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A REVIEW ON URINARY TRACT INFECTION ON PEDIATRIC AND WOMENS HEALTH

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Abstract

Urinary tract infections (UTIs) are among the most common bacterial infections affecting pediatric and women's health, with significant implications for morbidity, healthcare burden, and quality of life. This review aims to explore the epidemiology, pathophysiology, clinical manifestations, diagnosis, management, and prevention of UTIs in these two vulnerable populations. In pediatric patients, UTIs are often associated with anatomical abnormalities, vesicoureteral reflux, and immature immune systems, leading to recurrent infections and potential renal damage. In women, UTIs are highly prevalent due to anatomical and physiological factors, such as a shorter urethra, hormonal influences, and pregnancy-related changes, which increase susceptibility. The review highlights diagnostic challenges, including nonspecific symptoms in infants and the risk of asymptomatic bacteriuria in pregnancy, which requires careful screening. Advances in diagnostic tools, including rapid urinalysis techniques and molecular methods, are discussed alongside traditional culture-based approaches. Treatment strategies emphasize the importance of antibiotic stewardship to combat rising antimicrobial resistance, focusing on individualized therapy and non-antibiotic alternatives, such as probiotics and D-mannose. Preventive measures, including lifestyle modifications, immunoprophylaxis, and vaccination, are also explored .This review underscores the need for multidisciplinary approaches to address the unique challenges faced by pediatric and female populations. Enhanced awareness, early diagnosis, and evidence-based management are critical for improving outcomes and reducing complications, such as chronic kidney disease and adverse pregnancy outcomes. Future research should focus on personalized medicine, novel therapeutics, and preventive strategies.

Keywords: Urinary tract infection, Uropathogens, Escherichia coli, Diplipstick analysis, Antibiotic therapy.

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INTRODUCTION

A broad term used A to describe bacterial infection of the urethra, bladder and kidney -is a problem frequently encountered by health care providers today. And its main function is to filter blood by removing waste products and excess water. In addition to bacteria, viruses and fungi and other infectious agents that colonize the urinary tract.

Traditionally UTI'S are categorized as uncomplicated or complicated or by site Broad of infection [1].

Infections may be symptomatic or asymptomatic. Other important functions performed by the system are the normalized of the concentration of ions and solutes in the blood and the regulations of blood volume and blood pressure. Lower UTI'S include urethritis and cystitis and upper tract infections include pyelonephritis and renal abscesses. Acute infections are usually associated with a single pathogen; Chronic infections are usually polymicrobial [1].

The urinary tract is the most common site of hospital infection, accounting for more than 40% of nosocomial

infections (estimated to be 600,000 patients per year)reported by acute care hospitals. The vast majority of hospitals acquired infections are due to indwelling catheters. On average, a hospital-acquired UTI increases length of stay by one day, resulting in nearly one million extra hospital days [1].

Infectious organisms are emerging day by day through various adaptations and changes which lead to burden on global, social economics, environment and ecological factor . Infectious agents may transfer from animals to humans or disseminate from isolated groups into new populations . Knowledge towards emerging infectious organisms and mechanism of transmission is essential to prevent form spreading of diseases[2].

The economic impact is between 424 million a 451 million annually. UTI accounts for approximately eight million health care provider visits in the united states more than 100,000 hospitalizations per year are due to infections of the urinary tract.un complicated cystitis is by far the most common outpatient infection, while pyclonephritis accounts for the majority of inpatient visits. Diagnosis of UTIS accounts for an estimated 6 billion in health care expenditure [1].

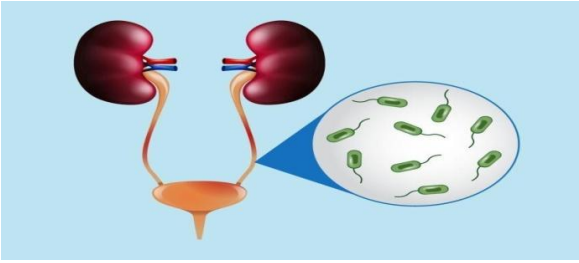

Fig 1: Urinary tract infection (UTI)-Urethritis, Cystisis, Ureteritis.

