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Microorganisms Implicated in Urinary Tract Infection in Children and Their Antimicrobial Susceptibility in a Part of North East India

(UTI in Children: Microorganisms & Antimicrobial Sensitivity)

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Abstract:- Background Urinary tract infection is an important cause of mortality and morbidity in children. The etiological agents of UTI in children and their antimicrobial sensitivity should be studied thoroughly in different regions of the world so that antibiotic stewardship can be practised and also effective antibiotics can be used to decrease the mortality and morbidity of UTI in children.

Objectives: to look for common bacterial microorganisms causing urinary tract infection in the patients attending the hospital and to know their antimicrobial sensitivity.

Methods: It is a hospital based observational study conducted in one of the busiest hospitals of Jorhat over a period of 12 months. Urine culture reports of all patients were traced from the hospital laboratory data. Positive culture reports for bacterial sepsis were studied and analysed statistically.

Results: Total 206 urine samples were tested from suspected cases out of which 43(21%) were culture positive urinary tract infection. The most common micro-organisms causing urinary tract infection was E Coli (58% of cases), followed by Klebsiella pneumonia(12%), Staphylococcus aureus(9%), Pseudomonas(7%), Proteus(5%), Enterococcus(5%), group B Streptococcus(2.5%) and Candida albicans(2.5%). E coli sensitivity was highest for nitrofurantoin(96%). Other antimicrobials to which it was highly sensitive were norfloxacin(88%), ciprofloxacin(84%), gentamicin(80%), while it was highly resistant to erythromycin(92%), tetracycline(76%), amoxicillin(76%).

Conclusion: Our study shows that the choice of antibiotic greatly depends on the microorganism causing UTI. However, as the most common bacteria causing UTI is E coli, one can use the antibiotic to which E coli showed maximum sensitivity while waiting for the culture reports if required.

Keywords:- *E Coli, Klebsiella Pneumonia, Nitrofurantoin, UTI.*

I. INTRODUCTION

Urinary tract infection is an important cause of mortality and morbidity in children[1]. The incidence of UTI among girls is 7% and 2% in boys[2]. Early diagnosis and treatment of Urinary tract infection with correct and judicious use of antibiotics is very essential to prevent complications like renal abscess, urosepsis, renal parenchymal damage[3]. To decrease the mortality and morbidity of UTI in children empirical use of antibiotics is advised even before the culture report is available [4]. But the injudicious use of antibiotic has increased the threat of antimicrobial resistance globally[5]. The micro organisms causing UTI show some variations in different regions of the world and their antimicrobial sensitivity pattern also varies in different geographical areas. So the etiological agents of UTI in children and their antimicrobial sensitivity should be studied thoroughly in different regions of the world so that antibiotic stewardship can be practised and also effective antibiotics could be used to decrease the mortality and morbidity of UTI in children. Very few studies have been done previously in our geographical area to see the microorganisms and their antimicrobial sensitivity.

II. AIMS AND OBJECTIVES

1/ to look for common bacterial microorganisms causing urinary tract infection in the patients attending the hospital
2/ to look for the antimicrobial sensitivity of the microorganisms causing Urinary tract infection in the children

III. METHODS AND MATERIALS

Place of Study: the study was conducted at Sanjivani Hospital, Jorhat, which is one of the busiest hospitals of Jorhat, Assam

Study Design: Hospital based observational study

Duration of Study: 12 months (November 2019 – October 2020)

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***Method of study*:** It is a cross-sectional study conducted among the patients less than 14 years attending the hospital with symptoms and signs of urinary tract infection. Among the children who were toilet trained, mid-stream clean catch urine was collected maintaining strict aseptic and antiseptic precautions, from the younger children urine was collected after catheterisation maintaining aseptic and antiseptic procedure. Urine was analysed in the laboratory as per standard hospital protocol. Quality assurance was strictly adhered to. Management of the patients was done according to standard hospital protocol. Culture reports of all patients were traced from the hospital laboratory data. Urine with bacterial colony count more than 10^5 CFU/ml among the patients with mid-stream clean catch urine and more than 10^4 CFU/ml among the patients in whom catheter was used to collect urine was considered as culture positive urinary tract infection. Positive culture reports UTI were separated and analysed. Consent was taken from the parents and patients. Institutional ethics committee clearance was obtained.

