Original Article

Isolation and Diagnosis of Bacteria Contaminating the Hospital Environment in Diyala Governorate

Salih Saood Yagoub and Ali Shakir Al-Ezee

ABSTRACT

Objective: To find out which antibiotic has the greatest effectiveness against bacteria.
Study Design: Cross sectional study
Place and Duration of Study: This study was conducted at the Department of Biology, College of Education for Pure Sciences, University of Diyala, 32001, Baqubah, Iraq from 10th December to 31st December 2024.
Methods: Thirty swabs were taken from beds and waste at Baqubah Teaching Hospital, Iraq and cultured on two types of media (blood agar and MacConkey agar). Five types of antibiotics (ciprofloxacin, amikacin, ampicillin, cefoxitin, and co-trimoxazole) were then applied to the growing bacteria.
Results: Ciprofloxacin, Amikacin, Ampicillin, Cefoxitin and Co-Trimoxazol on Escherichia bacteria grown on molar Hinton agar where taken from hospital beds to show any antibiotics have the greatest effect on them. The Ciprofloxacin antibiotic was the best for killing Escherichia, with Inhibition zone diameter 1.25 cm, while Amikacin and Ampicillin killing Escherichia bacteria, with Inhibition zone diameter 1 cm, and the antibiotics Cefoxitin and Co-Trimoxazol, killing bacteria, with Inhibition zone diameter of 30 mm
Conclusion: Ciprofloxacin antibiotic was the best for killing Escherichia bacteria, with inhibition zone diameter 1.25 cm, while Amikacin and Ampicillin kill Escherichia bacteria, with inhibition zone diameter 1 cm, and the antibiotics Cefoxitin and Co-Trimoxazol, killing bacteria, with inhibition zone diameter of 30 mm.

Key Words: Hospital beds, Antibiotic, Escherichia coli

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INTRODUCTION

Environmental factors like the availability of materials and equipment, administrative apathy, or personal factors like education and experience can all have an impact on adherence to safety precautions (SPs).[1] According to health-care organizations, health-care workers should closely follow established protocols to prevent illnesses linked to healthcare.[2] By reducing the frequency of infections linked to healthcare, adherence to fundamental safety measures is a practical and efficient method to improve the quality of healthcare. Protecting patients, communities, nurses, and other healthcare professionals is also essential. Particularly in resource-poor communities, there is a high frequency of serious, contagious diseases like HIV, Hepatitis B, and C, and very few prophylactic measures are in place.[1,3]

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Theodor Escherich, a German pediatrician who lived from 1857 to 1911, identified the germs Escherichia coli from infants' feces in 1885. Gram-negative, non-sporulating, rod-shaped, facultatively anaerobic, and coliform, Escherichia coli is a common bacteria found in food, the environment, and the lower stomach of warm-blooded animals. It is the most extensively researched prokaryotic model organism in the fields of microbiology and biotechnology. It is commonly employed as an indicator organism for water contamination and may survive for extended periods of time in soil, water, and feces. Under aerobic conditions, the bacterium grows quickly in new feces for two to three days, but then its numbers progressively decline. Gram-negative, straight, rod-shaped, non-sporing, non-acid fast, and bacilli that can exist alone or in pairs, E. coli is a type of bacteria. Usually formed like a rod, cells have dimensions of 1-3 μm × 0.4-0.7 μm (micrometer), which is approximately 1 μm long, 0.35 μm broad, and 0.6-0.7 μm in volume. Very few strains are non-motile because of the peritrichous flagellar configuration, which makes it motile. Although 37°C (98°F) is the ideal temperature for E. coli development, many lab strains can thrive at as high as 49°C (120.2°F). Under ideal circumstances, reproduction can occur in as little as 20 minutes. There are two types of fibriated strains: motile and non-motile. Certain strains of E. coli that were isolated from extraintestinal illnesses have been found to contain a polysaccharide

capsule. Using negative staining techniques, which create a bright halo over a dark background, the E. coli capsules are easily visible. They only have one or two peptidoglycan layers in their thin cell wall.

