TMP UNIVERSAL JOURNAL OF RESEARCH AND REVIEW ARCHIVES

VOLUME 4 | ISSUE 1 | YEAR 2025 | JAN – MAR 2025

RECEIVED DATE	ACCEPTED DATE	PUBLISHED DATE
28/01/2025	19/02/2025	03/03/2025

Article Type: Research Article

Available online: www.tmp.twistingmemoirs.com

ISSN 2583-7214

INVESTIGATING THE ANTIBIOTIC RESISTANCE PATTERN OF MICROORGANISMS ISOLATED FROM DIFFERENT CLINICAL SAMPLES IN THE CHILDREN'S DEPARTMENT ZAHEDAN

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ABSTRACT

Introduction and Objective: The overuse and unnecessary consumption of antibiotics have led to resistance in many bacteria, creating a global challenge. This study aims to investigate the antibiotic resistance patterns of microorganisms isolated from various clinical samples in the pediatric ward of Ali Ibn Abi Talib Hospital in Zahedan.

Materials and Methods: In this descriptive study, after obtaining approval from the ethics committee, we reviewed 531 pediatric hospitalization records at Ali Ibn Abi Talib Hospital. Only complete files meeting the study's inclusion criteria were analyzed.

Results: Among 283 bacteria isolated from urinary samples, the most common were Escherichia coli (64.3%), Klebsiella (14.5%), Staphylococcus (6.4%), Enterobacter (5.7%), and Proteus (5.7%). Of 180 bacterial isolates from blood cultures, the most prevalent were Staphylococcus epidermidis (51.11%), Staphylococcus aureus (10%), Acinetobacter (10%), and Escherichia coli (9.44%). Among wound infections, Pseudomonas aeruginosa accounted for 31.7%, followed by Staphylococcus aureus (16.8%), Acinetobacter (10.17%), and Klebsiella (9.59%).

Discussion and Conclusion: Overall, the study revealed the highest sensitivity to imipenem and ciprofloxacin, whereas ampicillin exhibited the highest bacterial resistance.

Keywords: Antibiotic resistance pattern, pediatric ward, Ali Ibn Abi Talib Hospital

INTRODUCTION

Antimicrobial resistance, often referred to as drug resistance, occurs when microorganisms

such as bacteria, viruses, fungi, and parasites undergo changes that render previously effective medications ineffective. Prior to the advent of antibiotics, pediatric mortality from infections reached as high as 90%. (1) However, with the introduction of antibiotics, these rates decreased to 24%-58%. (2)

Unfortunately, improper and excessive use of antibiotics has led to the emergence of multidrug-resistant bacteria, especially gram-negative bacteria. (3)

In many countries, antibiotics account for 30%-50% of all prescribed medications. Incorrect or excessive use of antibiotics has increasingly contributed to drug resistance, making some bacterial diseases as untreatable as they were before the discovery of penicillin.

This irrational use of antibiotics is a significant factor behind increased morbidity, mortality, and healthcare costs. Antibiotic resistance of bacterial agents in pediatric septicemia (4)

The term septicemia was first introduced into medical culture by Purdue in 1884, which refers to clinical conditions in which microorganisms enter the bloodstream and cause severe systemic symptoms such as fever and shock, and differs from bacteremia (temporary and transient passage of microorganisms in the blood) in the clinical manifestations of the disease.(5) Septicemia is the most common cause of death in underdeveloped and developing countries in infants, especially in the first week of life and young children, and despite important advances in childbirth and the emergence of broad-spectrum antibiotics that are effective against infections, it still threatens the lives of infants and children even in developed countries, and their survival depends to some extent on the capacity of the immune system to respond to pathogens .(6)

At birth, a group of immune factors in the infant's body is fully prepared for defense, while parts of the immune system are not ready for defense, and for this reason, factors that do not cause significant complications at an older age cause severe and fatal infections in the infant's body. Gram-negative bacteria, herpes virus, cytomegalovirus, and Candida albicans are among the above. The infant's immune system is fully prepared to defend against pathogens such as chickenpox, measles, rubella, and Haemophilus influenzae that cause disease in older children (7). On the other hand, between the ages of 3 and 5, the chance of contracting infections such as Neisseria meningitidis and Haemophilus influenzae is higher. Also, the presence of some other underlying diseases increases the chance of contracting bacterial infections in children . Infections that are considered hospital infections can ultimately cause bacteremia and septicemia (8,9).

According to the results of the aforementioned studies, antibiotic resistance resulting from inappropriate use of antibiotics is increasing in developing countries, including Iran. Due to the lack of capabilities to diagnose antibiotic-resistant strains and the lack of access to new antibiotics to treat them, resistant bacterial strains are becoming more prevalent, leading to an overall increase in healthcare costs. The lack of coordination in prescribing drugs by physicians in our country, and the resulting development of drug resistance, is a serious issue, and a precise policy on prescribing antibiotics seems necessary. However, before that, it is important to have a complete understanding of the details of the resistance-susceptibility pattern and antibiotic prescribing in hospitals, so that it can be used as a basis for planning future interventions. Also, given the increasing incidence of resistance in hospital and healthcare center infections, determining the pattern of antibiotic resistance in common pathogenic bacteria can be important in experimental and specific treatments against a specific pathogen.

