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A Review on Urinary Tract Infection

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Abstract

Urinary tract infections (UTIs) are a common infection that affects women at various stages of life, with women experiencing an 8:1 higher rate than males. By the age of 24, one person in three experienced once in their life symptomatic UTI requiring antibiotic treatment. Women make up the bulk of annual doctor visits and are especially vulnerable to UTIs.

Gram-positive and gram-negative bacteria, along with certain fungi, can be transmitted through urinary tract infections. Pathogenic Escherichia is the most frequent cause of both simple and complex UTIs. Other common causes include klebsiella pneumoniae, Eter coccus fecal is, group B Streptococcus, Proteus mirabilis, Pseudomonas aeruginosa, Staphylococcus aureus, and Candida spp. A prevalent UTI pathogen in young women is S. saprophyticus. Fungal UTIs are also becoming more common, especially those brought on by Candida species and, to a lesser degree, Aspergillus species and Cryptococcus neoformans. Recurrent UTIs are defined as more than two symptomatic episodes in a six-month period or more than three symptomatic episodes in a 12-month period. The largest risk factor for recurrent UTIs in young women is the frequency of sexual activity. Risk factors include genetic, age-specific, pregnancy-related, behavioral, vulnerability, and urine catheterization variables. Urine culture, microscopic urinalysis, and dipstick urinalysis are the three primary tests used in laboratory analysis for UTIs. Clinicians can identify UTIs more precisely by adjusting the pretest probability of UTI based on urine dipstick and microscopic urinalysis results. Empirical treatment tends to be successful for women who experience dangerous urine symptoms and a high posttest likelihood; cultural confirmation may not be warranted.

Keywords: Urinary Tract Infection, UTI, Escherichia coli, Risk Factors, Diagnosis, Recurrent UTI, Antimicrobial Resistance, Women's Health, Fungal UTI, Empirical Treatment

1. Introduction

Urinary tract infections (UTIs) are one of the most prevailing infections that women live through at various points of life. Due to the arrangement of the female lower urinary tract and its proximity to the reproductive organ, UTIs are substantially more common in women than in males [1]. Urinary tract infections (UTIs) are eight times more common in women than in men. One in three women will have experienced at least one symptomatic episode by the time they are twenty-four, and between fifty and sixty percent of women admit to having at least one UTI in their lifetime [2]. This term refers to the presence of microbiological infections in the urinary system, and the next step is often the administration of antibiotic medicine. Women make up the bulk of annual medical visits and are especially vulnerable to UTIs. Potential causes for the increased incidence of UTIs in females, reaching 60% in adult females [3]. Possible reasons for the higher prevalence of UTIs in women, which can approach 60% in adult females [3]. In both men and

women, the bacteria typically form colonies near the entrance to the urinary system. Usually, they are wash out when you urinate. Infections occur when these colonies enter the bladder before urination and are not eliminated during urination. Because there is less room between the urethral entry and the bladder in women, bacteria are more likely to enter the bladder before being expelled during urination. Because the rectum and vaginal cavity are so near to the urethral entry, women are more vulnerable to bacterial proliferation [6]. UTIs are the second most frequent infection in the general population and the most common infection in hospital settings. Urinary tract infections (UTIs) are a severe problem for women, with up to one-third of them experiencing one at some point in their life.18 The newborn may experience preterm labor, pyelonephritis, or Group B streptococcal infection if treatment is not received [4]. There are two clinical categories for UTIs: basic and complex. Uncomplicated UTIs typically occur in otherwise healthy individuals without any abnormalities of the urinary system, either neurological or anatomical. There are two different kinds of infections: upper UTIs (pyelonephritis) and lower UTIs (cystitis). Conditions that impact the urinary tract or host defense, such as immunosuppression, urinary obstruction, retention brought on by nervous system illnesses, renal failure, renal transplantation, pregnancy, and foreign substances, can cause complicated UTIs [5].

