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Consensus statement

Executive summary of the diagnosis and treatment of urinary tract infection: Guidelines of the Spanish Society of Clinical Microbiology and Infectious Diseases (SEIMC)

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A B S T R A C T

Most urinary tract infections (UTI) are uncomplicated infections occurring in young women. An extensive evaluation is not required in the majority of cases, and they can be safely managed as outpatients with oral antibiotics. *Escherichia coli* is by far the most common uropathogen, accounting for >80% of all cases. Other major clinical problems associated with UTI include asymptomatic bacteriuria, and patients with complicated UTI. Complicated UTIs are a heterogeneous group associated with conditions that increase the risk of acquiring infection or treatment failure. Distinguishing between complicated and uncomplicated UTI is important, as it influences the initial evaluation, choice, and duration of antimicrobial therapy. Diagnosis is especially challenging in the elderly and in patients with in-dwelling catheters. The increasing prevalence of resistant uropathogens, including extended-spectrum β-lactamases and carbapenemase-producing Enterobacteriaceae, and other multidrug-resistant Gram-negative organisms further compromises treatment of both complicated and uncomplicated UTIs.

The aim of these Clinical Guidelines is to provide a set of recommendations for improving the diagnosis and treatment of UTI.

Resumen ejecutivo del diagnóstico y tratamiento de las infecciones del tracto urinario. Guía de la Sociedad Española de Enfermedades Infecciosas y Microbiología Clínica (SEIMC)

Palabras clave:
Infecciones del tracto urinario
Bacteriuria asintomática
Cistitis aguda
Pielonefritis aguda
Infecciones recurrentes del tracto urinario
Infecciones urinarias asociadas al sondaje vesical

R E S U M E N

La mayoría de infecciones del tracto urinario (ITU) son infecciones no complicadas que se presentan en mujeres jóvenes. En la mayoría de los casos no se requieren pruebas diagnósticas complementarias y se pueden tratar ambulatoriamente de forma segura con antibióticos por vía oral. *Escherichia coli* es el uropatógeno más frecuente causando más del 80% de estas infecciones. La bacteriuria asintomática (BA) y las ITUs complicadas son otras formas de presentación de la ITU. Las ITU complicadas son un grupo heterogéneo de condiciones que incrementan el riesgo de adquisición de la infección o de fracaso del tratamiento. La distinción entre ITU complicada y no complicada es fundamental para decidir la

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evaluación inicial del paciente, la elección del antimicrobiano y la duración del mismo. El diagnóstico es especialmente difícil en ancianos y en pacientes con sondaje permanente. El incremento de cepas resistentes a los antibióticos, especialmente Enterobacterías productoras de beta-lactamasas de espectro extendido y de carbapenemasas y de otros Gram negativos multirresistentes, dificultan la elección del tratamiento de las ITU complicadas y no complicadas.

El objetivo de esta guía clínica es proporcionar recomendaciones basadas en la evidencia para mejorar el diagnóstico y tratamiento de las ITU.

Introduction

Urinary tract infection (UTI) is one of the most common clinical problems in both the community and healthcare-associated settings. Community-acquired uncomplicated UTIs (uUTI) are particularly common among women, the vast majority of whom experience at least one episode of infection in their lifetime. A significant subset (25–40%) of women also develop recurrent urinary tract infections (rUTI), with multiple infections that recur over months, or years, in some cases. Other relevant clinical problems associated with UTI include asymptomatic bacteriuria (AB) and patients with complicated urinary tract infection (cUTI). Nosocomial UTI (generally a reflection of catheter-associated infections) constitutes about 20–30% of all hospital-acquired infections and are common sources of nosocomial bacteremia. One of the most important factors impacting the management of UTI in recent years has been the emergence of antimicrobial resistance among uropathogens, particularly isolates causing community-acquired UTI. Although at the moment antimicrobials can generally ensure the successful treatment or prevention of UTI, the emergence of antimicrobial resistance among uropathogens may soon limit our ability to do so.