MATERIALS AND METHODS

In this descriptive study, after obtaining a letter from the ethics committee, we reviewed 531 files of children hospitalized in Ali Ibn Abi Taleb Hospital. After confirming the inclusion criteria, the patients' information was entered into an information form, including demographic characteristics such as age, gender, and essential information consistent with the objectives of the study, including time of hospitalization, main complaint, duration of hospitalization, history of antibiotic intake and its type, history of specific underlying disease, type of birth, and type

(to evaluate the outcome criteria of our study) of bacteria found. Then, for examination, the samples prepared under sterile conditions were inoculated on blood agar and MacConkey agar culture media and kept in an incubator at 37 degrees Celsius for 24 hours (since our study was a descriptive study, these methods had been performed previously). In all cultures obtained after heating, first, Gram staining was performed to determine whether the bacteria were Gram-negative or Gram-positive. Then, by determining the Gram type, special differential and diagnostic tests were performed to determine and identify the bacteria. The Gram-positive bacteria studied were Enterococcus, Streptococcus, and Staphylococcus aureus and coagulase-negative, and the Gram-negative bacteria included E. coli, Enterobacter, Klebsiella, Pseudomonas, and other Gram-negatives, which were included in the results. To determine antibiotic susceptibility, the disk diffusion method or Kirby-Bauer test and Mueller-Hinton broth medium were used to establish the 0.5 standard, McFarland and Mueller-Hinton agar medium were used for the antibiogram, and finally, the CLSI standard table was used to read the results (given the descriptive nature of the study, this type of evaluation has been used as a routine method in the hospital laboratory). The antibiotic discs used included: ceftriaxone (CF), ceftazidime (CZ), vancomycin (V), amikacin (AN), colistin (CHL), and imipenem (IPM). Finally, the data was entered into SPSS22 software for analysis.

Study Population:

The study included 531 pediatric hospitalization records from Ali Ibn Abi Talib Hospital. Records were reviewed for completeness and assessed against inclusion criteria. Only clinical samples that met the study's inclusion criteria (urine, blood, and wound cultures) were analyzed. Incomplete records were excluded.
Data were gathered using a checklist designed to record information about patient demographics, type of clinical sample, and the microorganisms isolated. The checklist also included data on antibiotic susceptibility and resistance patterns.

Ethical Considerations:

Ethics approval for the study was obtained from the Zahedan medical university's ethics committee with code IR.ZAUMS.REC.1397.087. Patient confidentiality was strictly maintained throughout the study. Data were analyzed using SPSS software version 22.

FINDINGS

The total number of children studied in this study was 531.
The mean age of the study group was (7.88 ± 3.96). The maximum age was 15 years and the minimum age was 1 year. 304 were girls (57.3%) and 227 were boys (42.7%).
A total of 170 microorganisms were gram-positive bacteria and 361 Gram-negative bacteria were isolated from the studied samples.
The most common bacteria isolated from urine samples were: Escherichia coli (64.3%)

Table 1: Determination of the frequency of antibiotic resistance of microorganisms isolated from urine

Staphylococcus (A(18)	Proteus (16)	Enterobacter (16)	Klebsiella (41)	E coli (182)	Antibiotic
100	50	8/30	40	2/57	Cefixime
40	0	1/7	3/7	2/17	ciprofloxacin
5/54	50	25	9/35	5/43	Ceftriaxone
40	9/90	3/56	8/13	5/21	Nitrofurantoin
0	20	3/33	6/30	4/31	gentamycin
75	5/38	7/41	6/29	4/52	Nalidixic acid
9/42	60	7/66	1/47	5/66	Cotrimoxazole

Of the 180 bacterial isolates isolated from blood cultures, 92 were Staphylococcus epidermidis (51.11%), The highest antibiotic resistance based on bacterial isolation from blood culture among Staphylococcus epidermidis isolates was related to vancomycin (66.30%).

Table 2: Determining the frequency of antibiotic resistance of microorganisms isolated from blood cultures

Surachai (2)	Shigella (3)	Streptococcus (8)	Enterobacter (10)	Staphylococcus saprophyticus (12)	E coli(17)	Acetobacter (18)	Staphylococcus aureus (18)	Staphylococcus epidermis (92)	Antibiotic
50	33/33	25	50	33/33	64/17	44/94	11/11	52/31	Cefotaxime
50	-	-	20	33/33	82/58	22/22	66/16	52/31	Ciprofloxacin
50	-	25	-	66/41	29/35	33/33	55/5	34/29	Gentamycin
-	66/66	-	-	-	88/5	77/27	-	-	Nalidixic acid
100	33/33	50/62	20	-	94/52	33/83	-	-	Tetracycline
50	100	50/12	30	33/33	76/11	22/72	22/22	39/42	Ceftriaxone
100	-	50/12	50	-	82/58	100	66/16	95/11	Amikacin
-	-	50/62	40	-	52/23	11/61	66/16	82/47	Ceftazidime
-	33/33	-	-	33/83	-	-	22/22	17/52	Erythromycin
-	-	50/12	-	-	-	55/5	-	17/2	Nitrofurantoin
50	-	-	20	66/16	76/11	22/22	66/16	08/26	imipenem
-	66/66	-	-	66/91	-	-	33/33	30/66	Vancomycin
100	50	66/66	50	-	82/58	100	66/16	95/11	Ampicillin