Exclusion criteria:
1/ Patients with pre-existing urinary tract disease
2/ Patients on antimicrobials for some other disease
3/ Children with pre-existing renal disease

Variables studied included
1/Age and sex distribution of Culture positive urinary tract infection patients
2/ Microorganisms causing neonatal sepsis and their distribution
3/ Antimicrobial susceptibility of the microorganisms causing neonatal sepsis.

Statistical Methods *:* The data obtained was tabulated and analysed statistically using social science system version SPSS.16

IV. RESULTS AND OBSERVATION

Total 206 urine samples were tested from suspected cases out of which 43 were culture positive urinary tract infection. The incidence of Urinary tract infection was 21% of which 27(63%) were females and 16(37%) were males.

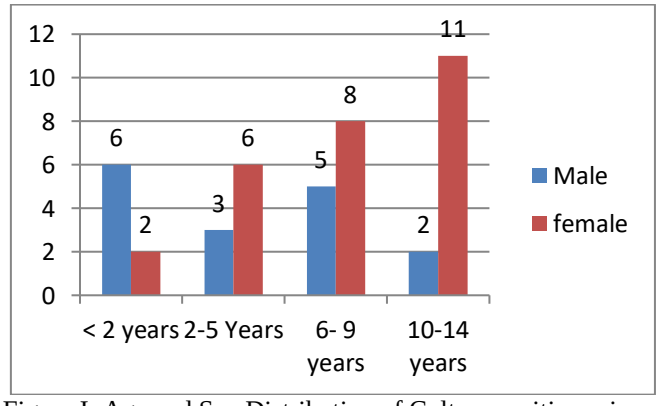

Figure I: Age and Sex Distribution of Culture positive urinary tract Infection

Analysis of the data shows that among the patients having culture positive urinary tract infection 8(19%) were children less than 2 years out of which 6 were males and 2 were females(male:female ratio is 3:1), 9(21%) were children between 2 to 5 years out of which 3 were males and 6 were females(male:female ratio was 1:2), 13(30%) were children between 6 to 9 years out of which 5 were males and 8 were females(male:female ratio 2:3) and 13(30%) were between the age group of 10-14 years out of which 2 were males and 11 were females (male:female ratio is 1:6).

Table 1: Age wise distribution of micro-organisms in urinary tract infection

	< 2 years	2-5 years	6-9 years	10-14 years	Total
E coli	4	5	9	7	25
Klebsiella pneumoniae	1	1	1	2	5
Proteus	0	0	1	1	2
Enterococcus	0	1	0	1	2
Staphylococcus aureus	2	1	1	0	4
Pseudomonas	0	1	0	2	3
Group B Streptococcus	0	0	1	0	1
Candida albicans	1	0	0	0	1
	8	9	13	13	

The most common micro-organisms causing urinary tract infection was E Coli 58%(25 out of 43), second was Klebsiella pneumoniae 12%(5 out of 43), third was Staphylococcus aureus 9%(4 out of 43), fourth was Pseudomonas 7%(3 out of 43), this was followed by Proteus and Enterococcus 5% (2 out of 43) each and finally group B Streptococcus and Candida albicans 2.5%(1 out of 43) each

Table 2: Antimicrobial sensitivity of E Coli

	Sensitive	Resistant	Total
Tetracycline	6(24%)	19(76%)	25
Cotrimoxazole	10(40%)	15(60%)	25
Chloramphenicol	16(64%)	9(36%)	25
Erythromycin	2(8%)	23(92%)	25
Amoxicillin	6(24%)	19(76%)	25
Cephalothin	9(36%)	16(64%)	25
Ceftriaxone	16(64%)	9(36%)	25
Gentamicin	20(80%)	5(20%)	25
Ciprofloxacin	21(84%)	4(16%)	25
Norfloxacin	22(88%)	3(12%)	25
Nitrofurantoin	24(96%)	1(4%)	25

E coli was the most common organism causing urinary tract infection in our study and its sensitivity was highest for nitrofurantoin(96%). Other antimicrobials to which it was highly sensitive were norfloxacin(88%), ciprofloxacin(84%),

gentamicin(80%); while it was highly resistant to erythromycin(92%), tetracycline(76%), amoxicillin(76%).

