

Urinary tract infection in women

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Abstract

Urinary tract infection (UTI) is one of the most common infections afflicting women. UTI often accompanies vaginal infections and is frequently caused by pathogens originating in the digestive tract. The paper discusses the prevalence of UTI in various patient populations, including postmenopausal, pregnant, diabetic, epileptic, and perioperative female patients. Current UTI treatment and prevention guidelines both for primary and recurring UTIs were reviewed. Antibiotic treatment duration should be minimized, with the exact dosage and time schedule depending on the type of infection. Asymptomatic bacteriuria does not always require antibiotic treatment, because their excessive use may lead to the emergence of antibiotic resistant strains. The role of non-antibiotic prophylaxis of recurrent infections involving immunomodulants (OM-89), probiotics, and behavioural interventions was underlined.

Key words: urinary tract infections, menopause, pregnancy, prevention, treatment.

Introduction

Urinary tract infections (UTIs) in women are one of the most prevalent infections occurring at various stages of life. Women are much more prone to UTIs than men, mainly due to the female lower urinary tract anatomy and its proximity to the reproductive organs. The female urethra is relatively short, reducing the distance for bacterial ingress. Furthermore, it opens into the vulvar vestibule, i.e. a structure that is also quite prone to infections, given the prevalence of vulvar vestibulitis and vaginitis. In this case, sexual activity as well as excessive use of intimate hygiene products interfering with natural vaginal microbiome are often to blame. On the other hand, the proximity of the anus facilitates the colonization of both the reproductive organs and distal parts of the urinary tract by *Escherichia coli*, *Enterococcus fecalis*, and the *Streptococcus* species. Pregnancy and the perinatal period are other characteristic timepoints marked by frequent urinary tract infections. The increasing number of caesarean sections and perioperative catheterizations are yet another risk factor. In the post-menopausal period falling oestrogen levels interfere with the vaginal epithelium, contributing to its gradual atrophy, while glycogen deficiency reduces the lactic acid bacteria counts. As a result, post-menopausal vaginas are often colonized by other bacteria, mainly *Escherichia coli*, which may spread and infect the urinary tract. Pelvic organ prolapse and urinary in-

continence also contribute to frequent UTIs. These are believed to affect between 30% and 50% of women above the age of 50 years. It is estimated that every other woman will have had at least one UTI during her lifetime [1, 2], with 10–60% of all women having a symptomatic UTI at least once in their lives [3, 4]. The infection risk increases with age [5].

Recurring UTIs in women are defined as at least 2 UTIs occurring within a 6-month period or at least 3 UTIs in a 12-month period. The prevalence of recurring UTIs in women is estimated at 25–50% of all infections [6–9].

Diagnosis

All UTI cases can be classified as either asymptomatic or symptomatic. An asymptomatic UTI is diagnosed based on urinalysis results. Careful sample collection is crucial given the external urethral opening position in women. The number of leukocytes is the key criterion utilized in UTI diagnosis; a count > 10 leukocytes/mm³ suggests an infection. In pregnant patients the cut-off is higher, at > 20 leukocytes/mm³. Sample contamination by vaginal secretions containing mucus and lactic acid bacteria may result in erroneous diagnosis of multiple mucus threads and abundant bacterial growth in urine sediment. Sometimes the mucus even

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yields a mistaken diagnosis of proteinuria. Period, postpartum bleeding, or any other uterine bleeding may result in sample contamination with red blood cells. In such cases, a detailed history and a better-prepared repeat analysis is necessary. Urinalysis results not accompanied by the patient's symptoms are not sufficient to initiate treatment. A urine culture can be used to confirm or disprove a hypothesis of an UTI. The culture sample should be collected in a sterile container to avoid contamination, preferably from first morning urine. The presence of $\geq 10^5$ colony forming units per millilitre (CFU/mL) confirms an infection, while an antibiogram will help verify the efficacy of a given treatment.

