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Original Research Article

Characterizing Paediatric Urinary Tract Infections: Clinical and Laboratory Profiles in A Tertiary Care Setting

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Abstract:

Introduction: Paediatric urinary tract infections (UTIs) pose significant health risks, demanding a nuanced understanding of their clinical, demographic, and microbiological profiles. This study aimed to comprehensively analyse these facets among paediatric UTI cases in Chh. Sambhajinagar Tertiary Care Hospital.

Methodology: A retrospective observational analysis was conducted on 178 paediatric UTI cases, focusing on demographic distributions, clinical presentations, imaging and laboratory findings, and microbial profiles. Data were collected from electronic records, and statistical analyses were performed to delineate patterns and associations.

Results: The study revealed a higher prevalence of UTIs among females and uncircumcised males, with rural areas exhibiting a higher incidence. Socioeconomic disparities were evident, reflecting potential correlations with UTI occurrences. Clinical manifestations varied widely, and while imaging often presented as normal, urine cultures unveiled a diverse spectrum of pathogens, notably Acinetobacter baumannii and Escherichia coli.

Conclusion: The findings highlight the multifaceted nature of paediatric UTIs, emphasizing demographic disparities, varied clinical presentations, and a diverse microbial profile. Tailored approaches, considering gender, circumcision status, residential settings, and socioeconomic factors, are imperative in formulating effective diagnostic and therapeutic strategies for paediatric UTIs.

Keywords: Paediatric UTIs, Demographic Patterns, Clinical Presentations, Microbiological Profile, Socioeconomic Disparities, Tailored Treatment Strategies.

Introduction

Urinary tract infections (UTIs) are prevalent among paediatric populations and can pose substantial health risks if not promptly diagnosed and managed.[1] In the context of tertiary care facilities like the Chh. Sambhajinagar Hospital, understanding the clinical and laboratory profiles of children presenting with UTIs is paramount for effective treatment strategies.

Urinary Tract Infection (UTI) is one of the most common bacterial infections in childhood.[2,3]According to global studies, the overall prevalence of UTIs among febrile infants and young children is estimated to be approximately 4%–7%.[4,5] The risk of having a UTI before the age of 14 years is approximately 1-3% in boys and 3-10% in girls.[6] The diagnosis of UTI is often missed in infants and young children, as urinary symptoms are minimal and often non-specific.[7,8]

The infection may affect the upper urinary tract (referred to as pyelonephritis) or the lower urinary tract (referred to as cystitis). Unfortunately, it may be difficult, if not impossible, to distinguish pyelonephritis from cystitis based on clinical symptoms and signs, especially in infants and young children This study aims to comprehensively examine the diverse spectrum of paediatric UTIs, focusing on the clinical manifestations and corresponding laboratory findings within the hospital's patient cohort. By delving into this multifaceted profile, we seek to elucidate patterns, causative agents, and associated risk factors contributing to UTIs in children within this specific healthcare setting.

The clinical aspect will encompass a thorough analysis of presenting symptoms, demographic factors, comorbidities, and therapeutic approaches employed.

Simultaneously, the laboratory component will scrutinize microbial cultures, antibiotic sensitivity patterns, and any emerging antibiotic resistance, shedding light on prevalent pathogens and their susceptibilities in this population.

Insights gained from this study not only provide a detailed portrait of paediatric UTIs but also offer invaluable guidance for clinicians in optimizing diagnostic protocols and treatment regimens tailored to the characteristics of UTIs prevalent in this tertiary care hospital, thus enhancing the overall management and care for affected children.

Methodology

This study adopts a cross sectional study design to analyse the clinical and laboratory profiles of paediatric patients diagnosed with urinary tract infections (UTIs) at Chh. Sambhajinagar Tertiary Care Hospital.

The study includes all paediatric patients 3 month to 12 years diagnosed with UTIs and admitted to the hospital during the specified timeframe. Patients with confirmed UTIs through clinical symptoms and positive laboratory findings, including urine cultures were included. Medical records meeting the inclusion criteria were retrieved from the hospital's electronic database.