OBJECTIVE

- A review on lower and upper urinary tract parts.
- A review on effective treatment.
- A review on relive symptoms.
- A review on diagnose urinary tract.
- A review on risk factors for urinary tract infection.

PATHOGENESIS OF UTI

Urinary tract infections begin when gut -resident uropathogens colonize the urethra and subsequently the bladder through the action of specific adhesions. If the hosts inflammatory response fails to eliminate all bacteria, they begin to multiply, producing toxins and enzymes that promote their survival. Subsequent colonization of the kidneys can evolve into bacteremia if the pathogen crosses the kidney epithelial barrier. In complicated UTI'S infection by uropathogens is followed by bladder compromise, which occurs with catheterization. A very common situation is the accumulation of fibrinogen on the catheter. As a result of the strong immune response induced by catheterization [2].

Uropathogens, through the expression of fibrinogen -binding proteins bind to the catheter. Bacteria also multiply as a result of biofilm protection, and if the infection is left untreated, it can progress to pyelonephritis and bacteremia.UTI'S are the most common bacterial infection in humans world-wide and the most common hospital -acquired infection.

The spread of UTI'S is closely linked to the effectiveness of a number of strategies that uropathogens have developed to adhere to and invade host tissues. Complicating factors that are involved in the progession of UTI are biofilms, urinary stasis due to obstruction, and catheters. In contrast, sympatomatic UTI'S are commonly treated with antibiotics that can alter the intestinal and vaginal microbiota, increasing the risk factors for the spread of multi drug -resistant micro-organisms [2].

CAUSATIVE UROPATHOGENS ON UTI

UROPATHOGENIC ESCHERICHIA COLI (UPEC)

UPEC is the leading cause of UTIs and is responsible for at least 80% of community- contracted UTIs and 65% of hospital-contracted UTIs. Although UPEC strains are present in the human intestinal tract, they differ from commensal strains of E. coli in their ability to express a multitude of virulence factors that allow their transit from the intestinal tract to the urinary tract following fecal contamination of the per urethral area [2].

The host's inflammatory response leads to the rapid recruitment of neutrophils into the bladder lumen and exfoliation of infected bladder epithelial cells.

UPECs remain viable for a long time within quiescent intracellular compartments. These structures, located in the underlying transitional cells, contain some viable non-replicating bacteria (usually less than 10). These can reactivate, causing recurrent urinary tract infections. UPEC strains express a broad spectrum of virulence factors, but their ability to cause UTIs is fundamentally related to their ability to produce a number of adhesions that can facilitate adhesion under different environmental conditions. These factors are also crucial for the survival of this microorganism [2].

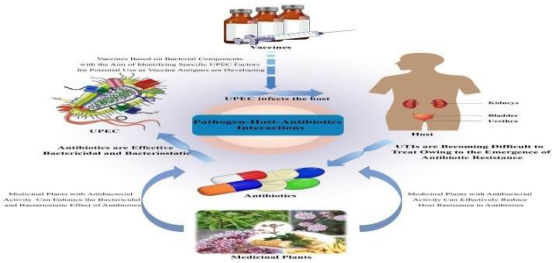

Fig 2: In UTI Pathogen host antibiotics interactions.

TYPES OF URINARY TRACT INFECTION

They are two types

1) Based on the site of infection.
   (a) Urethritis is inflammation of the ureter.
   (b) Urethritis refers to inflammation of the ureter.
   (c) Cystitis and pyelonephritis involve the bladder & kidney.
2) UTI's are further classified according to the presence of predisposing conditions for infection.
   (a) Complicated. (b) Uncomplicated [3].

DIAGNOSIS

Uncomplicated cystitis
Complicated cystitis
Acute pyelonephritis
Perinephric abscess
Urinalysis [4].