In the case of elevated leukocyte values in urine sediment combined with clinical symptoms, treatment should be initiated. When dealing with pregnant patients, it is recommended to take a culture sample at the start of treatment due to increased risk of premature birth associated with urinary tract infections as well as limited antibiotic treatment options compatible with pregnancy. Typical symptoms will still indicate the need for treatment. In the absence of abnormal vaginal discharge and burning sensation in the vulvar vestibule, typical UTI symptoms lead to infection confirmation in as many as 90% of young women [10, 11]. In 15% of cases, urine cultures are positive in spite of elevated leukocyte count in the urinalysis [3].

Characteristic patient groups

The main reasons behind the increased prevalence of urinary tract infections in peri- and postmenopausal women include hormonal changes (oestrogen insufficiency) and connective tissue aging (urinary incontinence, pelvic organ prolapse). Factors conducive to UTIs in the perimenopausal period include urinary incontinence (impeding proper hygiene), atrophy of vaginal mucous membranes (increasing the risk of vaginal infections that may spread into the urinary tract), and anterior vaginal prolapse (precluding complete voiding of the bladder). Prevalence of asymptomatic bacteriuria increases in the peri- and postmenopausal period, reaching levels of 4–19% as compared to 1.5% in premenopausal women [12]. In peri- and postmenopausal women, oestrogen deficiency may be conducive to both urinary incontinence and urinary tract infections. Topical vaginal (but not systemic) application of oestrogens was proven to significantly reduce the risk of bacteriuria (OR = 0.3; 95% CI: 0.13–0.68) [13]. The recommendation of topical oestrogen use in peri- and postmenopausal patients to prevent UTIs is also included in guidelines published by research associations [14].

Diabetes constitutes a significant UTI risk factor for postmenopausal women [15, 16]. Studies involving a total of 256,725 females with type 2 diabetes showed sig-

nificantly more prevalent UTI diagnoses starting from ages 45–49 years onward, with the difference as high as 100% in the said age range and yet another 80% for those aged 50–54 years [16]. Another study compared 2 groups of women aged 55–75 years diagnosed with acute UTI – 901 diabetic patients and 913 controls [15]. Diabetes in postmenopausal women turned out to increase UTI risk twofold (OR = 2.2; 95% CI: 1.5–3.1). Significant factors included oral pharmacotherapy or insulin treatment (OR 2.8 and 2.7, respectively) and type 2 diabetes (OR = 2.2). Disease duration and glycaemia control assessed by glycated haemoglobin HbA1c levels turned out not to be significant. In patients 57 years and older, undergoing surgical treatment constitutes yet another risk factor for UTIs [17].

Diabetes mellitus, uncontrolled in particular, is a risk factor for both urinary and reproductive tract infections (involving the vulva, vulvar vestibule, and/or vagina). Fourteen per cent of women with type 1 diabetes and 23% of women with type 2 diabetes are diagnosed with UTIs [18]. The most significant risk factors in this group include glycaemia control and glycosuria. Infections are also more prevalent in perimenopausal patients with longer disease duration. In a well-documented trial involving 1357 female patients with type 1 diabetes, increased prevalence was observed for the following: acute cystitis (OR = 1.46; 95% CI: 1.10–1.95; $p = 0.001$), acute vaginitis (OR = 1.20; 95% CI: 1.01–1.42; $p = 0.044$), and acute vulvitis (OR = 2.12; 95% CI: 1.56–2.90; $p < 0.001$) [10]. In a group of 241 women with type 1 diabetes, the most significant risk factors for symptomatic infections included sexual intercourse, use of oral contraceptives, and microangiopathy [18]. Urinary incontinence, more prevalent in diabetic females than in the general population, may be another contributing factor (OR = 1.64; 95% CI: 1.19–2.26; $p = 0.001$) [10]. In type 2 diabetes, asymptomatic bacteriuria is more frequent than in healthy controls (17.5% vs. 10%, $p = 0.015$). Asymptomatic bacteriuria may progress to symptomatic UTI in 20% of patients during 6 months [19, 20]. In another study of 348 women with type 2 diabetes, asymptomatic bacteriuria also constituted the primary risk factor for developing a symptomatic infection [18]. It may also lead to decreased renal function [21]. The available data suggest that periodic urine cultures in diabetic patients, in particular those with type 2 diabetes, should be recommended.

