CURRENT TRENDS OF RESISTANCE AMONG GRAM NEGATIVE AND GRAM POSITIVE BACTERIA ISOLATED FROM TERTIARY CARE HOSPITAL

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Abstract

Background and Objectives: Nosocomial infections (NIs) following antimicrobial resistance has become serious public health concern across the world. It affects the length of hospital stay and cost burden on the health care system. Rapid increase in resistance against commonly used antibiotics results in emergence of multi-drug resistant organisms. This study was conducted to assess the current resistance pattern of gram positive and gram negative bacteria isolated from clinical samples of a tertiary care hospital.

Methods: This retrospective study was done at CMH Sialkot over the period of six months. All types of clinical samples were included and were processed by using standard microbiological procedures. Organisms were identified by using different biochemical tests. AST were performed by Kirby-Bauer disc diffusion method on MH agar according to CLSI guidelines.

Results: Total 402 organisms were isolated among which 57% were gram positive while 43% were Gram negative bacteria. MRSA (31%) was most prevalent in Gram positive bacteria while E.Coli(50%) was found to be most common in Gram negative bacteria. Gram-positive bacteria showed maximum resistance against Fluoroquinolones, while Co-trimoxazole and Cephalosporins were least susceptible against Gram-negative bacteria.

Conclusion: Because of the clinical burden and importance of nosocomial infections, antibiotic usage policies should be considered and implemented on a priority basis in the agenda of the infection control committees of hospitals.

Key words: Nosocomial infections, antimicrobial sensitivity testing, Mueller-Hinton agar, Clinical and Laboratory Standard Institute.

Nosocomial infections represent a serious public health concern across the world. Nosocomial infections (NIs) also called hospital-acquired infections can be spread to patients admitted to health care settings or hospitals by health-care personnel or through hospital environment.[1] Infections ensues after 48 hours of hospital admission or a month after hospital discharge, both are considered as nosocomial infections.[2] Most common form of NIs nosocomial pneumonia infection (NPNEU) which accounts for 80% of cases. Other forms include nosocomial urinary tract infections (UTIs), nosocomial bloodstream infection (NBSIs) and nosocomial surgical site infections (SSIs).[3] The incidence rate of NIs varies geographically along with other discrepancies. Hospital-acquired infections results in increased rate of morbidity and mortality. It also affects the clinical outcome of patient; length of hospital stays and economic burden. An epidemiological study conducted by World Health Organization (WHO)

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of fourteen different countries reported that about 8.7% of hospitalized patients has a NIs or hospital-acquired infection.[4] Bacteria are considered as the most imperative pathogens causing multiple types of hospital-acquired infections. For instance, E.coli considered as a major cause of urinary tract infections, P.aeruginosa in causing respiratory tract infections,[5] while S.aureus along with other Gram-positive bacteria commonly results in skin and soft tissue infections, bacteremia and septicemia.[6,7] Various studies reported that through proper and precise usage of antibiotics in patients with bacterial infections, emergence of resistant isolates can be controlled.[8] Antimicrobial resistance leads to substantial health care burden and increase the economic cost on the individual as well on public health.[9] The capriciously use of antibiotics without prescription can results in resistance of bacteria against commonly used antibiotics. While on molecular level, exchange of genetic elements causing resistance in bacterial species can results in multi-drug resistant strains. Rapid increase in resistance among bacterial pathogens resulted from over-the-counter sale without prescription and inappropriate usage.[10] Therefore, the present study was designed to check the bacterial spectrum and antimicrobial sensitivity pattern of nosocomial infections.

METHODS

This retrospective study was done at Combined Military Hospital Sialkot over the time period of six months from 1st January to 30th June 2023. Consecutive sampling technique was used to collect the samples. All types of clinical samples from Patients with nosocomial infections including pus, urine, blood, tissue, tracheal secretion, bronchoalveolar lavage (BAL), pleural fluids, cerebrospinal fluid (CSF) and ascitic fluid were included in the study. Repetitive samples from the same patient were excluded.

