

Role of Family Physician in Diagnosis and Management of Urinary Tract infection in PHC

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Abstract

Background: Urinary tract infection is a rather common disease, especially in the primary care setting. The role of the family practitioner is critical in identifying clinical symptoms. Family practitioners should have high clinical thinking in order to provide the best management plan and reduce the undiagnosed rate and recurrence of this disease. **Objectives:** We wanted to review the studies relevant to pathophysiology, clinical features, diagnosis, management, and prognosis in urinary tract infection, as related to the family physician setting. **Methodology:** PubMed database was used for articles' selection, and the following keywords were used in the mesh: "Urinary Tract Infection" [Mesh]; and "Evaluation"[Mesh] or "Management"[Mesh] or "Diagnosis"[Mesh]. **Conclusion:** Currently, understanding clinical presentation, management options, and referral criteria by the primary care physicians should play an important role in urinary tract infection control. Large infectious focus is the main pathophysiological mechanism behind the disease, and it may overlap with other diagnoses. The burden of repetitive visits and the yearly cost is noxious to patients, health organizations, and the general community. The adequate antibiotic regimen should be prescribed according to the condition of the patient and is it complicated or non-complicated; as this would prevent future episodes from occurring and development of resistant organisms.

Keywords: Urinary tract infection, family physician care, primary health care, diagnosis

INTRODUCTION

One of the most commonly seen diseases in the primary health care setting is urinary tract infections (UTIs), which is defined as any infection residing within the urinary tract. Both gram-positive and gram-negative bacteria can cause these types of infections [1]. Globally, approximately 150 million people are affected by UTI each year. The clinical visits to the family physicians (in the US alone) were estimated to be nearly 10.5 million [2, 3]. With a prevalent disease like this, the health care costs for these patients is high, along with the significant morbidity this disease carries. Urinary tract infections are seen more frequently in females. They are so commonly seen that around 50% of all women will have a UTI in their lifetimes; with up to 25% having recurrent UTI [4]. The family physician's role is to identify, treat and follow these cases up. This is because many complications are associated with the disease, and it has a high chance of recurrence. Variable new studies and approaches to management, especially due to the alarming levels of antibiotic resistance in the population, the family physician now has an integral role and is required to be

updated on this common ailment. In this paper, we will review the studies relevant to pathophysiology, clinical features, diagnosis, management, and prognosis in urinary tract infection. The disease is known to affect all age groups with a repetitive pattern and modulation difficulties each

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time, because of a large spectrum of pathologic sources, ranging from conditions that are relatively easy-to-treat to fatal cases [5]. As the urology specialists set the current path of management, the role of family physician becomes more important, in order to simplify and communicate all the available management options to his patient, leading to better compliance and overall outcome. In this paper, we will be reviewing pathophysiology, clinical features, diagnosis, and management aspect of UTI with special focus on the primary physician setting considering the prognosis and management plan.

METHODOLOGY

PubMed database was used for articles' selection, and the following keywords were used in the mesh: "Urinary Tract Infection" [Mesh]; and "Evaluation"[Mesh] or "Management"[Mesh] or "Diagnosis"[Mesh]. The articles were selected based on the following criteria: UTI evaluation, UTI management, diagnosis and prognosis, and UTI in the family physician setting. Exclusion criteria were all other articles, which did not have one of these topics as their primary endpoint, or repeated studies, and systematic reviews or meta-analysis.

DISCUSSION

Urinary tract infection describes an infection in any site of the urinary system from the bladder to the kidney. The main pathogens for such infections are bacteria (both gram-positive and gram-negative), however, fungal infection is seen in some cases as well. UTI can be classified clinically into complicated and uncomplicated. In uncomplicated UTI, the structural, functional, and neurological components of the urinary tract do not have any abnormalities, but complicated ones will have an abnormality in any of these components. Furthermore, another division of these infections is into an upper UTI (pyelonephritis, and affecting kidney), and the more common lower UTI (cystitis, and affecting bladder). These classifications have importance regarding the risk factors, complications, and common pathogens in each type. The evolution of the antibiotics has helped a lot in controlling the disease, however, due to the bacterial characteristics and antibiotic resistance, the prevalence and complications of the disease are still high [5, 6].

