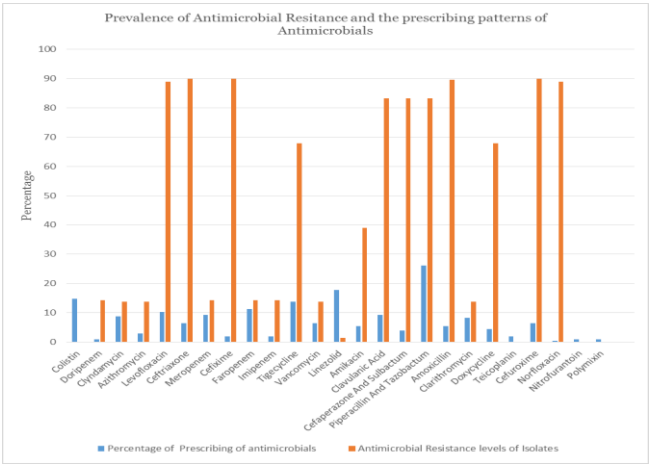
Graphical representation 2



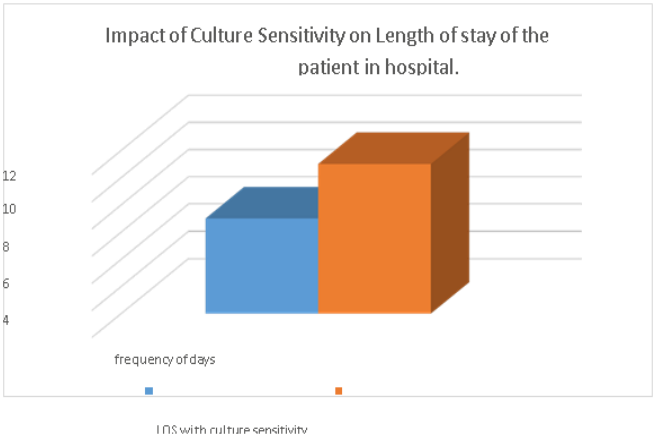
Graphical representation 3



Graphical representation 4

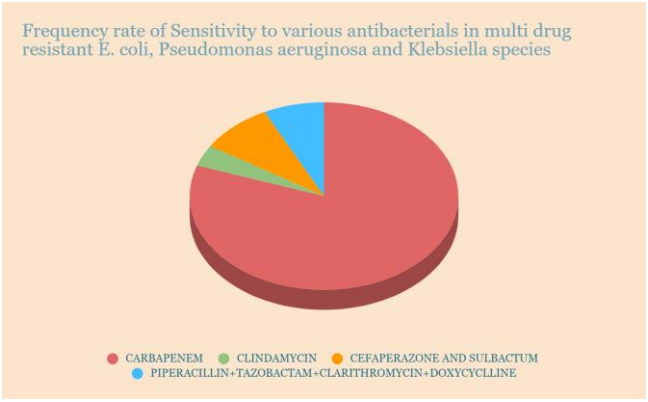


Graphical representation 5



Graphical representation 6

The below graph shows mean LOS was reduced from using a guidelines-based approach for better therapy, out of 261 patient's cases 58 cases was considered as baseline of patients who didn't have culture sensitivity report but were prescribed with anti-bacterial agents.



Graphical representation 7

As demonstrated below a total of 137 isolates in which E. coli (n=41), K. pneumonia (n=45), and P. aeruginosa (n=51) clinical isolates. All of these isolates were found to be sensitive to imipenem and Faropenem with a low proportion of resistance.

DISCUSSION

In patients with resistance, knowing the sensitivity pattern is important when prescribing antibacterial agents.

Gram-negative bacteria, such as E. coli, Pseudomonas aeruginosa and Klebsiella species, are common causes of infections. In our study, the resistance pattern of these species to specific antibiotics such as cephalosporins, beta-lactams or lactamases, and fluoroquinolones was observed. Carbapenems have been considered the most effective treatment for the serious infections resulting from such resistant bacteria. Extended - spectrum beta lactamases enzymes have the capacity to hydrolyze 3rd cephalosporins and aztreonam but are inhibited by clavulanic acid. Furthermore, ESBL-producing organisms demonstrate co-resistance to several other classes of antibiotics, limiting therapeutic options. Extended - spectrum beta lactamases markers were found in E. coli (n=41), K. pneumonia (n=45), and P. aeruginosa (n=51) clinical isolates. Co-resistance to various antibiotic classes was observed in ESBL producing isolates. All of the Extended - spectrum beta lactamases isolates were found to be sensitive to imipenem and faropenem with a low proportion of resistance.

