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ANTIBIOTIC RESISTANCE: AN OBSERVATIONAL STUDY FROM INTENSIVE CARE UNIT OF PEOPLE UNIVERSITY OF MEDICAL AND HEALTH SCIENCES, NAWAB SHAH SINDH, PAKISTAN.

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Abstract:
Infectious diseases are very common in all age groups and intensive care units are very sensitive areas of any hospital patients are very critical and all measures are adopted to avoid any sort of contamination and transmission of infections. Despite of that infections are frequently reported from theses sensitive areas of the hospitals. This study was conducted to evaluate the common pathogens responsible for in such population of patients. Antibiotic resistance is another challenge faced by the treating physicians indoor, out door and critically ill patients so the current research work also focused on this aspect of treatment and evaluated the response of antibiotic therapy against various pathogens by assessing culture and sensitivity in the samples obtained from patients admitted in the intensive care unit of the people university of medical and health sciences shaheed Benazir Abad (Nawab Shah, Sindh). Patients were selected through purposive and consecutive sampling, blood, urine and swab samples were collected under aseptic measures from patients running fever. There were 42 such cases

evaluated the mean age of the study participants was 17.38±7.13 years with the minimum age as 11 years while the maximum as 60 years. Common pathogens found on culture and sensitivity reports after 72 hours of incubation were Proteus, Klebsiella, Staphylococcus and Streptococcus. Cephalosporins, Penicillin group, Macrolides, Fluroquinolones, Linezolid, Aminoglycosides, Meropenem and Fosfomycin were the common antibiotics tested. There 26(61.90%) males and 16(38.10%) females and bacterial growth was seen in 10(23.81%) of the patients while no bacterial growth was reported for 32(76.19%) patients after an incubation of 48 hours. Proteus was found sensitive to Meropenem and Amikacin while Klebsiella was found sensitive to Fosfomycin and Imipenem.

Conclusion: Common pathogens isolated from the 23.81% of the ICU patients were Proteus, Klebsiella, Staphylococcus and Streptococcus whereas 76.19% patients didn't show any bacterial growth. Proteus and Klebsiella were resistant to majority of the antibiotics while staphylococcus and streptococcus were sensitive to many classes of antibiotics.

Introduction:

Antibiotic resistance is a serious rising threat in surgical intensive care units (ICUs) globally, often is called epicenter of infections, where vulnerable patients (reduced host defense deregulating the immune responses) and increased risk of becoming infected through multiple procedures like intubation, mechanical ventilation, arterial and venous lines, foley's catheter etc , which distorting the anatomical integrity-protective barriers of patients .limited resource usually result in high occupancy rates, overcrowding, an inadequate isolation facilities, poor infection control , frequent antibiotic uses create ideal conditions for the emergence and spread of multidrug-resistant (MDR) pathogens [1]. This resistance leads to higher infection rates, increased morbidity and mortality, and ultimately reduce treatment options for critically ill patients, it increases hospital stay, overburden of cost as well. Unfortunately, the prevalence of Nosocomial infections (NIs) has been increasing worldwide. In developed countries, the incidence rate of NIs in ICUs ranges from 5% to 10%, and approximately 7% among all hospitalized patients experience NIs. Worse situation is observed in developing countries where 20%-25% of the ICU patients and approximately 10% of hospitalized patients get infected [2]. Common resistant pathogens in Gram positive organisms, the most important resistant microorganism in ICU is Methicillin resistant Staphylococcus aureus, Vancomycin resistant enterococci. Among Gram negative bacteria Klebsiella Pneumonie, E. coli and Proteus mirabilis, Pseudomonas aeruginosa [3]. Early diagnosis and appropriate management of infections are crucial for reducing in-hospital morbidity and mortality. The timely administration of effective empirical antibiotic therapy within the first critical hours significantly improves patient outcomes, while inappropriate or inadequate treatment raises mortality risk.

