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Original Research Article

ANTI-BIO GRAM PROFILE IN THE SETTING OF A HIGH FREQUENCY OF MULTI-DRUG RESISTANT ORGANISMS AT DOCTORS HOSPITAL AND MEDICAL CENTRE, LAHORE, PAKISTAN

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Abstract: *Antimicrobial resistance (AMR) has emerged as a worldwide concern. The overuse and abuse of antibiotics pose a severe hazard to low-income nations in addition to reducing therapeutic choices. This is a retrospective cross-sectional study conducted at the Doctors Hospital and Medical Center surgical ICU in Lahore between January 1, 2021, and December 31, 2021. Three hundred sixty-four patients' blood, tracheal, and urine culture data were gathered from patients hospitalized in the intensive care unit and processed by CLSI's standard microbiological methods. Stanford University's web-based anti-bio gram and CLSI were used to construct the anti-bio gram. The study examined 364 individuals, and the cultures that were taken from various places included the trachea (13%), urine (33%), and blood (54%). No organism has been identified from blood cultures thus far. Klebsiella (5), Acinetobacter (4), and Pseudomonas (3) were the most frequently isolated species from tracheal cultures and E. coli, with four isolates, followed by Klebsiella with three and Pseudomonas with two isolated from urine cultures. Staphylococcus sp. exhibited 100% resistance to vancomycin and linezolid. For both Acinetobacter and Klebsiella, colistin showed 100% resistance. E. coli was resistant to moxifloxacin (p value= 0.04). Since multidrug-resistant bacteria are often seen in intensive care units (ICUs), we must use caution when prescribing broad-spectrum antibiotics to avoid overtaxing weaker strains. Preventing the spread of resistant isolates in critical wards and preserving ICU patients will have advantageous outcomes.*

Keywords: Anti-Bio Gram, Blood Cultures, Urine Cultures, Intensive Care Units, Antibiotic Resistance

Introduction

Numerous gram-positive and gram-negative microorganisms can lead to hospital-acquired infections in hospitalized patients, particularly in the case of immunocompromised patients, patients with severe underlying diseases, and ICU patients. These disorders that are commonly referred to as nosocomial infections (NI) or hospital-acquired infections (HAI) are linked to the healthcare system and impact a large number of individuals worldwide (Kollef et al., 2021). By lengthening hospital stays and raising medical costs, HAI not only increases patient morbidity and mortality but also poses a threat to public health. In high-income nations, the prevalence of hospital-acquired infections is 7.5%; however, other reports have shown that in European countries, the majority of HAIs is relatively less, ranging from 5.8% to 7.0% and 4.5% in the US; in low- and middle-income nations, the prevalence rate varies from 5.8% to 19.2% (Szabó et al., 2022). Since health-related infections (HAIs) are more common in developing countries, more infection control measures and increased surveillance are necessary (Allegranzi et al., 2011). The intensive care unit (ICU) has a 2 to 5 time's higher incidence of nosocomial infections than the overall inpatient hospital population. There is a significant risk of medicolegal complications if the patient or their family members seek payment and hold hospital employees responsible for the infection. Patients hospitalized in the intensive care unit (ICU) have a multiple-fold greater prevalence of non-infection (NI) than other patients because of predisposing variables such as invasive operations, prolonged hospital stays, overuse of antibiotics, and the presence of severe disease. Comparing Medical/Surgical ICUs to Cardiac or other ICUs, nosocomial infections are about twice as high (Brown et al., 1985). In intensive care units, gram-negative bacteremia is linked to significant morbidity and mortality (Sligl et al., 2006). Acinetobacter baumannii was shown to be the most often isolated pathogen in CLABSI patients, while Candida species was found to be the most often isolated pathogen in CAUTI patients. For VAP and CLABSI, excess mortality was 20.3%, whereas for carbapenem-resistant A baumannii CLABSI, it was 32.2% (Apostolopoulou et al., 2013). Gram-negative bacilli were the most often discovered among urinary catheter-related illnesses, followed by fungi, gram-positive cocci, and, more recently, gram-negative organisms that have gained resistance (Alvarez-Lerma et al., 2013). An effective nosocomial infection monitoring program in hospitals can reduce infection rates by around one-third (Nimer, 2022). Infections of the surgical site and bloodstream are first and second among NSIs in the Middle East, respectively (Nimer, 2022). The WHO states that the emergence of multi-drug resistance (MDR) has restricted how infectious illnesses may be treated (Organization, 2014). Anti-bio grams are reports that provide an overview of the data about the rate of bacterial sensitivity to antibiotics at a particular facility over a calendar year (Simpao et al., 2018). The current study aims to estimate the burden of nosocomial infections in patients admitted to intensive care units (ICUs), identify the microorganisms involved, their growth rate, and their susceptibility to different antimicrobial medicines in terms of both sensitivity and resistance. This study is the first of its kind in the area and adds value to the body of knowledge already accessible. The prevalence of nosocomial infections in patients admitted to intensive care units and their development and susceptibility to different antibiotics have all shown encouraging outcomes from this study. This study will have the drawback that patients referred from some other medical facility might already have organisms in their cultures, which may interfere with the results of this study. This study will also help determine empirical antibiotics that cover most of the isolates found in our ICU.