Antibiotic resistance is becoming a major worldwide issue that poses a threat to human health. Worldwide, Enterobacteriaceae have developed resistance in recent years[4]. Multidrug-resistant (MDR) bacteria are known to be most prevalent in South Asia, and in Pakistan, the number of multidrug-resistant Enterobacteriacea which are resistant to ampicillin, chloramphenicol, and co-trimoxazole is rising alarmingly.[5] Because these resistant enteric strains prolong illness and increase the likelihood of complications, they are considerably more difficult to manage and avoid in developing nations.[6] It is anticipated that resistant enteric bacteria, such as S. typhi and E. coli, will keep expanding in Karachi, Pakistan. This is because there hasn't been any notable success in reducing infectious diarrhea over the last ten years.[7] Furthermore, India and Pakistan have the highest incidence rates of acute gastroenteritis and enteric fever among Asian nations, with 214.2 and 451.7 cases per 100,000, respectively.[8] Managing MDR Salmonella (S) Typhi outbreaks can be challenging, especially in developing nations with limited resources.[9] In addition to first-line medicines, it has been observed that S. typhi is becoming more resistant to fluoroquinolones and cephalosporins worldwide, and Karachi is also seeing these resistant strains.[10] Additionally, it has been discovered that the E. coli strains in Karachi are resistant to the antibiotic Ciprofloxacin.[11] Since third-generation cephalosporins have been shown to be safe when used against E. coli, they can be utilized to treat resistant strains.[12] But third-generation cephalosporin resistance is also developing.[13] According to a single-center prospective research carried out in Karachi, strains of E. coli were resistant to ceftriaxone and ciprofloxacin but sensitive to imipenem and amikacin.[14]

Due to overuse and abuse of antibiotics, the problem of antibiotic resistance has spread, especially in poor nations like Pakistan.[15] According to a cross-sectional study carried out in Karachi, the primary cause of the city's rising antibiotic resistance is the local population's ignorance of antibiotic usage and doctors' illogical prescribing of antibiotics.[16] The management of frequent, prevalent enteric illnesses in our community is a critical future concern, especially in light of the threat posed by inadequate sanitation, contaminated water supplies, irrational antibiotic usage, and rising antibiotic resistance. Testing for resistance and sensitivity patterns at regular intervals is necessary to prevent the emergence of resistance and to guide local doctors.[17] Thus, this study's primary goal is to evaluate and contrast the effectiveness of four distinct antibiotics - Amikacin, Ceftriaxone, Ciprofloxacin, and Imipenem - against Salmonella typhi and Escherichia coli.

METHODS

Thirty swabs were taken from beds and waste at Baqubah Teaching Hospital and were cultured on two types of media (blood agar and MaCkonkey agar).The swabs taken from hospital beds are grown on culture media and placed in the incubator for 24 hours at 37°C after identifying the bacteria growing on the culture media for all samples (Escherichia coli). The antibiotics are applied to determine the extent of response to each of them; ciprofloxacin, amikacin, ampicilin, cefoxitin and co-trimoxazol.

RESULTS

Ciprofloxacin, Amikacin, Ampicillin, Cefoxitin and Co-Trimoxazol on Escherichia bacteria grown on molar Hinton agar where taken from hospital beds to show any antibiotics have the greatest effect on them. The Ciprofloxacin antibiotic was the best for killing Escherichia, with Inhibition zone diameter 1.25 cm, while Amikacin and Ampicillin killing Escherichia bacteria, with Inhibition zone diameter 1 cm, and the antibiotics Cefoxitin and Co-Trimoxazol, killing bacteria, with Inhibition zone diameter of 30 mm (Table 1, Fig.1).

