

Urinary Tract Infection among infants and school aged children: A review

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ABSTRACT

A considerable number of bacteria of the same species growing in the urine is known as a urinary tract infection (UTI). Currently, it is thought that the most common cause of a serious bacterial disease in children under the age of two is a febrile urinary tract infection. Boys are more likely than girls to have it in their early years, but after infancy, girls are far more likely to have it. UTIs can be classified into three groups based on their clinical presentations: asymptomatic bacteriuria, lower UTI (cystitis), and upper UTI (acute pyelonephritis). UTI prevalence varies by country, from 6% in industrialized nations to 37% in low-income countries. According to a study conducted in Saudi Arabia, 24% of people had UTIs. In children, gut flora, specifically *Escherichia coli* and *Klebsiella*, are the most frequent causal organisms of urinary tract infections. Kidney failure and kidney scarring are among the short- and long-term consequences that need for fast and suitable treatment. There could be a 30 to 50% chance of a return of UTI. This review discussed UTI prevalence, causes, classifications, complications, and treatment among age groups of infants and school aged children.

Key-words: Urinary tract infections, Asymptomatic bacteriuria, *Escherichia coli*, *Klebsiella*, School aged children.

INTRODUCTION

A urinary tract infection (UTI) is characterized by the development of a sizable number of bacteria belonging to one species in the urine while symptoms are present¹. Among the most common, recurring, and serious bacterial infections in children are UTIs. It has been estimated that 5% of pediatric patients worldwide have UTIs. Approximately 8% of kids between the ages of one month and eleven years will have at least one UTI².

The specificity of clinical signs diminishes with age; approximately 5–8% of children under the age of two may exhibit fever as their only sign of a UTI³. Boys have a higher prevalence of it (3.7%) in the first year of life compared to girls (2%) and beyond infancy, girls have a much higher prevalence⁴. Girls experience a 3% incidence during prepubertal age, compared to 1% for boys. Better methods for UTI evaluation in febrile children are required. Diagnosis, treatment, and follow-up of children with UTI are significant concerns for general physicians and include numerous considerations. This is because untreated UTI can result in catastrophic kidney impairment³.

UTIs can be classified into three groups based on clinical presentations: febrile upper UTI (acute pyelonephritis), lower UTI (cystitis), and asymptomatic bacteriuria. Understanding the pathophysiology of the infection is one of the key benefits of this classification, which is helpful for a number of reasons specially its role to understand the underlying infection pathophysiology⁵. Currently, it is thought that the most common cause of a serious bacterial disease in children under the age of two is a febrile urinary tract infection. Fever, dysuria, flank discomfort, and other short-term morbidities are caused by febrile UTIs, which affect one in six newborns⁶. These infections can also cause long-term kidney damage, such as irreversible kidney scarring. Another kind of UTI is known as asymptomatic bacteriuria, which is characterized as a urinary tract infection in which there is a significant bacterial count (typically 105 organisms/ml) in the child's urine without symptoms⁷.

Prevalence: UTI prevalence varies by country, from 6% in industrialized nations to 37% in low-income countries². Previous studies have evaluated UTI incidence in various developing nations. UTIs are more common in Nigeria (11%), India (12%), Kenya (6%), and South Africa (20%)⁸. The population of Saudi Arabia is varied and of many ethnicities. It is home to Egyptians, Syrians, Yemenis, Indians, Pakistanis, Bangladeshis, and Philippians in addition to Saudi nationals. According to a study conducted in Saudi Arabia, 24% of people had UTIs⁹.

From early infancy to late adolescence, UTIs can develop at any time during childhood, but they are most common in the youngest age groups. Age, sex, race, the existence of anatomical or functional defects, circumcision, and immune status all affect their prevalence and incidence³. About sex, by the time they are six years old, up to 7% of girls and 2% of boys have experienced a UTI. At two years old, the cumulative incidence of UTI is expected to be 2.1% for females and 2.2% for boys. According to reports, girls' cumulative incidence reaches 6.6% at age 6. The recurrence rate among children with UTIs is between 12% and 15%¹⁰.