Epileptic patients were also recognized as requiring more frequent UTI treatment than the general population [22], with the problem affecting around 58% women and 42% diagnosed with epilepsy ($p < 0.0001$). An analysis of reasons revealed that the most significant cause underlying the increased UTI prevalence in this population were anti-epileptic drugs. Urinary tract infections occurred more frequently in patients using phenytoin (OR = 1.78; 95% CI: 1.24–2.55; $p = 0.001$),

primidone (OR = 1.73; 95% CI: 1.21–2.49; $p = 0.002$), carbamazepine (OR = 1.61; 95% CI: 1.33–1.96; $p < 0.0001$), and valproate (OR = 1.52; 95% CI: 1.28–1.82; $p < 0.0001$), probably due to their immunomodulating properties. The said studies suggest the need to carefully plan therapies for epileptic patients with recurrent urinary tract infections.

Another group with elevated UTI risk are patients with indwelling urinary catheter or those requiring intermittent self-catheterization [23]. UTIs occur more than once a year in 15.4% to 86.6% patients in that group, with antiseptic product use probably reducing the risk.

The perioperative period may also be conducive to urinary tract infections [17]. Age above 57–60 years, diabetes, immunosuppressant therapy, obesity, and blood transfusions due to iatrogenic all constitute additional risk factors in this case. Preventative administration of antibiotics to patients catheterized for surgery with diagnosed asymptomatic bacteriuria significantly reduces the risk of progression to symptomatic infection (RR = 0.20; 95% CI: 0.13–0.31) [24]. Female patients are catheterized for a vast majority of surgeries due to their reproductive anatomy. In the case of caesarean sections, the catheter may stay in for a few hours after block anaesthesia, while with gynaecological procedures it typically stays in for around 24 hours. Surgical repairs of pelvic organ prolapse are an exception, however, requiring catheterization for 2–3 days at times.

Pregnancy is accompanied by a series of factors conducive to urinary tract infections – the urine is more basic in pregnant women, urine flow obstruction is more common (especially towards the end of pregnancy), as is proteinuria, diabetes, and anaemia. Taking a urinalysis sample is more difficult, in particular in the 3rd trimester, resulting in protein and bacteria detected in the samples that do not always signify an infection – typically these result from sample contamination by vaginal secretions. Protein may originate from mucus contamination, but in hypertensive patients it suggests proteinuria characteristic of preeclampsia. Multiple bacteria in the field of view when analysing urine sediment are typically lactic acid bacteria if the reading is not accompanied by elevated leukocyte count, with the latter constituting a key factor for differential diagnosis against UTI in a pregnant patient. Asymptomatic urinary tract infections affect 2–8% of pregnant women [25]. According to other sources, UTIs constitute the most common infections of pregnancy, diagnosed in as many as 50–60% of all pregnant women [26]. Research results suggest an increased prevalence of preterm birth associated with asymptomatic bacteriuria [27]. UTI is diagnosed more frequently in women with gestation-induced hypertension, and as such it is linked to increased risk of intrauterine growth restriction, premature birth, and caesarean section [28]. It must

be remembered, however, that a UTI diagnosis in itself does not necessitate any specific obstetric intervention. Recurrent urinary tract infections affect 1 in 4 pregnant women diagnosed with UTI and lead to pyelonephritis in 4–5% of cases [25]. UTI in a pregnant woman was also found to constitute a significant risk factor with regard to the child's UTI, at 30% vs. 6.8% (OR = 5.9 at 95% CI: 1.9–18.3; $p = 0.001$) [29].

