

Clinical, Epidemiological and Bacteriological Profile of Culture Positive Urinary Tract Infections in Febrile Children – A Cross Sectional Study

Bhavani Shankar Rokkam¹, Chowdary Babu Menni², Ramu Pedada³, Deepak Kumar Alikana⁴

¹Department of Paediatrics, Sri Venkateswara Medical College, Tirupati, Andhra Pradesh, India.

²Department of Paediatrics, ACSR Government Medical College, Nellore, Andhra Pradesh, India.

³Department of Paediatrics, Government Medical College, Ananthapuramu, Andhra Pradesh, India.

⁴Department of Paediatrics, Guntur Medical College, Guntur, Andhra Pradesh, India.

ABSTRACT

BACKGROUND

Urinary tract infections (UTI) constitute a common cause of morbidity in infants and children. When associated with abnormalities of urinary tract, they may lead to long-term complications including renal scarring, loss of function and hypertension. Most urinary tract infections remain undiagnosed if investigations are not routinely performed to detect them. Prompt detection and treatment of urinary tract infections and any complicating factors are important. The objective of the study is to know the clinical, epidemiological and bacteriological profile (i.e. clinical signs and symptoms, age, sex, family history, associated urinary tract abnormalities, & causative organisms) of urinary tract infections in febrile children with culture positive urinary tract infection.

METHODS

This descriptive, cross sectional observational study was conducted at outpatient clinics of our "child health clinics" between May 2016 and April 2017 (one year). All children aged 0 to 12 years with culture positive urinary tract infections were included in this study to evaluate the clinical, epidemiological and bacteriological profile.

RESULTS

A total of 69 children with culture positive urinary tract infections were included in this study. Out of 69 children included in this study, 36 (52.2 %) were females and 33 (47.8 %) were males. Overall female preponderance was seen and the M: F ratio was 0.9:1. But during first year of life in our study group we had more boys (10, 14.49 %) affected with urinary tract infection than girls. 49.3 % of urinary tract infections in the present study belonged to lower socio-economic status. Most common organism causing urinary tract infection in our group was *E. coli* (56.5 %). Fever (100 %), anorexia or refusal of feeds (52.2 %), dysuria (46.4 %), vomiting (46.4 %) and abdominal pain (39.1 %) were the predominant clinical manifestations observed in our study.

CONCLUSIONS

Urinary tract infection is a common medical problem in children and it should be considered as a potential cause of fever in children. As febrile children with urinary tract infection usually present with non-specific signs and symptoms, urine culture should be considered as a part of diagnostic evaluation.

KEYWORDS

Urinary Tract Infections (UTI), Febrile Children, Bacteriological Profile, Urine Culture

Corresponding Author:

*Dr. Deepak Kumar Alikana,
Sai Ram Apartment,
Hotel Grandbay Road,
Flat No. 201, D/No.15-2-6/11,
Maharanipeta, Visakhapatnam,
Andhra Pradesh, India.
E-mail: drdeepakmd99@gmail.com*

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BACKGROUND

Urinary tract infection (UTI) is one of the most important causes of long-term morbidity and mortality with an estimated 150 million UTIs annually (Globernado et al. 2007).¹ Urinary tract infection (UTI) is a common medical problem in children, affecting 3 – 10 % girls and 1 – 3 % boys. They are an important cause of morbidity and might result in renal damage, often in association with vesico ureteric reflux (VUR).

The usual age for occurrence of the first symptomatic UTI is the first year of life, particularly in boys, when it mainly affects the upper urinary tract. The incidence of UTI in term neonates is approximately 1 % and in preterm is 3 % both with male preponderance. During infancy the risk of developing UTI is equal in boys and girls and there after higher in girls. The risk is higher in children with malnutrition and chronic diarrhoea. Large prospective studies estimate UTI incidence as approximately 7 % in febrile infants and young children. Obstructive lesions may be found in 5 to 10 % of boys investigated for UTI and 30 % of patients show the presence of VUR. The occurrence of UTI below two years of age, delay in starting treatment and presence of dilating VUR or obstruction are chief risk factors for renal scarring. About 90 % of the first symptomatic UTI and 70 % of recurrent infections are due to *E. coli*. Other organisms including klebsiella, *Staphylococcus saprophyticus* and *Streptococcus faecalis* may occasionally be responsible. Proteus and pseudomonas are associated with recurrent UTI, instrumentation, urolithiasis and nosocomial infections. The manifestations of UTI are related to the patient age, stage in toilet training, location of infection in the urinary tract and severity of the infection.