The diagnosis of a urinary tract infection (UTI) begins with a detailed evaluation of symptoms, such as frequent urination, burning during urination, cloudy or foul-smelling urine, pelvic pain, or blood in the urine. In more severe cases, symptoms like fever, chills, back pain, or nausea may indicate kidney involvement. A physical examination may reveal tenderness in the lower abdomen or flanks, particularly over the kidneys. Laboratory tests are crucial, with a urinalysis identifying the presence of white blood cells, red blood cells, nitrites, or bacteria in the urine. A urine culture is often performed to confirm the specific bacteria responsible and to guide antibiotic treatment. In complicated or recurrent cases, imaging techniques like ultrasound or CT scans may be used to detect structural abnormalities or obstructions. Diagnosis is confirmed through a combination of clinical findings, laboratory results, and, when necessary, imaging studies, ensuring accurate identification and treatment of the infection.

TREATMENT

Amoxicillin has been traditionally a first-line antibiotic for UTIs, but with the increased rate of E. coli resistance, it has become a less acceptable choice, and studies have found another antibiotic with higher cure rates, that is, trimethoprim/sulfamethoxazole. Other commonly used antibiotics to treat bacterial UTIs include amoxicillin/clavulanate, cefixime, cefprozil, levofloxacin, nitrofurantoin, fosfomycin and nalidixic acid. Introduction of antibiotics has describe the morbidity and mortality rate due to bacterial infections. But in recent years, we have witnessed an increase in resistance to antibiotics among these uropathogens. For making effective antibiotics, there is a need to understand the mechanism of mode of action of antibiotics.

These are

1. Inhibition of bacterial cell wall synthesis.
2. Inhibition of bacterial nucleic acid synthesis.
3. Inhibition of bacterial protein synthesis.
4. Inhibition of metabolic processes.
5. Inhibition of membrane function [5].

NONANTIBIOTIC TREATMENT

Fig 3: alternative methods used to treat minor urinary tract infections.

PREVALENCE

During the first year of life, the incidence of UTI is approximately 0.7% in girls and 2.7% in uncircumcised boys. In febrile infants in the first two months of life, the incidence of UTI is approximately 5% in girls and 20% in uncircumcised boys. During the first 6 months, uncircumcised boys have a 10 to 12-fold increased risk of developing UTI. In the neonatal period, UTI is more common in premature infants than term infants. After one year of age, girls are much more likely than boys to develop UTI. UTI has a bimodal age of onset with one peak in the first year of life and another peak at between 2 and 4 years of age which corresponds to the age of toilet training. It has been estimated that approximately 7.8% of girls and 1.7% of boys by the age of 7 years will have had a UTI. By the age of 16 years, 11.3% of girls and 3.6% of boys will have had a UTI. Hispanic and white children have a two- to-four fold higher prevalence of UTI than do black children. Generally, recurrence rates are 30 to 50%. Recurrence of UTI is especially common in girls. Approximately 75% of Caucasian and 50% of African American school-aged girls in the United States with UTI have at least one recurrence of UTI [6].

TREATMENT

Tabel 1: Antibiotics Commonly Used to Treat Urinary Tract Infections in Children

Antibiotic	Dosing	Common adverse effects
Amoxicillin/clavulanate (Augumentin)	25to 45 mg per kg per day. Divided every 12 hours	diarrhea,nausea / Vomiting, rash
Cefixime (suprax)	8 mg per kg every 24 hours or Divided every 12 hours	Abdominal pain, diarrhea, flatulence, rash
Cefpodoxime	10 mg per kg per day, Divided every 12 hours	Abdominal pain, diarrhea, nausea/ Vomiting, rash
Cefprozil (Cefzil)	30 mg per kg per day, Divided every 12 hours	Abdominal pain, diarrhea, elevated results on liver function test area
Cephalexin(keflex)	25to 50 mg per kg per day. Divided every 12 hours	Diarrhea,
Trimethoprim/sulfamethaxazole (Bactrim, septra)	8to 10 mg per kg per day. Divided every 12 hours	Diarrhea, Vomiting,