Methodology

This research was a retrospective and cross-sectional study. This study was conducted in the surgical ICU of the Doctors Hospital and Medical Center in Lahore between January 1, 2021, and December 31, 2021, for one year. In this study, patients hospitalized in the intensive care unit (ICU) older than eighteen years of age, regardless of gender, were included. During our investigation, 502 patients were hospitalized in the intensive care unit.
Data on the blood, tracheal, and urine cultures of three hundred sixty-four patients were collected and examined for research purposes. Three hundred sixty-four culture reports were removed, with 55 indicating community-acquired illnesses at the time of presentation. To prevent bias, all laboratory testing was conducted at a single laboratory.
The CLSI's standard microbiological methods were followed during the processing of each culture. For urine cultures, CLED (Cysteine-Lactose-Electrolyte deficient Agar) was utilized; for tracheal and sputum cultures, Mac-Conkey, Chocolate, and Blood Agar were employed. The automated BACT/ALERT blood culture system was used to process blood cultures. The number of patients with nosocomial infections was recorded along with information on antibiotic sensitivity and pathogen type. Stanford University's web-based anti-bio gram and CLSI were used to construct the anti-bio gram.
The Doctors Hospital and Medical Centre in Lahore's ethical review committee approved. Each participant provided informed consent, understanding that their information would only be used for the combined records in this study and would not be shared with any one party.
The 64-bit SPSS version was used to conduct the statistical analysis. For every studied antimicrobial agent, the data were categorized as a percentage of sensitivity.

Results

Of the 364 individuals examined in the research, blood (54%), urine (33%), and tracheal (13%) were the locations from which the cultures were taken.
Our investigation has identified no organism from blood cultures thus far. Klebsiella (5), Acinetobacter (4), and Pseudomonas (3) were the most frequently isolated species from tracheal cultures, as shown in Figures 1, 2, 3, and Table 1.
The most frequently isolated bacterium from urine cultures was E. coli, with four isolates, followed by Klebsiella, with three, and Pseudomonas, with two (Figure 3). Charts and anti-bio grams were used to display the results. Staphylococcus sp. exhibited 100% resistance to vancomycin and linezolid. For both Acinetobacter and Klebsiella, colistin showed 100% resistance. E. coli resisted moxifloxacin (p value= 0.04) (Table 2 a & b).

