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Survey of Antibiotic-Resistant Bacterial Species in Hospitals in Maysan Governorate

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Abstract: spans ages 15-60, highlighting the broad impact of this pathogen. The antibiotic resistance of Enterobacter aerogenes, Pseudomonas aeruginosa, Klebsiella pneumonia to" Meropenem Amikacin, Gentamycin, Ciprofloxacin, Tigecycline, Trimethoprim, Piperacillin, Cefazolin Cefoxitin, Ceftazidime, Ceftriaxone, Cefepime, Imipenem Levofloxacin.

"This study investigates the prevalence and antibiotic resistance of three major bacterial pathogens - Pseudomonas aeruginosa, Enterobacter aerogenes, and Klebsiella pneumoniae - in hospital settings in Maysan Governorate. Pseudomonas aeruginosa was identified as highly resistant to multiple antibiotics, complicating treatment protocols. Similarly, Enterobacter aerogenes and Klebsiella pneumoniae showed significant resistance levels, for all above antibiotic except Tigecycline ,while Pseudomonas aeruginosa showed resistance for all above antibiotic. underscoring the need for stringent antibiotic stewardship and infection control measures. The findings emphasize the critical importance of addressing antibiotic resistance to ensure effective treatment options remain available and to mitigate the substantial burden on healthcare systems.

Keywords: Pseudomonas aeruginosa, Enterobacter aerogenes, Klebsiella pneumoniae, Antibiotic Resistance.

1. Introduction

Pseudomonas aeruginosa is a type of bacteria known for its high resistance to many antibiotics. It is commonly found in the environment, such as soil and water, and can cause challenging infections in hospital settings, particularly in people with weakened immune systems. This bacterium can cause respiratory, urinary tract, and wound infections. It can form biofilms, making it even more resistant to antibiotics and disinfectants. The study highlights its resistance to antibiotics like cefepime, cefotaxime, ceftazidime, cephalosporin, and levofloxacin, emphasizing the need for strict infection control measures.

Enterobacter aerogenes (previously known as Enterobacter aeruginosa) is a Gram-negative bacterium that is part of the Enterobacteriaceae family. Found in the environment and the human gastrointestinal tract, it can cause infections such as urinary tract infections, respiratory tract infections, bloodstream infections, intra-abdominal infections, and skin and soft tissue infections. Its resistance to multiple antibiotics necessitates susceptibility testing to determine effective treatments.

Klebsiella pneumoniae is another Gram-negative bacterium that can cause a range of infections, especially in healthcare settings. It can cause pneumonia, urinary tract infections, bloodstream infections, and liver abscesses. Known for its ability to develop resistance to multiple antibiotics,

Klebsiella pneumoniae poses significant treatment challenges, particularly for individuals with weakened immune systems.

Overall, this study underscores the urgent need for effective antibiotic stewardship programs and infection control measures to manage the spread and impact of these antibiotic-resistant pathogens in hospital settings.

2. Materials and method:

The study was conducted in hospitals within Maysan Governorate, where clinical samples were collected from patients. The following clinical specimens were included:

- Blood
- Nasal

The bacteria examined in this study were:

- Pseudomonas aeruginosa
- Enterobacter aerogenes
- Klebsiella pneumoniae

Methods Bacterial Isolation and Identification Bacterial species were isolated from the clinical samples using standard microbiological techniques. The isolation process involved culturing the samples on selective media to promote the growth of the target bacteria.

Antibiotic Susceptibility Testing The antibiotic susceptibility of the isolated bacteria was determined using the VITEK 2 system, an automated microbiology system widely used for the identification and antimicrobial susceptibility testing of bacteria. The process involved the following steps:

1. **Sample Preparation**: Clinical samples were cultured, and bacterial colonies were selected and suspended in a saline solution.
2. **Inoculation**: The bacterial suspension was loaded into the VITEK 2 cards, which contain wells with various antibiotics.
3. **Incubation**: The inoculated cards were placed in the VITEK 2 instrument, where they were incubated and monitored.
4. **Analysis**: The VITEK 2 system analyzed the bacterial growth in the presence of antibiotics, providing data on the minimum inhibitory concentrations (MICs) and categorizing the bacteria as susceptible, intermediate, or resistant based on predefined breakpoints.