However, guiding this initial therapy is complicated by the fact that pathogens causing infections in ICU patients and their antibiotic susceptibility profiles exhibit considerable variation, not only between different hospitals but even among departments within the same hospital. Therefore, obtaining up-to-date local microbiological data to inform empirical antibiotic selection for ICU patients is of paramount importance[4,5].key Strategies for Control antibiotic resistance are implement stewardship programs, promote appropriate antibiotic uses and reduce unnecessary antibiotic prescriptions, enhance infections control measures Strict hygiene protocol, utilize patient isolation strategies for infected patients, and improved ventilation to prevent the transmission and spread of pathogens. Surveillance & Data Utilization Conduct regular monitoring of resistance patterns, Develop and apply local antibiograms, use data to guide treatment and policy [6-7].

Antimicrobial resistance is among the top threats to global public health as well as the global development being estimated as the direct cause of 1.27 million deaths globally in year 2019 while a contributing factor in 4.95 million deaths [8]. According to an estimation by the World Bank the

healthcare costs could increase to US$ 1 trillion by 2050 due to antimicrobial resistance and up to US$ 3.4 trillion GDP (gross domestic product) losses per year by 2030 [9].Regardless of raising global awareness of antimicrobial resistance (AMR), significant gaps persist in understanding its epidemiology, main factors, and real burden within specific high-risk settings such as the Surgical Intensive Care Unit (SICU) at Peoples University of Medical & Health Sciences for Women (PUMHS-W). This lack of locally specific characterization hinders effective counter measures. Understanding the specific patterns of resistance prevalent among our SICU patient population, determining the risk factors contributing to colonization and infection with multidrug-resistant pathogens (MDRPs), and analyzing the clinical outcomes of these resistant infections is not just an academic exercise, it directly impacts patient care and public health so we planned this study.

Methodology:

This research work was conducted at intensive care unit of the people university of medical and health sciences shaheed Benazir Abad (Nawab Shah, Sindh) in March 2025. There were 42 patients selected through purposive and consecutive sampling with no age limits of patient, samples of blood, urine and swab were collected under aseptic measures after obtaining written informed consent from patients' attendants. Samples were sent for culture and sensitivity to PUMHS research lab. Different pathogens were isolated and their response to various antibiotics was assessed through culture and sensitivity. Mean and SD was calculated for quantitative variable and frequency and percentage was measured for qualitative parameters. Results were presented in tables, figures and charts while SPSS version 22 was used for data analysis.

Results:

There were 42 such cases evaluated the mean age of the study participants was 17.38±7.13 years with the minimum age as 11 years while the maximum as 60 years. Sample of blood, urine and swab were collected as shown in [figure-1]. Common pathogens found on culture and sensitivity reports after 72 hours of incubation were Proteus, Klebsiella, Staphylococcus and Streptococcus [Figure-2]. Cephalosporins, Penicillin group, Macrolides, Fluroquinolones, Linezolid, Aminoglycosides, Meropenem and Fosfomycin were the common antibiotics tested. There 26(61.90%) males and 16(38.10%) females and bacterial growth was seen in 10(23.81%) of the patients out of which 09(21.43%) were males and 01(2.38%) were female. No bacterial growth was reported in 32(76.19%) patients after an incubation of 48 hours out of which 17(40.48%) were males and 15(35.71%) were females [Table-1]. Proteus was found sensitive to Meropenem and Amikacin while it was resistant to Nitrofurantoin, Norfloxacin, Ciprofloxacin.

Fosfomycin, Levofloxacin, Ceftriaxone, Linezolid and Cefepime. Klebsiella was found sensitive to Fosfomycin and Imipenem whereas it was resistant to Augmentin, Piperacillin, Tazobactam, Ciprofloxacin. Levofloxacin, Ceftriaxone, Linezolid, Cefepime, Azithromycin and Amikacin. Staphylococcus showed sensitivity to Ciprofloxacin. Levofloxacin, Amikacin, Azothromycin, Linezolid while it was resistant to Augmentin, Ceftriaxone and Cefepime. Streptococcus was sensitive to Nitrofurantoin, Amikacin, Ciprofloxacin, Levofloxacin, Fosfomycin, sulbactam and linezolid whereas it was resistant to Augmentin, Ceftriaxone, Cefepime, cefixime, Azithromycin [Table-2].

