



Original Article

Clinical, Bacteriological Profile and Management Practices in Culture Positive Urinary Tract Infection in Children

Authors

Sharon Victoria Mendez, Jaidev M.D, Pavan Hegde, Habeeb Ullah Khan

Abstract

Introduction: Urinary tract infection (UTI) is seen in approximately 3-5% of girls and 1 % of boys. UTI can be the first presentation in 30% of children with urinary tract anomalies. Failure to identify these patients can result in damage to upper urinary tract and long term sequelae like renal scarring and hypertension.

Materials and Methods: Retrospective, time-bound case notes review over a period of one year of children with culture positive UTI admitted in Father Muller medical college hospital. Patient information was collected in a pre-structured and pre-validated proforma from case records. Mean, frequency, percentage, standard deviation were calculated for all descriptive data while continuous data was analysed using student's t-test. P-value <0.05 was considered significant.

Results: A total of 40 children were included in the study. Majority of study subjects were females in the age group of 1-5 years (60%). Most common symptoms reported in children <5 years was fever (58%) and excessive cry while passing urine (58%) whereas 50% of children >5 years had complaints of pain abdomen. Previous history of UTI was present in 22% of subjects. Urine analysis had a sensitivity of 75% and specificity of 67%. The organism predominantly causing UTI continues to be *E. coli* (67%). Multidrug resistance was noted in 52.5% of isolates. In children less than 5 years, 88% of USGs were abnormal. All abnormal MCUs were in children below 5 years of age. Dimercaptosuccinic acid (DMSA) scan was abnormal in 50% of children in whom it was performed.

Conclusion: UTI in children presents with a wide variety of non-specific symptoms. UTI can be the first presentation of a child with genitourinary abnormalities. Urine microscopy can be used as a screening test in UTI. Abnormal USG and MCU studies are commonly seen in children less than 5 years with culture positive UTI hence imaging studies are warranted. There is increasing incidence of multidrug resistant strains causing UTI.

Keywords: UTI, Urine culture, Urine analysis, Genitourinary abnormalities, Imaging studies.

Introduction

Urinary tract infection (UTI) is seen in approximately 3-5% of girls and 1 % of boys.^[1] UTI may be the first sign in 30% of children with urinary tract anomalies. Failure to identify these patients can result in damage to the upper urinary

tract.^[2] Clinical presentation is often non-specific and uncontaminated urine samples are difficult to obtain.^[3] Early diagnosis, appropriate investigations and prompt management has an impact on morbidity in children. In children with febrile UTI, 10-40% has permanent renal scarring on

DMSA at later date.^[4] Long term sequelae include hypertension and progressive renal damage due to scarring.^[5] A systematic approach to infants and children diagnosed with UTI is the need of the hour.

Materials and Methods

Materials

This study was a retrospective, time-bound case notes review of infants and children in the age group of 1 month to 15 years with culture positive urinary tract infection from 1st January 2016 to 28 February 2017. Data was collected using a pre-structured and pre-validated proforma from case records.

Definitions:^[1]

Urinary Tract infection: Infection of the urinary tract is identified by the growth of a significant number of single species, in the presence of symptom.

Urine culture: Urine culture was considered positive if there was $\geq 10^5$ colony forming units of a single organism.

Pyuria/ Bacteriuria: More than 5 leukocytes per high power field or any bacteria in a freshly collected and uncontaminated centrifuged sample was considered as pyuria/ bacteriuria.

Urine collection methods:

- Mid-stream clean catch samples- mid-stream urine collected in a wide mouthed sterile container after washing the genitalia with soap and water.
- Urine bags- sterile urine bags attached to the perineum to collect urine.
- Suprapubic aspiration- Urine sample collected by supra-pubic puncture under strict aseptic precautions with or without USG guidance.

Methods

Convenience sampling was used. Total number of cases fulfilling inclusion and exclusion criteria in a time period of one year was 40.

Inclusion Criteria

Infants and children above 1 month of age to 15 years with culture positive UTI.