All Klebsiella pneumoniae causing UTI were sensitive to imipenem, meropenem and colistin. All Proteus in our study were susceptible to cefotaxime, ceftazidime, cefipime, meropenem and amikacin. All Enterococci were sensitive to ciprofloxacin, amoxicillin plus clavulanate and vancomycin. Staphylococcus was sensitive to chloramphenicol, levofloxacin and imepenem. All Pseudomonas in our study were susceptible to imipenem, meropenem, piperacillin-tazobactum, ceftriaxone-sulbactum

V. DISCUSSION

In our study we tried to find out the common causes of urinary tract infection in children in our region and their antimicrobial sensitivity. We found that the incidence of urinary tract infections was more in girls as compared to boys. Girls have a shorter urethra close to the anus, this makes them more susceptible to urinary tract infection[6]

Maximum number(60%) of children having culture positive sepsis were in the age group between 6 to 14 years in our study. In children less than 2 years of age, the incidence of UTI was found to be 19%. The incidence of culture positive UTI among the suspected cases in our study was found to be 21%. Nader Shaikh et al in their study found that he incidence of UTI among infants was 7% and that of older children was 7.8% [7]

The male : female ratio was found to be 3:1 in children less than 2 years in our study. In children between the age group of 2 to 5 years the male : female ratio was 1:2, while the ratio was 2:3 and 1:6 in children between the age group of 6-9years and 10 to 14 years respectively. MS Vinodkumar et al in their study found that the incidence of UTI among males was 63.4% and that among females was 36.6%. Males outnumbered females in children less than 5 years(71.4%) and females outnumbered the males (62.5%) in children more than 5 years in their study[8]

The most common micro-organisms causing urinary tract infection was E Coli comprising 58%, followed by Klebsiella pneumoniae, third was Staphylococcus aureus, fourth was Pseudomonas, this was followed by Proteus, Enterococcus, group B Streptococcus and Candida albicans. G.K Rai et al from Nepal in their study also found Escherichia coli to be the most common organism causing UTI in children comprising of 93.3% of total cases, followed by Proteus sp, Klebsiella sp, Citrobacter sp, Staphylococcus aureus and others [9]

E coli was the most common organism causing urinary tract infection in our study and its sensitivity was highest for nitrofurantoin(96%). Other antimicrobials to which it was highly sensitive were norfloxacin(88%), ciprofloxacin(84%), gentamicin(80%). While it was highly resistant to erythromycin(92%), tetracycline(76%), amoxicillin(76%). M Kirbet et al in their study have also found E coli to be resistant to erythromycin, amoxicillin and tetracycline while the isolates in their study were sensitive to gentamicin, nitrofurantoin, ciprofloxacin and chloramphenicol[10]. The result of the study is also consistent with some other studies conducted in different parts of the world[11,12]

The second most commom organism causing UTI was Klebsiella pneumoniae. Klebsiella pneumoniae belongs to the family of Enterobacteriaceae. It is a gram negative bacteria. All Klebsiella pneumoniae causing UTI were sensitive to imipenem, meropenem and colistin. Lin et al in their study have found that Klebsiella pneumoniae was sensitive to cefotaxime, cefepime, piperacillin, tazobactum and ciprofloxacin[13]

All Proteus in our study were susceptible to cefotaxime, ceftazidime, cefipime, meropenem and amikacin.I Stock et al in their study found that Proteus was susceptible to all β-lactams except penicillin G and oxacillin[14]

All Enterococci were sensitive to ciprofloxacin, amoxicillin plus clavulanate and vancomycin. Maria Rudy et al in their study have found all strains of Enterocooci to be susceptible to vancomycin and teicoplanin[15].

