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# **Diagnosis and management of a urinary tract infection (UTI)**

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## **Abstract**

A urinary tract infection (UTI) is a common bacterial infection and is the leading reason for treatment in primary care within the United Kingdom. Women are more frequently affected with a UTI than men and the debilitating condition often presents itself with painful urination, urinary frequency, the inability to start urinating, the sensation to suddenly urinate and many other symptoms. Assessment and identification of the infection is crucial and nurses have a fundamental role when assessing symptoms, examining a specimen of urine and promptly reporting the findings.

## **Introduction**

A urinary tract infection (UTI) is a common bacterial invasion of the urinary tract, and is the leading reason for treatment in primary care within the United Kingdom (NICE 2013). Recent studies have shown that women are more frequently affected with a UTI than men, requiring prudent antibiotic treatment (Asma, Vicky et al. 2018). It has been reported that a UTI is a common medical condition accounting for 7 to 8 million clinic visits per year (Robinson, Giarenis et al. 2015). The urinary tract is constantly exposed to bacteria from the exterior environment, particularly because of the anatomical placement of the urethra, in the vicinity of the rectum for females (Okragla, Szychowska et al. 2014). A UTI is a debilitating condition in severe cases and can produce the onset of painful urination (Dysuria), urinary frequency, the inability to start urinating (hesitancy) and the sensation to suddenly urinate (urgency) (Bono and Reygaert 2018).

## **The bladder and the process of a UTI**

The lower urinary tract consists of the ureters, the bladder, the trigone and the urethra (Watson 2011). The bladder has three distinctive layers, the outer tissue layer which is known as serosa; the middle smooth layer is called the detrusor muscle which is responsible for the contractions that set off the sensation to void and the innermost lining layer is called the urothelium and comprises of transitional cell epithelium that provides an elastic barrier that is impervious to urine (Patel and Chapple 2008).

Mysorekar and Hultgren (2006) report that an infection of the lower urinary tract occurs when bacteria invades the urethra, migrates to the urothelium and colonises the cells of epithelium of the bladder. When the superficial bladder cells have been invaded, the uropathogens rapidly begin to replicate inside the bladder cells and form intracellular communities, also known as intracellular colonisation. Intracellular pathogens such as *Escherichia Coli* hijack bladder cells which line the urothelium, allowing pathogens to reach an appropriate intracellular position for their survival and replication (Panek, El Alaoui et al. 2014). The process of intracellular colonisation has been related to the development of urinary biofilms, which is the process in which infected bladder cells form a protective barrier, hindering the suppression of infected cell multiplication and promoting the progression of the UTI (Flores-Mireles, Walker et al. 2015). The multiplication of biofilms in the bladder cells hinder the bladder function triggering lower urinary tract symptoms (LUTS) such as urinary hesitancy, reduced urinary stream, bladder pain and incomplete bladder emptying also known as urinary retention (Rosen and Klumpp 2014).

### **Symptoms and assessment**

When patients report lower urinary tract symptoms (LUTS), in most cases this is indicative of a sudden or worsening onset of a UTI also known as an acute flare, which presents its self as storage, voiding and incontinence symptoms (Haylen, De Ridder et al. 2010). An assessment of symptoms using a validated tool such as the female lower urinary tract symptoms questionnaire (FLUTS) (Jackson, Donovan et al. 1996) and the quality of life questionnaire for urinary incontinence (I-QOL) (Wagner, Patrick et al. 1996), are systematic methods for measuring and assessing the presence of urinary frequency, urgency, urinary incontinence, voiding symptoms and bladder pain (Al Buheissi, Khasriya et al. 2008), and the impact it has

on a patient's quality of life. It is good practice for nurses to use a validated assessment tool, but depending on the clinical settings such as hospital, community or outpatient departments, assessment tools may have been developed based upon the concept of the FLUTS and I-QOL questionnaires.

### **Urine samples and diagnostic testing**

A UTI is often diagnosed by examining a urine sample. In nursing practice, there are two main methods for obtaining a urine specimen which is the clean-catch midstream urine method (MSU), capturing the middle part of the urinary stream and the catheter specimen method (CSU), which is the insertion of a thin hollow tube, along the urethra and into the bladder to obtain a specimen (Dougherty, Lister et al. 2015). The selection of the collection method depends upon the patient's clinical case, but more commonly a MSU is requested for testing.