2. SYMPTOMS OF UTI

Urgency: An intense need to urinate caused by an uncontrollable bladder muscle spasm. Frequency: excessive and frequent urinating the presence of bacteria in urine has been referred to as "bacteriuria"; an abundance of more than 105 bacterial colonies/mL of urine is deemed significant. When WBCs are found in the urine, it is defined as pyuria. The feeling of burning, discomfort when urinating is known as dysuria. Frequent nighttime urination caused by a bladder infection or urinary tract infection is known as nocturia. Urinary incontinence is a refusal to control one's bladder, leading to in a tiny amount of waste flowing after sneezing or laughing [6].

FIGURE NO 1. SYMPTOMS

3. CAUSES

UTIs can be implemented by gram-positive and gram-negative bacteria, some fungi also. Both simple and complex UTIs are most commonly caused by Ur pathogenic Escherichia; Klebsiella pneumoniae, Eter coccus fecal is, group B Streptococcus, Proteus mirabilis, Pseudomonas aeruginosa, Staphylococcus aureus, and Candida spp. are all known to cause UTIs [7]. A frequent UTI pathogen in younger women is

S. saprophyticus. In a very tiny percentage of women, it is thought to colonize the rectum and, to a lesser extent, the cervix and urethra. The prevalence of fungal UTIs is also rising, particularly those caused by Candida species and, to a lesser extent, Aspergillus species and Cryptococcus neoformans. According to one study, 5% of urine samples from a standard hospital and 10% of urine samples from a tertiary-level care facility tested positive for Candida spp. [8].

4. RISK FACTORS

When more than two symptomatic episodes occur within six months or more than three symptomatic episodes occur within twelve months, it is referred to as a recurrent UTI [9].

Frequency of sexual activity is the biggest risk factor for recurrent UTIs in young women [10]. Women are more susceptible to UTIs than men for reasons more than just their physical characteristics. Recurrent UTIs in women are caused by a number of additional risk factors. These are genetic, age-specific, pregnancy-related, behavioral, vulnerability, and urine catheterization variables.

There are no discernible anatomical or functional abnormalities of the urogenital system in the majority of affected women, hence it seems likely that behavioral variables possibly partially to blame for urinary tract infections [11]. risk factors, including alterations in the bacterial microbiota in the vagina, frequent sex (more than four times per week), having several partners, using spermicides that alter the pH of the vagina, not urinating after sex, vaginal douching, wearing uncomfortable underwear, poor or inadequate hygiene, and a personal or family history of childhood UTIs [12]. It has been found that poor hygiene during the menstrual cycle increases the risk of UTI and vaginitis. In underdeveloped nations, women from lower socioeconomic classes frequently wear cloth during their periods. Cotton clothing is often used by women, who rarely replace it and repurpose it after washing [13]. The act of suppressing the impulse to void and delaying voiding was referred to as delayed voiding behavior [14]. Relatively little attention has been paid to the 56 million postmenopausal women in the community who are generally healthy and between the ages of 55 and 75. Most research has concentrated on UTIs in young, healthy women and older, disabled women. In order to assess potential risk variables such as sexual activity, history of UTI, diabetes, incontinence, and estrogen supplementation, we conducted a case control study of acute, symptomatic UTI among women in this age group who were usually healthy[15]. The risk of UTI is correlated with variables such as age, parity, and gestational age. Additionally, the use of immunosuppressants, a person's financial situation, and their geographic location all have a significant role in the infection. Medications known as immunosuppressants are administered to patients following transplant surgery to prevent organ rejection. Immune suppressants are known to weaken a person's immune system, and pathogenic bacteria can more easily assault a weakened immune system. Although financial circumstances might not be a major contributing factor, 17% of pregnant women had UTIs [16]. Here are a few more risk factors:

1. Genetic factor
2. Anatomical structure
3. Altered vaginal biota
4. Blood groups
5. Pregnancy
6. Dysfunctional voiding
7. Diabetes

5. DIAGNOSIS

Urine culture, microscopic urinalysis, and dipstick urinalysis are the three primary tests used in laboratory analysis for UTIs. Clinicians can identify UTIs more precisely by adjusting the pretest probability of UTI based on urine dipstick and microscopic urinalysis results. Women who have strong urine symptoms and a high posttest likelihood are likely to benefit from empirical treatment and may not require cultural confirmation [17].