Demographic details, clinical presentations, including presenting symptoms and associated comorbidities, were extracted from patient records. Laboratory data, including urine culture results, antibiotic sensitivity profiles, and any other pertinent diagnostic tests related to UTI diagnosis, were documented.

Table 1: Demographic Characteristics of Subjects

Characteristics	Number of Cases	Percentage (%)
Total Participants	178	-
Gender		
- Female	97	54.5
- Male	81	45.5
Circumcision Status		
- Circumcised	26	14.61
- Uncircumcised	55	30.9
Residential Area		
- Rural	107	60.11
- Urban	71	39.88
Socioeconomic Class (Modified Kuppuswamy Scale)		
- SEC III	103	57.86
- SEC IV	45	25.28
- SEC II	24	13.48
- SEC V	6	3.37

Quantitative analysis was conducted to describe the demographic characteristics, clinical presentations, and laboratory findings of the paediatric UTI cases. Descriptive statistics, such as mean, median, standard deviation, and frequencies, were used to summarize continuous and categorical variables. Statistical tools like chi-square tests, t-tests, or non-parametric equivalents were employed to assess associations between clinical parameters and laboratory findings, aiding in identifying potential risk factors, prevalent pathogens, and trends in antibiotic resistance patterns among the UTI cases.
This study adheres to ethical guidelines, ensuring patient confidentiality and anonymity. Approval from the hospital's Institutional Review Board (IRB) or Ethics Committee has been obtained before commencing data collection and analysis.

Results

Table 1 – Demographic Characteristics of Subjects

The study comprised 178 paediatric participants diagnosed with urinary tract infections (UTIs). The demographic breakdown revealed a slightly higher representation of female subjects (54.5%) compared to males (45.5%). Notably, a significant portion of the male cohort was uncircumcised (30.9%), potentially indicating a consideration for the impact of circumcision on UTI occurrence in this population.

Moreover, the residential distribution demonstrated a higher incidence of UTIs among children residing in rural areas (60.11%) compared to urban dwellers (39.88%). This observation could suggest varying environmental factors or healthcare access disparities influencing UTI prevalence across different residential settings.

Regarding socioeconomic class, the majority of participants fell within SEC III (57.86%) and SEC IV (25.28%) categories. This distribution hints at a

potential association between certain socioeconomic strata and the likelihood of UTI occurrence in paediatric populations. Factors such as sanitation, access to healthcare, and living conditions linked to different socioeconomic classes might contribute to the observed variations in UTI prevalence. These findings underscore the importance of considering gender, circumcision status, residential environment, and socioeconomic factors when analysing the prevalence and potential predisposing factors for paediatric UTIs. Further exploration and targeted interventions addressing these demographic disparities could aid in developing more effective preventive strategies and tailored healthcare approaches for paediatric UTIs.

Table 2: Clinical Features and Lab Investigations

Characteristics	Number of Cases	Percentage (%)
- Oliguria	9	5.1
- Suprapubic Tenderness	8	4.5
- Renal Angle Tenderness	4	2.2
- Hepatomegaly	2	1.1
- Shock	5	2.8
- Raised Serum Creatinine	15	8.4
USG Findings		
- Cystitis	24	13.48
- Pyelonephritis	4	2.24
- Hepatomegaly	2	1.12
- Reflux (MCU)	2	1.12
- Normal	146	82.92
Gross Urinary Examination		
- Turbid Appearance	34	19.1
- Clear Appearance	144	80.89
Urine Proteins		
- Nil	131	73.59
- Trace or +1	22	12.35
- +2 or more	25	14.04
Urine Leukocyte Esterase Dipstick		
- Negative	96	53.93
- Positive	82	46.06
Urine Nitrite Dipstick		
- Negative	154	86.51
- Positive	24	13.48
Urine Microscopy		
- Normal	151	84.83
- Significant Pyuria	27	15.17
Urine Culture		
- Sterile	147	82.58
- Positive	31	17.42