All the above reasons illustrate how variable and complex these infections are, which is why the Spanish Society of Clinical Microbiology and Infectious Diseases (SEIMC) requested a panel of experts to provide an update on many of the issues involved, including the aetiology, microbiology, prevention, diagnosis, and treatment of various UTI syndromes. The related topic of prostatitis falls outside the scope of these guidelines. The present statement was written following SEIMC guidelines for consensus statements (www.seimc.org), as well as *Agree Collaboration* (www.agreecollaboration.org) recommendations for evaluating the methodological quality of clinical practice guidelines. Over various meetings, the authors selected a set of questions designed to form the basis of the document. Their recommendations are based on a systematic critical review of the literature including, when necessary, the opinion of experts, who are SEIMC members. Their recommendations have been adjusted according to the scientific evidence available (Appendix A). All the authors and the coordinators of the statement have agreed on the contents and conclusions of the document. Before final publication, the manuscript was made available online for all SEIMC members to read and to make comments and suggestions.

Clinical impact of resistance

What microbiological and clinical data should be used to guide empiric treatment of UTI?

Recommendations:

- Studies of the susceptibility of uropathogens in the community tend to overestimate resistance rates. To guide empiric treatment, susceptibility and clinical data (type of UTI (uncomplicated versus complicated), sex, age and previous antibiotic therapy should be considered (**A-II**)).
- An antimicrobial agent is not recommended for empiric treatment of urinary tract infections if local resistance prevalence is over 20% for cystitis (**B-II**) or 10% for pyelonephritis (**C-III**).

Diagnosis

When is a urine culture necessary for the diagnosis of uncomplicated cystitis?

Recommendations:

- In women with uncomplicated cystitis, empiric treatment should be initiated on the basis of symptoms alone. A urine culture is generally not necessary (**E-I**).
- A pre-treatment urine culture should be obtained when the diagnosis is not clear from the history and physical examination, when the episode represents an early symptomatic recurrence, when there is reason to suspect antimicrobial resistance or the patient's therapeutic options are limited due to medication intolerance (**A-II**).
- Routine post-treatment cultures are not indicated for asymptomatic women following treatment for cystitis (**E-II**) and should only be obtained if symptoms persist or recur soon after treatment (**A-II**).

Are blood cultures useful in the management of patients with acute pyelonephritis?

Recommendations:

- The available evidence suggests that there is no need to routinely take a blood culture from women with uncomplicated pyelonephritis (**E-II**). It seems reasonable, however, to obtain a blood culture from patients with complicated infections, those receiving antibiotics or who have severe sepsis (**B-II**).

What number of bacteria in urine is considered significant for the diagnosis of UTI?

Recommendations:

- Urine samples for culture should be collected in a manner that minimizes contamination (**A-II**).
- For symptomatic women, a culture definition for cystitis is $\geq 10^2$ CFU/mL (**A-I**) of a uropathogen, and for pyelonephritis $\geq 10^4$ CFU/mL (**A-II**). In non-catheter-related cystitis, counts of $\geq 10^2$ CFU/mL are significant in urine samples obtained by catheterization (**B-III**).
- In males with cystitis, a culture of $\geq 10^3$ CFU/mL is considered to be significant (**A-III**).

- In women with cystitis, the concomitant isolation of enterococci or group B streptococci with an enterobacteriaceae in a midstream urine culture has low clinical significance (**A-I**).
- In patients with indwelling urethral, indwelling suprapubic, or intermittent catheterization, symptomatic UTI is microbiologically defined as the presence of $\geq 10^3$ CFU/mL of a bacterial species in a single catheter urine specimen or a midstream voided urine specimen from a patient whose urethral, suprapubic, or condom catheter has been removed within the previous 48 h (**A-III**).
- In bladder urine obtained by suprapubic aspiration, any number of bacteria is considered to be significant (**A-II**).
- In women with asymptomatic bacteriuria, two consecutive clean-voided specimens with the same uropathogen at counts of $\geq 10^5$ CFU/mL, or one positive urine culture with a positive nitrite test in another sample, are required for diagnosis (**B-II**). In men, bacteriuria is defined as a single uropathogen isolated at a count of $\geq 10^5$ CFU/mL (**B-III**).
- Asymptomatic bacteriuria in patients with indwelling urethral, indwelling suprapubic, or intermittent catheterization is microbiologically defined as the presence of $\geq 10^5$ CFU/mL of a bacterial species in a single catheter urine specimen or a midstream voided urine specimen from a patient whose urethral (**A-III**), suprapubic (**A-III**), or condom catheter (**A-II**) has been removed within the previous 48 h.