In the patients' wounds, Pseudomonas aeruginosa was the highest percentage of isolated pathogenic bacteria, 31.7%. In examining the sensitivity of the isolated bacteria to antibiotics, it was found that a very high percentage of the isolated Pseudomonas aeruginosa were resistant to common antibiotics such as ampicillin, cephalosporins, and gentamicin.

Table 3: Determining the frequency of antibiotic resistance of microorganisms isolated from wound cultures

Coagulase-negative staphylococcus (6)	Enterobacter (6)	Klebsiella pneumoniae (9)	Acetobacter (10)	Staphylococcus aureus (16)	Pseudomonas aeruginosa (31)	Antibiotics

100	100	100	100	93/87	-	Ampicillin
5/4	-	-	-	0	-	Vancomycin
18/68	26/78	75/75	14/57	24/67	3/63	Ceftazidime
27/77	91/73	6/60	14/57	06/62	05/66	Cefotaxime
72/72	100	63/63	60	82/94	90/89	Gentamycin
27/77	17/52	21/21	14/77	48/84	21/53	Amikacin
18/68	82/47	65/69	28/72	68/70	05/66	Ciprofloxacin
-	-	0	-	0	0	Imipenem

DISCUSSION

Urinary Tract Infections:

The most prevalent microorganism isolated from urinary samples was *Escherichia coli* (64.3%), followed by *Klebsiella* (14.5%).
This finding aligns with global patterns, where *E. coli* is the leading cause of pediatric urinary tract infections. The high sensitivity of *E. coli* to imipenem and ciprofloxacin suggests these antibiotics as effective options for treating such infections
However, the resistance to ampicillin highlights the need for caution in its use as a first-line treatment.
In a similar study conducted in Babol on hospitalized children, resistance to cotrimoxazole, nalidixic acid, and ceftriaxone was close to the results of the present study, but resistance to ciprofloxacin was lower in this study than in the Babol study (11). In another similar study conducted in Birjand, resistance to antibiotics cefixime, ceftriaxone, gentamicin, and nalidixic acid was lower than in our study, but sensitivity to nitrofurantoin was significantly higher in the present study (12). In the present study and the study by Fesharkinia etal.(12), the study by Alaei et al. (13), Kalantar et al(14). , and in Greece (15) and Tunisia (16)was found that Escherichia coli was the most common cause of urinary tract infection in all ages, which was consistent with the reference book .

Bloodstream Infections:

In blood cultures, the most frequently isolated microorganism was *Staphylococcus epidermidis* (51.11%), commonly associated with contaminants or hospital-acquired infections, followed by *Staphylococcus aureus* (10%). Numerous bacterial agents are involved in the development of blood infections, and early treatment of this type of infection is of great importance. On the other hand, resistant strains of bacteria have emerged due to the incorrect, excessive, and arbitrary use of various antibiotics in medicine, veterinary medicine, and even in plant pest control, and the treatment of various bacterial infections has faced serious problems due to the presence of these resistant strains. (17)
The bacterial isolates in our study were almost identical to those isolated in the Zaragoza and Maleki study. Hospital wards are considered a reservoir for pathogenic bacteria, which are often highly resistant to antibiotics. Bacterial species are easily spread between patients by the hands of staff or by equipment, resulting in the colonization of patients with different microorganisms (18).
The presence of multidrug-resistant organisms such as *Acinetobacter* and *Klebsiella* indicates a significant challenge in managing sepsis, necessitating antibiotic stewardship and targeted therapy based on susceptibility patterns (19).

Wound Infections:

In wound infections, *Pseudomonas aeruginosa* (31.7%) was the most common pathogen, demonstrating a high level of resistance to ampicillin. The observed sensitivity to ciprofloxacin and imipenem provides therapeutic insights, though emerging resistance calls for the

development of alternative treatment strategies.

Overall Findings:

The study underscores the critical need for implementing stringent antibiotic stewardship programs in pediatric wards to address rising resistance trends. Regular surveillance of resistance patterns, adherence to empirical treatment guidelines, and minimizing unnecessary antibiotic prescriptions are crucial measures to combat antibiotic resistance in clinical settings (20).

CONCLUSION

Due to the high prevalence of antibiotic resistance, it is recommended to avoid the excessive use of antibiotics and not to sell them as over-the-counter drugs, and all professors and students should wash and disinfect their hands when entering treatment wards.

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