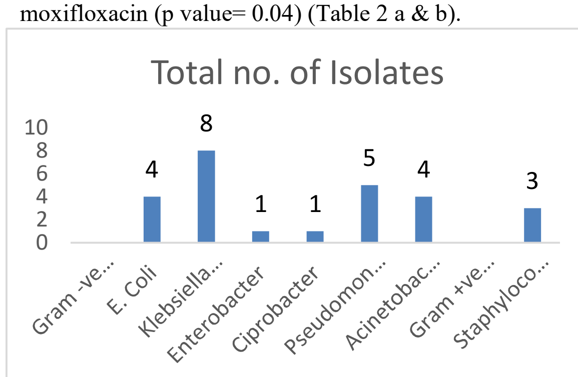

Figure 1: Total number of Isolates

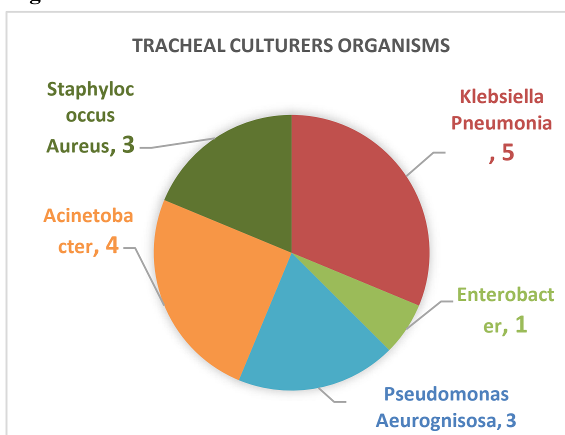

Figure 2: Organisms isolated from Tracheal cultures

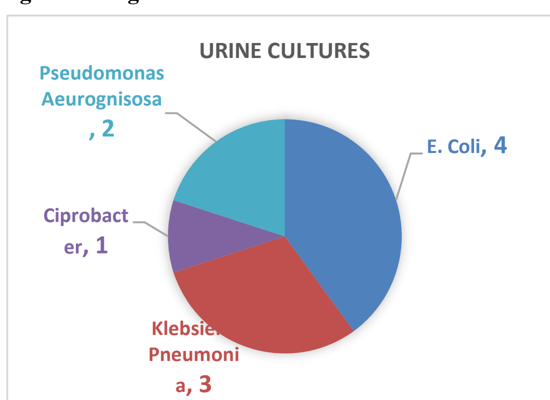

Figure 3: Organisms isolated from Urine cultures.

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Table 1: Total number of Isolates

Gram -ve Organisms	Tracheal Cultures Organisms	Urine cultures
E. Coli	-	4
Klebsiella Pneumonia	5	3
Enterobacter	1	-
Ciprobacter	--	1
Pseudomonas Aeurognisosa	3	2
Acinetobacter	4	-
Gram +ve Organisms		
Staphylococcus Aureus	3	-

Table 2(a): Anti-bio gram

Gram -ve Organisms	No. Of isolates	Amoxicilin/ Clavulanate	Meropenem	Piperaciliin / Tanzobactam	Cefuroxime	Cefazidine	Cefotaxime	Cefixime	Cefipime	Nalidixic acid	Levofloxacin	Moxifloxacin	Ciprofloxacin	Doxycycline
E. Coli	4	60%	100%	60%	20(I)	20%	20%	20%	40%	50%	60%	0	60%	60%
Klebsiella Pneumonia	8	40%	57.10%	28.60%		14.30%	0	0	14.30%	50.00%	28.60%		28.60%	42.90%
Enterobacter	1	0.00%		100%		0	0	0	0		100%		100%	100.%
Ciprobacter	1	0.00%	50%	50%		0	0	0	0	100%	50%		50.00%	100%
Pseudomonas Aeurognisosa	5		66.70%	50%		50%			33.30%		83.30%		50%	
Acinetobacter	4		33.30%	33.30%		33.30%	50%		33.30%		33.30%		0.00%	66.70%
Gram +ve Organisms														
Staphylococcus Aureus	3										0	0	0.00%	50%