Data Analysis The results from the VITEK 2 system were compiled and analyzed to determine the antibiotic resistance patterns of the isolated bacterial species. Data were presented in tabular form, highlighting the number of patients, age ranges, and the antibiotics to which the bacteria showed resistance.

Ethical Considerations The study was conducted in accordance with ethical guidelines and received approval from the relevant institutional review boards. Informed consent was obtained from all participants.

This methodology ensures a comprehensive analysis of antibiotic resistance among bacterial pathogens in hospitals within Maysan Governorate, providing valuable insights for infection control and antibiotic stewardship.

3. Result

3.1 Klebsiella pneumoniae

- **Resistant:** Ampicillin, Piperacillin, Cefotaxime, Ceftazidime, Ceftolozane, Cefipime, Imipenem, Meropenem, Amikacin, Gentamicin, Ciprofloxacin, Trimethoprim
- **Sensitive:** Tigecycline

3.2 Enterobacter aerogenes

- **Resistant:** Piperacillin, Cefazolin, Cefoxitin, Ceftazidime, Ceftriaxone, Cefipime, Imipenem, Amikacin, Ciprofloxacin, Levofloxacin
- **Sensitive:** Tigecycline

3.3 Pseudomonas aeruginosa

- **Resistant:** Levofloxacin, Gentamicin, Ciprofloxacin, Tigecycline, Cefipime, Imipenem, Ceftazidime

Each of these bacteria shows resistance to a range of antibiotics, with Tigecycline being the only antibiotic showing sensitivity for Klebsiella pneumoniae and Enterobacter aerogenes. Unfortunately, Pseudomonas aeruginosa shows resistance to all listed antibiotics.

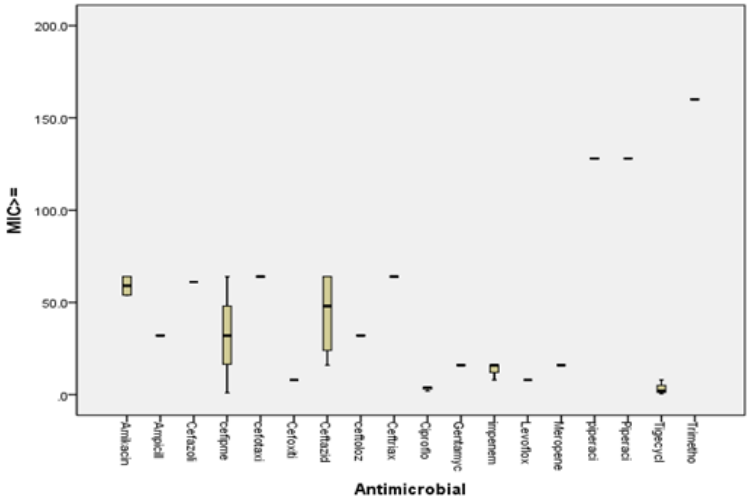

Fig 1 -This study uses boxplots to visualize the Minimum Inhibitory Concentrations (MICs) of 18 antimicrobial drugs against a microorganism. The graph shows varying MIC distributions across drugs, suggesting different effectiveness levels. Lower MICs (e.g., Tigecycline, Meropenem) indicate greater susceptibility, while higher MICs (e.g., Ampicillin) may indicate resistance.

