ORIGINAL RESEARCH PAPER
Volume - 12 | Issue - 05 | May - 2023 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

ANEMIA, ALONG WITH OTHER RISK FACTORS AND UROPATHOGENS ISOLATED IN CHILDREN WITH URINARY TRACT INFECTION.

Paediatrics

Dr. Asit Patil M.D. Pediatrics, Practicing Pediatrician. Completed Residency at K.J. Somaiya Medical College Hospital and Research Centre.

Dr. Varsha Phadke* M.D. Pediatrics, DCH, Dean and Professor Department of Pediatrics, K.J. Somaiya Medical College Hospital and Research Centre *Corresponding Author

ABSTRACT

Urinary tract infection is a common cause of bacterial infection resulting in long term complications in children, hence effects must be directed towards identifying risk factors. **Methodology:** Routine urine examination, microscopy and culture, antibiotic sensitivity done by obtaining specimen of mid stream urine. A detailed history of urinary habits and associated risk factors were analyzed. **Result:** E coli was the commonest organism isolated. Most common risk factors were common toilet usage 20 (40%), diaper usage 14 (28%), straining to void 12 (24%), constipation 11 (22%), reduced water intake 10 (20%) and voluntary withholding 10 (20%) children. Non circumcision seen in 15 out of 19 Males, cleaning perineum from back to front was identified in 20 out of 31 females. Significant association was found between Anaemia and UTI by E.coli ($p = 0.0018$). **Conclusion:** Escherichia coli was the most common isolated uropathogen. Anemia was a risk factor for E.coli induced UTI.

KEYWORDS

Urinary tract infection, Uropathogens, Risk factors, Antibiotic sensitivity

INTRODUCTION

Urinary tract infection (UTI) is a common cause of morbidity in infants and children[1].

Urinary tract infection may be suspected based on symptoms and findings on routine urine examination and confirmed by urine culture. Initial choice of antibacterial therapy should be based on knowledge of predominant organisms causing the disease.

Bryan C.S. et al reported E.coli as common pathogen causing UTI in 85% of cases[2]. Arvind Bagga et al stated 90% of first symptomatic urinary tract infection and 70% of recurrent infection were due to E.coli [1].Many other studies also showed E.coli as a common organism causing UTI[3]. Other Urinary pathogens include Pseudomonas aeruginosa, Klebsiella spp, Citrobacter spp, Enterobacter cloacae, Proteus mirabilis, Providencia stuartii, Serratia species, Gram-positive cocci like Enterococcus spp, Streptococcus group B and D, Staphylococcus species, Streptococcus faecalis and Other pathogens like Candida spp, Chlamydia trachomatis, Adenovirus[4]. Drugs that are usually administered against uropathogens include cotrimoxazole, ampicillin, amoxicillin, aminoglycosides, cephalosporins and nitrofurantoin, however many reports have indicated multidrug resistance in organisms causing UTI [5,6]. The urological society of India Guidelines for management of pediatric urinary tract infection suggest to give oral or parenteral antibiotics for 7 to 14 days [7].

Lack of awareness of UTI in the community has made it one of the most common infections in children. Risk factors that ultimately lead to causation of disease once known can help to prevent the disease. Basic sanitation habits, daily activities, community based customs form a major aspect of risk factors for UTI. Many other studies showed a number of risk factors[8,9,10] and yet there are numerous such factors still to be exposed.

Urinary tract infections, especially the recurrences may lead to long term consequences such as hypertension and chronic kidney disease. In developing countries the efforts must be directed towards appropriate therapy, cost-effectiveness and preventive nephrology [11]. Identifying risk factors in time may lead to decreased morbidity and mortality in children and also the financial burden on family can be prevented. This study aims to identify the common risk factors and causative organisms with antibiotic susceptibility associated with UTI in children.

Methods/Approach:

It is a cross sectional study conducted at tertiary care centre from 1st January 2020 to 31st October 2021.

Inclusion Criteria:

1) All Children admitted in pediatric ward suffering from Urinary tract infection confirmed by urine culture with a colony count of > 10^5CFU/ml of a single uropathogen.
2) Age group of 1 month to 12 years.