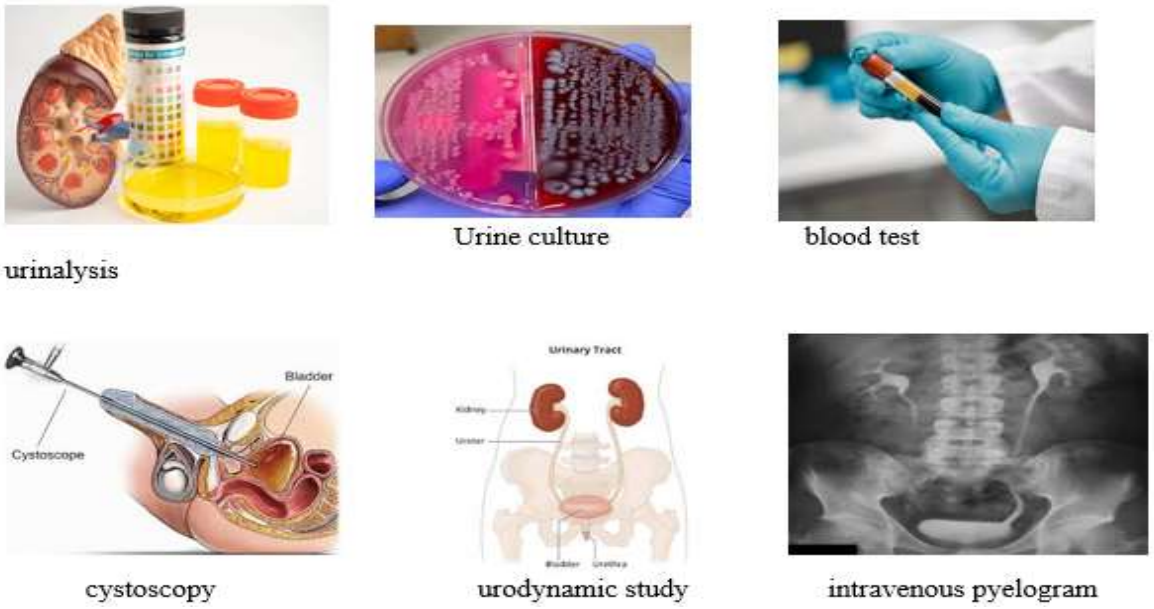

FIGURE NO.2 DIAGNOSTIC METHODS

5.1.Dipstick Urinalysis

One of the most widely utilized tools for diagnostic testing when there is clinical proof that a patient has a UTI is a urine dip stick. Most frequently used are Multisite, which may be able to detect blood, protein, leukocyte esterase, and nitrite. With a likelihood ratio of 2.6 to 10.6, the presence of nitrite raises the risk of a urinary tract infection [18].

5.2.Microscopic Urinalysis

Although microscopy might be faster and less expensive than culture, it takes more time and money to do than a dipstick test. Similar to dipstick testing, a UTI can be properly ruled in and out using a combination of microscopy for bacteriuria and dysuria. If the microscopy is negative for one of the two bacteria and positive for either pyuria or bacteriuria, the test result is once more ambiguous [19].

5.3.Urine Culture

The most reliable method for identifying the microbe that causes a UTI is a urine culture. The benchmark by which all collecting techniques are evaluated is frequently sterile procedure. Sterile collection methods are being abandoned in favor of self-collection methods where the patient controls their sample due to patient discomfort and clinical setting requirements [20].

5.4.Dip slide Method

In general practice, fresh urine samples from patients exhibiting symptoms or indicators of a potential UTI were analyzed using a dip slide, urine sediment, and nitrite test. After being inoculated, a second dip slide was sent to the hospital's microbiology lab for culture. This culture served as a benchmark. The sensitivity and specificity of the tests that were conducted were computed [21].