Bacteria identification key to therapy selection

Studies analysing the typology of pathogens causing urinary tract infections in non-diabetic patients quote *Escherichia coli* (69%), *Enterococcus* sp. (10%), *Klebsiella* sp. (4%), *Pseudomonas aeruginosa* (4%), *Proteus* sp. (4%), and *Staphylococcus* sp. (2%) as the most prevalent bacteria [30, 31]. For diabetic patients, the most typical pathogens observed were *Escherichia coli* (71%), *Klebsiella* spp (6%), *Staphylococcus* spp (5%), and *Enterococcus* spp (4%) [31]. In pregnant women, urinary tract infections are usually caused by *Escherichia coli* (30.8–90%), bacteria from the *Staphylococcus* genus (4.3–32%), *Proteus mirabilis* (10.2%), *Enterococcus faecalis* (1–8.1%), and *Klebsiella pneumoniae* (6.1–9.1%) [25, 26, 32]. In infants, the most common pathogens included *Escherichia coli* (65.9%), *Klebsiella* (14.6%), and *Staphylococci* (9.8%) [29].

Antibiotic treatment

French guidelines issued by the French Language Infectious Pathology Society recommend sequential administration of fosfomycin, nitrofurantoin, and quinolones to treat cystitis, and third-generation cephalosporins to treat pyelonephritis [33].

Antibiotic dosages proposed by international associations are included in the Table 1 [14].

Any treatment of pregnant patients with asymptomatic bacteriuria should be targeted, requiring a urine culture antibiogram prior to treatment initiation. In acute cases treatment should be initiated while waiting for culture results. Cephalosporins are the drug of choice in pregnant patients. Kashif *et al.* [25] suggest particular caution when treating pregnant women with nitrofurantoin (because it may cause haemolytic disease of the foetus), augmentin (necrotizing enterocolitis was observed in foetuses in the 3rd trimester), and trimethoprim (folic acid antagonist). Between 7 and 10 days after treatment course completion a repeat urine culture should be taken to confirm treatment efficacy. Single-dose fosfomycin can be a good treatment alternative. A meta-analysis published in 2020 showed its efficacy to match that of other antibiotics while

Table 1. Proposed antibiotic dosage (based on guidelines published by the American Urological Association, Canadian Urological Association, Society of Urodynamics, Female Pelvic Medicine & Urogenital Reconstruction, and the European Urological Society)

Indication	Antibiotic	Dosage	Treatment duration
Prophylaxis in asymptomatic bacteriuria; continuous treatment	Trimethoprim	100 mg 1x a day	
	Trimethoprim + sulfamethoxazole	40–200 mg 1x a day 40–200 mg 3x a week	
	Nitrofurantoin	50–100 mg a day	
	Cephalexin	125–250 mg 1x a day	
	Fosfomycin	3 g every 10 days	
Prophylaxis in asymptomatic bacteriuria; periodic treatment	Trimethoprim + sulfamethoxazole	40/200 mg 80/400 mg	
	Nitrofurantoin	50–100 mg	
	Cephalexin	250 mg	
Uncomplicated cystitis	Fosfomycin	3 g	For 1 day
	Nitrofurantoin	50–100 mg a day	For 5 days
	Extended-release nitrofurantoin	100 mg 2x a day	For 5 days
	Pivampicillin	400 mg 3x a day	For 3–5 days
	Cephalosporins	500 mg 2x a day	For 3 days
	Trimethoprim + sulfamethoxazole	80/400 mg 2x a day	For 3 days
	Trimethoprim	100 mg 2x a day	For 3–5 days
Complicated cystitis	Ciprofloxacin	500–750 mg 2x a day	For 7 days
	Levofloxacin	750 mg a day	For 5 days
	Trimethoprim + sulfamethoxazole	160/800 mg 2x a day	For 14 days
	Cefpodoxime	200 mg 2x a day	For 10 days
	Ceftibuten	400 mg a day	For 10 days
Pyelonephritis, parenteral therapy 1 st line of treatment	Ciprofloxacin	400 mg 2x a day	
	Levofloxacin	750 mg a day	
	Cefotaxime	2 g 3x a day	
	Ceftriaxone	1–2 g a day	
Pyelonephritis, parenteral therapy 2 nd line of treatment	Cefepime	1–2 g 2x a day	
	Piperacillin/tazobactam	2.5–4.5 g 3x a day	
	Gentamycin	5 mg/kg a day	
	Amikacin	15 mg/kg a day	

Not all antibiotics are available in Poland.

maintaining high safety levels both in pregnant and non-pregnant patients [34].