Table-1: Gender distribution and culture spectrum in the studied patients

	MALE	FEMALE	Total
Growth seen	09(21.43%)	01(2.38%)	10(23.81%)
Growth Not seen	17(40.48%)	15(35.71%)	32(76.19%)
Total cases	26(61.90%)	16(38.10%)	42(100%)

Table-2: Isolated Organisms and their response to different antibiotics

Organism	Resistant Antibiotics	Sensitive Antibiotics
Proteus	Nitrofurantoin, Norfloxacin, Ciprofloxacin. Fosfomycin, Levofloxacin, Ceftriaxone, Linezolid, Cefepime	Meropenem Amikacin
Klebsiella	Augmentin, Piperacillin, Tazobactam, Ciprofloxacin. Levofloxacin, Ceftriaxone, Linezolid, Cefepime, Azithromycin, Amikacin	Fosfomycin Imipenem
Staphylococcus	Augmentin, Ceftriaxone, Cefepime	Ciprofloxacin. Levofloxacin, Amikacin, Azothromycin, Linezolid,
Streptococcus	Augmentin, Ceftriaxone, Cefepime, cefixime, Azithromycin	Nitrofurantoin, Amikacin, Ciprofloxacin, Levofloxacin, Fosfomycin, sulbactam, linezolid

