Original Article

ANTIBIOTICS RESISTANCE PATTERNS IN GRAM POSITIVE UROPATHOGENS IN CHILDREN

Madiha Tahir[1], Huma Anwar[2], Hareem Khalid[3], Afsheen Batool Raza[4], Saadia Choudhary[5]

Abstract:

Background: Children and infants are commonly infected with UTIs due to several anatomical reasons and hygiene measures. The most common organisms causing UTI in children are gram-negative pathogens but some gram-positive pathogens. The objective of study was to see antibiotic-resistant patterns in Gram Positive Uropathogens in children in Children's Hospital, Lahore.

Materials & Methods: Urine samples obtained from 200 children taken with non-probability, convenient method presenting with UTI were cultured on CLED agar and then drug sensitivity testing of isolated gram positive bacteria (n=25) was performed using Disk diffusion (Kirby Bauer) method on Muller Hinton agar plates as per standard laboratory guidelines. A descriptive study (cross-sectional) was conducted to assess sensitivity against Ampicillin, Cotrimoxazole, amoxicillin, cefotaxime, Ceftriaxone, tobramycin, amikacin, Sulbactam, Nitrofurantoin, and Polymixin B.

Results: The mean age of children in this study was 2.4 years from 0 to 5 years. Among Gram positive uropathogens Staphylococcus aureus (65%) was the commonest organism isolated. Enterococci were isolated in 25% of cases. Coagulase-negative staphylococci were 10%. Gram positive cocci included Methicillin Sensitive Staphylococcus Aureus (MSSA) (50%) and Methicillin Resistant Staphylococci (MRSA) (50%). The highest resistance was noted against Ampicillin (68%). The lowest resistance was noted against tobramycin (24%).

Conclusion: Emerging antibiotic resistance has rendered many first-line drugs ineffective against UTI-causing organisms and treatment regimens need to be revised.

Keywords: Urinary Tract Infection, Urinalysis, Gram Positive Uropathogens, Antibiotic sensitivity, Resistance

doi: https://doi.org/10.51127/JAMDCV06I03OA01

How to site this:
Tahir M., Anwar H., Khalid H., Raza A. B., Choudhary S., Antibiotics Resistance Patterns in Gram Positive Uropathogens in Children. JAMDC, 2024: 6(3): 87-90
doi: https://doi.org/10.51127/JAMDCV06I03OA01

INTRODUCTION

Urinary tract infections (UTIs) in children are an extremely common clinical condition, with millions of young sufferers globally every year.[1] UTIs have, therefore, been an important health concern not only in developing countries but also in developed countries where they impose a heavy burden on the healthcare system.[2] UTIs in children are resource-intensive, all the way from the clinical diagnosis by a very experienced physician to the exact identification of the causative microorganism in the laboratory through culture and sensitivity testing.[3] Beginning from the collection of the specimen to the isolation and identification of the microorganism, it

[1]PGR, Peads., Children Hospital, Lahore
[2]Demo., Pathology Department, LMDC.
[3]4th Year Student, LMDC, Lahore
[4]Asst. Prof., Peads., Children Hospital, Lahore
[5]Prof., Microbiology, LMDC
Date of Submission: 28-06-2024
Date of 1st Review: 22-07-2024
Date of 2nd Review: 29-07-2024
Date of Acceptance: 20-08-2024

includes thorough steps. This calls for proper observation of guidelines and fair utilization of resources at its disposal in the course of the same process.[4]

A timely diagnosis and proper therapy of UTI are crucial in children, as untreated infection may lead to complications like acute and chronic pyelonephritis, renal scarring, and hypertension later in life.[5] Historically, Gram-negative bacteria comprised the preponderance of UTIs in children, with Escherichia coli accounting for the vast majority.[6] However, UTIs caused by Gram-positive pathogens, although relatively rare, do occur and pose a different challenge because of increased resistance to normally used antibiotics.

Several studies document the growing trend in antibiotic resistance of Gram-positive bacteria, including Enterococcus spp. and Staphylococcus saprophyticus.[5] Continued surveillance and development of further antimicrobial strategies are therefore needed. Taking into account that a host of host-related or other factors influence the epidemiology of UTIs in children, which may range from age, sex, genetic predisposition, and underlying health conditions, this could misleadingly complicate the diagnosis and treatment protocols of UTI infection.[6]

Recent advances in the development of diagnostic technologies, such as rapid molecular assay and enhanced culture methods, enabled the identification of causative agents of UTI with much accuracy and speed, thus providing an avenue for early effective treatment.[7,8] However, the rising prevalence of antibiotic-resistant strains in circulating pathogens mandates continued research efforts and even more robust implementation of antimicrobial stewardship programs if UTIs are going to be managed effectively in children.[9]

MATERIAL AND METHODS

Research was conducted after approval from IRB Children's Hospital & ICH , Lahore IRB no: 2021-259-CHICH dated 26-03-2021.

