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Review Article

Urinary tract infection related to hospitalized patients: A Review

Abstract

Urinary tract infection (UTI) is the most common type of bacterial infection acquired in a hospital and may affect the upper (pyelonephritis) or lower urinary tract (cystitis). UTIs associated with bladder catheterization are extremely common, with infection occurring due to the use of contaminated materials, lack of aseptic insertion techniques, or prolonged catheterization. This study aimed at reassessing hospital protocols and procedures as well as evaluating the causes, etiology, diagnosis, and treatment of UTIs in hospitalized patients. The database was consulted: Medline, Pubmed, Scielo, Latin American and LILACS. The terms used for the search were the following descriptors: infection, urinary tract, symptoms, diagnoses and treatments. As a result, a wide variety of approaches were evidenced, with treatment of the urinary infections (29.63%), followed by description of general data (25.93%), mechanisms of infection (22.22%), prevention (11.11%) and diagnosis 11.11%). Although Escherichia coli is the most common etiological agent, UTIs can be caused by various other factors such as hospital conditions and the location of the hospital. Linezolid is used to treat gram-positive bacteria, while fluoroquinolones are used to treat gram-negative bacteria; therefore, urine culture was performed to determine the treatment to be administered. This study highlights an increased resistance to commonly used drugs, which raises an imminent warning for outpatient UTI cases.

Introduction

Hospital-acquired infections, also called nosocomial infections, are those that are acquired in a hospital environment, after discharge, or during hospital procedures [1].

There are several risk factors associated with infection during bladder catheterization delay, including colonization of the urethral meatus and the duration of catheterization. Colonization of the urethral meatus by potentially pathogenic bacteria was considered in a univariate analysis as the most important risk factor for bladder catheterization related bacteriuria [2].

In an intensive care unit, the most commonly found infections are urinary tract infections (UTI) or bacteriuria associated with the bladder catheter, pneumonia associated with mechanical ventilation, and bacteremia associated with the central venous catheter— all with very high morbidity and mortality [3,4].

Females are more susceptible to UTIs than males, with adult women 50 times more likely to acquire UTIs than men. Of these, 30% of women have symptomatic UTIs throughout their lives. The main route of urinary tract contamination is ascending; this is attributed to the short female urethra and the greater proximity between the vagina and the anus, characteristic of the female anatomy [5].

Although more common in women, the incidence of UTIs increases among men over 50 years of age [6]. Urinary tract instrumentation including bladder catheterization and the occurrence of prostatic disease are the factors most implicated in the increasing incidence of infection in males [4]. Among elderly and hospitalized individuals, UTI rates are elevated by the aforementioned factors as well as the presence of comorbidities that increase susceptibility to infections. UTI rates are much higher in male homosexuals, due to the practice of unprotected anal sex, in individuals with intact foreskin, and in HIV-infected patients [4].

Therefore, we believe that it is extremely important for health care professionals to understand the factors that influence the incidence of UTIs, with bladder catheterization

being an major factor that predisposes this infection, so that we can take necessary actions to minimize its risks [7,8]. The present study hopes to contribute to the improvement of the quality of care provided to patients.

Methods

This study consisted of a review of the literature referring to the main publications that described the relationships between causes, risk factors, symptoms, diagnoses and treatments of UTIs.

The publication dates were from 1997 to 2016 and the accepted languages were Portuguese, English and Spanish. The researches were carried out in the electronic databases Medline, Pubmed, Scielo, Latin American and Caribbean Health Sciences Literature (LILACS). The terms used for the search are the following descriptors: infection, urinary tract, symptoms, diagnoses and treatments. Studies that related the descriptors, and presented relevance in the subject, as well as fit the period mentioned above were included in this study. The exclusion criteria were: Repeated articles in the databases consulted, and experimental studies without clinical application.

Results

After consulting the scientific articles on the different platforms, 25 studies were selected for evaluation and description. Among the variables listed in the articles are infection mechanism (N = 6), prevention (N = 3), treatment (N = 8), diagnosis (N = 3), and general approach (N = 7), where two articles evaluated more than one item, totaling 27 events related to the theme of this review. The treatment referral approach was highlighted with 29.63% of the studies, followed by description of general data (25.93%), mechanisms of infection (22.22%), prevention (11.11%) and diagnosis (11.11%) (Table 1).

Discussion

Our study allowed us to verify a high incidence of the number of studies related with hospital urinary infection, thus demonstrating an eminent concern with the number of individuals suffering from the disease, as well as the increase of infections linked to multiresistant microorganisms. UTIs are defined by the presence of a minimum of 100,000 bacterial cfu/mL of urine [5]. Signs and symptoms associated with UTIs include polaciuria, urinary urgency, dysuria, change in the color and appearance of urine, accompanied by changes in urinary sediment, hematuria, and pyuria (>10,000 leukocytes/mL).

Abdominal pain is more common in the topography of the hypogastrium (projection of the bladder) and in the dorsum (projection of the kidneys), which may sometimes lead to fever [6]. UTIs can affect the lower urinary tract, known as cystitis, and the upper urinary tract, known as pyelonephritis. Lower UTI or cystitis may be symptomatic or asymptomatic [9].