Fever, vomiting, lethargy, irritability, poor feeding and failure to thrive are the most common clinical features in infants < 3 months with UTI. Abdominal pain, jaundice and haematuria are less common in these infants. Fever, abdominal pain, loin tenderness, vomiting and poor feeding are common clinical features in infants > 3 months with UTI, whereas lethargy, irritability, haematuria and failure to thrive are less common features in them. Older children with UTI commonly present with frequent urination, dysuria, abdominal pain, loin tenderness, dysfunctional voiding and incontinence. Fever, malaise, vomiting and haematuria are less common features of UTI in older children. It is difficult to clinically differentiate between UTI involving renal parenchyma (pyelonephritis) from that confined to the bladder and urethra. Fever may be the only manifestation of clinical pyelonephritis or it may be characterised by any or all of the following: abdominal, back or flank pain, malaise, nausea, vomiting and occasionally diarrhoea.² Febrile UTI in young children should therefore be assumed to involve the upper tract.

The diagnosis of UTI often is missed in infants and young children, as urinary symptoms are minimal and often nonspecific.³ Rapid evaluation and treatment of UTI is important to prevent renal parenchymal damage and renal scarring that can cause hypertension and progressive renal damage.⁴ The diagnosis of UTI is based on growth of significant number of organisms of a single species in the

urine. Significant bacteremia is defined as a colony count of $> 10^5$ / mL of a single species in a clean catch sample. Urine is obtained by supra pubic bladder aspiration or urethral catheterisation in children below 2 years. Any colonies on supra pubic aspiration and $> 50,000$ / mL on urethral catheterisation are considered significant. The occurrence of significant bacteriuria in the absence of symptoms is termed asymptomatic bacteriuria. The presence of > 10 leucocytes / mm³ in fresh uncentrifuged sample, or > 5 leucocytes per high power field in centrifuged samples is useful for screening. Dipstick examination combining leucocyte esterase and nitrite has moderate sensitivity and specificity for detecting UTI.

Once UTI is suspected, a urine specimen is sent for culture and treatment started. Infants below 3 months of age and children with complicated UTI should initially receive parenteral antibiotics. The initial choice of antibiotic is empiric and is modified once the culture results are available. While a 3rd generation cephalosporin (cefotaxime or ceftriaxone) is preferred therapy with a single daily dose of aminoglycoside is also safe and effective. Once oral intake improves and symptoms abate, usually after 48 to 72 hours, therapy is switched on to an oral antibiotic (cefixime, co-amoxiclav, cephalixin, cefadroxil, amoxicillin and ciprofloxacin).³ The duration of treatment for complicated UTI should be 10 to 14 days. Older infants and patients with simple UTI should receive treatment with oral antibiotics for 7 to 10 days. Adolescents with cystitis may receive shorter duration of antibiotics lasting for 72 hours. Patients with asymptomatic bacteriuria do not require treatment.³

METHODS

This is a descriptive, cross sectional observational study conducted on the outpatients of our "child health clinics of Andhra Medical College, Visakhapatnam" between May 2016 to April 2017 (1 year). The study included all children aged 0 – 12 years with culture positive urinary tract infections while investigating them for suspected febrile UTI. Children who had other associated infections such as malaria, enteric fever, viral haemorrhagic fever (mixed infections) and children with proved nephrotic syndrome were excluded from the study. Detailed history and physical examination with relevant investigations were carried out and documented in a standard proforma after taking informed consent. Data management and statistical analysis were performed by using Statistical Package for the Social Sciences (SPSS) software version 17.0. The collected data was analysed descriptively regarding clinical, epidemiological, socioeconomic status (as per modified B.G. Prasad's [revised 2014] classification and bacteriological profile of urine culture in the present study population.

RESULTS

In our study, we included 69 children aged between 0 – 12 years who had culture positive urinary tract infection. 52.2

% (36 / 69) of our study population were girls and we found the boys: girls ratio was 0.9:1 in our study. But in our study we found more number of boys than girls 14.49 % (10 / 69) were infected with UTI in first year of life. More number of UTI cases were found in 7 to 12 years age group in both sexes (5.94 & 24.64 % respectively).

Age (Months / Years)	Male (Number %) (N = 33)	Female (Number %) (N = 36)	Total Cases (%) (N = 69)
0 – 3 months	4 (5.79)	2 (2.9)	6 (8.69)
3 months – 12 months	6 (8.7)	4 (5.8)	10 (14.49)
13 months - 2 years	7 (10.14)	9 (13.04)	16 (23.2)
3 years - 6 years	5 (7.24)	4 (5.8)	9 (13.04)
7 years - 12 years	11 (15.94)	17 (24.64)	28 (40.58)
Total	33 (47.8)	36 (52.2)	69 (100)

Table 1. Distribution of Culture Positive UTI Cases According to Age and Sex in the Present Study

In the present study, majority of the cases belonged to lower socioeconomic class (49.3 %).