Pathogens:

The most common identified cause is uropathogenic *Escherichia coli* (UPEC) in both complicated (75-95%) and uncomplicated infections (65%) [7]. Other pathogens that are prevalent in uncomplicated infections include *Klebsiella pneumoniae*, and *Staphylococcus saprophyticus*. On the other hand, in complicated infection *Enterococcus* spp., *K. pneumoniae*, and *Candida* spp. are prevalent (see **table 1** for a more complete list of pathogens). Moreover, nosocomial UTI pathogens include *Enterobacter*, *Citrobacter*, *Serratia*, *Pseudomonas*, *E faecalis*, *Staphylococcus*, and *Candida* [8].

Table 1: Common causative pathogens of urinary tract infections (UTI)

| Type | Pathogens (in decreasing order of prevalence) |
|-------------------|--|
| Uncomplicated UTI | 1. UPEC |
| | 2. <i>Klebsiella pneumoniae</i> |
| | 3. <i>Staphylococcus saprophyticus</i> |
| | 4. <i>Enterococcus faecalis</i> |
| | 5. group B <i>Streptococcus</i> (GBS) |
| | 6. <i>Proteus mirabilis</i> |
| | 7. <i>Pseudomonas aeruginosa</i> |
| Complicated UTI | 1. UPEC |
| | 2. <i>Enterococcus</i> spp. |
| | 3. <i>K. pneumoniae</i> |
| | 4. <i>Candida</i> spp. |
| | 5. <i>S. aureus</i> |
| | 6. <i>P. mirabilis</i> |
| | 7. <i>P. aeruginosa</i> |
| | 8. GBS |

Pathophysiology:

There are multiple factors that come into play when it comes to the development of UTI including adherence, colonization, evading immune surveillance, persisting, and disseminating along the urinary tract. One of the most initial important steps in pathophysiology is periurethral contamination. This happens due to the fact that most pathogens are residing already in the gastrointestinal system. This contamination results in bacterial colonization of the urethra and subsequent ascension of bacteria to the bladder. This step is one of the most significant events because it requires the pathogen to have a mechanism of migration such as pili or flagella. A lot of complex host-pathogen interactions will decide whether the uropathogen will stay and colonize the bladder, via bacterial adhesins interaction, or be eradicated. Invasion, and subsequent colonization, is only the beginning. The pathogen then starts producing toxins, proteases, and siderophores, which result in releasing the nutrients needed from the host cells and subsequently obtain iron. In complicated UTI pathogens, biofilms formation happens and it has a major role in colonization and persistence of such bacteria. The bonus step that may happen with further multiplication and avoiding the body defenses is ascending to the kidney with the same fashion earlier (adhesins and/or pili), and the same events earlier from colonization and toxins production occur. Moreover, uropathogens can pass the tubular epithelial barrier, entering the bloodstream, which will result in bacteremia.

In bacteria that cause uncomplicated UTI, the ability to directly attach and bind to the bladder epithelium is there. However, it is not there in complicated UTI pathogens, and they need another site or factor. These sites include the urinary catheter, a kidney stone or bladder stone and some

factors that may help is urinary retention by physical obstruction, and all of these are considered as risk factors for the disease [6]. Bacterial colonization happens as a result of stagnation and retention of urine due to any causes [8].

Risk Factors:

There are many risk factors associated with this disease, and all should be taken into account by the family physician when dealing with UTI patients. These factors include gender (females being more susceptible to UTI), age, postmenopausal women, history of UTI, active sexual life, new sexual partner, recent or ongoing vaginal infection, obesity, diabetes, and genetics, which may play an important part (family history of UTI). Other causes that facilitate bacterial colonization include anatomical abnormalities as in incompetence of the ureterovesical valve, grown masses as in male Benign Prostatic Hypertrophy (BPH), functional abnormalities like neurogenic bladder as a result of spinal cord injuries, and instrumentation as in urethral catheterization. The family physician needs to be aware of other risk factors, which may cause relapse and reinfection such as usage of spermicide, urinary incontinence, pelvic floor prolapses, and elevated post-void residual volumes. For identifying the complicated urinary tract infections, it is vital to recognize any possible abnormality of the tract or person's immunity. These include urinary retention, renal failure, urinary obstruction, renal transplantation, immunosuppression, and the presence of foreign bodies (like calculi and catheter). Pregnancy, malignancy, chemotherapy, and immunosuppression; and hospital or health care exposure are other factors to be considered in the cases of complicated UTI [3, 5, 9].

