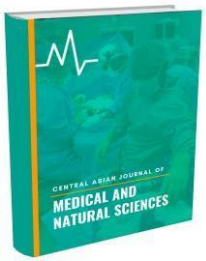

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Article

Prevalence of Urinary Tract Infections in Male and Female: A Review

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Abstract: Adults with Urinary Tract Infections (UTIs) frequently get bacterial infections that impact several urinary system components. All ages and both sexes affect with this infection. This infection, usually more susceptible to women, and has a higher prevalence compared to the men. In female the close anatomical relationship between urethra and the anus, menopause, poor personal hygiene, and pregnancy, some of the risk factors contributing to this high prevalence. Enterobacteriaceae, particularly E. coli, are typically the most common uropathogens associated with this infection, accounts for 80–90% of all isolates. Thus, this study reviews the risk factors and prevalence for urinary tract infections (UTIs) in adults. Since UTIs are a common infection and the primary cause of medical expenses, it is crucial to understand the risk factors that lead to these infections because they can act as a guide for individuals.

Keywords: Bacterial Infection, Prevalence, Urinary Tract Infection (UTI), Risk Factor, Male and Female.

1. Introduction

Anywhere in the urinary tract in which a substantial number of microorganisms are present might result in an infection known as a urinary tract infection (UTI). Infections usually results from bacterial from the digestive system ascending the urethral opening and starting to multiply (1,2). Patients with severe bacteriuria who have symptoms that could be related to the urinary tract are considered to have symptomatic bacteriuria. UTIs can also be asymptomatic. UTIs could be caused by both Gram-negative and Gram-positive bacteria, and certain fungi. Uropathogenic Escherichia coli (E. coli) is the final dominant biological pathogen.

The hallmark of asymptomatic bacteriuria (ABU) is bacteriuria devoid of traditional symptoms (3). Women are more likely to get UTIs. At least one UTI occurs in the lifetime of one out of every two people. Risk factors for prior UTIs include sexual activity, spermicide and diaphragm usage, young age at first UTI (less than 15 years old), and maternal history of UTI in young women. (4). Tampon or male condom use was linked to a higher incidence regarding UTI in women (5); using antibiotics (2-4) weeks prior was linked to an increased risk of UTI, presumably as a result of altered physiological vaginal

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flora (6). The same bacteria that result in UTIs in non-pregnant patients also cause them in pregnant patients. E. coli is the cause of 80% to 90% of illnesses (7).

Classification of UTIs:

1. Symptomatic UTIs: Infections in the upper tract (pyelonephritis) or lower tract (cystitis) are separated under this classification.
2. Asymptomatic bacteriuria: This classification is described as women without urinary symptoms who have a sustained colonization of large numbers of bacteria in their urinary system.
3. Cystitis: This classification differentiated from asymptomatic bacteriuria in afebrile women without signs of systemic illness by the existence of symptoms, like urgency, dysuria, nocturia, frequency, suprapubic discomfort, and haematuria (8, 9).
4. Pyelonephritis: This classification is characterized as severe bacteriuria with systemic disease and symptoms (rigor, pyrexia, vomiting, nausea, flank or renal angle pain) (8, 9).

2. Materials and Methods

Study Design

This review study was designed to analyze and summarize the prevalence of urinary tract infections (UTIs) in male and female adults. The study focused on identifying the risk factors and comparing the incidence rates between genders.

Data Sources

Data for this study was gathered from various peer-reviewed articles, clinical trials, and medical records that discuss UTIs. The primary sources of information included medical journals, published clinical studies, and relevant literature on urinary tract infections.

Inclusion Criteria

The studies included in this review met the following criteria:

1. Focused on adults diagnosed with UTIs.
2. Provided data on the prevalence of UTIs in both male and female populations.
3. Discussed risk factors, clinical symptoms, and microbiological aspects of UTIs.

Data Collection

The information was collected by reviewing and analyzing various medical and scientific databases such as PubMed, Google Scholar, and Web of Science. The data was then categorized based on gender, types of UTIs (symptomatic and asymptomatic), and the identified risk factors.

Analysis

The data was systematically reviewed to identify trends in the prevalence of UTIs among different gender groups. Comparative analysis was done to determine the differences in infection rates and to explore the underlying reasons for these differences. The review also examined the microbiological profile of the pathogens responsible for UTIs.

Materials

The following materials were used for the microbiological analysis of UTIs:

a. Bacterial Cultures: Samples of Escherichia coli, Klebsiella pneumoniae, Staphylococcus aureus, Enterococcus faecalis, Pseudomonas aeruginosa, Proteus mirabilis, and Candida albicans were obtained from clinical isolates.
b. Laboratory Equipment: Standard microbiological equipment, including incubators, autoclaves, and microscopes, were used for the identification and analysis of the bacterial cultures.
c. Chemical Reagents: Specific reagents such as Gram stain, MacConkey agar, and biochemical test kits were used to identify and differentiate the bacterial species.

