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RISK FACTORS OF URINARY TRACT INFECTION AND ITS MANAGEMENT: A REVIEW

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Abstract

Urinary tract infection (UTI) is one of the most prevalent bacterial infections affecting individuals of all ages and genders, with a higher incidence among females due to anatomical and physiological factors. It involves infection of any part of the urinary system, including the urethra, bladder, ureters, and kidneys. Various risk factors, such as poor personal hygiene, sexual activity, urinary retention, and the use of urinary catheters, influence the development of UTI. In women, hormonal changes during pregnancy and menopause further increase susceptibility, while in men, prostatic enlargement may lead to urinary stasis. Underlying medical conditions such as diabetes mellitus, immunosuppression, and structural abnormalities of the urinary tract also predispose individuals to infection. The management of UTI involves both pharmacological and non-pharmacological approaches. Empirical antibiotic therapy is initiated based on clinical symptoms and later adjusted according to urine culture and sensitivity results. Commonly used antibiotics for uncomplicated cases include nitrofurantoin, trimethoprim-sulfamethoxazole, and fosfomycin, while fluoroquinolones or beta-lactam antibiotics are reserved for complicated infections. Supportive measures, including adequate hydration, good perineal hygiene, and avoidance of irritants, play a vital role in recovery and prevention of recurrence. In recurrent or complicated cases, addressing the underlying causes, prophylactic antibiotic therapy, and patient education are essential. Effective management and prevention of UTIs require early diagnosis, appropriate antimicrobial use and lifestyle modifications. Public awareness and adherence to preventive measures can significantly reduce the incidence and recurrence of UTIs, improving overall urinary health outcomes.

Keywords: *Antibiotic therapy, Nitrofurantoin, Perineal hygiene, Prevention, Risk factors, Urinary tract infection (UTI)*

INTRODUCTION

The urinary system is made up of bladder, urethra, and kidneys. UTIs can be most typically categorized according to the place of the infection, which may be the kidneys, urethra, or bladder. Among the symptoms that underline the importance of early diagnosis and treatment, one may distinguish frequent urination, pain during urination, and pain in the lower abdomen. The kidneys produce urine and get rid of waste in the blood. The urinary tract consists of the urine, which is collected at the kidneys, stored and discharged during urination through the urinary bladder, urethra and ureters. This system is necessary to clear the body from waste and extra fluid. Infections and overall health problem are prevented by a healthy functioning of the urinary tract. Based on data on the prevalence and incidence of the disease, there are more than 150 million UTI infections around the world every year (1). Both sexes may be infected with urinary tract infection, but due to their physiological characteristics, females are more susceptible. Pregnancy-related UTIs are complicated concerns that are yet to be fully comprehended. Most of the writers think that the search is still on the go although some have done much work in the past. Although both sexes can be affected by urinary tract infections, their physiological characteristics cause them to be more

vulnerable to the infection. UTIs during pregnancy remain a complicated and rather unrecognized phenomenon. Most of the authors have the opinion that the search continues even though some have already done much work in the past (2). Presence of more than 100,000 bacteria in one milliliter of urine and similar clinical manifestations such as cystitis indicate an infection of urinary tract. Even though UTIs may occur at all age groups, women are those who are ten time more likely to have such manifestations (3).

Depending on where the infection occurs, urinary tract infections can be classified as either bladder (cystitis), urinary tract (urethritis), or renal (pyelonephritis). UTI infections are usually caused by a variety of bacteria. Gram-positive and Gram-negative bacteria may involve including species of *Proteus mirabilis*, *E. coli*, *P. aeruginosa*, *Providencia stuartii*, *Staphylococcus epidermidis* and *Enterococcus faecalis* (4). A UTI can affect anyone, but infection rates differ depending on gender, age, and other factors associated with risk. Urinary tract infections are the most prevalent bacterial diseases that affect women (5). Ten percent of women have a chance to contract an infection each year, and sixty percent women get one at some point in their lives. Most people who have infections are somewhere between the ages of 16 and 35. Almost half of individuals have recurrences within a year (6).