All types of clinical samples including blood, urine, pus and different types of secretions were collected by experienced staff nurses according to the standard protocols. Samples were labelled properly and were transported to the microbiology laboratory. In the laboratory, samples were processed according to standard microbiological protocols. Samples were cultured on blood, MacConkey and chocolate agar and were incubated overnight at 37°C. After overnight incubation,

growth was identified by their colony morphology, pigmentation and hemolytic pattern. Confirmation of bacterial isolates was done by using different biochemical tests including catalase, coagulase, Urease, citrate, TSI and API. Antimicrobial sensitivity testing was performed by using Kirby-Bauer Disc Diffusion method on Mueller-Hinton agar and results were interpreted according to CLSI Guidelines 2021. Data were analyzed by using Microsoft Excel 2010.

RESULTS

Total 402 organisms were isolated in the study period among which 229 (57%) were Gram positive while 173 (43%) were Gram negative bacteria. Methicillin resistant Staphylococcus aureus were the most prevalent among gram positive bacteria (Figure 1) while in gram negative bacteria, E.coli was most prevalent. (Figure 2).
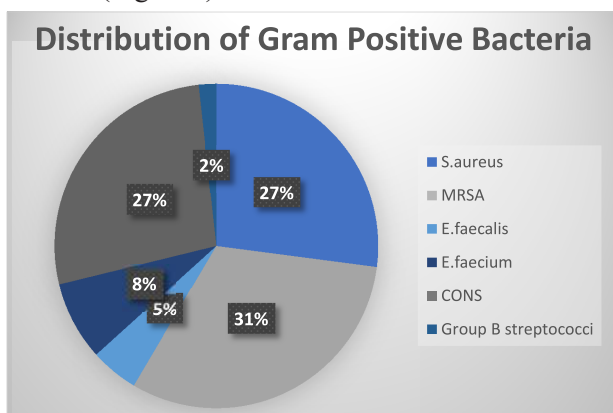

Figure 1: *Frequency of different Gram-positive bacteria in Nosocomial infections.*
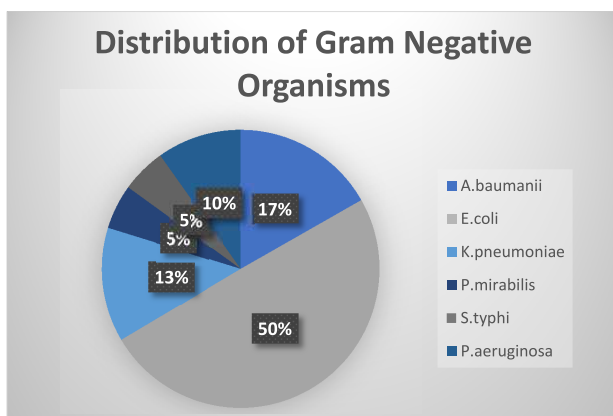

Figure 2: *Frequency of different Gram-negative bacteria in Nosocomial infections*

Gender distribution revealed that 58.7% positive cultures were isolated from males which 41.3% positive cultures were from female patients.

Maximum number of positive cultures were isolated from skin and soft tissue infections and body fluids (48.5%), followed by urine samples (21%), blood (18.2%) while 12.3% were isolated from other samples.

Antibiotic sensitivity testing of gram-positive bacteria revealed highest resistance against Fluoroquinolones (71%), followed by Aminopenicillin (65.1%) Co-trimoxazole (53.6%). (Figure 3)
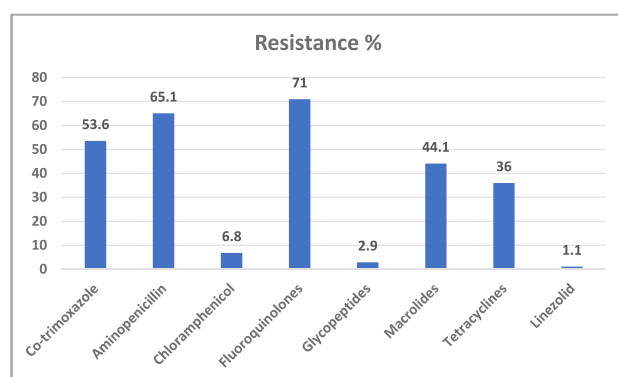