5.5.Enzymatic Method

The most often used enzymatic tests for identifying pyuria or bacteriuria are leukocyte esterase, glucose oxidase, catalase, and nitrate reductase (Greiss test). These tests have mostly been utilized at the bedside, in doctor's offices, in the laboratory's urinalysis department, and, more recently, in home testing. They were created to identify the presence of urinary tract infection-related enzymes. The exams are quick, simple, and reasonably priced [22].

5.6.Oxidase Method

A bacterial colony was rubbed against filter paper that had been impregnated with indophenol dye and tetramethyl-p-phenylenediamine dihydrochloride; in the positive result, the filter paper's zone turned blue or purple, whereas in the negative result, there was no color change [23].

5.7. Greiss Method

The Greiss nitrate reduction test has occasionally attracted renewed interest as a method of identifying significant bacteriuria in people. One milliliter of the Greiss reagent is added to one milliliter of urine to perform the Greiss test. A test is deemed positive if the color changes from pink to red in a few seconds. Before testing with the Greiss reagent, the urine was incubated for an hour at room temperature with 0.5 ml of a 10% potassium nitrate solution, according to a modified method described by Smith et al. that we employed more frequently in our investigation [24].

6. PREVENTION OF UTI

Although the reasons for prophylactic measures in patients preparing for urologic procedures are debatable, they serve two purposes: (1) to keep bacteria that are colonizing the periurethral region from entering the bladder, and (2) to avoid inserting a catheter into an area that is already infected [25].

6.1.Sexual Intercourse

Post-coital prophylaxis may be beneficial for women who report a direct link between sexual activity and subsequent cystitis. Cystitis cannot be avoided by postcoital voiding. Alternative forms of contraception should be recommended for sexually active women with a history of RUTIs who use vaginal spermicide or diaphragms [26].

6.2.Probiotics

Gram-positive rods known as lactobacilli are mostly facultative or strict anaerobes with a typically exacting growth requirement. By generating lactic and other acids, they contribute to the creation of an acidic environment, which is what they want. For more than a century, lactobacilli have been considered nonpathogenic members of the intestinal and urogenital floras and have not generally been linked to illness [27]. The use of lactobacilli as probiotics has been crucial in stopping harmful bacteria from colonizing the vagina. To verify the safety and efficacy of Lactobacillus vaginal suppositories against the recurrence of bacterial urinary tract infections (UTIs), a prospective clinical pilot investigation was conducted [28].

6.3.Dietary Factors, Cranberry

Products made from cranberries have the ability to prevent E. coli from adhering to primary cultured bladder and vaginal epithelial cells in biologically relevant model systems. There is a dose-dependent link to this effect. These results offer more biological plausibility and mechanistic support for the idea that cranberry products can help prevent UTIs [29].

7. TREATMENT

Individuals with diabetes mellitus, pyelonephritis, recent antibiotic usage, fluoroquinolone contraindicat