General aspects of antimicrobial therapy for the treatment of uncomplicated UTIs

Which pharmacokinetic/pharmacodynamics parameters of an antibiotic describe exposure-response relationships in general?

Recommendations:

- Bacterial killing is best described by indices incorporating the antimicrobial's PK and PD parameters and the minimum inhibitory concentration (MIC), the lowest concentration of the antimicrobial required to prevent the growth of the target organism (**B-II**).

Are urine-specific breakpoints necessary?

Recommendations:

- Specific susceptibility breakpoints for UTI isolates are recommended (**B-III**). EUCAST and CLSI have published several breakpoints that are valid only for isolates in uncomplicated urinary tract infections.

Is the antibiotic concentration in serum or urine the most important?

Recommendations:

- Human data indicates that urinary concentrations are more closely associated with clinical outcomes than serum concentrations for lower UTI. For the treatment of pyelonephritis, however, high serum concentrations of the antimicrobial agent are required (**A-III**).
- With beta-lactams, the efficacy of sequential therapy may decrease due to the significant reduction in exposure to the active drug when switching to oral formulations for pathogens with higher MIC values (**C-III**).

Asymptomatic bacteriuria

Is pyuria useful for diagnosing asymptomatic bacteriuria?. Are urine rapid tests recommended for screening of asymptomatic bacteriuria?

Recommendations:

- Pyuria cannot be considered as an adequate criterion for the diagnosis of AB nor for indication for treatment in a patient with AB (**A-II**). Urine test stripes are not recommended for the detection of AB (**A-II**).

Asymptomatic bacteriuria in at-risk populations

Pregnant women

Recommendations:

- Systematic screening and treatment of AB is recommended for pregnant women (**A-I**) in order to reduce the risk of pyelonephritis (**A-I**), preterm labour and low birth weight infants (**B-II**). An initial urine culture between the 12th and 16th weeks of pregnancy is recommended (**A-I**).
- A follow-up urine culture is recommended in order to verify that the bacteriuria has been eradicated (**A-III**). Subsequent monthly urine cultures until delivery are recommended (**C-III**).

Patients who must undergo urological procedures

Recommendations:

- Systematic screening for and treatment of AB is recommended prior to performing a TURP of the prostate (**A-I**) or any other high-risk urological procedure (**A-II**).
- Screening and prophylaxis for AB is not recommended for patients scheduled to undergo low-risk urological procedures (**A-I**).
- Antibiotic prophylaxis should be initiated immediately before performing the procedure (**A-II**) and may be prolonged only in patients with a short-term urethral catheter, until removal (**C-III**).

Premenopausal, non-pregnant women

Recommendations:

- Systematic screening for AB is not recommended for non-pregnant women under the age of 60 (**E-I**).
- Treatment of AB in non-pregnant women under the age of 60 increases the risk of sUTI and rates of antibiotic resistance (**B-I**).

Diabetic women

Recommendation:

- Systematic screening for and treatment of AB is not recommended for non-pregnant diabetic women (**E-I**).

Patients with urinary catheters

Recommendations:

- Systematic screening for and treatment of AB is not recommended for patients with short-term (**E-II**) or long-term urinary catheters (**E-I**).

- Treatment of AB in women is recommended only if AB persists 48 h after removal of the catheter (**B-I**).
- Systemic antibiotic prophylaxis is not recommended during catheter replacement, since the risk of onset of symptomatic bacteremia is low (**E-II**); nonetheless, it may be recommended in cases of traumatic replacement associated with hematuria (**C-III**).

Elderly persons residing in the community

Recommendation:

- Systematic screening and/or treatment of AB is not recommended for elderly patients living in the community (**E-II**).

Elderly institutionalised subjects

Recommendation:

- Systematic screening and/or treatment of AB is not recommended for institutionalised elderly patients (**E-I**).