Studies by Malmartel *et al.* [31] analysed the prevalence of antibiotic-resistant bacteria causing urinary tract infections. Resistance to ofloxacin and cefixime was slightly higher in diabetic patients, see data in Table 2.

Non-antibiotic prophylactic treatment – immunomodulation

OM-89 is an immunomodulatory drug [11, 36]. It is effective against *Escherichia coli* infections, constituting 70–80% of all urinary tract infections. Women with recurring urinary tract infections treated with OM-89 for 6 months had a twofold reduced further recurrence rate (67.3% vs. 32.7%) [37]. Uncontrolled diabetes significantly reduced the treatment efficacy, however. In

Table 2. Percentage of strains resistant to selected antibiotics

Antibiotic	Percentage of resistant strains	
	In study by Malmartel [31]	According to NICE guidelines [23]
Ofloxacin	10.8%	
Cefixime	3.8%	9.9%
Trimethoprim, sulfamethoxazole	16.8%	30.3%
Nitrofurantoin	4.05%	2.5%
Fosfomycin	3.2%	
Pivampicillin		7.5%

NICE – National Institute for Health and Care Excellence

a multi-centre double blind study involving 453 women, a 34% reduction of urinary tract infections was observed after 3 months of initial treatment and a 10-day booster course of OM-89 [30]. The same treatment structure

was utilized in a retrospective study of 79 patients, with *Escherichia coli* identified as the main pathogen in 49% of the population [11]. Sixty-three per cent of those infected with *Escherichia coli* and 53% of the whole population had a positive response to treatment.

OM-89 efficacy was also confirmed in a study involving menopausal women. A clinical trial was carried out with a group of patients aged 66 years on average. The number of recurrent infections in the group dropped from 3.4 to 1.8 (a reduction of 65%) after the immunomodulatory treatment [38].

OM-89 oral immunomodulatory treatment for the prevention of recurring UTIs is recommended both by the European Association of Urology (EAU) in uncomplicated UTIs in women (strong evidence, highest recommendation level, 1a) [12] and by the Polish Association of Urology in prevention of recurring urinary tract infections. The treatment helps reduce the frequency of recurring infections, patients' symptoms, antibiotic prescriptions, and the risk of antibiotic resistance [39]. To prevent recurring UTIs, OM-89 is administered once a day before a meal, for a total of 90 days. The drug can be used in parallel with antibiotic treatment during the acute phase of an infection, without prior urine culture results, because it induces a strong immune response not only to *E. coli*, but also to other pathogens causing UTIs.

OM-89 is characterized by the highest level of evidence of all non-antibiotic methods of UTI prevention [12].

Other non-antibiotic methods of prevention

In accordance with the 2017 Cochrane database analysis [40], the impact of probiotics on reducing urinary tract infections in patients with bladder function disorders requires further research.

In vitro studies have shown that cranberry juice reduces adherence of *Escherichia coli* bacteria to the urinary tract and vaginal epithelium [41, 42]. As a result, patients' symptoms associated with bacterial irritation should be relieved. Reduced symptom levels, however, are not equivalent to infection eradication. Prospective randomized trials with women aged 18–45 years did not detect any statistically significant difference in UTI prevalence diagnosed by urine cultures between groups drinking cranberry juice and those drinking placebo [43]. Similar conclusions were presented in a Cochrane analysis published in 2012 [44].