An important clinical finding that frequently supports the decision to begin antimicrobial therapy is asymptomatic bacteriuria, which is defined as the presence of bacteria in the urine in the absence of urinary symptoms¹¹. In clinical practice, asymptomatic bacteriuria is highly prevalent. The prevalence of asymptomatic bacteriuria varies by geographic location and socioeconomic class. In Egypt, the prevalence rate for school-age children is 7%, whereas in India, it is approximately 16.5%. It has been discovered that boys who are circumcised experience fewer UTIs¹². An OR of 0.13 indicated that circumcision decreased the incidence of UTI in a meta-analysis of 12 studies¹³.

Etiology: The intestinal flora of children is the most frequently found source of causal organisms; *Escherichia coli* and *Klebsiella* were shown to be the most common uropathogens. *Escherichia coli* is the cause of between 85% and 90% of UTIs (60.3%). *E. faecalis* came next (22.4%). *Klebsiella*, *Proteus*, *Enterococcus*, and *Enterobacter* species are other prevalent organisms¹⁴. While infections with urea-splitting organisms (like *Proteus*) are linked to stone formation. Species like *Pseudomonas*, group B *Streptococcus*, and *Staphylococcus aureus* are typically connected with CAKUT, genitourinary surgery, a foreign body (like a catheter), or recent antibiotic therapy¹⁵. Males are more likely than females to have *Proteus mirabilis*¹⁴. Newborn babies are comparatively more likely to contract *Streptococcus agalactiae*¹⁶.

Resistance: As one of the main causes of drug resistance, an increasingly serious threat to global health that has made it more difficult to treat a number of infections as medications lose their effectiveness against pathogens, antimicrobial resistance is an internationally recognized threat to health. It is primarily caused by the overuse or inappropriate use of antimicrobial agents¹⁴. Antimicrobial stewardship initiatives have identified incorrect treatment of asymptomatic bacteriuria as a major cause of needless antimicrobial use, and antimicrobial resistance is rising globally¹⁷. Because resistant types of bacteria are increasingly isolated from urine, UTIs are crucial to comprehending the extent of antibiotic resistance¹⁸.

Since primary healthcare provides roughly 80% of the antibiotics given within the health sector, its contribution is very

Received on 22-12-2023

Accepted on 13-03-2024

significant. Since they receive a disproportionately large quantity of primary healthcare treatments, children also receive a disproportionate amount of antibiotics¹⁹. Antibiotic-resistant bacteria can reduce the number of available treatments, making it more difficult to treat certain bacterial infections—such as urinary tract infections—that are often encountered. Infections resistant to antibiotics are also twice as likely to be linked to higher rates of morbidity and mortality as well as higher medical expenses²⁰.

It has been shown that higher rates of resistance are linked to higher antibiotic exposure. Antibiotics used as preventive measures are frequently given, although their use has dubious benefits and increases the development of bacteria resistance²¹. Antibiotics like amoxicillin-clavulanic acid and cotrimoxazole cause a high rate of resistance (20–30% of isolates in most years) in *E. coli*, whereas *P. mirabilis* (the predominant bacteria in the group of other Enterobacteriaceae) exhibits resistance to nitrofurantoin²².

After respiratory tract infections, UTIs have been found to be the second most common reason for prescribing antibiotics (mostly cephalosporins and penicillins) to pediatric outpatients in Greece²³. Due to widespread resistance to frequently given antibiotics (such as amino-penicillins) and the rising incidence of multi-drug-resistant organisms that cause UTIs, the appropriate treatment of UTIs has become increasingly difficult. The most common cause of UTIs, Gram-negative germs have been found to have a significant prevalence of multidrug resistance²⁴.

Antibiotics are primarily only available with a prescription in more developed nations, however several antibiotics, especially those frequently used to treat urinary tract infections, are available over-the-counter in "developing" nations without a prescription. Fluoroquinolones (FQs) were the antibiotics that were prescribed most frequently. It has been estimated that the overall resistance to trimethoprim/ sulfamethoxazole (TMP/SMX) and fluoroquinolones (FQs) is as high as 34% and 16.4% respectively, with *E. coli* accounting for all of the resistant microbes²⁵.