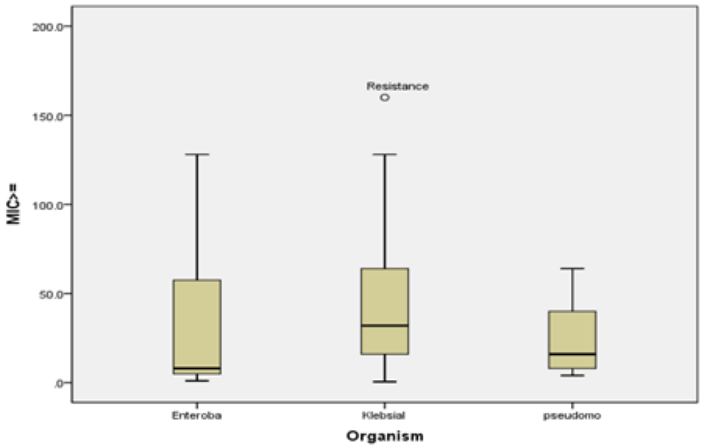

FIG 2 - This graph compares the Minimum Inhibitory Concentrations (MICs) of an unknown antimicrobial drug against Enterobacter, Klebsiella, and Pseudomonas bacterial species. It reveals varying susceptibility levels across the three species. Enterobacter and Klebsiella show higher MICs and wider ranges, suggesting potential resistance, with Klebsiella exhibiting a clear "Resistance" outlier. Pseudomonas demonstrates lower MICs and less variability, indicating greater susceptibility to the drug. The boxplots illustrate the median, interquartile range, and outliers of MIC values for each species. Knowing the specific antimicrobial and MIC breakpoints is crucial for clinical interpretation.

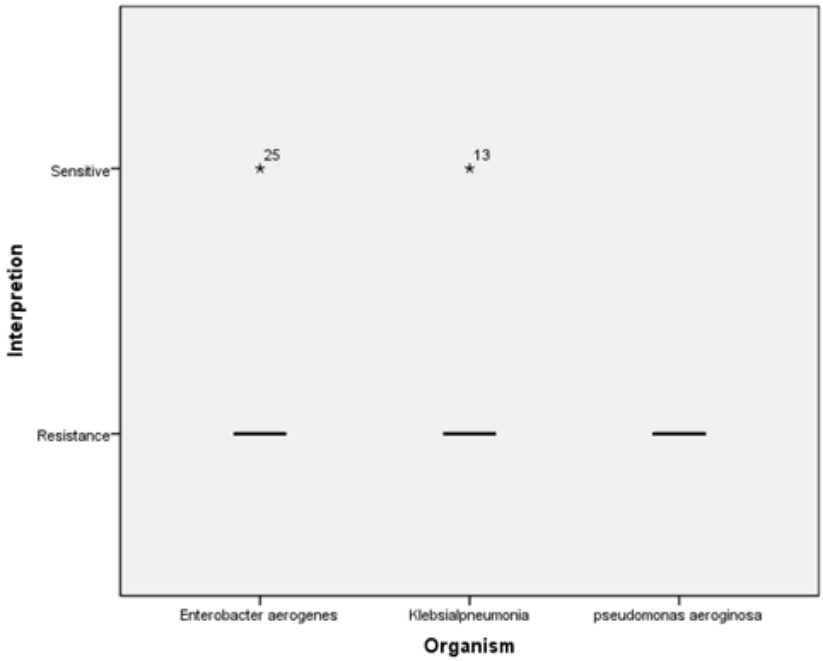

Fig 3 this figure survey shows from 32 antibiotic tested 30 was resistance while 2 was sensitive this regarded major problem for random uses of antibiotic from mankind in government.