Clinical Features and Investigations revealed diverse presentations among the paediatric cohort with urinary tract infections (UTIs). A small proportion exhibited oliguria (5.1%), indicating potential renal involvement or impaired urinary output, while a notable percentage presented with suprapubic tenderness (4.5%) and renal angle tenderness (2.2%). Additionally, the occurrence of shock (2.8%) highlights the severity of UTIs, potentially leading to systemic complications. USG findings depicted varying manifestations, with cystitis (13.48%) and pyelonephritis (2.24%) being identified in a subset of cases. Notably, the majority exhibited a normal USG (82.92%), suggesting a potential lack of structural abnormalities in most UTI presentations. Gross urinary examination revealed turbid appearance in a significant proportion (19.1%), possibly indicative of higher bacterial load or presence of sediments, while most cases presented with a clear appearance (80.89%). In urine analysis, a substantial number had nil urine proteins (73.59%), while a minority showed trace or higher levels, possibly indicating varying degrees of renal involvement. Notably, positive results for leukocyte esterase (46.06%) and nitrite (13.48%) dipsticks suggest the presence of leukocytes and potential bacterial infection in a significant subset of cases. Microscopic examination revealed significant pyuria (15.17%) in a portion of cases, aligning with the leukocyte esterase and nitrite dipstick findings indicative of inflammation or

infection. Urine cultures, however, displayed a predominantly sterile profile (82.58%), with a minority showing positive cultures (17.42%), featuring diverse pathogens such as Acinetobacter baumanni, E. coli, Klebsiella pneumonia, among others. These findings underscore the heterogeneity in clinical presentations, diagnostic markers, and microbiological profiles within paediatric UTIs. The presence of various clinical features alongside a mix of positive and negative investigations highlights the complexity in diagnosing and managing paediatric UTIs, necessitating a multifaceted approach for comprehensive evaluation and tailored treatment strategies.

Table 3: Pathogens Identified in Urine

Pathogens Identified in Positive Cultures		
Pathogens Identified	**Number of Cases**	**Percentage (%)**
- Acinetobacter baumanni	8	4.5
- E. Coli	8	4.5
- Klebsiella pneumonia	5	2.8
- Enterococcus	4	2.2
- Candida species	2	1.1
- Proteus	2	1.1
- Pseudomonas	2	1.1

Pathogens identified in positive urine cultures among paediatric urinary tract infection (UTI) cases displayed a diverse microbial profile. The most prevalent pathogens identified were Acinetobacter baumannii and Escherichia coli, both accounting for 4.5% of positive cases each. These bacteria are known for their potential pathogenicity, contributing significantly to UTIs and often requiring specific antibiotic management due to their resistance patterns.

Klebsiella pneumonia, Enterococcus species, Candida species, Proteus, and Pseudomonas were also identified, each in a smaller proportion of cases, ranging from 1.1% to 2.8%. These pathogens encompass a wide spectrum of microbial flora, suggesting varying degrees of complexity in the causative agents responsible for paediatric UTIs.

The significance of these findings lies in the diversity of microbial flora contributing to positive urine cultures in paediatric UTIs. The presence of both common uropathogens like E. coli alongside less frequent pathogens such as Acinetobacter baumannii, Klebsiella pneumonia, and Candida species underscores the importance of considering broad-spectrum antibiotics and individualized treatment strategies based on culture-specific sensitivities.

Additionally, the identification of these diverse pathogens emphasizes the need for prudent antibiotic use and regular surveillance to monitor and manage emerging resistance patterns among the causative agents of paediatric UTIs.

This insight into the microbial profile aids in guiding empirical therapy while highlighting the importance of culture-guided antibiotic selection to optimize treatment efficacy and minimize the emergence of antimicrobial resistance.