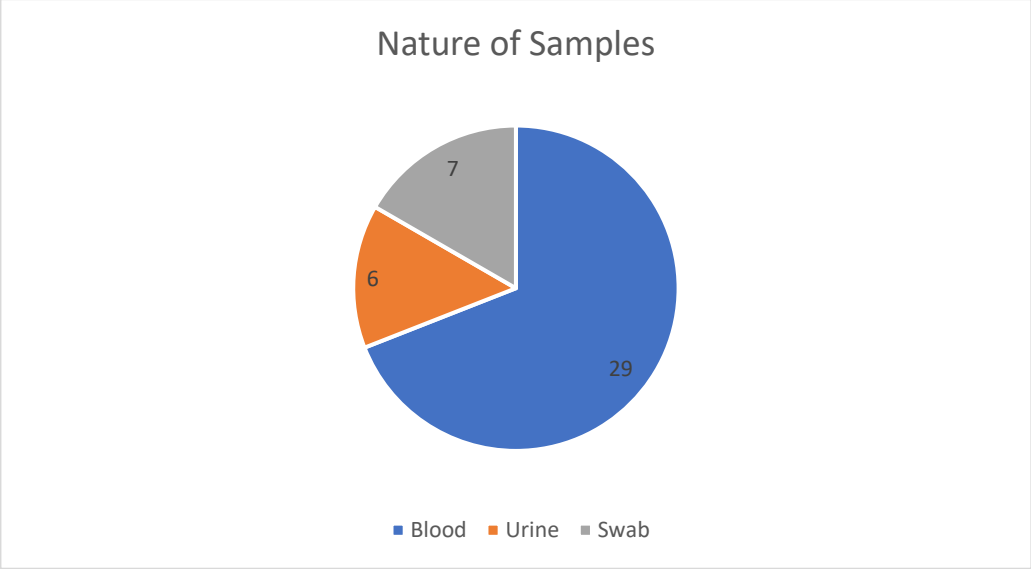

Figure-1: Nature of the specimen samples collected for culture and sensitivity

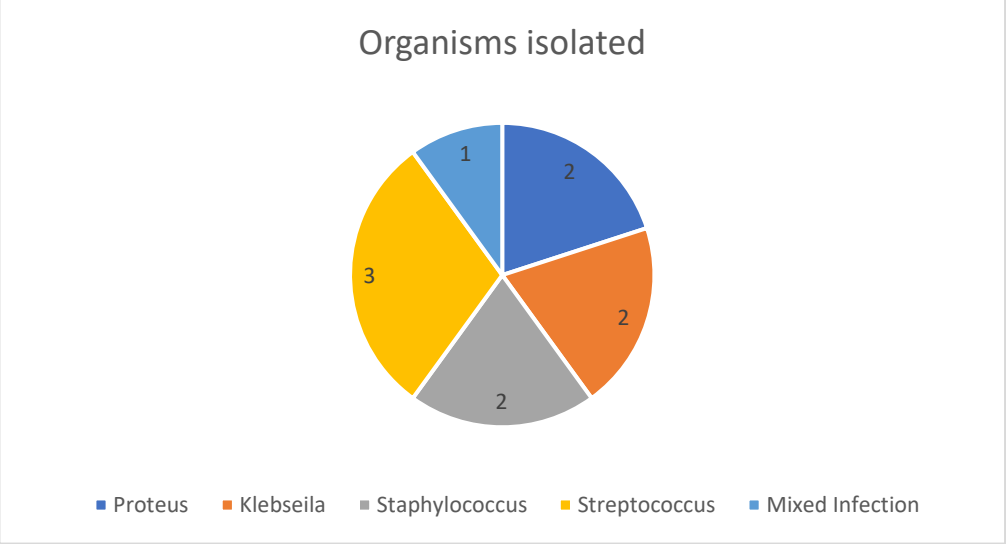

Figure-2: Frequency of Isolated organisms

Discussion:

Almighty Allah has provided the defense mechanism to all creatures from human beings to microorganisms for their protection against enemies and for their survival. Bacteria also develop and modify their defense system according to need and time with the advancement and new drug

development. Antibiotic resistance has been a challenge since very long and well addressed by the research community through developing new drugs and different strategies to minimize this issue. Various mechanisms have been explored and described for antibiotic resistance which includes modification of channels of entry thus minimizing the drug entry into the bacterial cell e.g gram negative organism modify their porin channel to reduce the entry of cephalosporins[10,11], developing the efflux pumps by the bacteria thus removing the drug from the bacterial cell e.g Bacteroides remove the tetracycline [10,12], developing the enzymes inside the bacteria that breaks down the drug molecules e.g beta-lactamase breaks the beta lactam ring of penicillin derivatives [10], esterases dissolve the macrolide group of antibiotics [10,13] and acetyltransferase renders chloramphenicol and aminoglycosides as inactive [10,14] , modifications in the binding sites inside the bacterial cell thus the drug molecules can not bind to their respective targets e.g modification in PBP (Penicillin Binding Protein) by S. Pneumoniae results in resistance against penicillin derivatives which cannot bind on their targets [10] similarly modifications in the DNA gyrase results into resistance against fluroquinolones [15,16] . Millions of lives are saved through appropriate use of antibiotics has saved millions of lives but its inappropriate use leads to the development of antimicrobial resistance which is the most serious global public health problem that increases the duration of illness along with hospital stay and increasing the cost of alternative drug 100 times which is unaffordable by the poor patient and even the governments of the developing world [10]. The contributing factors to the development of AMR (Antimicrobial resistance) include misuse and overuse by the health care providers, noncompliance and self-medication by the patients, antibiotic usage in agriculture, aquaculture and animal husbandry, lack of proper infection control in healthcare facilities along with sanitation and hygiene [10]. Our study was a limited study with a smaller sample size which was limitation more studies are recommended on large scale.

Conclusion: Common pathogens isolated from the 23.81% of the ICU patients were Proteus, Klebsiella, Staphylococcus and Streptococcus whereas 76.19% patients didn't show any bacterial growth. Proteus and Klebsiella were resistant to majority of the antibiotics while staphylococcus and streptococcus were sensitive to many classes of antibiotics.

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