THE ANATOMY OF THE URINARY TRACT SYSTEM

The urinary system consists of the kidneys, ureter, bladder, and urethra infections of the urinary tract UTIs are first described as lower and upper, depending on the anatomical location of emergence of infection. The upper urinary tract is found in the kidneys and ureters, whereas the lower urinary tract is found in the Bladder, and urethra. Kidneys are used to filter the blood and get rid of the waste, hence the production of urine. The urine is emptied out of the kidneys and collected before being emptied out through the process of elimination through the urinary system which consists of the bladder, urethra and ureters. Along with flushing and eliminating waste products out of the body, the urinary system keeps the blood pressure, ions, water, calcium, and pH within equilibrium (7).

URINARY TRACT INFECTIONS (UTIS)

UTIs are estimated to cause 400 million infections and billions of dollars in medical expenses and any infection of the kidneys, bladder, or urethra. Living and non-living factors can cause urinary tract infections. Even though *Klebsiella, Enterococcus, Pseudomonas*, *Staphylococcus* and even yeast, such as *Candida* genera can be causative agents of UTI, Uropathogenic *Escherichia coli* is the most related to urinary tract infections. UTIs can affect both men and women, as well as healthy and immunocompromised patients. However, certain patient characteristics, like being female, having a history of UTIs, or having a recurring urinary catheter, increase the risk of illness (8).

COMMON SIGNS AND SYMPTOMS OF URINARY TRACT INFECTIONS

The presence or lack of symptoms can determine whether both asymptomatic and symptomatic UTIs are possible Therefore, symptoms help with the diagnosis in young, healthy women. Youngsters are less likely to get sick. Cystitis, a condition which affects the bladder, is commonly referred to as a bladder infection. It causes the symptoms like decrease in pelvic pressure, urinary urgency, dysuria, or painful urination, nocturia or night time urination and polyuria, or frequent micturition.

It is believed that the most common form of cystitis in females is traumatic cystitis, which causes bladder bruises. Based on its cause and method of treatment, cystitis is further divided into several groups. This is often followed by bacterial cystitis. An acute urinary tract infection is another name for pyelonephritis, a kidney disease. Another name for it is "pyelitis". In extreme cases, "pyonephrosis," or the accumulation of pus around the kidneys, happens. In accumulation to signs of a lower urinary tract infection, pyelonephritis can also manifest as fever and flank pain. Urinary tract infections only show up as a high fever in young children, and they might be hard to spot in older adults. Thus, it is recommended to conduct a urine culture analysis (9).

URENARY TRACT INFECTIONS (SYMPTOMATIC AND ASYMPTOMATIC)

Both symptoms and asymptomatic UTIs are brought on by bacteria that grow and proliferate in the urinary tract. Urinary tract infection-causing bacteria can either develop asymptomatically or show symptoms. Urinating blood, burning when urinating, lower abdominal pain even when passing small amounts of urine, frequent and intense urges to urinate, and stronger-than-normal urine for both symptomatic and asymptomatic individuals and strong odor of urine are the signs of urinary tract infections (UTI). Symptomatic UTIs are more prevalent than asymptomatic ones, according to UTI data (10).

COMMON RISK FACTOR FOR INFECTION OF THE URINARY TRACT

Numerous risk features are linked to urinary tract infections, including those pertaining to sexual and reproductive health, medical conditions, and lifestyle and behaviors issues, utilization of antibiotics and resistance factors, the immune system, chemical, biological, hereditary, and allopathic elements, in addition to external and environmental elements (2).

URINARY TRACT INFECTIONS AFFECTED BY ANATOMICAL FACTORS

UTI is an illness that impacts any part of the urinary system. The urinary system consists of urinary tract, kidneys, ureters, urinary bladder and urethra. The lower urinary tract (bladder and urethra) is the place where most infections happen. Women are more likely to have a UTI than males. A bladder-only infection can be challenging and uncomfortable (11).