Figure 3: *Antimicrobial Resistance Pattern of Gram-positive bacteria*

While gram-negative bacteria showed 79.2% resistance against Co-trimoxazole, followed by Cephalosporins (72.8%) and Fluoroquinolones (64.4%). (Figure 4).
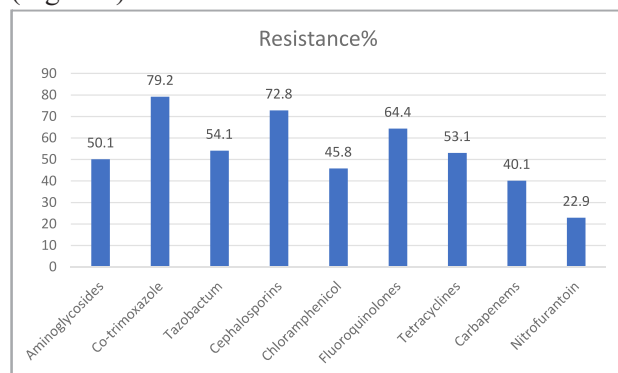

Figure 4: *Antimicrobial Resistance pattern of Gram-negative bacteria.*

DISCUSSION

Hospital acquired infections are considered as one of the most important public health concerns across the world. In spite of developments in healthcare system and antibiotic prophylaxis treatment plans, nosocomial infections are consistent in many hospitalized patients.[11] In our study, we determined the distribution and antimicrobial sensitivity pattern of patients who were referred to Combined Military Hospital, Sialkot, over a period of six months from 1st January 2022 to 30th June 2022.

In the present study, total 402 organisms were isolated from different clinical samples, among which 57% were gram-positive bacteria while 43% were gram-negative bacteria. The most common gram positive organism was found to be Methicillin-resistant S.aureus which is consistent with the findings of Wang et al.[12] According to our results, E.coli was most prevalent Gram-negative organism causing nosocomial infections, followed by K.pneumoniae and A.baumanii which is in agreement with the results of Tolera et al, and Sikka et al.[13,14] However, in the study conducted by Davoudi et al., P. aeruginosa and Acinetobacter baumannii were identified as the most communal organisms, while another study conducted by bijariet al in Iran[15,16] reported that K. pneumoniae, P. aeruginosa and E. coli were more common in causing nosocomial infections as compared to other bacteria. The increase in number of nosocomial infections caused by Gram-negative organisms in recent years might be due to variations in health care system, prevention and control practices of infections at hospitals, and inappropriate antimicrobial usage.

In the current study, maximum number of positive cultures were isolated from male patients. Similar results were reported in Tunisia, in which 67.2% male patients were found to develop HAI.[11]

The findings of the current study revealed a serious problem with the increasing antimicrobial resistance rate among the bacterial isolates from the hospital-acquired infections, comparable to the worldwide trends.[17,18] In our study, Gram-negative bacteria showed extreme resistance against co-trimoxazole. Similar to

our results, a study in 2023 reported 88.2% resistance against ampicillin-clavulanic acid among Pseudomonas.[19] According to our results, Gram-negative bacteria showed 72.8% resistance against Cephalosporins class which were similar to results of a study in which 70% resistance were reported against cephalosporins among Gram-negative bacteria.[19]

In our study, Gram-positive bacteria showed 99% susceptibility against Vancomycin. The annotations of Mun et al. showed the similar results, as all their gram-positive bacteria were found to be susceptible to vancomycin.[21] Another study reported similar results in 2023 in which Gram-positive bacteria showed 100% sensitivity to vancomycin. Our study, similar to another Iranian research,[21,22] showed the high efficiency of ami-kacin, vancomycin, imipenem, and gentamycin for the treatment of nosocomial infections.

CONCLUSION

Nosocomial infections resulting antibiotic resistance is an emerging threat in developing countries, and it results in noteworthy morbidity and mortality rates. Considering the findings presented in this study, it is needed to conduct further studies reporting countrywide surveillance data of antimicrobial resistance. Develop-ment of suitable healthcare mechanisms followed by regular supervision should be implemented. Because of their importance, antibiotic usage policies should be taken and implemented on a priority basis in the agenda of the infection control committees of hospitals.

Ethical Approval:

The ethical Approval was obtained from Institute CMH Sialkot. (Reference No. ERC/06/2023)

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