Table 3(b): Anti-bio gram

Gram -ve Organisms	No. Of isolates	Minocycline	Tetracy-clin	Amikacin	Gentamicin	Tobramycin	Colistin	Chloramphenicol	Fosfomycin	Vancomycin	Linezolid	Teicoplanin
E. Coli	4	60%	60%	100%	80%	80%	100%	100%	100%			
Klebsiella Pneumonia	8	42.90%	42.90%	57.10%	42.90%	42.90%	85.7%	100%	50%			
Enterobacter	1	100.%	100%	100%	0.00%	0.00%	100%	100%				
Ciprobacter	1	0.00%	50%	100%	100%	100%	100%	0.00%	100%			
Pseudomonas Aeurognisosa	5			66.70%	66.70%	66.70%	100%					
Acinetobacter	4	33.30%	0.00%	33.30%	66.70%	66.70%	100%					
Gram +ve Organisms												
Staphylococcus Aureus	3	50%	0.00%		0.00%			100%		100%	100%	100%

Discussion

Antimicrobial resistance has been a significant issue in critical patients, especially in ICU settings, as it increases their ICU stay and expenses. The use of increasingly wrong prophylactic and therapeutic strategies has led to an increased incidence of antimicrobial resistance in ICU isolates. Our study was based on blood, urine, and tracheal cultures. No organism was detected in blood cultures. Klebsiella was the most common in tracheal cultures, and E. coli was the most common in urine cultures. These results are similar to another study conducted in the ICU of a tertiary care hospital in Peshawar, Pakistan (Ullah et al., 2016).

In our study, all tracheal gram-positive isolates were 100% sensitive to Chloramphenicol, Vancomycin, Linezolid, and Teicoplanin and 50% exposed to doxycycline and minocycline. At the same time, they were all resistant to levofloxacin, moxifloxacin, ciprofloxacin, tetracycline, and gentamycin. Vancomycin and linezolid showed 100% sensitivity for staphylococcus, so they can be used as empirical drugs overall against gram-positive organisms. The cause of resistance against these antibiotics could be the misuse of these antibiotics in our general population.

The primary source of infection in the intensive care unit was gram-negative bacteria. More gram-negative organisms (88.46%) than gram-positive organisms (11.53%) were found (Alhumaid et al., 2021; Onwubiko and Sadiq, 2011). The most common gram-negative bacteria were Klebsiella found in tracheal cultures, which were 100% sensitive to chloramphenicol only, followed by 85.7% to colistin, 57.1% to amikacin and meropenem, 50% to niladic acid and Fosfomycin, 40% to amoxicillin/Clavulanic acid and then 42.9% to doxycycline, minocycline, tetracycline, gentamycin, tobramycin. 28.6% to ciprofloxacin and levofloxacin, while least sensitive to piperacillin, ceftazidime, cefotaxime, and cefixime. One isolate of Klebsiella Pneumonia was resistant to Collistin, a concerning global sign, in accordance with a 5.6% resistance to Collistin in another study in India (Sodhi et al., 2020). Colistin showed 0% resistance to Acinetobacter and a 14.3% resistance pattern for Klebsiella, so it can be used as the best empirical drug against gram-negative organisms in our ICU, while Moxifloxacin was resistant against most gram-negative organisms, so its use is discouraged. Given the prevalence of multidrug-resistant bacteria in intensive care units, we should use caution when prescribing broad-spectrum antibiotics to avoid overtaxing delicate strains. This may help save patients in intensive care units and stop resistant isolates from spreading to other critical wards.

Conclusion

Since multidrug-resistant bacteria are seen in intensive care units (ICUs) often, it is imperative that we use caution when prescribing broad-spectrum antibiotics to avoid overtaxing weaker strains. Preventing the spread of resistant isolates in critical wards and preserving ICU patients will have advantageous outcomes.

Declarations

Data Availability statement
All data generated or analyzed during the study are included in the manuscript.
Ethics approval and consent to participate
Approved by the department Concerned.
Consent for publication
Approved
Funding
Not applicable

Conflict of interest

The authors declared absence of conflict of interest.

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Study Design, Review of Literature
Coordination of collaborative efforts
Conception of Study, Development of Research Methodology Design, Study Design,, Review of manuscript, final approval of manuscript
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Data acquisition, analysis.
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Conception of Study, Development of Research Methodology Design, Study Design,, Review of manuscript, final approval of manuscript.

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