However, serious health problems could result if a urinary tract infection extends to the kidneys. Because women's urinary tracts are shorter than men's, pathogens require to travel less distance to reach the bladder, increasing the risk of infection (11).

IMPACT OF PHYSIOLOGICAL FACTORS ON URINARY TRACT INFECTIONS

Physical causes of urinary tract infections include immunological suppression, hormonal fluctuations, and urinary stasis. Physiological factors significantly contribute to the development and progression of urinary tract infections (UTIs). Hormonal fluctuations, such as those experienced during pregnancy or menopause can increase the risk of UTIs. Anatomical characteristics, like shorter urethras in women or urinary tract abnormalities, can also facilitate bacterial entry and growth. Additionally, bladder function issues, such as overactive or underactive bladder, can lead to urine retention, further increasing the risk. Individuals with compromised immune systems, such as those with diabetes or HIV/AIDS, are also more susceptible to UTIs. Understanding these physiological factors is crucial for identifying high-risk individuals, developing targeted prevention strategies, and creating effective treatment plans to mitigate the impact of UTIs (12).

PHYSIOLOGICAL CHANGES OF URENARY TRACT DURING PREGNANCY

Healthy women are at risk for severe urinary tract problems due to physiological changes that occur during pregnancy. Pregnancy-related physiological changes have been identified by researchers as one of the primary causes of UTIs. The primary causes of changes in the urinary tract during pregnancy are hormone-related, mechanical, and physiological changes (12).

ROLE OF BEHAVIOURAL AND LIFESTYLE FACTORS IN URINARY TRACT INFECTIONS

There are other factors, such as vaginal pressing, wearing fitted underwear, wiping procedures, deferred voiding habits and voiding habits before and after coitus have been thought to increase a woman's risk of invasive urinary tract infection (RUTI). Two typical examples of conventional practices that are no longer considered as independent risk factors are diet and water intake. However, genital hygiene practices that were associated with a reduced UTI rate include frequent coitus, post coitus urination, bathing, changing of clothes frequently, washing of genital prior to and following coitus, and washing of sexual

organ in backward and forward directions (5). High levels of family disruption, mental illness low income, anxiety, depression, insufficient water intake, low level of education, anemia, catheterization, poor personal hygiene, inability to access condoms which do not contain spermicidal, and inability to access the appropriate healthcare system are other risk factors (13).

THE EFFECT OF FEMININE HYGIENE ON URINARY TRACT INFECTION

Numerous factors, including personal tastes as well as social and cultural issues, influence feminine hygiene practices. Regular cleansing of the uterus is essential to prevent vaginal douching that has been shown to have no health benefits at all and can alter the normal flora of the vagina, exposing the body to more susceptibility to infection and accumulating of vaginal waste, sweat, urine and feces that all contribute to the development of an unpleasant body scent called odor. Vaginal cleaning can be a beneficial addition to medical treatment, even though it is not intended to treat infections. Despite this, there is now more personal hygiene products on the market designed to help people manage their odors and stay clean (14).

EFFECT OF DIABETES ON URINARY TRACT INFECTIONS

High blood sugar levels associated with diabetes, a metabolic disorder, can have catastrophic consequences. There is sufficient evidence to imply that diabetes contributes to UTI, and research studies have demonstrated the significance of diabetes in relation to UTI. Women with diabetes have a higher risk of UTIs than women without the disease. It is well documented that infections begin as asymptomatic UTIs and develop to symptomatic bacteriuria. Studies have demonstrated negative consequences of asymptomatic UTIs and their connection to kidney abnormalities when therapy is not administered (15).

MEDICAL PROCEDURE EFFECT ON URINARY TRACT INFECTION

Invasive microbes are usually connected to the complex pathology of Cather Associated Urinary Tract Infection (CAUTI), the medical procedure, the intra-procedural therapeutic device, and the host. The interaction between the catheter, the environment of the urethra and the pathogenic microorganism is dependent on great number of factors, including the technique of catheterizing, the history of the patient, the state of his or her urinary system, the kind of microbes present in the urine, the substance properties of the catheter and the surface of catheter. The introduction of catheterization in the progression of CAUTIs is regarded as the initial step since microorganisms can enter the urine tube through the urethra and further into the bladder. Besides the risk of pathological contamination of the catheter surface, the catheter in the course of the procedure can lead to mechanical trauma and immunological response that can contribute to the pathogenic adhesion and colonization (16).