Clinical Features:

Clinical Features vary depending mainly on the site of infection (upper or lower UTI). The patients usually present to the primary health care with symptoms of dysuria, change in urinary frequency, urgency, suprapubic pain, and hematuria. These symptoms are considered classical features of lower UTI. In upper UTI, patients may present like lower infection with the addition of fever, vomiting, and/or costovertebral angle tenderness. As a family physician, any systemic symptoms, like high fever, loss of consciousness shall raise suspicions for possible bacteremia. Some differential diagnoses that the family physician needs to have in mind and rule them out include acute urethritis, vaginitis, pelvic inflammatory disease, and interstitial cystitis. The primary care provider can easily work out lower UTI, however, once complicated UTI develops, referral is necessary [10].

Diagnosis:

Diagnosing this disease has come a long way in recent years, with many tests that can be done for such patients. However, the most important and most commonly used ones are urine dipstick, urinalysis, and culture. In patients with complicated UTI, further examining the abnormality of the urine tract is vital, and will establish the full clinical picture in such

patients. However, recent studies have suggested a new approach to diagnose and empirically treat patients based only on the clinical symptoms, with positive promising results to this approach in uncomplicated cases. Urine dipstick is an easy and noninvasive way to provide a quick analysis of the urine and can be carried out in the primary health care setting. Therefore, teaching the patient how to catch a mid-stream urine sample is important to avoid contamination. This quick and simple urinalysis provides great clues into diagnosis, with positive leukocyte esterase, which is the result of immune system reaction, and an indication of pyuria, having high specificity (up to 98%) and reliable sensitivity (between 75 and 96%) if the pathogen count is around 100,000 colony-forming units (CFU) or higher per mL of urine.

Another finding is positive nitrite, which is found if the pathogen reduces the normally found nitrate into nitrite, and thus it is usually pathologic. However, it can be falsely negative if the bacteria are non-nitrate reducing ones such as enterococci, *S. saprophyticus*, *Acinetobacter*, and/or the urine sample is too diluted. Thus, the sensitivity of this finding is lower than leukocyte esterase, ranging between 35 and 85%, but with a reliable specificity of up to 95%. Urine dipstick can also detect hematuria, which is found in almost half of UTI patients, and if the patient still has hematuria even after infection treatment, further testing into the cause is needed. Usually, urine cultures are reserved for patients who fail initial treatment, for those with recurrent UTI, complicated UTI, and patients with severe pyelonephritis or suspected bacteremia. Recent protocols suggest a colony count of 1,000 CFU per mL for symptomatic patients to establish the diagnosis. Furthermore, a colony count of 100,000 CFU per mL or higher is sufficient to diagnose UTI (bacteriuria) in asymptomatic patients. Sensitivity testing can be done as well along with culturing and it can be a very critical step, especially in patients where the initial treatment failed to rule out any antibiotic resistance. Contamination is a big concern when conducting such a test as it reaches as high as 30%, most commonly with vaginal flora. Clinically, if more than 20 epithelial cells per HPF are reported, then contamination is probable [11, 12]. Colonization interferes with the normal flora, including staphylococci, streptococci, and diphtheroid organisms in male patients at distal urethral ends. The shorter urethra in females and its opening into the perineum increases the chances of *Escherichia coli* and other colonic organisms' invasion and quicker ascending to the bladder [13].

Accurate differentiation in diagnosing UTI required a detailed assessment of history and laboratory reports to reduce inappropriate antibiotic use. In healthy status, urine is sterile throughout the urinary tract, from the renal glomerulus to the external sphincter in males and to the bladder neck in females, maintained by constant unobstructed forward flow, acidic urine environment, immunologic defenses, and mucosal barriers. Once those mechanisms are disrupted, chances of infections increases and inflammatory response is triggered [14]. Pyuria indicates inflammatory cells in urine

while bacteriuria indicates the bacteria in the urine, defined as at least 105 CFU/mL on culture or a positive dipstick result [15].