Ethical Considerations

The study adhered to ethical standards for conducting research, ensuring that all sources of data were properly cited and that the integrity of the research process was maintained throughout the study.

This section outlines the approach taken to review the prevalence of UTIs in males and females, along with the methods used to analyze the collected data and identify key findings related to the study.

3. Results and Discussion

Clinical Features

There are specific UTI symptoms and signs that vary based on the kind of infection. Asymptomatic bacteriuria is the term used for describing a condition in which there are detectable bacteria in the urine, yet no symptoms of an infection (3). Frequency, urgency, pyuria, dysuria, hematuria, and absence of systemic illness indications are clinical symptoms and signs of cystitis. Systemic symptoms of pyelonephritis include tenderness at the costovertebral angle (CVAT; mainly on the right side), fever (>37.9 °C), flank pain, nausea, vomiting, trembling, elevated white blood cell count, chills, and, less often, cystitis symptoms (10).

Pathogenesis

Female UTIs are four times more common compared to male ones, according to sufficient reliable experimental and clinical data (11). The female urethra, which is 3–4 cm long, is found close to the rectum and vagina, two locations where enteric flora have been colonized (12). Many factors, such as the urethral meatus and the greater distance between the anus (the typical source of uropathogens), the longer male urethra, the drier environment surrounding the male urethra, and the antibacterial activity of prostatic fluid, are thought to contribute to the significant difference in UTI prevalence between women and men (13). Through the blood, lymph, or urethra, microorganisms can enter the renal system and cause damage. However, the main cause of UTIs is the introduction of microorganisms through the urethra, which only applies to enteric or intestinal bacteria (like Escherichia coli and microorganisms from the Enterobacteriaceae family). It makes a contribution to the higher likelihood of UTI in women. Furthermore, there is an increased risk of infection with bladder catheterization or instrumentation. Within 4 weeks of catheterization, nearly all patients develop bacteriuria due to the migration of bacteria within the mucopurulent space between the catheter and urethra. Some bacteria cause an early infection elsewhere in the body, which leads to a hematogenous infection. Furthermore, the pathogenicity of UT depends on the body's innate defense system (11).

Microbiology

UTIs could be caused by both Gram-negative and Gram-positive bacteria, along with specific fungi. The last major biological pathogen is UPEC. Following Proteus mirabilis, P. aeruginosa, group B streptococcus (GBS), S. aureus, K. pneumoniae, and Enterococcus faecalis, UPEC is the most prevalent bacteria causing simple UTIs (14–18).

Escherichia coli

Gram-negative Escherichia organism that is present in endotherms' lower intestines is called E. coli. Those are the rod-shaped, facultatively anaerobic bacteria (19). While most strains of E. Coli are not dangerous, occasionally food adulteration results in product recalls because specific serotypes can result in extremely serious food poisoning in the host (20). Fecal waste releases E. Coli into surrounding environment. For three days, the bacteria in fresh feces multiplies quickly in aerobic conditions before declining in quantity (21). Specific E. coli strains could cause UTIs, newborn meningitis, and gastroenteritis. It also results in acute abdominal discomfort, intermittent fever spikes, and bloody diarrhea which generally occurs within 24 hours. In rare instances, infectious strains could result in bacteremia, inflammation of the peritoneum, gram-negative pneumonia, chronic hemolytic anemia, inflammation of the breast, and thrombocytopenia, in addition to necrotizing enterocolitis (NEC) (22).

Klebsiella pneumoniae

The two common habitats of Klebsiella species, which are pervasive or ubiquitous, are surface and plants water, soil, and sewage (23). As a saprophyte, K. pneumoniae can be defined as a gram-negative bacterium which inhabits the nasopharynx as well as the digestive tract of humans. K. pneumonia is the main cause of nosocomial Klebsiella infections, pneumonia, wound infections, septicemia, and newborn septicemia (24). The urinary system is where contamination usually occurs. Klebsiella is responsible for (6-17) % of nosocomial UTIs, and the risk of infection is significantly higher in some patient populations (like those with neuropathic bladders or diabetes mellitus) (25).

Staphylococcus aureus

Gram-positive facultative aerobe S. aureus could proliferate through fermenting or through utilizing another electron acceptor. According to a number of studies, oxygen is necessary for S. aureus pathogenicity since it generates virulence factors and enables the organism to endure in harsh environment (25). It often spreads along the surface regarding the skin and the person's respiratory system. It is encouraging that nitrate and catalase have decreased. S. aureus isn't often virulent, but it could frequently lead to boils, respiratory conditions including sinusitis, and food poisoning. Through generating potent protein toxins and transmitting cell-surface proteins which bind and deactivate antibodies, disease-associated strains frequently encourage infections. S. aureus strains that generate Panton-Valentine leukocidin, such as Δ-PVL, are more virulent in their host phages. S. aureus infections are very common in workers with atopic dermatitis (26). UTIs in the general population are not frequently caused by S. aureus. In specific cases, S. aureus results in infection and ascending urinary tract colonization. Urinary tract S. aureus presence is increased by urinary tract instrumentation as well as urethral catheterization (26–28).