Exclusion Criteria:

1) Patients who have taken antibiotic treatment within 48hours before giving urine culture sample.

After Ethics committee approval, a written informed consent was taken from parents or legal guardians of all cases prior to enrolment in the study. A detailed history of urinary habits and possible associated risk factors were taken and analysed. Routine urine examination and microscopy was done by obtaining a clean catch specimen of mid stream urine. Another such specimen was used for urine culture and antibiotic sensitivity.

Diagnosis of UTI

1) Routine urine examination and microbiology.
2) Confirmed by urine culture with a colony count of > 10^5CFU/mm of a single uropathogen.

A predesigned and pretested Performa was used to collect data.

Statistical Analysis:

Frequency percentage and descriptive statistics were used as data summary measures while bar diagrams and pie charts were used for data presentation. Chi Square test was used as test of significance and p value of <0.05 was taken as significant.

RESULTS:

In our study out of 50 culture positive children with UTI total number of males were 19 (38%) and total number of females were 31 (62%).

Out of them 19 (38%) belonged to 0 to 1 year age group, 16 (32%) belonged to more than 1 year to 5 years and 15 (30%) were more than 5 year old as stated in table1.

Table 1: Distribution of Children with UTI according to Age group & Sex.

Age group (in years)	Sex		Total
	Male	Female	
0 to 1	8 (16)	11 (22)	19 (38)
>1 to 5	6 (12)	10 (20)	16 (32)
>5	5 (10)	10 (20)	15 (30)
TOTAL	19 (38)	31 (62)	50 (100)

Signs and symptoms:

- Most common symptoms included fever, increased frequency of micturition > 8 times, abdominal pain and abnormal stream.
- Fever was present in total 43 (86%) children.
- Increased frequency of micturition of > 8 times was present in total 34 (68%) children. Abdominal pain was present in total 22 (44%) children.

- Abnormal stream was present in total 21 (42%) children.
- Most common signs were Guarding seen in total 22 (44%) children and abdominal tenderness in total 17 (34%) children.

Figure1 shows distribution of signs and symptoms in patients with UTI.

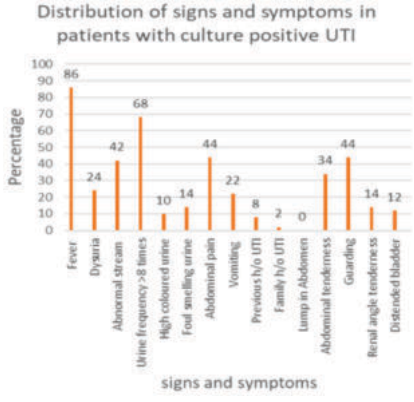

Figure1 : Distribution of signs and symptoms in patients with UTI.

Risk Factors:

In our study most common risk factors were common toilet usage 20 (40%), diaper usage 14 (28%), straining to void 12 (24%), constipation 11 (22%), reduced water intake 10 (20%) and voluntary withholding was seen 10 (20%) children.

Risk factors specific for males included non circumcision seen in 15 out of 19 males. Phimosis was present in 4 out of 19 male children. Risk factors specific for females included cleaning perineum from back to front was seen in 20 out of 31 females.

Other factors included history of recent hospitalization in 7 (14%) children, wearing tight underwear in 5 (10%) children, worm infestation in 7 (14%) children, neurological abnormalities in 3 (6%) children , malnutrition in 3 (6%) children, persistent diarrhea in 5 (10%) children, vesicouretric reflux in 1 (2%) child, anatomic abnormalities in 4 (8%) children, enuresis in 2 (4%) children. Neurologic bladder was not found in any child. Figure2 shows these risk factors.

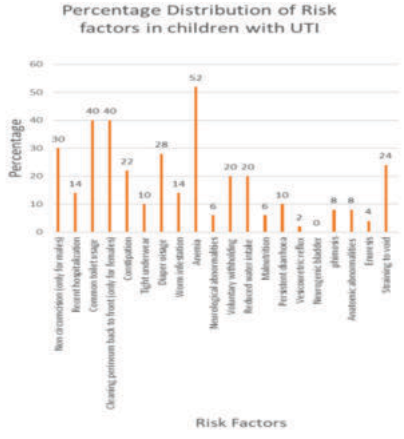

Fig 2: Distribution of Risk Factors in UTI children.