In this study, focus was on the isolation of gram positive bacteria in urine samples of children suffering from UTI. In a time, duration of six months, a total of 200 urine samples were received in the laboratory of Children's Hospital, Lahore. Out of these 200 urine samples from children, 25 samples yielded the growth of gram-positive bacteria which were gram-positive cocci, coagulase-negative staph, and enterococci. The disc diffusion (Kirby Bauer) method was used for the drug sensitivity testing using Muller Hinton agar. Data was analyzed using SPSS 23.

RESULTS

The age range in this study was from 0 to 5 years with a mean age of 2.424±1.14 years. Female patients were 70.7% and males were 29.3%. Percentage of sensitivity / Resistance of Gram Positive bacteria Against following Anti-microbials. (n=25) (Table 1)

Table 1:

Ampicillin		
	Frequency	**%age**
Yes	8	32%
No	17	68%
Cotrimoxazole		
	Frequency	**%age**
Yes	7	28%
No	18	72%
Cefotaxime		
	Frequency	**%age**
Yes	12	48%
No	13	52%
Ciprofloxacin		
	Frequency	**%age**
Yes	11	44%
No	14	56%
Amikacin		
	Frequency	**%age**
Yes	8	32%
No	17	68%
Sulbactam/Cefoprazone		
	Frequency	**%age**
Yes	10	40%
No	15	60%
	Frequency	**%age**
Yes	15	60%
No	10	40%
Polymixin B		
	Frequency	**%age**
Yes	16	64%
No	9	36%
Tobramycin		
	Frequency	**%age**
Yes	19	76%
No	6	24%

DISCUSSION

In this current research, there has been an increased resistance of Gram-positive bacteria isolated from UTIs in children to antimicrobial agents. This presents a serious challenge to the treatment strategies. The finding presented agrees with studies performed on the emerging trend of antibiotic resistance.[1,2] Despite developments in antibiotic therapy, limited therapeutic options are available in events of UTIs as a result of limited effective options available. Empirical therapy with broad-spectrum agents is often practiced, but resistance rates of over 20% undermine their effectiveness.[2,4] In our study, we found quite alarmingly that the resistance was very high, specifically against Cotrimoxazole of 72%, while with tobramycin it was the lowest, that is, 24%. These figures are much higher in comparison with rates of resistance reported previously.[13] Broad-spectrum coverage and the frequent indication of Cotrimoxazole in pediatric UTIs make it challengeable as a result of rising levels of resistance and underscore the importance of prudent antibiotic selection given local resistance patterns.

Comparative studies showed variable sensitivity and resistance patterns across different regions and also proved regional disparities in antibiotic resistance. For example, in our study, it had higher resistance to amikacin 68%, ciprofloxacin 56%, and cefoperazone 60% compared with European and African data.[14] Such variations bring out the salient need for tailored antibiotic stewardship programs and continuous surveillance to take up the challenge posed by resistance effectively.

Among children, the emergence of obesity as a risk factor for UTIs portrays a different pattern of epidemiology and management of the infection.[3] In this case, individualization of therapy should be involved in the management of the complex relationship between obesity and susceptibility to UTI.

CONCLUSION

The growing antibiogram of resistance to gram-positive bacteria causing UTIs in children is a major therapeutic concern. Highest resistance is noted with Tobramycin, Polymixin B and Nitrofurantoin. Effective management requires a tailored selection of antibiotics based on local resistance profiles, coupled with stringent antibiotic stewardship practices.

CONFLICT OF INTEREST

None

SOURCE OF FUNDING

None

ACKNOWLEDGEMENTS

1. Asadullah Yousaf, Postgraduate Resident General Surgery, KEMU, Lahore, who has done SPSS Analysis & Data Entry.

AUTHOR'S CONTRIBUTION

MT: Manuscript writing, Data collection
HA: Critical Review, Data Collection
HK: Manuscript writing
ABR: Manuscript writing
SC: Manuscript writing, Critical Review