THE IMPACT OF HOSPITAL-ACQUIRED INSTRUMENTS ON URINARY TRACT SYSTEM

Poor diagnosis may cause urinary tract infection which is the most common hospital acquired infection. The orderly operation of the urinary system is due to the lower and upper tract that is known to perform numerous regulatory roles such as the production and release of urine. The pathogen lead to infection by spreading into the urinary tract most often by the urethra (5).

HEREDITARY FACTORS INFLUENCING THE UTIS

It is known that urinary tract infections have a genetic component. Numerous studies have connected genetics to urinary tract infections. Women are more likely to inherit recurrent UTIs. People who get UTIs often are more susceptible to *Escherichia coli* binding, which has been proven. It affects the urinary and vaginal mucosa in addition to the buccal mucosa and it may be caused by genetic differences in mucosal traits rather than environmental changes (17). Recessive and non-secretor phenotypes are associated with an increase in the density of urinary epithelial receptors that can bind to bacterial adhesions (5). In a community study of women, recurrent UTI and pyelonephritis were consistently and significantly linked to a history of UTI in female relatives. A higher risk of infection was linked to stronger family history indices,

indicating a genetic component that increases susceptibility to these infections. Another study found that six of the 14 genes analyzed in humans, TLR2, TLR4, and HSPA1B, CXCR1, TGF-β1 were associated with an increased risk of recurrent UTIs (18).

IMPACT OF AGE ON URINARY TRACT INFECTIONS

In women, the most significant age specific risk factor regarding UTI is estrogen. Female bodies undergo significant changes that increase the risk of urinary tract infections (UTIs). Older adults, particularly women, are more prone to UTIs due to hormonal changes, weakened immune systems and age-related changes in the urinary tract. Postmenopausal women are at higher risk due to decreased estrogen levels, which can lead to thinner, drier tissues in the urinary tract, making it easier for bacteria to grow. In men, an enlarged prostate gland can cause urinary retention, increasing the risk of UTIs. Other factors that contribute to UTIs in older adults include weakened bladder muscles, decreased mobility, and underlying medical conditions like diabetes or kidney problems. UTIs in older adults can be challenging to diagnose, as symptoms may be atypical, such as confusion or delirium, rather than the classic symptoms of painful urination or frequent urination (19).

IMPACT OF PREGNANCY ON URINARY TRACT INFECTIONS

UTIs are independently associated with pregnancy. Pregnant women are more likely to get upper urinary tract infections like Asymptomatic Bacteria (ABU) than non-pregnant women, because of pregnancy-related psychological changes which raise the risk of ABU (5). When a pregnant woman has a fetal infection with the group B *Streptococcus* bacteriuria, the genital tract may become colonized. It significantly raises the risk of UTIs. Additionally, it has been proposed that diabetes, sickle cell diseases, anatomical abnormalities of the urinary tract, advanced age, and a woman's lower socioeconomic status are factors linked to an increased risk of these infections during pregnancy (20). Pyelonephritis develops in 25–40% of pregnant women with untreated bacteriuria. ABU is more common in pregnant women, and if treatment is not received, it can result in pyelonephritis. One of the causes of neonatal death is believed to be pyelonephritis globally. UTIs are the most communal infection that requires medical attention during pregnancy, and asymptomatic UTIs are the primary cause for concern. Asymptomatic UTIs are thought to affect 2% to 10% of pregnant women globally. Preterm birth, low birth weights from caesarean sections, and pre-eclampsia are among the serious outcomes of upper urinary tract infections during pregnancy (21).