Discussion

The comprehensive assessment of paediatric urinary tract infections (UTIs) at Chh. Sambhajinagar Tertiary Care Hospital revealed multifaceted insights into demographic, clinical, and microbiological profiles. Understanding these facets is crucial for refining diagnostic approaches and tailoring effective treatment strategies for paediatric UTIs.

Demographic Patterns: The gender distribution in our study showcased a slightly higher prevalence among female children, aligning with established trends indicating a higher susceptibility in girls. The higher incidence among uncircumcised boys implies a potential association between circumcision status and UTI occurrence, warranting further investigation. Kjell Tullus shows that Urinary tract infections (UTIs) in children are among the most common bacterial infections in childhood. They are equally common in boys and girls during the first year of life and become more common in girls after the first year of life.[9]

Residential area disparities emerged, with a greater representation of UTIs in rural areas. This observation might reflect varying environmental exposures or disparities in healthcare access, emphasizing the need for targeted interventions in specific geographical settings. Abbye W. Clark et al emphasized that Inappropriate antibiotic prescribing is quite common for the treatment of uncomplicated UTI. Rural women are more likely to receive inappropriately long antibiotic durations. Antimicrobial stewardship interventions are needed to improve outpatient UTI antibiotic prescribing and to reduce unnecessary exposure to antibiotics, particularly in rural settings.[10]

Socioeconomic Implications:

The distribution across different socioeconomic classes elucidates potential correlations between socioeconomic status and UTI prevalence. Understanding these associations could aid in addressing social determinants influencing UTI occurrences in paediatric populations. Mehvish Saleem et al also reported that Prevalence of UTI in the lower socioeconomic status was56.4% and 43.6%. UTI in higher socioeconomic status was 51.6% and 48.4%. Commonly recovered UTI isolates were E. coli, Enterococcus faecalis, Pseudomonas aeruginosa, and Staphylococcus aureus. UTI was alarming indiabetic patients belonging to the lower socioeconomic status.[11]

Clinical and Diagnostic Findings: The diverse clinical presentations, including oliguria, suprapubic tenderness, and raised serum creatinine, underscore the varied symptomatology of paediatric UTIs. Imaging and laboratory findings revealed a substantial portion of cases with normal USGs, indicating the potential limitations of imaging in diagnosing UTIs and the necessity for a multifaceted diagnostic approach.

Microbiological Insights: Positive urine cultures displayed a spectrum of pathogens, with Acinetobacter baumannii and Escherichia coli being the most prevalent. The identification of diverse pathogens emphasizes the complexity of UTIs and the importance of culture-guided therapy, especially in the context of emerging resistance patterns among these causative agents. Alan Ronald et al also reported that The microbial etiology of urinary infections has been regarded as well-established and reasonably consistent. Escherichia coli remains the predominant uropathogen (80%) isolated in acute community-acquired uncomplicated infections, followed by Staphylococcus saprophyticus (10% to 15%). Klebsiella, Enterobacter, and Proteus species, and enterococci infrequently cause uncomplicated cystitis and pyelonephritis.[12]

Clinical Implications: The heterogeneous clinical and microbiological profiles underscore the necessity for tailored treatment strategies. Considering gender, circumcision status, residential environment, and socioeconomic factors is critical in formulating personalized approaches to diagnosis, management, and preventive measures for paediatric UTIs.

Limitations: The retrospective nature of the study and reliance on available medical records pose inherent limitations. Additionally, the study's setting in a single tertiary care hospital might limit generalizability to broader paediatric populations.

Conclusion: This study provides a comprehensive portrayal of paediatric UTIs, highlighting demographic disparities, clinical complexities, and microbial diversity. The findings emphasize the need for holistic approaches, integrating demographic, clinical, and microbiological aspects, to optimize diagnosis and management strategies for paediatric UTIs.

Further prospective studies across diverse settings are warranted to validate these observations and establish more nuanced guidelines for the management and prevention of paediatric UTIs.

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