Delaying treatment or prescribing inadequate therapy for *Enterobacter* species causing urinary tract infection, or failing to treat co-morbid conditions such as pneumonia or sepsis, would burden the patient and hospital with undue costs of antibiotics, that could have otherwise been avoided [16]. Another important clinical point for the family physicians is the differentiation between relapse and reinfection in patients coming with recurrent UTI infections. If the recurrent infection is caused by the same pathogen despite treatment, then it is a relapse. However, if it is a different pathogen or the same pathogen but with negative culture for a period of more than two weeks then it is considered reinfection. In the primary health care setting, patients showing reinfection are more prevalent. Recurrent infection cases most often present within three months of the first UTI, however, *E.coli* may still recur in up to 6 months [17, 18]. Sigler *et al.* [19] investigated data of UTI patients relating to the antibiotic regimen used. They reported that the majority of the patients were receiving treatment according to guidelines. Furthermore, the problem suggested lied in the duration of treatment which was prolonged. The recommendation was to give adequate regimens as it would prevent the recurrence of infection and the emergence of resistant strains [19].

Several clinical features can help the clinician suspect a complicated UTI (see table 2). Complicated UTI should be treated more vigorously and the patient should be admitted if septic, not responding to outpatient treatment, or not expected to be compliant with the treatment. However, when not comorbid, patients might be just observed for 12 hours in the hospital and then discharged to continue their treatment at home. This is illustrated in a study that proved this approached to be effective in 97% of patients with complicated UTI [20].

Table 2: Clinical features of complicated UTI

| Feature | Notes |
|---|--|
| High-grade fever | The temperature threshold is not agreed on. So, the patient's baseline temperature should be considered. |
| Sever flank pain or costo-phrenic angle tenderness | These signs are indicative of upper UTI (i.e. pyelonephritis) |
| Pelvic or perineal pain in men | This is indicative of accompanying prostatitis. |

Treatment:

The treatment approach by the clinician aims to eradicate this infection and limit the complications. This can be achieved (in most cases) by effective antibiotic usage. The mainstay of treatment is quick empirical antibiotics, and this showed mostly good outcomes in patients. A recent study in lower

UTI patients found that four out of five patients received empirical antibiotic on the same day that they were diagnosed [21]. Current guidelines try to limit the number of antibiotics used as the first line of treatment in UTI due to higher bacterial resistance rates. Infectious Diseases Society of America (IDSA) advises treating uncomplicated UTI with one of the following agents: trimethoprim-sulfamethoxazole (TMP-SMX), nitrofurantoin, or fosfomycin for 3–5 days. Nitrofurantoin can be safely given in pregnant ladies as well. If the patient responds well to the treatment, then the second urine culture and urological evaluation are mostly not required. However, if the treatment fails, the physician shall take a second urine culture and can do further evaluation. Clinicians shall keep in mind the possibility of using quinolones, cephalosporins, and/or carbapenems in these situations until the sensitivity tests give the doctor the best option. Complicated UTI, patients with severe complications (such as sepsis and shock), or high-risk patients (comorbid) shall all be referred to higher centers for optimum care [22].

CONCLUSION

UTI is one of the most common presentations in primary health care settings, and any family physician should be able to easily identify such patients. Diagnosing such patients is primarily derived by good clinical judgment, and establishing any risk factors the patient has along with ruling out complicated UTI, and this can be solidified by tests such as urine dipstick. As a family physician, treating such disease is not as easy as prescribing only antibiotics anymore due to the increasing resistance rate and high possibility of recurrence. Thus, the physician should assess the risk factors for resistance and tolerability towards the treatment regimen individually to ensure an optimum outcome. Future studies into the effect of empirical treatment of UTI based on clinical symptoms only, in uncomplicated cases, with larger study size and proper design may prove crucial to lowering the load on physicians and the economic burdens of this disease.

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