Treatment of chronic urinary tract infections and preventing further recurrences is yet another challenge. D-mannose was found to be efficient in preventing recurring UTIs by reducing bacterial adherence to urinary tract epithelium. A meta-analysis published in 2020 included 8 papers overall, but the final results were based on data from merely 163 patients [35]. The results are

promising, but further research is necessary to determine the optimum dosage and treatment duration.

Antibiotic prophylaxis

Some doctors recommend long-term prophylactic use of antibiotics in women with recurring urinary tract infections. A Cochrane meta-analysis indicated positive outcomes of prophylactic use of antibiotics in young women with recurring UTIs [45]. Results published by Ahmed *et al.* [46], however, show that long-term antibiotic prophylaxis had positive outcomes in patients aged 65 years and above only when continued for more than 2 years. The patients received nitrofurantoin, cephalexin, or trimethoprim. The treatment reduced the frequency of recurring symptomatic urinary tract infections (OR = 0.57; 95% CI: 0.55–0.59) and the need for additional antibiotic prescriptions (OR = 0.61; 95% CI: 0.59–0.62). At the same time, a small but statistically significant increase of hospitalizations due to UTIs was observed (OR = 1.16; 95% CI: 1.05–1.28).

According to EAU guidelines, antibiotic prophylaxis should be introduced when neither behavioural interventions nor non-antibiotic prevention is successful.

International and domestic recommendations

According to American Urological Association (AUA), Canadian Urological Association (CUA), and Society of Urodynamics (SUFU), Female Pelvic Medicine, and Urogenital Reconstruction guidelines, most recommendations are classified as level B or C [14]. Diagnosis of recurring UTI should always be confirmed by a urine culture. Prior to treatment initiation, the practitioner should review urinalysis and urine culture results. In case of very severe symptoms, however, antibiotic treatment may be initiated while waiting for laboratory test results. Asymptomatic bacteriuria should not be treated; it does not necessitate urinalyses or urine cultures, either. Antibiotic treatment of symptomatic UTI (with nitrofurantoin, trimethoprim-sulfamethoxazole, and fosfomycin as the first line of treatment) should follow the results of an antibiogram. Antibiotic treatment should not exceed 7 days, and it may be administered parenterally whenever required. If symptoms recede, no post-treatment laboratory tests are required. If symptoms persist, a repeat urine culture should be carried out to guide further treatment. Topical vaginal administration of oestrogens is recommended in post- and perimenopausal women (unless there are contraindications). In accordance with the WHO plan to counteract inducing excessive antibiotic resistance, the aforementioned research associations permit prophylactic use of cranberry and other alternative therapies.

European Association of Urology guidelines are complete with a note providing a current literature review [12]. The strength levels of the recommendations were also provided. The authors recommend not diagnosing or treating asymptomatic bacteriuria with the exception of pregnant patients (weak recommendation) and patients with discontinuity of mucous membranes of the bladder (strong recommendation). When considering an uncomplicated urinary tract infection, the diagnosis should be based on clinical symptoms in the absence of vaginal infection. Urinary culture is recommended only when considering a diagnosis of acute pyelonephritis, dealing with pregnant patients, and women with unconventional presentation of symptoms or symptoms not receding within four weeks after treatment completion. The first line of treatment should include fosfomycin, pivampicillin, or nitrofurantoin. Treatment of uncomplicated cystitis with aminopenicillins or fluoroquinolones is not recommended (strong recommendation). The authors indicated that using test strips to diagnose uncomplicated cystitis carried low strength of evidence. Diagnosis of recurring UTI must be confirmed by urine culture with antibiogram. Non-antibiotic prevention of recurring infections should involve, as the first line of treatment, behavioural interventions and OM-89 immune system stimulation.