REFERENCES

1. Tullus K, Shaikh N. Urinary tract infections in children. Lancet. 2020 May 23; 395(10237):1659-68. doi:10.1016/S0140-6736(20)30676-0.
2. Ondari DM. Urinary tract infections caused by enteric bacteria and antibiotic sensitivity among symptomatic males visiting special treatment center. Nairobi City County, Kenya. Kenyatta University. Oct 2020. Available from: http://ir-library.ku.ac.ke/handle/123456789/21254.
3. Grier WR, Kratimenos P, Singh S, Guaghan JP, Koutroulis I. Obesity as a risk factor for urinary tract infection in children. Clin Pediatr (Phila). Sept 2016; 55(10):952-6. doi:10.1177/0009922815617974.
4. Stephens GM, Akers S, Nguyen H, Woxland H. Evaluation and management of urinary tract infections in the school-aged child. Prim Care. Mar 2015; 42(1):33-41. doi:10.1016/j.pop.2014.09.007.
5. Sharef SW, El-Naggari M, Al-Nabhani D, Al Sawai A, Al Muharrmi Z, Elnour I. Incidence of antibiotics resistance among uropathogens in Omani children presenting with a single episode of urinary tract infection. J Infect Public Health. Sept-Oct

2015;8(5):458-65. doi:10.1016/j.jiph.2015.01.005.

6. Mishra MP, Sarangi R, Padhy RN. Prevalence of multidrug resistant uropathogenic bacteria in pediatric patients of a tertiary care hospital in eastern India. J Infect Public Health. May-Jun 2016; 9(3):308-14. doi:10.1016/j.jiph.2015.10.002.
7. Delbet JD, Lorrot M, Ulinski T. An update on new antibiotic prophylaxis and treatment for urinary tract infections in children. Expert Opin Pharmacother. Oct 2017;18(15):1619-25. doi:10.1080/14656566.2017.1383383.
8. Stein R, Dogan HS, Hoebeke P, Kocvara R, Nijman RJ, Radmayr C, et al. European Association of Urology; European Society for Pediatric Urology. Urinary tract infections in children: EAU/ESPU guidelines. Eur Urol. Mar 2015; 67(3):546-58. doi:10.1016/j.eururo.2014.11.007.
9. Burckhardt I, Panitz J, van der Linden M, Zimmermann S. Streptococcus pneumoniae as an agent of urinary tract infections - a laboratory experience from 2010 to 2014 and further characterization of strains. Diagn Microbiol Infect Dis. Sept 2016;86(1):97-101. doi:10.1016/j.diagmicrobio.2016.06.009.
10. Schlager TA. Urinary Tract Infections in Infants and Children. Microbiol Spectr. Oct 2016;4(5):1659-68. doi:10.1128/microbiolspec.UTI-0022-2016.
11. Tullus K, Shaikh N. Urinary tract infections in children. The Lancet. 2020 May 23;395(10237):1659-68. doi:10.1016/S0140-6736(20)30676-0.
12. Giri A, Kafle R, Singh GK, Niraula N. Prevalence of E. coli in urinary tract infection of children aged 1-15 years in a medical college of Eastern Nepal. J Nepal Med Assoc. Jan 2020; 58(221):11-14. doi:10.31729/jnma.4796.
13. Kline KA, Lewis AL. Gram-positive uropathogens, polymicrobial urinary tract infection, and the emerging microbiota of the urinary tract. In: Mulvey MA, Klumpp DJ, Stapleton AE, editors. Urinary tract infections. 2nd edition. 2017 Feb 15:459-502. doi:10.1128/9781555817404.ch19.
14. Mir N, Khurshid R, Zafar A, Saleem S, Ch S, Ali U. Frequency and susceptibility profile of pathogens causing urinary tract infections in pediatric population. Pakistan Journal of Medical & Health Sciences. 2022 Mar 24;16(02):142-. doi:10.53350/pjmhs22162142.
15. Gajdacs M, Abrok M, Lazar A, Burian K. Increasing relevance of Gram-positive cocci in urinary tract infections: a 10-year analysis of their prevalence and resistance trends. Sci Rep. 2020 Oct 19; 10(1):17658. doi:10.1038/s41598-020-74834-y.
16. Salman HA, Alhameedawi AK, Alsallameh SM, Muhamad G, Taha Z. Prevalence of multi-antibiotic resistant bacteria isolated from children with urinary tract infection from Baghdad, Iraq. Microbiol Biotechnol Lett. 2022; 50(1):147-56. doi:10.48022/mbl.2110.10011.
17. Thaddanee R, Khilnani G, Shah N, Khilnani AK. Antibiotic sensitivity pattern of pathogens in children with urinary tract infection in a tertiary care hospital in Kachchh, Gujarat, India. Int J Contemp Pediatr. Nov 2017; 4(6):2103-8. doi:10.18203/2349-3291.ijcp20174740.