Table No.1: Activities not used in the study

Antibiotic	Sensitivity	Resistance
Ciprofloxacin	100%	-
Amikacin	80%	20%
Cefoxitin	100%	-
Co-Trimoxazol	100%	-
Ampicillin	80%	20%

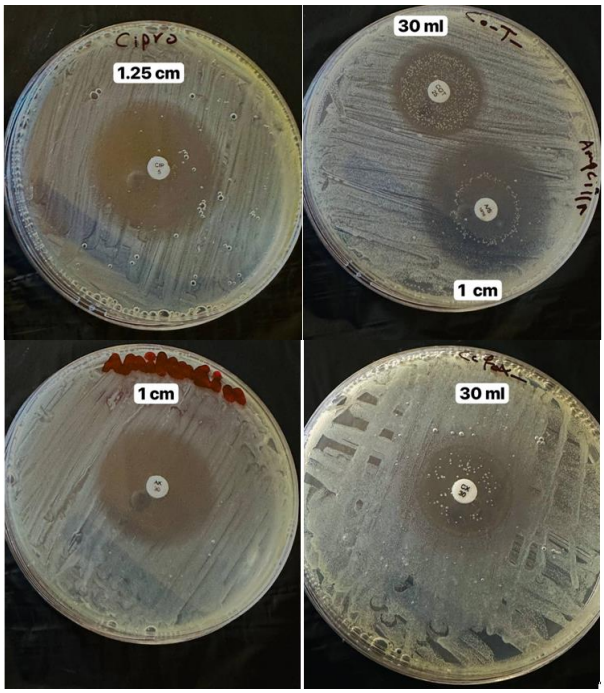

Figure No. 1: Escherichia coli bacteria with different types of antibiotics.

DISCUSSION

Ciprofloxacin was the most effective antibiotic against Escherichia bacteria. Ciprofloxacin is a fluoroquinolone antibiotic known for its strong activity against Gram-negative bacteria, including Escherichia coli. According to CLSI guidelines, inhibition zones for Ciprofloxacin against E. coli typically range between 1.5-3.0 cm depending on resistance profiles. The observed inhibition zone of 1.25 cm suggests reduced susceptibility, which may be due to increasing fluoroquinolone resistance globally.

Amikacin is an aminoglycoside antibiotic often used for Gram-negative bacterial infections. Global studies indicate variable effectiveness due to the emergence of aminoglycoside-modifying enzymes, leading to resistance. Ampicillin is a β-lactam antibiotic, but resistance is widespread due to E. coli producing β-lactamases (e.g. TEM, SHV, and CTX-M) results (1 cm inhibition zone) align with global trends showing that many E. coli strains exhibit resistance to Ampicillin, making it less effective in hospital-acquired infections.[18]

Cefoxitin, a second-generation cephalosporin, is commonly used as a surrogate marker for detecting Methicillin-resistant Staphylococcus aureus (MRSA), but it also has activity against E. Coli. If your inhibition zone is 30 mm (3 cm), it suggests significant susceptibility. However, many global reports indicate rising cephalosporin resistance in E. coli, particularly in extended-spectrum beta-lactamase (ESBL)-producing strains.[18] Co-Trimoxazole (Trimethoprim-Sulfamethoxazole) is frequently used for E. coli infections, but resistance rates vary widely (from 20-60% in hospital settings) observed 30 mm inhibition zone suggests that the tested strain is highly susceptible, which is less common in many hospital-acquired E. coli infections.[19-21]

Recommendations

1. Nurses and doctors must be careful and wear medical gloves and special clothing to prevent the transmission of bacteria and viruses from one patient to another and to workers.
2. Continuous use of sterilizers when dealing with patients for fear of transmission of infection
3. Take breaks from work to focus and avoid mixing tools specific to each disease.

CONCLUSION

Escherichia coli bacteria are the most common type found in hospital beds. The antibiotic ciprofloxacin is best for killing these bacteria with an inhibition zone of 1.25 cm but Amikacin and Ampicillin killing Escherichia bacteria, with Inhibition zone diameter 1 cm, and the antibiotics Cefoxitin and Co-Trimoxazol, killing bacteria, with Inhibition zone diameter of 30 mm.

Author's Contribution:

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Drafting or Revising Critically:	Salih Saood Yagoub, Ali Shakir Al-Ezee
Final Approval of version:	All the above authors
Agreement to accountable for all aspects of work:	All the above authors

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