- Out of total children with UTI by E.coli, anaemia was present in 21 (42%). Anaemic children with UTI by other uropathogens were 5 (10%).
- Children without anaemia were 24 (48%).
- Distribution of hemoglobin and uropathogen is shown in table2.

Table 2: Distribution of hemoglobin and uropathogen.

Hemoglobin	Uropathogen		Total
	E.Coli	Non E.Coli	
Hb <10	21 (42)	5 (10)	26 (52)
Hb >10	9 (18)	15 (30)	24 (48)
Total	30 (60)	20 (40)	50 (100)

Significant association was found between Anemia (hemoglobin <10gm/dl) and UTI by E.coli (p = 0.0018, S).

Etiology:

Among the 50 culture positive children, Ecoli was isolated in 30 (60%) children, Enterococcus in 5 (10%), Klebsiella in 3 (6%) children. Table3 describes this distribution of uropathogens.

Table 3: Distribution of Children with UTI According to Uropathogens.

No. of children		Total
Uropathogens	E. coli	30 (60)
	Proteus M.	1 (2)
	Proteus V.	2 (4)
	Enterococcus	5 (10)
	Citrobacter F.	1 (2)
	S. Aureus	2 (4)
	Acinetobacter	1 (2)
	Klebsiella	3 (6)
	Streptococcus	1 (2)
	MR Staph	1 (2)
	Citrobacter K.	2 (4)
	Pseudomonas	1 (2)
Total		50 (100)

Antibiotic sensitivity:

Among all antibiotics, E.coli, Enterococcus and klebsiella were sensitive to Ceftriaxone, Gentamycin, Nitrofurantoin and Norfloxacin.

DISCUSSION:

Females were more affected than males in all age groups in our study. Similar to us Hanna-Wakim RH et al concluded that in their study females were predominant (77.7%) among all age groups with UTI except in infants less than 2 months, 60.9% who were males[6].

Fever was the most common symptom, seen in 43 children, followed by increased frequency of urination of > 8 times seen in 34 children, Abdominal pain in 22 children and abnormal stream in 21 children. Among signs Guarding and abdominal tenderness were most common, seen in 22 (44%) children and 17 (34%) children respectively.

Similar to us, in study by Kavitha J. et al total fever cases summed up to 64.8% and was the most common symptom observed in their study[15].

As per study by Sivaraj P. et al 40% children with culture positive UTI had urgency and frequency as presenting symptoms[16].

Among the urine culture positive children we analysed 22 risk factors of which the most common were diaper usage, common toilet usage, straining to void, constipation, reduced water intake and voluntay withholding.

Non circumcision was seen 15 males out of 19, making non circumsion a major risk factor among males in our study similar to D Singh-Grewal et al[17] , Ali E et al[14] and Herzog LW. et al[18]. Morris BJ. Et stated lifetime UTI risk was 32% in uncircumcised males and 8.8% in circumcised males[19]. In many societies circumcision plays a significant cultural and religious role.

On medical ground it provides benefits of improved hygiene thus reducing incidence of urinary tract infection[17].

Among urine culture positive females, cleaning perineum from back to front was seen in 20 out of 31 females, making most common risk factor among females comparable to Ferdaus J. et al[9].

Cleaning the perineum from back to front increases the risk of **introducing organisms from the anal region into the urethra thus causing urinary tract infection.**

Study by Ferdaus J. et al observed that a child uses nappy for the first five years of life was 8 times more at risk of developing UTI[9].

In our study Worm infestation was seen as a risk factor similar to study by Ok UZ et al[20].Anatomic abnormalities as a risk factor for UTI was also studied by Shankar M et al[21] and retrospective study on same lines

done by Gluhovschi G et al revealed a high incidence of UTI in patients with anatomic abnormalities[22].

In our study there were 7 with history of Recent hospitalization. Among males Phimosis was present in a total 4 males. Common toilet usage was seen in 20 children. 11 children had Constipation. Wearing tight underwear was seen in only 5 children. Neurological abnormalities (h/o seizure) were seen in a total 3 children. Straining to void was seen in a total 12 children. Reduced water intake was seen in 10 children. Persistent diarrhoea was seen in 5 children, Enuresis in 2 children.