Exclusion Criteria

Nephrotic syndrome

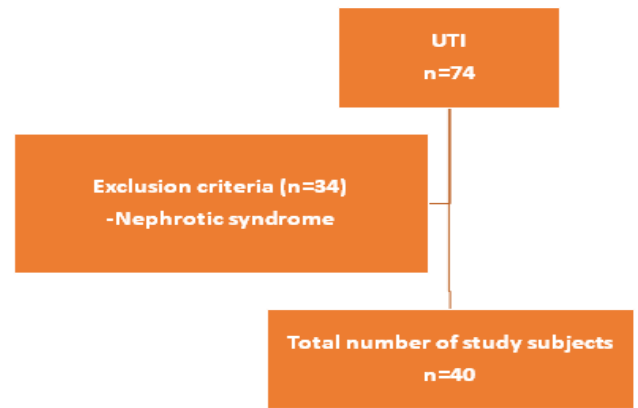


Figure 1: Flow diagram of study participants

Statistical Analysis

Mean, frequency, percentage, standard deviation were calculated for all descriptive data while continuous data was analysed using student’s t-test. P-value <0.05 was considered significant.

Results

During the study period, a total of 74 children with culture positive UTI were included. Thirty four children were excluded from our study and the final number of study subjects was 40. (Figure 1)

Majority of study subjects were females (60%) in the age group of 1-5 years (55%). Predominant symptoms recorded on presentation were fever (80%), excessive cry while passing urine (35%), and increased frequency (27.5%). Other symptoms included pain abdomen, increased frequency and burning micturition. Majority presented with more than one symptom (70%). In younger children <5 years, Fever and excessive cry (58%) while passing urine (58%) were predominant symptoms, whereas in children > 5 years pain abdomen (50%) was a common finding.

Table 1: Age-wise distribution of symptoms

Symptoms	<1 year (n=12)	1-5 years (n=22)	>5 years (n=6)	Total
Fever	7	20	5	32 (80%)
Excessive cry/ cry while passing urine	7	6	1	14 (35%)
Increased frequency	4	6	1	11 (27.5%)
Burning micturition	-	3	1	4 (10%)
Pain abdomen	-	2	3	5 (12.5%)
Vomiting	3	3	1	7 (17.5%)
Others	5	3	1	9 (22.5%)

Midstream clean catch samples (80%) and urine bags (17.5%) were the commonly used methods for collection for urine microscopy and culture.

Thirty children (75%) had Urine analysis suggestive of pyuria/bacteriuria. In our study population, urine analysis in comparison to culture had a sensitivity of 75%, specificity of 67%, positive predictive value of 73% and negative predictive value of 69%. The positive likelihood ratio was 2.27 and the negative likelihood ratio was 0.37. (Table 2)

Table 2: Urine microscopy in comparison to urine culture

Urine microscopy (Pyuria/Bacteriuria)	Urine culture		Total
	Positive n=40	Negative n=34	
Present	30	11	41
Absent	10	23	33
Total	40	34	74

Sensitivity=75% Specificity=67%

Positive predictive value=73%

Negative predictive value=69%

Positive likelihood ratio = 2.27

Negative likelihood ratio = 0.37

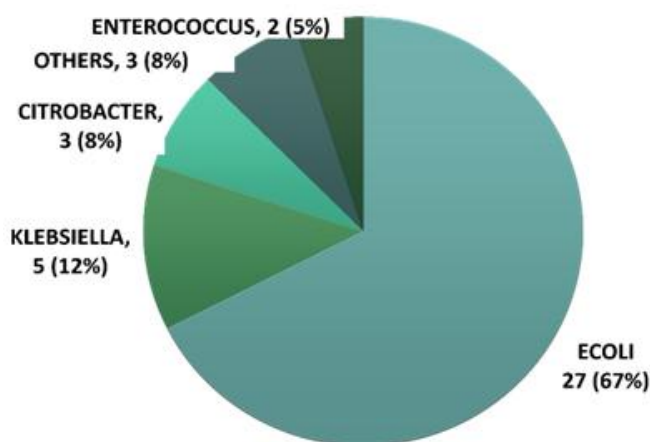


Figure 2: Etiological spectrum of UTI in study population

Escherichia coli (67%) continues to be the most common organism causing UTI, followed by Klebsiella (12%), citrobacter (8%), enterococcus (5%) and other organisms (8%) which included group B beta haemolytic streptococcus, proteus and pseudomonas (Figure 4). Antibiotics were used in accordance to culture sensitivity pattern in 60% of the study subjects. Nine children were

commenced on antibiotic prophylaxis after completion of treatment for UTI, majority (55%) were < 1 year of age. Sensitivity pattern revealed that among organisms causing UTI, 52.5% were multidrug resistant strains.