A Cochrane review analyzing short-duration (two to four days) versus standard-duration (seven to 14 days) oral antibiotics in 652 children with lower UTIs found no

significant difference in positive urine cultures between the therapies immediately after treatment (eight studies: relative risk = 1.06; 95% confidence interval, 0.64 to 1.76) or 15 months after treatment (10 studies: relative risk = 0.95; 95% confidence interval, 0.70 to 1.29). There was also no significant difference between short- and standard-duration therapies in the development of resistant organisms at the end of treatment. Thus, a two- to four-day course of oral antibiotics appears to be as effective as a seven- to 14-day course in children with lower UTIs. A single-dose or single-day course may be less effective than longer courses of oral antibiotics and is not recommended [10].

When the presenting symptoms are nonspecific for a UTI or the urine dipstick test is no diagnostic, there may be a delay in treatment while culture results are pending. Parents can be reassured that antibiotics initiated 24 hours after the onset of fever are not associated with a higher risk of parenchymal defects than immediate antibiotics in children younger than two years. However, delaying antibiotics by four days or more may increase the risk of renal scarring [10].

TREATMENT

Oral therapy with an empirically chosen antibiotic that is effective against gram- negative aerobic coli form bacteria (eg, Escherichia coli) is the principal treatment intervention in patients with cystitis. The first-choice agents for treatment of uncomplicated acute cystitis in women include the following:

- Nitrofurantoin monohydrate/macrocrystals
- Trimethoprim-sulfamethoxazole (TMP-SMX)
- Fosfomycin
- Considerations in antibiotic selection are as follows:
- Empiric antibiotic selection is determined in part by local resistance patterns
- Beta-lactam antibiotics (eg, amoxicillin-clavulanate, cefdinir, cefaclor, cefpodoxime-proxetil) may be used when other recommended agents cannot be used.
- Fosfomycin and nitrofurantoin monohydrate/ macrocrystals should be avoided in patients with possible early pyelonephritis.
- Clinicians may wish to limit use of TMP-SMX, to reduce the emergence of resistant organisms
- Fluoroquinolones typically are reserved for complicated cystitis
- Duration of antibiotic treatment for acute, uncomplicated cystitis in women who are not pregnant is as follows:
- TMP-SMX is given for 3 days
- Fosfomycin is given in a single dose
- Nitrofurantoin monohydrate/macrocrystals is given for 5-7 days
- Beta-lactam agents are given for 3–7-days
- The vast majority of women with UTI present on an ambulatory basis and can be treated as outpatients. Hospital admission may be indicated for some patients with complicated UTI. Complicating factors include the following:
- Structural abnormalities (eg, calculi, tract anomalies, indwelling catheter, obstruction)
- Metabolic disease (eg, diabetes, renal insufficiency)
- Impaired host defenses (eg, HIV infection, current chemotherapy, underlying active cancer).

PREVENTION

Preventing urinary tract infections (UTIs) in women involves adopting healthy hygiene practices, maintaining good hydration and addressing specific risk factors.

They are:

1. Practice good hygiene
2. Stay hydrated
3. Empty the bladder regularly
4. Choose the right clothing.15

CONCLUSION

Urinary tract infections (UTIs) significantly impact pediatric and women's health, presenting unique challenges in diagnosis, management, and prevention. In children, early identification and treatment are critical to prevent complications such as renal scarring and long-term kidney damage. In women, the high prevalence and recurrence rates underscore the need for targeted approaches, including lifestyle modifications and tailored pharmacological treatments. Advancements in diagnostic techniques, a better understanding of antimicrobial resistance, and non-antibiotic preventive strategies offer promising avenues for improved outcomes. Collaborative efforts between healthcare providers and patients, alongside a focus on individualized care, are essential to addressing the burden of UTIs effectively. Future research should prioritize exploring novel therapeutic options and optimizing prevention strategies to enhance the quality of care and reduce the overall health burden of UTIs in these populations.

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Conflict of Interest

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Informed Consent

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Author Contribution

All authors are contributed equally.

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