Cystitis usually presents with dysuria, voiding urgency, polaciuria, nocturia, and suprapubic pain; however, fever is not a usual symptom. Pyelonephritis usually begins with cystitis and is often accompanied by high fever, usually >38 °C, and is associated with chills and unilateral or bilateral lower back pain. Fever, chills, and lower back pain form the triad of symptoms characteristic of pyelonephritis, being present in most cases [4].

The etiological agents most commonly responsible for community-acquired UTIs are in order of frequency: *Escherichia coli*, *Staphylococcus saprophyticus*, *Proteus* and *Klebsiella sp.*, and *Enterococcus faecalis*. *E. coli* alone accounts for 70% to 85% of community-acquired UTIs and 50% to 60% of elderly patients admitted to institutions [10].

When a UTI is acquired in an inpatient setting, the etiological agents are quite diverse, with enterobacteria predominating; with a reduction in the frequency of *E. coli* (although it remains the usual cause); and a growth of *Proteus sp*, *Pseudomonas aeruginosa*, *Klebsiella sp.*, *Enterobacter sp.*, *Enterococcus faecalis*, and fungi, especially *Candida albicans* [11,12].

The term bacteriuria refers to the presence of bacteria in urine, without tissue invasion. In UTIs, tissue invasion by the above microorganisms causes local inflammation, which manifests signs and symptoms characteristic of this infection. The diagnosis of UTI is based on bacteriuria associated with signs and symptoms that indicate inflammation of the urinary tract [13].

The collection of urine for culture through urination should be performed after external genital cleansing. In catheterized patients, it is recommended to collect urine by puncturing the drainage system in the designated place, after thoroughly disinfecting 70% of the area with alcohol, keeping the system closed [13].

In a hospital, the diagnosis of UTI is complicated by several factors [14]. The presence of urinary catheters makes it difficult or impossible to verify the signs and symptoms associated with UTI. Dysuria, urinary urgency, or suprapubic discomfort may be related to the presence of a urinary catheter, regardless of the presence of UTI [15].

Most cases of UTI occur after bladder catheterization. Approximately 80% of hospital UTIs are associated with the use of a bladder catheter and 5% to 10% by other manipulations of the urinary tract. Approximately 10% of patients are catheterized during hospitalization for an average duration of 4 days. Between 10% and 20% of catheterized patients develop bacteriuria and 2% to 6% develop UTI symptoms. Urinary probing for more than 7 days is associated with UTI development in up to 25% of patients with a daily risk of 5% [13].

Table 1: Frequency of the variables related to urinary tract infection.

	Mechanism of infection	Prevention	Treatment	Diagnosis	General approach
Absolute values - N	6.0	3.0	8.0	3.0	7.0
Relative values - %	22.22	11.11	29.63	11.11	25.93
Total events - N					27

Complementary tests that may be useful for diagnosis are as follows: urine routine, uroculture, antibiogram, blood culture, and imaging (ultrasound, computed tomography, and magnetic resonance imaging).

The choice of antimicrobial therapy for UTI varies according to the presentation of the infection, host, and agent. Strategies involving different therapeutic regimens according to specific groups of patients maximize therapeutic benefits, in addition to reducing costs, incidence of adverse effects, and the emergence of resistant microorganisms [16].

Several studies have shown good sensitivity of gram-negative bacteria to ciprofloxacin and norfloxacin [17,18,19]. However, recent studies have shown a trend towards the development of microbial resistance to these drugs, highlighting factors such as empirical treatment, adherence to treatment, and costs [20]. For severe infections caused by Enterobacteriaceae, the use of gentamicin is recommended; this drug inhibits protein synthesis by blocking the formation of the initiation complex, binding to the bacterial ribosomal portion 30S [21,22].

Linezolid is a promising drug for the treatment of infections with multiresistant gram-positive microorganisms. It is an oxazolidinone that inhibits protein synthesis by blocking formation of the initiation complex, binding to the bacterial ribosomal 50S portion [23]. Low levels of resistance were observed and may be associated with mutations in ribosomal RNA; however, it is suggested that susceptibility tests to this antimicrobial drug are performed before starting antibiotic therapy [24].

Conclusion

UTIs are responsible for high hospital infection rates. *E. coli* is the main etiological agent causing infections at home and in outpatients, whereas various other microorganisms cause infections in hospitalized patients.

Bladder catheterization delay is the main cause of UTIs in hospitalized patients, with an incidence of 80%. As a consequence of the main agent generally being gram-negative, the drugs of choice are either ciprofloxacin and norfloxacin; for gram-positive cases, the drug of choice is linezoline. There are also various treatments against microbial susceptibility, given the large ratio of hospital resistances, including to the abovementioned drugs.

Infection is more frequent in women than in men due to the short female urethra and is directly related to bladder catheterization. From the moment the signs appear, the antibiotics of choice are indicated and a culture is performed to know the sensitivity profile of the agent.

However, the present study allows us to conclude that the hospital conditions are linked to more heterogeneous UTIs, the type of microorganism, as well as the treatment and forms of contagion. In addition, the quality of care provided to patients may reduce the number of hospital UTIs cases and result in shorter hospital stays.

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