According to Patricks et.al, the antibiotic piperacillin-tazobactam can be considered as an equivalent alternative antibiotic treatment for gram-negative infections.[7]

The delivery of suitable antibiotics to patients can minimize the progression of the infection. Obtaining cultures before the administration of antibiotics can help doctors identify the causative bacterium, which will guide for possible de-escalation through effective therapy.

The application of guidelines in Aster Prime hospitals reduced the average length of stay (LOS) from 11 to 7 days. The mean LOS was reduced from using a guidelines-based approach for better therapy as well as the decreased duration of treatment by short duration of

prognosis of the disease and decreased risk of secondary infections and overall decreased economic cost of treatment was observed.

CONCLUSION

The prevalence of antibacterial resistance in various bacteria the prescription patterns by physicians was observed. An incidence of 98 percent effective delivery of antibacterial therapy was achieved in this study as prescriptions of empirical antibacterial therapy were following WHO practice guidelines. Inadequate antibiotic medications were linked to an increased risk of prolonged treatment, secondary infections, the increased economic cost of treatment, and delayed prognosis of the treatment. In 98 percent of patients, the empirical therapy was de-escalated and escalated which resulted in a decreased duration of treatment by short duration of prognosis of the disease and decreased risk of secondary infections, and overall decreased economic cost of treatment. Improvement measures for further treatment include that the physician should emphasize that the culture is sent for sensitivity testing to tailor the therapy according to the patient's needs and further we include that the microbiologist should report to the Physician regarding Culture Sensitivity Report for rational prescribing of anti-bacterial therapy and better patient health management. We as health professionals should instill the importance of knowing the pattern of resistance shown by specific bacteria and the best antibacterial treatment. As this helps to identify drug-resistant bacteria and can aid the physician in prescribing antimicrobials. Early identification of Multi drug resistant microbial isolates is important to know the pattern of resistance. Clinical studies are required to identify risk factors for Multi drug resistant microbial development, as well as the economic impact of these infections, as well as the most effective antimicrobial therapies and duration of therapy to enhance outcomes in the treatment of infections.

REFERENCES

1. Drugs and therapy [Internet]. Professionals.ufhealth.org, 2006; 7: 2021. Available from: http://www.professionals.ufhealth.org/files/2011/11/1006-drugs-therapy- bulletin.pdf
2. Leone M, Bourgoin A, Cambon S, Dubuc M, Albanèse J, Martin C. Empirical antimicrobial therapy of septic shock patients: Adequacy and impact on the outcome*. Critical Care Medicine, 2003; 31(2): 462–7.
3. Linhares I, Raposo T, Rodrigues A, Almeida A. Frequency and antimicrobial resistance patterns of bacteria implicated in community urinary tract infections: A ten- year surveillance study, 2000–2009). BMC Infectious Diseases, 2013; 13(1).
4. Styers D, Sheehan DJ, Hogan P, Sahm DF. Laboratory-based surveillance of current antimicrobial resistance patterns and trends among Staphylococcus aureus: 2005 status in the United States. Annals of Clinical Microbiology and Antimicrobials, 2006; 5(1).
5. Tacconelli E. Methicillin-resistant Staphylococcus aureus bacteremia diagnosed at hospital admission: Distinguishing between community-acquired versus healthcare- associated strains. Journal of Antimicrobial Chemotherapy, 2004; 53(3): 474–9
6. Francis JS, Doherty MC, Lopatin U, Johnston CP, Sinha G, Ross T, et al. Severe community-onset pneumonia in healthy adults caused by methicillin-resistant Staphylococcus aureus carrying the panton-valentine leukocidin genes. Clinical Infectious Diseases, 2005; 40(1): 100–7.
7. Harris PNA, Peleg AY, Iredell J, Ingram PR, Miyakis S, Stewardson AJ, et al. Meropenem versus piperacillin-tazobactam for definitive treatment of bloodstream infections due to ceftriaxone non-susceptible Escherichia coli and Klebsiella species (the MERINO trial): study protocol for a randomized controlled trial. Trials [Internet]., 2015, 2022; 24, 16(1): 24. Available from: https://pubmed.ncbi.nlm.nih.gov/25623485/
8. Office of the Commissioner. Antimicrobial resistance info [Internet]. U.S. Food and Drug Administration, 2022; 2022; 24. Available from: https://www.fda.gov/emergency-preparedness-and-response/mcm-issues/antimicrobial-resistance-information-fda