IMPACT OF BACTERIA ON URINARY TRACT INFECTIONS

Bacteria that emerge from the intestinal or vaginal mucosa cause most of both lower and upper urinary tract infections in females. The most prevalent pathogens from the intestinal and vaginal flora are resident facultative anaerobes and gram-negative bacteria. About 85% of UTIs are caused by *E. coli*, 10% by *Staphylococcus saphrophyticus*, and the remaining 5% by Enterobacteriaceae species, *Proteus*, and *Klebsiella (5). E. coli* is the most frequent uropathogen implicated in community-acquired UTIs because it is a part of the normal flora of the intestines of humans, which facilitates its colonization of the urinary tract. *Pseudomonas aeruginosa* is one of the recently identified infectious agents that can cause UTIs in the general population; it is estimated that 10% to 15% of cases are caused by this bacterium. *S. saphrophyticus* is thought to be the most common Gram-positive bacterium that causes urinary tract infection (22).

EFFECT OF ANTIBIOTIC USE ON URINARY TRACT INFECTIONS

Urinary tract infections (UTIs) account for most reported public infections and are the leading cause of antibiotic use globally. Bacteria that are resistant to a small number of antimicrobial agent classes make up the most organisms that are resistant to drugs (MDRO). Since the discovery that *E. coli* is unaffected to sulfamethoxazole-trimethoprim on a global scale, the use of cephalosporins and fluoroquinolones, such as antibiotics, has improved. Enterobacteriaceae that express gram negative wider range beta lactamases are increasingly problematic because of resistance to antibiotics and the possibility of sev ere, difficult infections (23). The hard treatment issue of antibiotic resistance has be fallen *Escherichia coli*, the most regular

component of the Enterobacteriaceae family associated with infection disease in human. Several studies on the antibiotics amoxicillin (AMZ), fluoroquinolones (FQs), clavulanic/amoxicillin acid (AMC), and trimethoprim-Sulfamethoxazole (SXT) have reported the patterns of antibiotic resistance in this microorganism that were discovered in clinical isolates. Furthermore, several publications have looked at and explained the complex mechanisms underlying antibiotic resistance in *E. coli*. (24).

IMPACT OF UROPATHOGENESIS AND VIRULENCE FACTORS ON URINARY TRACT INFECTIONS

The gastrointestinal tract, which is home to both the bacteria *P. mirabilis* and *E. coli*, is most likely the source of urinary tract infections. Majority of UTIs are ascending infections. Not all *E. coli* strains can cause UTI. Uropathogenic a specific group of extra-intestinal pathogenic bacteria is *E. coli* (25). However, it appears that every strain of *P. mirabilis*, regardless of isolate origin, can infect the UTI (26 Toxic production, metal acquisition, motility and adherence are all common uropathogenic *E. coli* and *P. mirabilis* pathogenesis strategies. According to this article, a virulence factor is any protein (including a toxin) or protein or macromolecular structure that, though not required to be virulent, gives some competitive advantage to infection, and a macromolecular structure (like a flagellum or fimbria) that enhances the pathogen's capacity to cause disease. Each pathogen has unique characteristics that set it apart from the others. For example, uropathogenic *E. coli* can form intracellular bacterial communities, and *P. mirabilis* can produce urease. These infectious processes were revealed following years of study by multiple scientists (25).

DIFFERENT DIAGNOSIS TYPES FOR URINARY TRACT INFECTION

The most significant and concerning global health issue is thought to be the identification of uropathogens. Much work is being done to detect, monitor, and measure uropathogens in a timely manner. If urinary tract infections are not identified in their early phases, they may have serious health effects. UTIs can be recognized by examining the culture of bacteria in the patient's urine. A free urine sample is generally regarded as a positive indicator of a symptomatic UTI if the bacterial count is higher than 10^5 cfu/mL. Conventional methods and advanced established techniques include both culture and non-culturing techniques, PCR, ELISA, and isotherm micro calorimetry (27).