Patients about to undergo orthopaedic surgery

Recommendations:

- Systematic diagnosis or treatment of AB is not recommended for patients scheduled to undergo total hip or knee arthroplasty (**A-I**).
- Screening and treatment of AB prior to performing instrumental spinal surgery is recommended for patients with urinary catheters, neurogenic bladders or urinary incontinence in order to reduce the risk of Gram-negative surgical site infections (**B-II**).

Patients with spinal cord injury

Recommendation:

- Systematic screening and treatment of AB is not recommended for patients with spinal cord injury treated with intermittent urinary catheterization (**E-II**).

Transplant recipients

Recommendations:

- For kidney transplant patients, the screening and treatment of AB is only recommended in the first month after transplantation (**B-III**).
- For cases of hematopoietic stem cell transplants and SOTs other than kidney transplants, no recommendations for the screening and treatment of AB can be made (**C-III**).
- Systemic antifungal therapy for asymptomatic candiduria is not recommended for transplant patients, except for neutropenic patients or those scheduled to undergo urological procedures (**D-III**).

Orthotopic neobladder

Recommendation:

- Systematic screening and treatment of AB is not recommended in patients with an orthotopic neobladder (**D-III**).

How long does it take to treat an asymptomatic bacteriuria?

For pregnant women with asymptomatic bacteriuria

Recommendation:

- Standard 4- to 7-day treatment regimens are better than short one-day treatments for eradicating bacteriuria (**A-I**). Only a single 3 g dose of FT offers similar results to the standard treatment regimen (**A-I**).

For patients scheduled to undergo high-risk urological procedures

Recommendations:

- The administration of a single-dose of an appropriate antibiotic is recommended immediately prior to the procedure (**A-II**).
- Prolonging antibiotic treatment after these procedures is only recommended for patients with a short-term urethral catheter and until it has been removed (**C-III**).

Treatment for acute uncomplicated cystitis

What is the first-choice empiric antibiotic treatment recommended for acute uncomplicated cystitis?

Recommendations:

- Due to minimal resistance and propensity for collateral damage, fosfomycin-trometamol (3 g in a single dose) and nitrofurantoin (for 5–7 days) are considered the first-choice drugs for therapy of uncomplicated cystitis (**A-I**).
- Fluoroquinolones (ciprofloxacin, levofloxacin and norfloxacin) are highly efficacious in 3-day regimens (**A-I**), but should be considered as alternative antimicrobials because of their high propensity for collateral damage (**B-III**).
- β-Lactam agents, including amoxicillin-clavulanate, cefuroxime, ceftibuten, for 5 days, and cefixime for 3 day regimens, are appropriate choices for therapy when other recommended agents cannot be used (**B-I**). β-Lactams generally have inferior efficacy and more adverse effects when compared with other UTI antimicrobials (**B-I**). Ampicillin and amoxicillin should not be used for the empiric treatment of uncomplicated cystitis, given the high incidence of antimicrobial resistance to these agents (**E-I**).
- Co-trimoxazole is not recommended for empiric treatment in Spain, because the resistance rate in *E. coli* is greater than 20% (**E-I**). If the infectious organism is susceptible to co-trimoxazole, this agent is very effective therapy (**A-I**).
- In men, and in women with symptoms longer than 7 days, recent UTI, diabetes, renal insufficiency, immunosuppression or with a vaginal diaphragm a longer course of antibiotic therapy (at least 7 days) is recommended (**C-III**).

Community-acquired acute pyelonephritis

What are the criteria for hospital admission in adult patients?

Recommendations:

- Women with uncomplicated APN and mild to moderate symptoms (fever <39 °C, no severe flank pain, no vomiting) can be treated as outpatients (**A-II**).
- Women with uncomplicated APN but with social, mental or physical disabilities that might hinder adherence to a prescribed therapeutic regimen should be admitted to hospital (**C-III**).