Enterococcus faecalis

Those are facultatively anaerobic, ovoid-shaped, gram-positive organisms. They appear in little chains or across various cells on smear in both groups. E. faecalis is catalase negative because it lacks cytochrome enzymes, such as streptococci, despite the fact that

certain strains do make pseudo catalase (29). Among their characteristics are the capacity for reproducing in 6.5% NaCl at pH 9.6, multiplying at 10 and often 45 °C, and, for the longest duration, to endure for 30 mins at 60 °C (30, 31). Enterococci are the primary cause of UTIs, particularly in hospitalized patients. Additionally, enterococcal prostatitis and perinephric abscesses were reported. No structural problems or frequent infections are seen in young, healthy females who have not had instrumentation. Under 5% of UTIs are caused by enterococci (29).

Pseudomonas aeruginosa

A common Gram-negative bacterium that has been isolated from water, plants, and the earth is P. aeruginosa. Moreover, it is an opportunistic human pathogen which infects individuals with compromised immune systems or other medical conditions. Many virulence factors, including phospholipase C, exotoxin A, and elastase, are present in P. aeruginosa. For the first time, their cytotoxic activity is used to biochemically identify them. Extracellular enzymes or secretory virulence features such as hemolysins (rhamnolipids), elastase, protease, phopholipase, pyocyanin, pexotoxin A, siderophores, and exoenzyme S are among the many virulence factors found in P. aeruginosa. Cell-related aspects including flagellum, lipopolysaccharide (LPS), pilus, alginate, and non-pilus adhesins accompany these factors. Those characteristics point to a major role in the pathogenesis of infections induced by P. aeruginosa, such as respiratory tract, keratitis, and burn (32). Woods et al. report that bacteria isolated from the UTI site exhibit much more elastase and protease production than isolates from other infection sites (33). Consequently, P. aeruginosa is the third most frequent microbe connected to UTIs brought on by catheters obtained in hospitals (34).

Proteus mirabilis

Rod-shaped and gram-negative, Proteus mirabilis belongs to the Enterobacteriaceae family of bacteria, which also includes E. coli. It produces hydrogen sulfide and is motile, lactose-negative, indole-negative, and urease positive. This is a pathogen that is typically found in the urinary tract, especially in patients who are chronically catheterized. P. mirabilis could cause two common UTIs: pyelonephritis and cystitis. It is discovered in cases of asymptomatic bacteriuria, which mainly affect elderly type 2 diabetic patients. Additionally, these infections cause bacteremia, which can progress to potentially dangerous urosepsis. Furthermore, urinary stones (urolithiasis) are caused by P. mirabilis infection. P. mirabilis accounts for 1–10% of urinary tract infections (35).

Candida albicans

A highly polymorphic fungus species, Candida albicans could transition between several vegetative growth forms in vivo in response to variations in temperature, CO2, pH, serum presence, and nutrient availability, among other environmental factors. The capability to adjust phenotypically is a crucial aspect of virulence. It facilitates invasion of epithelium, spread throughout the host, and adaptation to diverse host conditions. Moreover, it hinders immune thwart and control the host immunological response. No environmental reservoirs are known to exist. Both nosocomial infection and mother-to-child transmission are ways in which it spreads. In healthy people, Candida albicans is usually a harmless human commensal; nevertheless, in rare cases, it could lead to infections of the nails or skin and external mucosal diseases, such as oral or vaginal thrush. Moreover, it becomes harmful in hosts with weakened immune systems by resulting in fatal bloodstream as well as systemic infections, which have a 50% mortality rate. It is the

most common cause of serious fungal infections and a significant factor in nosocomial infections acquired in hospitals (36). It contributes to candiduria as well. An excellent medication for treating Candida UTIs is fluconazole. Urine contains a high concentration of flucytosine, which has a variety of anti-Candida effects. However, because it is toxic, it should be used with caution. Amphotericin B at low doses may help some patients with Candida UTIs (37).

Risk factors

1. Structural abnormality of urinary tract.
2. History of previous urinary tract infections.
3. Low socio-economic status
4. Neurogenic bladder retention.
5. Sickle cell trait.
6. Presence of renal stones.
7. Diabetes mellitus.

4. Conclusion

Women experience UTIs four times more frequently than men do.Both Gram-negative and Gram-positive bacteria, and certain fungi, could lead to UTIs. Risk factors for UTIs include a history of prior UTIs, sickle cell trait, neurogenic bladder retention, the presence of renal stones, urinary tract structural abnormalities, and a low socioeconomic status. UTI could be either asymptomatic or symptomatic.

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