NON-CULTURAL METHOD

The urine dipstick method is the most common method of UTI diagnosis. This technique utilizes Mult six, which can possibly indicate the presence of nitrate, a metabolic byproduct of specific UTIs, leucocyte esterase, blood (as an indicator of inflammation), etc. The sample has leucocyte esterase or nitrate, which predisposes the occurrence of a UTI, the dipstick method of blood and protein, however, is sensitive and specific with low sensitivity and specificity and is deceptive when it comes to identifying UTIs (29).

CULTURE METHOD

It belongs to the oldest methods of the identification of microorganisms. The different types of microbes in this need varying supplement and growing media. Routine urine cultures are plated using the calibrated loops of the semi-quantitative approach. This technique yields the number of colony-forming units per milliliter as well as information on the isolated colonies for identification and antibiotic sensitivity testing. Usually, Mac Conkey agar and blood agar are used as culture media (30).

CARE FOR INFECTIONS IN THE URINARY TRACT UROLOGICAL EVALUATION

Urinary tract infections in recipients of renal transplants require a comprehensive urological assessment. During this assessment, any structural anomalies or disruptive circumstances that might be the source of the UTI are found and treated using imaging methods and referral to urology doctors. By detecting and eliminating these issue, medical professionals can reduce the chance or reoccurring infections and issues that may compromises the functionality and viability of the new kidney transplanted (31).

ANTIBIOTIC MEDICATION

The timely start of effective and targeted antibiotic therapy is one of the most crucial parts of treating UTIs in kidney transplant recipients. For initial treatment, intravenous injections are commonly used to ensure reliable and efficient medication delivery. Sensitivity tests and urine culture results can assist identify the organism and its susceptibility profile, which can change the antibiotic decision. Treatment should be customized to the causative organism's susceptibility pattern in order to eliminate the infection (32).

CURRENT INSPECTION

Complex UTIs, particularly those involving pyelonephritis, may require hospitalization. Hospitalization provides the opportunity for intensive treatment, including intravenous antibiotics and fluid resuscitation, to treat severe infections. The detection and treatment of these issue can help medical practitioners reduce the risk of any recurring infection and issue that may compromise the functionality and fitness of the transplant kidney, the graft's performance must also be regularly monitored while the patient is in the hospital. To maximize results, inpatient care enables close monitoring and therapy modification (33).

MEDICAL ASSISTANCE

In some cases, urinary tract infections in patients of kidney transplants may require surgery. This is especially true if there are obstructive uropathies, which are chronic problems that don't go away with just antibiotics. Surgery may be necessary to clear blockages, drain abscesses, or fix anatomical abnormalities in order to address the fundamental problems and prevent new infections (31).

EMPIRICAL ANTIBITIC MEDICATION

Antibiotic medication is one of the most crucial initial therapies for UTIs in kidney transplant recipients. This approach involves initiating antibiotic treatment immediately while awaiting urine culture findings. Commonly utilized empirical treatments are antibiotics that offer protection against a variety of uropathogens, such as ceftriaxone ciprofloxacin or levofloxacin. Though, since resistance can differ by patient population and region, it is crucial to understand that the Local resistance patterns and the patient's particular requirements should both be taken into consideration when choosing empirical antibiotics. Tailoring empirical therapy to local resistance profiles is essential to maximizing its effectiveness (34).

ANTIBIOTIC SUSCEPTIBILITY TESTING

The treatment plan should be modified based on the pathogen's susceptibility profile when the urine culture results are obtained. To ensure focused therapy, this stage chooses antibiotics to which the causative bacteria are sensitive. By optimizing the course of treatment, medical professionals can reduce the likelihood of antibiotic resistance development and increase the likelihood that the urinary tract infection will resolve successfully (35).

PRE-EXISTENCE SCREENING FOR UTIS

The pre-transplant evaluation process must include thorough screening for pre-existing UTIs in recipients of renal transplants. It is crucial to identify and treat any current UTIs as soon as possible for several reasons. First, infections that go untreated can cause issues during and after transplantation. Second, they might make the transplanted kidney surgery more prone to infection. Both the organ and the patients that were transferred are safeguarded and the chance of difficulties is reduced by treating pre-existing UTIs before the procedure (36).