A dipstick urinalysis is generally used in clinical practice, as it is a rapid inexpensive diagnostic test which is used in conjunction with or in place of a urine culture (Huysal, Budak et al. 2013). The dipstick urinalysis distinctively measures the markers of pyuria and bacteriuria, the two diagnostic factors often associated with a UTI (Turner, Beigi et al. 2014). When interpreting a dipstick urinalysis, pyuria is the measurement of urinary leukocytes and bacteriuria is the presence of nitrites (Pappas 1991). Not all dipstick urinalysis tests detect the presence of leukocytes and nitrites, but identifying any one of these signs increases the positive predictive value of the urinalysis (Raza-Khan, Kenton et al. 2006). Although it is a standard method for routinely screening for the presence of infection, the dipstick has been discredited due to its inability to sensitively detect the presence of a UTI in comparison to urine microscopy (Khasriya, Khan et al. 2010).

Urine microscopy has been used to identify urinary leukocytes since the early 1890s. Cuthbert Dukes (1928) introduced another method of assessing urine using a counting chamber to enumerate the white cells in a fresh unspun specimen. From then onwards newer studies investigated the use of urinary microscopy for identifying bacteriuria, as an alternative to relying on urine cultures (Hallstrom, Hallstrom et al. 1975, Vickers, Ahmad et al. 1991, Hiraoka, Hida et al. 1993). Urine microscopy is also used to detect the presence of

haematuria (Yeoh, Lai et al. 2013) and uroepithelial cells which originate from the bladder wall (Horsley, Malone-Lee et al. 2013, Khasriya, Sathiananthamoorthy et al. 2013). More recent studies advocate the use of light microscopy as a standard screening practice for detecting pyuria and bacteriuria in males and females (Sorrentino, Cartwright et al. 2014, Gill, Kang et al. 2018). Nurses in some clinical settings are undertaking urinary microscopy however; adequate training is the initial important step for developing the skill.

Urine cultures have been recommended as the gold standard for diagnosing the pathogens that are responsible for a UTI (Davies and Lewis 2004), and although nurses are not trained to perform urine cultures, the ability to promptly send a urine specimen for microbiological testing, culture and antibiotic sensitivity is an important task. Bacterial infections recognised as the most common etiological cause of a UTI, and accounts for 75 to 90% diagnosed cases of a UTI in both outpatient and inpatient settings (Kashef, Djavid et al. 2010). Evidence has shown that a bacterial infection of the bladder can disrupt the function of the urothelium, a protective lining of the bladder, triggering an inflammatory response that causes the parasitised transitional cells to migrate to the surface of the bladder, exfoliate and pass out as part of the urinary stream (Anderson, Palermo et al. 2003, Reigstad, Hultgren et al. 2007, Khasriya, Sathiananthamoorthy et al. 2013). Nowadays, these exfoliated urothelial cells, detected on microscopy, are regarded as important diagnostic markers of infection. Some methods of analysis would interpret these cells as contaminants (Collier, Matjiu et al. 2013) but novel methods of cell identification have shown these cells to originate from the bladder and are a reflection of the infection (Horsley, Malone-Lee et al. 2013).

### **Nursing management of a UTI**

Nurses have the ability to assess and identify the presence of UTI with appropriate training. When a UTI has been identified, nurses should refer the patients to a registered medical doctor or a nurse prescriber who will then proceed with treatment options. Acute and chronic UTI are often managed by a physician who prescribes antibiotics and Methenamine, an effective bladder antiseptic for preventing the progression of a UTI (Lee, Bhuta et al. 2012). Treatment cessation is usually permitted when there is a reduction in LUTS and there is a visible reduction urinary pyuria (Swamy, Barcella et al. 2018).

It is important that nurses encourage patients to report the initial onset of bladder symptoms, as this often helps to prevent the progression of the infection with an early intervention. The fundamental role of the nurse when managing a UTI is to conduct a comprehensive symptom assessment and educating the patient on symptom characteristics. Symptom assessments using validated questionnaires is an integral part of urology practice and is a structured method to distinguish duration of symptoms, triggers and exacerbating factors (Betschart, Abt et al. 2018). Understanding the symptom characteristics will support nurses when educating the patient on the importance of early reporting of symptoms. Examining a specimen of urine will determine whether an infection is present and promptly reporting the findings will hasten the facilitation of the treatment process (Nik-Ahd, Lenore Ackerman et al. 2018).

### **Conclusion**

A UTI is frequently diagnosed as a common debilitating condition, with women being more affected than men. Understanding the anatomy of the bladder provides a clearer perspective of how bacterial invades the bladder causing the infection. The assessment and identification of the infection is crucial and nurses have a fundamental role when assessing symptoms, examining a specimen of urine and promptly reporting the findings.

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