Antibiotic prophylaxis is only recommended in the case of UTI recurring in spite of non-antibiotic prevention – antibacterial prophylaxis after sexual intercourse, periodic short-term antibacterial treatment in women for whom the treatment was successful (strong recommendation). At the same time, the recommendation to treat postmenopausal women with oestrogens and introduce behavioural modifications, and the wide use of imaging technologies in women with uncomplicated cystitis was classified as weak in terms of evidence. Urinalysis (laboratory based or strip test), urine culture, and imaging are recommended in all cases of pyelonephritis. The authors of the guidelines recommend treatment of uncomplicated pyelonephritis with short courses of fluoroquinolones and hospitalization only in the case of parenteral antibiotic administration, until the patient can be converted to an oral route. At the same time, treatment with nitrofurantoin, fosfomycin, or pivampicillin is not recommended (strong recommendation). In the case of complicated recurring pyelonephritis, aminoglycosides combined with amoxicillin or second-generation cephalosporin is recommended. Another option is intravenous treatment with third-generation cephalosporin in the case of generalized symptoms emerging. Ciprofloxacin is only recommended for oral treatment of cases that do not require hospitalization, or for patients with known allergies to the other available antibiotics. Ciprofloxacin and other fluoroquinolones are contraindicated if the patient has received them in the past 6 months (strong recommen-

dation). The authors do not recommend routine antibiotic treatment in patients after catheter removal.

The British committee National Institute for Health and Care Excellence guidelines published in 2020 discuss treatment of lower urinary tract infections [47]. Outside of pregnancy, a 3-day treatment course is as effective as 5-day or 10-day courses. In older women, the treatment may continue for 3 to 6 days. Nitrofurantoin or trimethoprim is the recommended first-line treatment, with fosfomycin or pivampicillin constituting the second line of treatment. Pregnant patients should be treated for 7 days, making sure that, prior to treatment initiation, no antibiotic resistance to the selected drug has been observed in the past. Drugs recommended in cases of asymptomatic bacteriuria include nitrofurantoin, amoxicillin, and cefalexin, and in the case of symptomatic infections – amoxicillin or cefalexin.

Polish guidelines for the diagnosis, treatment and prevention of urinary tract infections in adults were developed in 2015 under the National Antibiotic Protection Program [48]. Asymptomatic bacteriuria requires treatment with antibiotics only during and before surgery of the urinary system. Treatment of acute uncomplicated cystitis in young women can be undertaken based on clinical symptoms. In such cases the diagnosis does not require laboratory test results, such as urine sediment test or urine culture. Most patients may receive outpatient treatment. According to the guidelines, evidence-based treatment of uncomplicated cystitis should not involve fluoroquinolones. These should be limited to treatment of complicated or severe cases. In the case of recurrence, a urine culture should be taken together with evidence-based antibiotic treatment initiated while waiting for laboratory test results. In the case of complicated UTIs, the following tests should be carried out: urinalysis, blood panel, CRP, creatinine concentration, GRF, and urine culture. Treatment should be modified in line with antibiogram results. Acute pyelonephritis diagnosed based on clinical presentation should always be confirmed by a urine culture, accompanied by a blood culture for more severe cases. Initial evidence-based treatment should be modified to account for culture results. For pregnant patients, the authors recommend a urine culture in the first trimester of pregnancy, to prevent pyelonephritis and premature birth risk. In the case of cystitis in the patient's history, repeat urine cultures should be taken every 1–2 months. Fluoroquinolones are contraindicated throughout the pregnancy, and co-trimoxazole should not be used in the first trimester.

Conclusions

Urinary tract infection is one of the most common infections afflicting women. UTI occurs in females at any age, with the highest prevalence in pregnant and

postmenopausal patients. UTI often accompanies vaginal infections and is frequently caused by pathogens originating in the final section of the digestive tract. Antibiotic treatment duration should be minimized, with the exact dosage and time schedule depending on the type of infection.

Asymptomatic bacteriuria does not always require antibiotic treatment, because their excessive use may lead to the emergence of antibiotic resistant strains. When dealing with chronic infections and asymptomatic bacteriuria, alternative treatment to reduce the risk of recurrence should always be considered.

For recurrent urinary tract infections, non-antibiotic prevention is recommended as the first line of treatment, based on behavioural interventions and immune system modulation.

Disclosure

The authors report no conflict of interest.

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