UROLOGICAL EVALUATION

Before transplantation, a detailed urological assessment should be done to detect anatomy aberrations in the urinary tract. Possible disorders that can be treated prior to a donation include urethral

structure. Correction of these abnormalities enhances the long-term success of the graft by decreasing the likelihood of urinary tract infection and other complications that would occur following a transplant (37). Urinary tract infections remain a major concern among renal transplant recipients. Female sex, advancing age, and poor glycemic control are important risk factors for the development of UTIs in this population. Additionally, a high level of resistance to commonly used antibiotics, particularly ampicillin and quinolones, has been observed in renal transplant recipients (38).

ASSESSMENT OF COMORBIDITIES

An important part of the pre-transplant assessment would be investigating comorbidities in the medical history of the recipient that can increase her risk of UTIs. Individuals with ailments such as diabetes that may affect immunity and lead to easy susceptibility to infections should be guided appropriately before transplantation. Healthcare workers can mitigate the post- transplant UTIs through addressing comorbidities and improving the general health of the recipient (31).

IMMUNOSUPPRESSION RISK ASSESSMENT

It is significant to select an immune suppressive regimen at the pre-transplant stage. Since, it can influence risk of urinary tract infection. To lead this risk without increasing graft function and minimize the risk of graft denial, medical practitioners ought to take a measure of them. UTIs risk profile of an immunosuppressive regimen and modify as required. The recipients maintaining this balance is what determines health following the transplant and overall success of the transplant (36).

ASEPTIC TECHNIQUES

Aseptic urinary tract and surgical site procedures are also necessary in a renal transplant to avoid infection of the kidney transplant. Such practices include hand hygiene, sterilization surgical instruments, and sterile operating room. To ensure the efficient success of the transplant and long-term well-being of the recipient, medical staff members are required to follow the principles of aseptic to reduce the chance of infection transmission throughout the procedure (39).

URETERAL REPLANTATION

The surgery requires careful techniques, as the patient of the donor kidney is being joined to the bladder of the new patient through a procedure called ureteric replantation. UTIs and urine stasis may result during ureteral restrictions or obstructions that can be prevented through attention to details. To maintain the integrity of the urinary tract, the surgical team should ensure an anastomosed urinary tract with the minimum chance of complications and free of tension (40).

PROPHYLACTIC ANTIBIOTICS

Preventative antibiotics are one of the effective methods that can be used to reduce the risk of severe post- transplant urinary tract infection during surgery. To ensure that agents that are chosen will be effective against most of the likely pathogens, it is important to consider local resistance patterns when selecting antibiotics to use in prophylaxis. Prophylactic antibiotics improve the patient outcome and lower the need of post- transplant therapy and prevent infections that may complicate early success of the transplant (41).

CATHETER SERVICE

Minimizing the use of catheters for urinary purposes and adhering to sterile catheter installation and maintenance procedures are necessary to lower the risk of catheter-associated UTIs. Urine catheters should only be used temporarily and when clinically necessary to prevent potential pathogens from developing in the urinary tract. By adhering to strict prevention of infections prescriptions during placement of catheters and maintenance, the risk of catheter- related UTIs can be also minimized (42).

INFLUENZA AND PNEUMOCOCCAL

It is important to encourage pneumococcal and influenza vaccination against infection in renal transplant patients. UTIs can be increased by influenza and pneumonia due to the systemic conditions caused by these infections. Vaccination of the transplant recipients against these pathogens will allow the healthcare provider to minimize the risk of systemic infection that may put them at risk of UTIs and other adverse effect (43).

VIRAL VACCINATION

Vaccination against certain viruses, e.g. CMV, hepatitis B, and hepatitis C, should be considered. Such immunization can also indirectly decrease the incidence of UTIs by preventing systemic viral infection, the effect of which can spread to the urinary tract. By avoiding these viral infections, the transplant recipient's susceptibility to UTIs can be reduced and their overall health and immunity maintained (44).