ions, and urinary tract abnormalities were not included. Women were randomized to receive either 250 mg of ciprofloxacin twice daily orally for three days, followed by a placebo for four days (93 patients in the 3-day group) or 250 mg of ciprofloxacin twice daily orally for seven days (90 patients in the 7-day group). Two days following treatment completion, the occurrence of bacterial eradication, clinical improvement, and adverse events were assessed; six weeks following treatment completion, the occurrence of reinfection or relapse was assessed [30]. Included were all randomized controlled studies (RCTs) that compared various oral antibiotic treatment durations for older women with lower urinary tract infections that were symptomatic but not complicated. We collected outcome data for older women who were part of studies with a wider age range whenever feasible. Trials having treatment durations more than 14 days, preventative trials, and patients with fever, flank pain, or aggravating conditions were not included. Preventative trials, and patients with fever, flank pain, or aggravating conditions were not included [31]. According to a randomized study conducted on women with acute uncomplicated pyelonephritis, patients treated with trimethoprim-sulfamethoxazole had a significantly lower clinical and bacteriological success rate when the infecting organism was resistant to the medication than when the organism was susceptible to it[32]. Up until recently, it was commonly known that women were particularly vulnerable to trimethoprim-sulfamethoxazole (TMP-SMX) for the bacteria that cause acute, simple UTIs. 6. E. Coli resistance to TMP-SMX (from 9% to 18%), cephalothin (from 20% to 28%), and ampicillin (from 26% to 34%) increased significantly over the course of five years, despite no changes in the distribution of uropathies. Over the course of five years, E. Coli resistance to ciprofloxacin and nitrofurantoin stayed at 1% [33]. Instead of serum levels, the concentration of the antimicrobial agent in the urine has been linked to the remission of bacteriuria in the treatment of UTIs. Every antimicrobial medication that has been authorized for the treatment of UTIs reaches inhibitory urine concentrations that are noticeably higher than serum levels. Additionally, the best long-term treatments for simple UTIs appear to be medicines like trimethoprim-sulfamethoxazole or fluoroquinolones that kill aerobic gram-negative bacteria but have less impact on the anaerobic bacteria in the vagina and feces [34]. Controlling the prevalence of UTIs and assessing the efficacy of recent advancements in alternative medicine are the goals of this study. Two well-known remedies for UTIs are cephalosporins and quinolones. Cranberry extract is the only expensive non-Indian plant-based medication. Thus, some hope has been raised by creative, alternative approaches to treatment. The treatment options included herbal-based drugs, homeopathic remedies, Ayurvedic remedies, and Unani remedies. In the future, nanoparticles might have novel, untested functions in the battle against UTIs. Medicinal plant-based nanotechnology approaches have shown promising outcomes. Thus, research on herbal remedies for UTIs, such as Ayurvedic Biology, must continue [35]. The 1940s saw the introduction of sulfonamides, the first antibiotics used orally to treat acute, simple UTIs. Nitrofurantoin, nalidixic acid, cephalexin, TMP-SMX, and amoxicillin were among the more common choices for antimicrobial therapy by the middle of the 1970s (Table 2). Fosfomycin, the fluoroquinolones, and a number of oral cephalosporins, including cefuroxime acetyl and cefixime, are recent additions to the arsenal of oral antibiotics [36]. According to clinical study, probiotics, mannose, and cranberries are the greatest natural solutions for long-term protection. Berberine and uva ursin are two botanicals that can be useful for both short-term prevention and at the earliest indication of an illness. Potassium salts can alkalinize the urine and lessen dysuria, while estriol cream and vitamins A and C have also been demonstrated to prevent UTIs [37].

8. CONCLUSION

Both healthy postmenopausal women and women in institutions frequently have bacteriuria, especially asymptomatic bacteriuria. Recurrent UTI in this population is linked to urological variables, including urine incontinence, the presence of any grade of cystocele, and post voiding residual volume, in addition to prior UTI and non-secretor status. According to certain research, bacteriuria and diabetes or sexual activity are related. It is yet unclear what part oral or vaginal estrogen, probiotics, and lactobacilli play [38]. Pee holding for extended periods of time has been shown to be a significant risk factor, and the most frequent cause of pee holding is unsanitary public restrooms. Higher self-reported UTI rates are linked to women's attitudes, behavioral traits, and urine holding [39]. The pretest risk of UTI may be somewhat increased by individual indications and symptoms. Diagnostic accuracy is greatly improved when used in conjunction with dipstick tests, particularly those for nitrites [40]. E. coli and Staphylococcus are the most prevalent bacteria implicated in the etiology of ASB and UTI in pregnant women. Better management choices for prevention, screening, and treatment of this issue are advised since the health of mothers and women forms the basis of the family and public health [41]. The likelihood of infection is roughly 50% in women who exhibit one or more UTI symptoms. Certain symptom combinations (such as dysuria and frequency without vaginal discharge or discomfort) increase the likelihood of a UTI to over 90%, hence excluding the diagnosis based only on the patient's medical history [42]. The best management strategy is still customized antibiotic prophylaxis, even if risk factors should be recognized and managed appropriately. There is insufficient data to support the widespread use of non-antibiotic preventive techniques such cranberries, vitamin C, and methenamine salts as alternatives to antibiotics [43].

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