- Women with uncomplicated APN and severe symptoms (fever ≥39 °C, severe flank pain, vomiting) should be referred to an emergency room for evaluation, parenteral antibiotics and supportive measures (**A-II**). If, after 24 h, there is improvement and good oral tolerance, the patient may be sent home with oral antibiotics (**A-II**).
- Patients with complicated APN or healthcare-associated APN and those with risk factors for MDR Enterobacteriaceae should be admitted to hospital (**A-II**).
- Pregnant women with otherwise uncomplicated APN and non-severe symptoms may be considered for treatment as outpatients if appropriate follow-up is assured (**B-I**). A normal abdominal ultrasonography is recommended before discharge (**C-III**).
- Selected APN patients with no severe sepsis, no obstructive uropathy (as recorded by ultrasonography), no altered mental status, no metabolic abnormalities and who have a responsible caregiver at home, may be managed in a hospital-based home care unit (**B-III**).

What are the main therapeutic options for pyelonephritis in the different clinical situations, and which are not recommended for empiric treatment because of the high rate of resistance in our setting?

Recommendations:

- In our setting, ampicillin, amoxicillin, amoxicillin-clavulanic acid, co-trimoxazole, fluoroquinolones, nitrofurantoin and fosfomycin-tromethamine are not recommended for the empiric treatment of acute pyelonephritis (**A-III**).
- Parenteral antibiotic treatment is recommended as initial therapy for patients requiring hospital admission (**A-III**).
- In patients with uncomplicated community-acquired acute pyelonephritis with no specific risk factors for ESBL-producing Enterobacteriaceae, empiric therapy with cefuroxime or a third-generation cephalosporin is recommended (**A-II**). For allergic patients, the alternatives are an aminoglycoside (**B-I**), aztreonam (**B-II**) or fosfomycin (**C-III**); a carbapenem is an acceptable option if the patient is closely monitored (**C-III**).
- In community-acquired APN with specific risk factors for ESBL-producing Enterobacteriaceae (at least two risk factors without severe sepsis and one with it) or previous infection/colonization with ESBL, ertapenem is an acceptable option (**C-II**), although other carbapenems (**B-II**) or piperacillin-tazobactam (**B-III**) are alternatives. For patients with penicillin allergy, the alternatives are amikacin (**B-I**) or intravenous sodium fosfomycin (**C-III**); a carbapenem is an acceptable option if the patient is closely monitored (**C-III**).
- In healthcare-associated APN, an antipseudomonal carbapenem is recommended (**A-III**) with ceftolozane-tazobactam or piperacillin-tazobactam as alternatives (**C-III**). For patients with severe sepsis, the addition of amikacin should be considered in order to increase the chances of providing appropriate empiric therapy against Gram-negative bacilli (**B-II**). For patients allergic to penicillin, alternative treatments are aztreonam, amikacin or intravenous sodium fosfomycin ± amikacin (**C-III**); a carbapenem is an acceptable option if the patient is closely monitored (**C-III**).
- Anti-enterococcal coverage is recommended for patients with healthcare-related APN and severe sepsis or cardiac conditions at high risk of endocarditis (**C-III**).
- When the antibiotic susceptibility pattern is known, treatment should preferably be adjusted to the drug with least ecological impact, such as co-trimoxazole (**C-III**).

What is the optimal duration of antibiotic therapy? Does it vary depending on the particular antibiotic administered?

Recommendations:

- In patients with uncomplicated acute pyelonephritis due to susceptible Gram-negative enteric bacilli, 5–7 days of levofloxacin or ciprofloxacin is recommended (**A-I**).
- In the case of third-generation oral or parenteral cephalosporins, a 7 to 10-day course is recommended (**A-I**). For amoxicillin-clavulanic acid and co-trimoxazole a 10-day course is recommended (**A-III**). For aminoglycosides, no more than a 5-day course is recommended (**A-II**).
- For patients with severe or focal APN or slow response to appropriate antibiotics, a longer duration of therapy may be required (**C-III**).

What are the main indications for performing urological studies?

Recommendations:

- Urological studies are only recommended for patients with uncomplicated APN who continue with fever after 3 days of appropriate antibiotic treatment (**A-III**), for APN that fulfils the definition of complicated infection in these guidelines (including severe sepsis) (**A-III**) or for recurrent APN (**C-III**).
- Urological study should also be considered when the clinical diagnosis is doubtful, either to confirm it or to rule out other processes (**C-III**).