Socioeconomic Status	Number	% (N = 69)
Upper class	12	17.4
Middle class	23	33.3
Lower class	34	49.3
Total	69	100

Table 2. Distribution of Febrile Children with Culture Positive UTI According to Their Family Socioeconomic Status

Most common organism causing UTI in our study was found to be *E. coli* (56.5 %; 39 / 69)

Organism	Number	%
<i>E. coli</i>	39	56.5
<i>Klebsiella</i>	12	17.4
<i>Pseudomonas</i>	9	13
<i>Proteus</i>	6	8.7
<i>Staphylococcus aureus</i>	3	4.4
Total	69	100

Table 3. Bacteriological Profile of Culture Positive UTI Cases in the Present Study

Signs and Symptoms	Number of Patients	Percentage
Abdominal pain	27	39.1
Abdominal tenderness	8	11.6
Anorexia / refusal of feeds	36	52.2
Constipation	3	4.3
Diarrhoea	6	8.7
Dribbling	3	4.3
Dysuria	32	46.4
Fever	69	100
Flank pain	2	2.9
Frequency	7	10.2
Genital discharge	4	5.8
Genital pain	3	4.3
Haematuria	6	8.7
Irritability	7	10.2
Nausea	19	27.5
Oliguria	3	4.3
Straining on urination	3	4.3
Urgency	9	13
Vomiting	32	46.4

Table 4. Distribution of Clinical Features in Culture Positive UTI Cases in the Present Study

Other bacterial isolates such as *klebsiella* (12 / 69; 17.4 %), *Pseudomonas aeruginosa* (13 %; 9 / 69); *proteus* (8.7 %; 6 / 69) and *Staphylococcus aureus* (4.4 %; 3 / 69) were found in our study. Fever was the most common symptom (100 %) since our study was conducted on febrile children whose urine culture was positive. Other symptoms such as

anorexia or refusal of feeds (52.550; dysuria (46.4 %); vomiting (46.4 %) and abdominal pain (39.1 %) were found in our study.

DISCUSSION

Urinary tract infection is a common bacterial illness among febrile infants and young children, with a reported prevalence between 4.1 % and 7.5 %.⁴⁻⁹ It is often overlooked, especially in children less than 2 years in whom the symptoms are vague and nonspecific. Most of these infections remain undiagnosed if investigations are not routinely performed to detect them. Otherwise unexplained renal scarring has been cited as one of the most common cause of end stage renal disease (ESRD) and is an established risk factor for subsequent hypertension.⁴ Nonspecific but common symptoms include fever (especially > 102.2° F or 39° C) and abdominal pain. For some children less than 2 years of age, these more subtle problems may be the only indicator of a UTI.

Associated symptoms of concern include flank pain, fever and vomiting. Obvious blood in urine (gross haematuria) as well as a positive family history for childhood urinary tract infection (especially in siblings) are also red flags and should raise the level of concern. Interestingly, the odour and colour (with the exception of obvious blood) of the urine are not predictors of a UTI. The physical examination of a child with suspected urinary tract infection should start with the vital signs (temperature, pulse, breathing rate and blood pressure, which is often measured with the vital signs). The presence of fever (especially over 102.2° F or 39° C) is highly correlated with the presence of a UTI. Blood pressure and assessment of height and weight provide helpful reassurance if normal or stable long-term renal function. Visual examination of the abdomen for enlargement related to potentially oversized kidney (s) or bladder is important. Tenderness during palpation of the abdomen (especially the suprapubic region containing the bladder) or the flank area (where the kidneys are situated) is very helpful in establishing the diagnosis. Examination of the genitalia is also very important to see if there is evidence of vaginal irritation (redness, discharge, evidence of trauma or foreign body). An uncircumcised male infant (especially with a foreskin that is difficult to retract) is more likely to experience a UTI when compared to a population of similar infant boys who have been circumcised. Lastly, consideration of other conditions that might be responsible for fever and abdominal pain is important. An abnormal urinalysis (including microscopic examination) may be indicative of urinary tract infection. However, the urine culture is mandatory in confirming the diagnosis of a UTI.

The culture provides both the exact bacterial cause as well as the antibiotic sensitivity profile to successfully treat the infection. In addition, studies have demonstrated a relatively short list of bacteria that commonly cause UTIs. A UTI caused by abnormal bacteria should be a source of concern. In a toilet-trained child, a clean-catch urine specimen should provide a reliable specimen for culture. A non-toilet-trained child or an uncircumcised boy whose tight

foreskin may lead to potential urine specimen contamination should have the specimen obtained by a sterile catheterisation. An alternative approach to catheterisation is called "suprapubic bladder aspiration."