Similar risk factors were found by Kavitha J. et al[15], Gondium R. et al[8] and Ferdaus J. et al[9].

Bauckman KA stated that severe bacterial burden is experienced by patients with iron dysfunction which may also lead to bladder urothelium damage. Uropathogenic Ecoli have evolved complex mechanisms for iron chelation from host cells[24].As per Subash chandrabose S. et al, in the battle of metals among host and pathogen, many metals including iron is critical for uropathogenic colonization[25]. In Iron deficiency anaemia there is poor immune development, poor response to infection and importantly, hepcidin level reduces which is associated with increased susceptibility to E.Coli infection[26]. Lee J et.al stated anaemia as independent risk factor for UTI in children less than 24 months of age and elevated NGAL concentration before treatment[27].

Thus our finding being statistically significant we can state that anaemia could be a risk factor for E.coli induced UTI. Further studies need to be done in this context.

In our study E. coli was found to be most common uropathogen amongst all age groups followed by Enterococcus and Klebsiella which is comparable to studies by Zorc JJ et al[12], Gupta P et al[10] and Shabbeer D. et al[13].

Study by Ali E, Osman A. et al showed E. coli was the most commonly isolated pathogen (60%), followed by other Gram-negative organisms like Klebsiella (12%) and Enterococcus faecalis (10%)[14].

We found ceftriaxone, nitrofurantoin and amikacin to be sensitive to most of the uropathogens.

Most of the E. coli were sensitive to meropenem followed by nitrofurantoin, amikacin, piperacillin tazobactum, ceftriaxone, gentamycin etc in ascending order of sensitivity, similar to study by Gupta P et al [10]. These results are consistent with other recommendation for management of UTIs[23].

CONCLUSION:

- Most of the risk factors identified in our study were preventable.
- Among various risk factors identified Anemia was found to be statistically significant in patients with UTI by escherichia coli.
- Escherichia coli was the most common isolated uropathogen.
- Most uropathogens were sensitive to Ceftriaxone, Gentamycin, Nitrofurantoin and Norfloxacin.

REFERENCES:

1) Hari Pankaj; Srivastav R.N. Urinary tract infections. In:Srivastav R.N; Bagga Arvind,(Eds). Pediatric Nephrology.6th Edition.New Delhi:Jaypee Brothers Medical Publishers (P) Ltd., 2016.p267-289.
2) Bryan CS, Reynolds KL. Hospital-acquired bacteremic urinary tract infection: epidemiology and outcome. The Journal of urology. 1984 Sep;132(3):494-7.
3) Saravanan.S. Prevalence and Antimicrobial Sensitivity Pattern of Urinary Tract Infection in Febrile Children Aged 1 Month to 5 Years. IOSR Journal of Dental and Medical Sciences (IOSR-JDMS) e-ISSN: 2279-0853, p-ISSN: 2279-0861. Volume 10, Issue 5 (Sep.- Oct. 2013), PP 15-18.
4) Chon C, Lai F, Shortliffe LM. Pediatric urinary tract infections. Pediatr Clin N Am 2001;48(6):1443.
5) Kahlmeter G. Prevalence and antimicrobial susceptibility of pathogens in uncomplicated cystitis. The ECO SENS study. Int J Antimicrob Agents 2003; 22: 49-52.
6) Hanna-Wakim RH, Ghanem ST, El Helou MW, Khafaja SA, Shaker RA, Hassan SA, Saad RK, Hedari CP, Khinkarly RW, Hajar FM, et al. Epidemiology and characteristics of urinary tract infections in children and adolescents. Front Cell Infect Microbiol. 2015;5:45.
7) Ansari MS, Shekar PA, Singh C, Joshi SS. The Urological Society of India Guidelines for the management of pediatric urinary tract infection (Executive Summary). Indian Journal of Urology: IJU: Journal of the Urological Society of India. 2021 Jan;37(1):10.
8) Gondim R, Azevedo R, Braga AA, Veiga ML, Barroso U. Risk factors for urinary tract infection in children with urinary urgency. International braz j urol. 2018 Mar;44:37883.
9) Ferdaus J, Moinuddin G, Islam MT, Rashid MH, Shawly MR, Alim A. Risk factors of urinary tract infection in preschool children in Dhaka, Bangladesh. Bangladesh Medical Journal. 2016;45(3):134-7.
10) Gupta P, Mandal J, Krishnamurthy S, Barathi D, Pandit N. Profile of urinary tract infections in paediatric patients. The Indian journal of medical research. 2015 Apr;141(4):473.
11) Indian Pediatric Nephrology Group. Consensus statement on management of urinary tract infections. Indian Pediatr. 2011;48:709-717.
12) Zorc JJ, Levine DA, Platt SL, Dayan PS, Macias CG, Krief W, Schor J, Bank D, Shaw KN, Kuppermann N, Multicenter RSV-SBI Study Group of the Pediatric Emergency Medicine Collaborative Research Committee of the American Academy of Pediatrics. Clinical and demographic factors associated with urinary tract infection in young febrile infants. Pediatrics. 2005 Sep;116(3):644-8.
13) Shabbeer D,Nizamuddin M. The Role of Renal Ultrasound in Children With Febrile Urinary Tract Infection. International Journal of Clinical Pediatrics. 2018 Apr 24;7(1-2):6-12.
14) Ali E, Osman A. Acute urinary tract infections in children in Khartoum State: pathogens, antimicrobial susceptibility and associated risk factors. Arab Journal of Nephrology and Transplantation. 2009;2(2):11-5.
15) Kavitha J, Aravind MA, Jayachandran G, Priya S. Risk factors for urinary tract infection in pediatric patients. Int J Contemp Pediatr 2018;5:184-9.
16) Sivaraj P, Pradhan S, Beriha S, Barik R, Tago N, Das L, Mohanty A. Study of risk factors associated with febrile urinary tract infection in children. Sri Lanka J Child Health. 2015 Sep 12;44(3):143-6.
17) Singh-Grewal D, Macdessi J, Craig J. Circumcision for the prevention of urinary tract infection in boys: a systematic review of randomised trials and observational studies. Arch Dis Child2005;90:853–8.
18) Herzog LW. Urinary tract infections and circumcision: A case control study. Am J Dis Child (1989) 143(3): 348-350.
19) Morris BJ, Wiswell TE. Circumcision and lifetime risk of urinary tract infection: a systematic review and meta-analysis. The Journal of urology. 2013 Jun 1;189 (6):211824.
20) Ok ÜZ, Ertan P, Limoncu E, Ece A, Özbakkaloglu B. Relationship between pinworm and urinary tract infections in young girls. APMiS. 1999 Mar;107(1.6):474-6.
21) Shankar M, Narasimhappa S, Madhura NS. Urinary tract infection in chronic kidney disease population: a clinical observational study. Cureus. 2021 Jan 4;13(1).
22) Gluhovschi G, Bozdog G, Schiller A, Trandafirescu V, Petrica L, Velciov S, Patrascu C, Boiboreanu P, Spataru D. Urinary tract infection in patients with solitary kidney. Facta Universitatis. 1998;5:37-9.
23) El-Gamasy MA. Prevalence of infective organisms of infections of urinary tract in a sample of Arab infants and children. Journal of Integrative Nephrology and Andrology. 2017 Oct 1;4(4):136.
24) Bauckman KA, Mysorekar IU. Ferritinophagy drives uropathogenic Escherichia coli persistence in bladder epith elial cells. Autophagy. 2016 May 3;12(5):850-63.
25) Subashchandrabose S, Mobley HL. Back to the metal age: battle for metals at the host–pathogen interface during urinary tract infection. Metallomics. 2015 Jun;7(6):935-42.
26) Abuga KM, Muriuki JM, Williams TN, Atkinson SH. How severe anaemia might influence the risk of invasive bacterial infections in African children. International Journal of Molecular Sciences. 2020 Sep 22;21(18):6976.
27) Lee JH, Yim HE, Yoo KH. Associations of plasma neutrophil gelatinase-associated lipocalin, anemia, and renal scarring in children with febrile urinary tract infections. Journal of Korean medical science. 2020 Mar 16;35(10).