Catheter-associated urinary tract infection

What is the etiology of UTI in patients with urinary catheters?

Recommendations:

- In patients with short-term catheterization, UTI is usually monomicrobial and frequently caused by Enterobacteriaceae (**B-II**).
- In patients with long-term catheterization, UTI is usually polymicrobial and frequently caused by antimicrobial-resistant bacteria (**B-II**).

What are the clinical and microbiologial features for diagnosis of symptomatic CA-UTI?

Recommendations:

- If an indwelling catheter has been in place for >2 weeks, the catheter should be replaced before obtaining urine for culture (**A-II**).
- Signs and symptoms compatible with CA-UTI include fever, rigors, altered mental state or malaise with no other identifiable cause, as well as focal signs in the urinary tract, such as flank or pelvic pain, costovertebral angle tenderness, and acute hematuria (**A-III**).
- In catheterised patients, the presence of urinary symptoms is of limited value for differentiating CA-AB from CA-UTI (**A-I**). In patients whose catheters have been removed, the presence of urinary symptoms is suggestive of symptomatic UTI (**A-III**).
- In patients with spinal cord injuries, increased spasticity, autonomic dysreflexia, or a sense of unease are suggestive of CA-UTI (**A-III**).
- In patients with indwelling catheters residing in LTCFs, the clinical criteria for obtaining urine cultures and initiating

antimicrobial therapy include fever, costovertebral angle tenderness, rigors or new onset delirium with no other obvious source (**A-II**).
- In catheterised patients, the presence or absence of odorous or cloudy urine should not be used to distinguish CA-AB from CA-UTI or as an indication for a urine culture or antimicrobial therapy (**A-III**).

Does the presence of pyuria indicate symptomatic UTI?

Recommendations:

- In catheterised patients, pyuria is not diagnostic of CA-AB or CA-UTI (**A-II**). The absence of pyuria in a symptomatic patient suggests a diagnosis other than CA-UTI (**A-III**).

Is the Gram stain useful for guiding empiric antimicrobial treatment in CA-UTI?

Recommendation:

- In catheterised patients, the urine Gram stain may be useful for guiding empiric antibiotic therapy in patients with severe UTI (**B-III**).

Should previous antibiotic use be considered for the selection of empiric therapy of CA-UTI?

Recommendation:

- In catheterised patients with suspected UTI, recent use of beta-lactams or quinolones should be investigated in order to evaluate the risk for MDR bacteria (**B-II**).

What is the empiric antimicrobial therapy for patients with CA-UTI?

Recommendations:

- Antimicrobial therapy is indicated for patients with symptomatic infection or clinical signs of sepsis (**B-III**).
- Patients with symptomatic UTI and criteria for severe sepsis should be treated with parenteral broad-spectrum antibiotics adapted to the local resistance patterns of uropathogens (**C-III**). Imipenem, meropenem and piperacillin/tazobactam are the most active antimicrobials in our setting. If the patient has septic shock or resistance to beta-lactams is suspected, combination therapy with amikacin should be considered (**C-III**).
- If the patient presents with symptoms of mild infection and a urinary origin is unlikely, antimicrobial therapy can be delayed until the urine culture results are known (**C-III**).

How long should antimicrobial therapy for CA-UTI last

Recommendations:

- Seven days is the usual duration of antimicrobial therapy for CA-UTI patients with prompt resolution of symptoms, and patients with cystitis following urinary catheterization (**A-III**); 10–14 days of treatment is recommended for those with delayed response (**A-III**), regardless of whether the patient remains catheterised or not.
- A 5-day course of levofloxacin may be considered for patients with mild CA-UTI (**B-III**). A 3-day course of antimicrobials (**B-II**) or a single-dose of fosfomycin trometamol (3 g) (**C-III**) may be considered for women who develop CA-UTI without upper urinary tract symptoms after removal of an indwelling catheter.
- Antibiotic prophylaxis should not be administered to patients for catheter placement (**E-I**) catheter removal (**D-I**) or replacement (**E-III**) in order to prevent CA-UTI.