This safe procedure involves passing a small needle through the skin into the urine-filled bladder cavity and aspiration of urine into the attached syringe. Collection of urine in a "urine bag" is not recommended. Some studies have indicated an 85 % false-positive rate of UTI diagnosis with this method, prompting unnecessary laboratory and diagnostic studies as well as inappropriately prescribed antibiotic therapy. Regardless of the mechanism chosen to obtain a child's urine specimen, it is very important to examine the urine as soon as possible since a delay can increase the risk of both false-negative and false-positive results. Establishing an accurate diagnosis (vs. a presumptive diagnosis) includes determining the causative bacteria of the infection, its antibiotic sensitivity profile, and determining whether any anatomical or functional risk factors are present that might predispose the child to the current infection. Such information is crucial to establish the individual's risk for recurrent urinary tract infections, which can predispose to scarring of the kidney and possibly renal failure (end-stage kidney disease, requiring either dialysis or transplant).

Children who experience an UTI generally have an excellent prognosis. If a child's UTI is associated with a red flag or high-risk characteristic (for example, male gender, usual type of bacteria, pyelonephritis, etc.), appropriate follow-up studies (renal ultrasound, renal scan and voiding cystourethrogram (VCUG)) will help to alert the doctor about unrecognised problems. These additional studies can help avoid progressive loss of kidney function or other health issues that might not be detected. UTI has accounted for febrile presentations in 7.5 % of 442 infants < 8 weeks, 5.3 % of 945 infants < 1 year, 4.1 % of 501 children < 2 years and 1.7 % of 664 children < 5 years (Schalger 2001). The Paediatric Research in Office Settings (PROS) network of the American Academy of Paediatrics study showed UTI in 9 % of 3066 febrile infants, < 3 months and 10 % of these had bacteraemia (Newman, Bernzweig et al. 2002). Meningitis has been reported in 3 - 5 % of infants in the first month of life with bacteraemic UTI (Wiswell 2000). Gram negative organisms are the most commonly isolated from urine samples of children with uncomplicated UTI with *Escherichia coli* (*E. coli*) accounting for 70 to 90 % of infections (Schalger 2001; Riccabona 2003). Few studies have assessed the frequency, sensitivity, specificity and predictive value of symptoms and signs associated with UTI in children (American Academy of Paediatrics 1999; Roberts and Akintemi 1999). Fever is the commonest symptom of UTI in infants and the presence of another source of fever on clinical examination does not exclude UTI (Shaw, Gorelick et al. 1998). In infants and young children, symptoms and signs of UTI tend to be non-specific. Older children may have symptoms including loin or abdominal pain, frequency, dysuria, urgency, hesitancy, enuresis and haematuria (Steele 1999).

The 1999 American Academy of Paediatrics practice parameter, based on the accompanying technical report,

recommended that UTI should be considered in any child younger than two years of age with unexplained fever. (American Academy of Paediatrics 1999; Downs 1999). Out of 69 children who had culture positive UTI, we found female preponderance with male to female ratio of 0.9:1. In our study we had male preponderance in less than 1-year age group. Similar observations were made by Ashoka C et al.¹⁰ (Male: Female ratio of 1:1.5), Singh S.D. et al.¹¹ Thaneja N et al.¹² and Anis-Ur-Rehman et al.¹³ studies. The present study showed majority of children with culture positive UTI belonged to 7 - 12 years age group and this finding was in agreement with Gamier AB et al. study.¹⁴ In our study we found 17.4 % (12 / 69), 33.3 % (23 / 69) and 49.3 % (34 / 69) of cases belongs to upper, middle and lower socioeconomic classes respectively according to B.G. Prasad social classification. *E. coli* was the most common organism causing UTI in our study group accounting for 56.5 % (39 / 69). This finding was in agreement with other studies such as Ashoka C et al., Aravind Bagga, Brayan CS et al., and Manohar BB et al.^{15,16,17} In the present study, fever was the most common symptom (100 %, 69 / 69) in all age groups followed by anorexia / refusal of feeds (52.2 %, 36 / 69), dysuria (46.4 %, 32 / 69), vomiting (46.4 %, 32 / 69), abdominal pain (39.1 %, 27 / 69) and nausea (27.5 %, 19 / 69) and these findings were in agreement with previous studies.

CONCLUSIONS

Urinary tract infection is a common medical problem in children and it should be considered as a potential cause of fever in children. As febrile children with urinary tract infection usually present with non-specific signs and symptoms, urine culture should be considered as a part of diagnostic evaluation. Hence, urine culture should be done routinely in all paediatric patients suffering from fever with no apparent cause.

Data sharing statement provided by the authors is available with the full text of this article at jebmh.com.

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