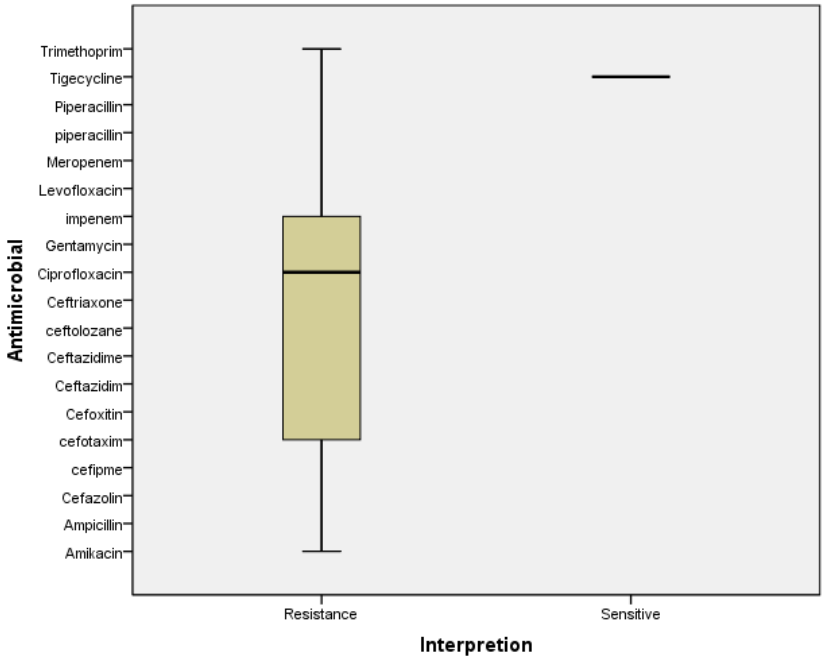

Fig 4 show relation between antibiotic and interpretation which appear only Tigecyclin sensitive and the others resistance .

Table 1 : Interpretion * Organism Crosstabulation

Count

		Organism			Total
		Enterobacter aerogenes	Klebsialpneumonia	pseudomonas aeroginosa	
Interpretion	Resistance	10	13	7	30
	Sensitive	1	1	0	2
Total		11	14	7	32

In this table shows number of antibiotic with sensitive and resistance charcters

4. Discussion

The findings from the antibiotic susceptibility test reveal several critical points:

1. **High Resistance in Klebsiella pneumoniae and Enterobacter aerogenes:** Both Klebsiella pneumoniae and Enterobacter aerogenes exhibit significant resistance to a broad range of antibiotics, which is a cause for concern. Tigecycline, however, remains effective against these bacteria, suggesting its potential as a treatment option.
2. **Pseudomonas aeruginosa Challenges:** The resistance profile of Pseudomonas aeruginosa is particularly alarming, as it shows resistance to all tested antibiotics, including Tigecycline. This highlights the difficulty in treating infections caused by this bacterium and underscores the need for alternative therapeutic approaches and novel antimicrobial agents.
3. **Implications for Clinical Practice:** The high levels of resistance observed in these pathogens necessitate vigilant antibiotic stewardship to prevent further development of resistance. It also emphasizes the importance of routine susceptibility testing to guide effective treatment choices.
4. **Need for New Antimicrobials:** The data strongly suggests the need for ongoing research and development of new antimicrobial agents. The current resistance patterns reduce the efficacy of many standard treatments, making it crucial to find alternative solutions.
5. **Infection Control Measures:** Beyond antibiotic treatment, stringent infection control measures are essential to limit the spread of these resistant pathogens within healthcare settings. This includes proper hygiene practices, isolation protocols, and environmental decontamination.

In conclusion, the findings serve as a stark reminder of the growing threat of antibiotic resistance and the urgent need for comprehensive strategies to address it, including the development of new antibiotics, better diagnostic tools, and robust infection control practices.

5. Conclusion

The data indicates a significant level of antibiotic resistance among the tested bacteria, highlighting the challenge of treating infections caused by these strains. Specifically:

Klebsiella pneumoniae and **Enterobacter aerogenes** demonstrate widespread resistance to most antibiotics tested, with the exception of Tigecycline, which remains effective against both bacteria.

Pseudomonas aeruginosa exhibits resistance to all tested antibiotics, posing a particularly difficult challenge for treatment.

Overall, the findings emphasize the urgency for careful antibiotic stewardship, alternative treatment strategies, and ongoing research to develop new antimicrobial agents.

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