All Staphylococci strains were sensitive to chloramphenicol, levofloxacin and imepenem. Nwankwo et al in their study have found that Staphylococcus was highly sensitive to gentamicin, vancomycin, ceftriaxone, levofloxacin and ofloxacin.[16] All Pseudomonas in our study were susceptible to imipenem, meropenem, piperacillin-tazobactum, ceftriaxone-sulbactum. Viren A et al in Gujarat have found that Pseudomonas species shows marked resistance to monotherapy of penicillin, cephalosporin, flurouquinolones, tetracycline and macrolides and only combination drugs like ticarcillin+ clavulinic acid, piperacillin+tazobactum, cefoperazone + sulbactum, ceftriaxone + sulbactum and monotherapy of amikacin showed higher sensitivity to Pseudomonas. Maximum sensitivity was shown by carbapenems[17]

In this study we have tried to find out the common microorganisms causing urinary tract infection in children in our region and their antimicrobial sensitivity. Studies have been done previously to see the spectrum of microorganisms causing urinary tract infection in children and to know their antimicrobial susceptibility. The spectrum of microorganisms shows some variation in different regions of the world and also in different hospitals of the same region. They also keep changing in due course of time because of antibiotic overuse. The result is evident in various previous studies where the microorganisms have shown significant level of resistance to most of the commonly used antibiotics. So, in this study, we have tried to find out the common bacterial organisms causing urinary tract infection in our region and their antibiotic susceptibility. We have found that the most common organism was E coli which is consistent to other studies worldwide. Our study shows that the choice of antibiotic greatly depends on the strain causing urinary tract infection. However, as the most common bacteria causing UTI is E coli, one can use the antibiotic to which E coli

showed maximum sensitivity while waiting for the culture reports.

Our study has one limitation, that is, our sample size was comparatively less than some other studies, but we have tried to gather as much information as possible. So it did not affect the study result as our findings are consistent with most other studies conducted worldwide.

VI. CONCLUSION

In this study we have tried to find out the common micro-organisms causing urinary tract infection in our region and their antibiotic susceptibility at present times. We have found that the incidence of urinary tract was more in girls as compared to boys. Maximum number(60%) of children having culture positive sepsis were in the age group between 6 to 14 years in our study. In children less than 2 years of age, the incidence of UTI was found to be 19%. The male : female ratio was found to be 3:1 in children less than 2 years. In children between the age group of 2 to 5 years the male : female ratio was 1:2, while the ratio was 2:3 and 1:6 in children between the age group of 6-9 years and 10-14 years respectively. The most common micro-organisms causing urinary tract infection was E Coli comprising 58%, second was Klebsiella pneumoniae. E coli was the most common organism causing urinary tract infection in our study and its sensitivity was highest for nitrofurantoin. Other antimicrobials to which it was highly sensitive was norfloxacin(88%), ciprofloxacin, gentamicin, while it was highly resistant to erythromycin, tetracycline and amoxicillin. Our study shows that the choice of antibiotic greatly depends on the strain causing urinary tract infection. However, as the most common bacteria causing UTI is E coli, if required one can use the antibiotic to which E coli showed maximum sensitivity while waiting for the culture reports.

REFERENCES

[1]. S. Habib, “Highlights for management of a child with a urinary tract infection,” *International Journal of Pediatrics*, vol. 2012, Article ID 43653, 6 pages, 2012.View at: Publisher Site | Google Scholar

[2]. R. S. Edlin, D. J. Shapiro, A. L. Hersh, and H. L. Copp, “Antibiotic resistance patterns in outpatient pediatric urinary tract infections,” *The Journal of Urology*, vol. 190, no. 1, pp. 222–227, 2013.View at: Google Scholar

[3]. R. Beetz and M. Westenfelder, “Antimicrobial therapy of urinary tract infections in children,” *International Journal of Antimicrobial Agents*, vol. 38, pp. 42–50, 2011.View at: Publisher Site | Google Scholar