Complications: Sepsis, kidney abscess, and acute kidney injury are examples of short-term concerns. Kidney scarring, recurrent infections, reduced kidney function, hypertension, end-stage kidney disease, and preeclampsia are examples of potential long-term consequences²⁶. The kidney parenchyma can be irrevocably damaged by a febrile UTI, which is typically seen as a sign of an upper UTI known as pyelonephritis. This can result in chronic kidney insufficiency and associated issues. Permanent kidney lesions may also be linked to febrile UTIs²⁷. Antibiotic therapy that is effective against the bacterial pathogen causing the fever must be started within three to four days of the onset of symptoms in order to minimize this risk²⁴.

In children who do not exhibit any symptoms, it is crucial to identify infections early on and take appropriate action to avoid kidney damage²⁸. Therefore, in order to prevent recurrent infections, complications (like kidney scarring), and sequelae (like hypertension and chronic kidney disease), it is crucial to obtain a precise clinical and etiological diagnosis, initiate early and effective treatment, and document the integrity of the urinary tract²⁹.

Treatment: The most popular course of treatment for kids with a suspected UTI is to give them an antibiotic empirically while they wait for the results of sensitivity testing and culture³⁰. Young children need to receive the right care as soon as possible since they are more susceptible to both short-term and long-term issues, such as kidney failure and scarring. *Escherichia coli* is the primary cause of urinary tract infections (UTIs) in both adults and newborns. It accounts for more than 80% of UTIs and is the most frequent cause of bacteremia³¹.

When choosing an empirical antibiotic treatment, *Escherichia coli*'s antibiotic susceptibility pattern is the first thing to be looked at. *Proteus mirabilis*, enterococci, various Gram-negative enteric bacilli, and *Klebsiella* species are other fecal bacteria that can infrequently cause UTIs³¹. Published guidelines prescribe parenteral antibiotics followed by oral antibiotics for the initial treatment of newborn UTI, depending on the patient's age and the severity of the illness³². Understanding the microorganisms

involved and the evolution of the most common uropathogens in each geographic setting's antibiotic sensitivity patterns are essential for effective empirical treatment³³.

Recurrence: Recurrence rates of UTIs can range from 30 to 50% in infants and children, with repeated infections occurring in the first six to 12 months following an initial UTI³⁴. In early life, the risk of recurrence can reach as high as 30%. 2 UTI recurrence is particularly common in females³⁵. Recurrent bouts, especially with vesicoureteral reflux (VUR), are thought to raise the risk of hypertension, end-stage kidney disease (ESRD)³⁶ and chronic kidney disease (CKD) since the 1960s, when treating UTIs in children was first introduced. In the US, school-age girls with UTI who are Caucasian (75%), and African American girls (50%) have had at least one UTI recurrence³⁷.

CONCLUSION

A urinary tract infection (UTI) is characterized by the development of a sizable number of bacteria belonging to one species in the urine while symptoms are present.

The specificity of clinical signs diminishes with age; approximately 5–8% of children under the age of two may exhibit fever as their only sign of a UTI. According to a study conducted in Saudi Arabia, 24% of people had UTIs. In children, gut flora, specifically *Escherichia coli* and *Klebsiella*, are the most frequent causal organisms of UTI. An acknowledged global health risk, antimicrobial resistance is mostly brought about by the excessive or improper use of antibiotics. Sepsis, renal abscess, acute kidney injury, renal scarring, recurrent infection, reduced renal function, hypertension, end-stage renal disease, and preeclampsia are among the complications that can arise from a urinary tract infection. Renal failure and renal scarring are among the short- and long-term consequences that need for fast, suitable treatment. There could be a 30 to 50% chance of a return of UTI. Global health awareness campaign are required to be planned at the national level for proper parent awareness about UTI among children and the related risk factors and preventive measures as well as when to seek the medical advice in the proper time.

Funding: Nil

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This article may be cited as: Alenazi SA: Urinary tract infection among in infants and school aged children: A review. *Pak J Med Health Sci*, 2024;18(4):3-5.