Out of 31 children in whom USG was performed, abnormalities were seen in 16 (51.6 %). Abnormal USG was seen in 88% of children younger than 5 years of age. In children with recurrent UTI, 66% of USG scans were abnormal. Most commonly found anomalies on USG were hydroureteronephrosis in 6 cases, cystitis in 4 cases and 2 cases each showed bladder wall thickening, enlarged kidneys and loss of corticomedullary differentiation. Medical renal changes, hypoplastic kidneys, renal artery stenosis and mesenteric lymphadenopathy were some of the other abnormalities noted. More than one anomaly was seen in 4 cases.

Table 3: Age based distribution of USG results in children with UTI

USG	< 5 years	>5 years
Normal	14	1
Abnormal	14	2
Total	28	3

Abnormal MCU findings were seen in 5 out of 7 children all of whom were below five years of age. Bilateral Vesicoureteric reflux was seen in 2 children. All abnormal MCUs were in children < 5 years of age. DMSA scan was done in 4 children of which 2 children had abnormal scans showing renal scarring.

Discussion

Urinary tract infection remains a common and vexing problem for the practicing paediatrician. In spite of guidelines regarding evaluation and management, there remains a lot of practical difficulty in diagnosing and treating UTIs. [3]

Predominant symptoms in our study group were fever (58%) and excessive cry while passing urine (58 %) especially in the younger age group (< 5 years). Pain abdomen was commonly reported by older children (50%). Children often have a difficult time articulating symptoms and may present with non-specific symptoms. Early

diagnosis of UTI is difficult because of varied symptomatology in the young child. Young children with UTI can present with fever, irritability, poor feeding, vomiting, excessive cry or failure to thrive. Older children may present with 'classic symptoms' of UTI like dysuria, increased frequency or urgency, pain abdomen or flank pain.^[6-8]

In our study it was observed that mid-stream clean catch (80%) was the commonly employed method followed by urine bags (17.5%). The appropriate method for urine collection for investigations has been a subject of debate. For children <2 years with a presumed UTI, the AAP recommends transurethral bladder catheterization or a suprapubic aspirate since these collection methods are less likely to yield a contaminant.^[9] The National Institute for Health and Care Excellence (NICE) have proposed clean catch urine as the method of choice for young children.^[3]

In our study population, urine analysis had a sensitivity of 75%, specificity of 67%, positive predictive value of 73% and negative predictive value of 69%. The positive likelihood ratio was 2.27 and the negative likelihood ratio was 0.37. In a systematic review of 8 studies comparing urine analysis and urine culture for diagnosis of UTI, Sensitivity ranged from 75% to 100%, specificity ranged from 32.3% to 92.6%, positive likelihood ratios ranged from 1.5 to 12.9 and negative likelihood ratios ranged from 0.02 to 0.27.^[10] A positive urine analysis may rule in UTI but urine culture is the specific test to be done for diagnosis of UTI.