[4]. F. E. Abdullah, A. A. Memon, M. Y. Bandukda, and M. Jamil, “Increasing ciprofloxacin resistance of isolates from infected urines of a cross-section of patients in Karachi,” *BMC Research Notes*, vol. 5, no. 1, pp. 696–701, 2012.View at: Google Scholar

[5]. S. Farajnia, M. Y. Alikhani, R. Ghotaslou, B. Naghili, and A. Nakhlband, “Causative agents and antimicrobial susceptibilities of urinary tract infections in the northwest of Iran,” *International Journal of Infectious Diseases*, vol. 13, no. 2, pp. 140–144, 2009.View at: Publisher Site | Google Scholar

[6]. *Urinary Tract Infection in Children: Causes and Treatment*. Healthline. (2020). Retrieved 21 December 2020, from https://www.healthline.com/health/urinary-tract-infection-children

[7]. Shaikh, N., Morone, N. E., Bost, J. E., & Farrell, M. H. (2008). Prevalence of urinary tract infection in childhood: a meta-analysis. *The Pediatric infectious disease journal*, *27*(4), 302–308. https://doi.org/10.1097/INF.0b013e31815e4122

[8]. Vinodkumar MS, Vishnu Mohan M(2018). International Journal of Scientific Study | April 2018 | Vol 6 | Issue 1, IndiaDOI: 10.17354/ijss/2018/133.

[9]. .Rai, G. K., Upreti, H. C., Rai, S. K., Shah, K. P., & Shrestha, R. M. (2008). Causative agents of urinary tract infections in children and their antibiotic sensitivity pattern: a hospital based study. *Nepal Medical College journal : NMCJ*, *10*(2), 86–90

[10]. Kibret, M., & Abera, B. (2011). Antimicrobial susceptibility patterns of E. coli from clinical sources in northeast Ethiopia. *African health sciences*, *11 Suppl 1*(Suppl 1), S40–S45. https://doi.org/10.4314/ahs.v11i3.70069

[11]. Bharathi MJ, Ramakrishnan R, Maneksha V, Shivakuma C, Mittal S. Comparative bacteriology of acute and chronic dacryocystitis. Eye. 2008;22:953–960. [PubMed] [Google Scholar] [Ref list]

[12]. Tesfaye G, Asrat D, Woldeamanuel Y, Gizaw M. Microbiology of discharging ears in Ethiopia. Asian Pac J Trop Med. 2009;2(91):60–67. [Google Scholar] [Ref list]

[13]. 8Lin, WP., Wang, JT., Chang, SC. *et al.* The Antimicrobial Susceptibility of *Klebsiella pneumoniae* from Community Settings in Taiwan, a Trend Analysis. *Sci Rep* **6,** 36280 (2016). https://doi.org/10.1038/srep36280

[14]. Stock I. (2003). Natural antibiotic susceptibility of Proteus spp., with special reference to P. mirabilis and P. penneri strains. *Journal of chemotherapy (Florence, Italy)*, *15*(1), 12–26. https://doi.org/10.1179/joc.2003.15.1.12

[15]. 10Rudy, M., Nowakowska, M., Wiechuła, B., Zientara, M., & Radosz-Komoniewska, H. (2004). Analiza lekowrazliwości Enterococcus spp. izolowanych z moczu [Antibiotic susceptibility analysis of Enterococcus spp. isolated from urine]. *Przeglad lekarski*, *61*(5), 473–476.

[16]. Nwankwo, E. O., & Nasiru, M. S. (2011). Antibiotic sensitivity pattern of Staphylococcus aureus from clinical isolates in a tertiary health institution in Kano, Northwestern Nigeria. *The Pan African medical journal*, *8*, 4. https://doi.org/10.4314/pamj.v8i1.71050

[17]. Javiya, V. A., Ghatak, S. B., Patel, K. R., & Patel, J. A. (2008). Antibiotic susceptibility patterns of Pseudomonas aeruginosa at a tertiary care hospital in Gujarat, India. *Indian journal of pharmacology*, *40*(5), 230–234. https://doi.org/10.4103/0253-7613.44156