VACCINATION IN SERONEGATIVE RECIPIENTS

To prevent CMV infection, recipients of renal transplants who are CMV-negative and get an organ from a donor who is CMV-positive may qualify for post-transplant prophylaxis or preemptive medication. CMV infections can lead to UTIs, viral transmission, and other problems. The choice of a prophylactic or therapeutic strategy should be made according to clinical guidelines, and the unique risk profile of a recipient must be considered (45).

VACCINATION AND IMMUNOMODULATORY TREATMENTS

Immuno-modulatory therapy and vaccination decisions must take transplant recipients' immunosuppressive regimens into account. Certain medications used in immunosuppressive treatment may hinder the growth of defensive immune responses to vaccines. Each patient's circumstances should be carefully evaluated by healthcare professionals, who should consider whether vaccination is necessary as well as any potential effects of immunosuppressive drugs on vaccine effectiveness (46).

MEDICATION OF THE URINARY TRACT INFECTIONS

Despite amoxicillin's long history as a first-line treatment for UTIs, studies have revealed that the combination of trimethoprim and sulfa has higher rate of cure than amoxicillin and due to the rise in *E. coli* resistance. Bacterial UTIs are also commonly treated with antibiotics like amoxicillin/clavulanate, cefixime, ciprofloxacin, levofloxacin, nitrofurantoin, fosfomycin, and nalidixic acid. Since the invention of antibiotics, the rate of morbidity and mortality from bacterial infections has decreased. But in recent years, we have observed an increase in antibiotic resistance in these uropathogens. Developing effective antibiotics requires an understanding of how they function. Antimicrobial drugs work in few main stages (47).

The suppression of bacterial cell wall synthesis is one of the stopping bacteria from producing nucleic acids, stopping bacteria from producing proteins, inhibition of metabolic processes and inhibition of membrane function.

NON-ANTIBIOTIC MEDICATIONS

Although simple, minor infections usually go away on their own, UTIs can be effectively treated with antibiotics. In such mild cases, people can try alternative methods to accelerate the healing process instead of using antibiotics. UTIs can be prevented and treated through the proper hydration, i.e. drinking plenty of water and avoiding beverages that irritate bladder, such as alcohol and caffeinated beverages. Water helps the body get rid of waste while preserving vital nutrients and electrolytes. Water consumption speeds up and dilutes urine, making it more difficult for bacterial infections to infect the urinary organs (48). Further, urinary incontinence influenced by age, parity, mode of delivery, infections and effects of menopause on females (49).

CONCLUSION

In conclusion, urinary tract infections (UTIs) are a significant health concern, and understanding the risk factors is crucial for effective prevention and management. By recognizing the demographic, medical

and lifestyle factors that contribute to UTIs, individuals can take proactive steps to reduce their likelihood of developing infections. Effective management of UTIs involves a combination of medical treatment, lifestyle modifications and preventive measures. By adopting strategies such as good hygiene practices, adequate hydration, and stress management individuals can alleviate symptoms, prevent recurrence and reduce the risk of complications. Furthermore, proper diagnosis and treatment are essential to ensure effective care and prevent long-term damage. By prioritizing urinary health and taking a proactive approach to prevention and management, individuals can reduce the impact of UTIs on their quality of life. Ultimately, awareness, education, and collaboration with healthcare providers are key to mitigating the risks associated with UTIs and promoting overall urinary health. By working together, we can reduce the burden of UTIs and improve health outcomes for individuals affected by these infections.

Conflict of interest:

There is no conflict of interest for the author.

Authors' contribution:

FK Conceptualized the review topic; MKT Supervised the study and provided overall guidance; IT Coordinated the review process; SK Performed the literature search; MB Contributed to data compilation; SA Assisted in manuscript drafting; MAK Reviewed and organized the references; IA Contributed to critical analysis; NR Assisted in structuring the manuscript; MF Reviewed the management-related literature; ZB Contributed to formatting and technical editing; MHK Critically revised the final manuscript.

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