The predominant microorganism isolated in our study group was *E. Coli* >10⁵ CFU. Spahiu L and Hasbahta Vin their study showed that the most common cause of UTI in all age groups is *Escherichia coli* (65%). Other common organisms include *Klebsiella* species, usually *Klebsiella pneumoniae* (23%) and *Proteus mirabilis* (7%).^[11] Sensitivity pattern showed in our study group revealed 52.5% multidrug resistant strains. In a study done by Gaspari RJ, Dickson E, Karlowsky

J and Doern G, 17.6% of isolates causing UTI were multidrug resistant.^[12]

Out of 31 children in whom USG was performed, abnormal findings were noted in 16 (51.6 %). In children less than 5 years, 88% of USGs were abnormal. Most commonly found anomalies on USG were hydronephrosis in 6 cases, cystitis in 4 cases and 2 cases each showed bladder wall thickening, enlarged kidneys and loss of corticomedullary differentiation. Out of 7 children in whom MCU was done, 5 (71.4%) were abnormal of which two children had bilateral Vesicoureteric reflux. DMSA scan was done in 4 children of which 2 (50%) had abnormal scans showing renal scarring. In a study done by Luk W, Woo Y, Au-Yeung A et al of 583 cases of culture positive UTI, 39 ultrasound (6.7%), 135 MCU (23.2%), and 55 DMSA scintigraphy (9.4%) scans were abnormal.^[13]

Conclusion

UTI in children can present with a wide variety of non-specific symptoms, especially in the younger age group. UTI can be the first presentation of a child with genitourinary abnormality. Higher incidence of genitourinary abnormalities are common in children below 5 years. Urine microscopy can be used as a screening test for UTI although the gold standard for confirmation of the same is Urine culture. More than half of the organisms grown on culture were resistant to multiple organisms.

Limitations

The limitations of our study were that it was a retrospective study; hence, the reliability of data was solely based on the documentation in case records. As DMSA was not available at our hospital there was significant difficulty in collection of data and loss of follow-up.

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Conflicts of Interest- There are no conflicts of interest.

References

1. Vijayakumar M, Kanitkar M, Nammalwar BR, Bagga A. Revised Statement on Management of Urinary Tract Infections, Indian Society of Pediatric Nephrology. *Indian Pediatr.*2011; 48:709-17.
2. Stein R, Dogan HS, Hoebeke P, Kocvara R, Nijman RJ, Radmayr C, Tekgul S. Urinary tract infections in children: EAU/ESPU guidelines. *Eur Urol.* 2015; 1 (67): 546.
3. National Collaborating Centre for Women's and Children's Health (UK). Urinary Tract Infection in Children: Diagnosis, Treatment and Long-term Management. London: RCOG Press; 2007. (NICE Clinical Guidelines, No. 54.)
4. Simões e Silva AC, Oliveira EA. Update on the approach of urinary tract infection in childhood. *J Pediatr.* 2015; 91: 2-10.
5. Elder JS. Urinary Tract Infections. In: Kliegman RM. *Nelson Textbook of Pediatrics.* 20th edition. Philadelphia: Elsevier; 2016; 2556-61
6. Bitsori M, Galanakis E. Pediatric urinary tract infections: diagnosis and treatment. *Expert Rev Anti Infect Ther.* 2012; 10(10):1153-1164.
7. Tanaka ST, Brock JW. Pediatric urologic conditions, including urinary infections. *Med Clin North Am.* 2011; 95(1):1-13.
8. Bhat RG, Katy TA, Place FC. Pediatric urinary tract infections. *Emerg Med Clin North Am.* 2011;29(3):637-653.
9. Urinary tract infection: Clinical practice guideline for the diagnosis and management of the initial UTI in febrile infants and children 2 to 24 months. *Pediatrics.* 2011; 128(3):595-610.
10. Whiting P, Westwood M, Bojke L, Palmer S, Richardson G, Cooper J, Watt I, Glanville J, Sculpher M, Kleijnen J. Clinical effectiveness and cost-effectiveness of tests for the diagnosis and investigation of urinary tract infection in children: a systematic review and economic model. *Health Technol Assess.* 2006;10(36).
11. Spahiu L, Hasbahta V. Most frequent causes of urinary tract infections in children. *Med Arh.*2010;64:88-90
12. Gaspari R, Dickson E, Karlowsky J, Doern G. Multidrug Resistance in Pediatric Urinary Tract Infections. *Microb Drug Resist.*2006;12(2):126-129.
13. Luk W, Woo Y, Au-Yeung A, Chan J. Imaging in Pediatric Urinary Tract Infection: A 9-Year Local Experience. *Am J Roentgenol.* 2009;192(5):1253-1260.