What are the most important measures for prevention of CA-AB and CA-UTI?

Recommendations:

- Indwelling catheters should be placed only when they indicated (**A-III**) and should be removed as soon as they are no longer required, in order to reduce the risk of CA-AB (**A-I**) and CA-UTI (**A-II**). Indwelling catheters should be inserted using the aseptic technique and sterile equipment (**B-III**) and a closed catheter drainage system should be maintained to reduce CA-AB and CA-UTI (**A-II** and **A-III**, respectively, for patients with short-term catheters; **A-III** and **A-III**, respectively, for patients with long-term catheters).
- Appropriate alternatives to short- and long-term urethral catheterization should be considered for reducing CA-AB, such as condom catheterization (**A-II** and **B-II**, respectively) intermittent catheterization (**C-I** and **A-III**, respectively), and suprapubic catheterization (**B-I** for short-term catheterization). Alternatives for reducing CA-UTI are intermittent catheterization (**C-III** for short-term and **A-III** for long-term catheterization) and suprapubic catheterization (**C-III** for short-term catheterization).
- In patients with short-term indwelling urethral catheterization, antimicrobial (antibiotic or silver alloy)-coated urinary catheters may reduce or delay the onset of CA-AB, but does not decrease the frequency of CA-UTI (**B-II**).
- Systemic antibiotic prophylaxis should not be routinely used to reduce CA-AB or CA-UTI in patients with short-term (**A-III**) or long-term (**A-II**) catheterization because of the concern of selection of antimicrobial resistance.

Risk factors and prevention strategies for recurrent urinary tract infections (rUTI)

What are the main risk factors of rUTI in premenopausal women?

Recommendations:

- In sexually active women, the main risk factor for rUTI is frequency of sexual intercourse (**B-I**).
- In sexually active women with rUTI, it is not necessary to perform a urological study if there is no suspicion of underlying urological disease (**A-II**).

Are hygienic measures effective in preventing rUTI?

Recommendation:

- In women who fail to prevent rUTI with hygiene measures, it is not necessary to insist on their implementation (**B-II**).

Is acidification of the urine useful for preventing rUTI?

Recommendations:

- Vitamin C (ascorbic acid) in acceptable dosing intervals in regular clinical practice is not useful in the prevention of rUTI (**B-II**).

- Although methenamine hippurate is useful for preventing rUTI (**B-I**), we do not recommend its use, given the potential carcinogenic risks (**C-III**).

When is it advisable to use prevention strategies?

Recommendations:

- In women with fewer than 3 UTIs per year, self-treatment of cystitis is a convenient and effective measure and also reduces the consumption of antibiotics associated with prophylaxis (**B-II**).
- The administration of continuous (**A-I**) or post-coital (**A-I**) antibiotics, topical vaginal estrogens (**A-I**), cranberries (**A-II**) or D-Mannose (**A-II**) for a 6-month period reduces the frequency of rUTI to a greater or lesser extent.

What is the efficacy of continuous or postcoital antibiotic prophylaxis?

Recommendations:

- In women with rUTI, continuous or postcoital antibiotic prophylaxis administered for 6–12 months is highly effective for reducing recurrence (**A-I**).
- The effectiveness of the different antibiotics used in prophylaxis (COT, NIT, trimethoprim, FQs and cephalosporins) is similar (**B-II**).
- If UTI recurs after cessation of prophylaxis, it is recommended to restart the same prophylaxis regimen for a longer period (1–2 years) (**C-III**).
- Due to its ecological impact, prophylaxis with FQs should be used only when no other preventive strategy is available (**C-III**).

What is the role of cranberries in preventing rUTI? Is antibiotic prophylaxis more effective than cranberries in the prevention of rUTI?

Recommendations:

- Cranberries administered for 6–12 months are moderately effective in preventing new episodes of UTI in patients with rUTI (**A-I**); in patients with few UTIs, they are not effective (**A-II**).
- Antibiotic prophylaxis is more effective than cranberries (**A-I**).
- A 72 mg dose, or higher, of PAC is recommended (**C-III**).

What are the main predisposing factors in postmenopausal women?

Recommendations:

- In menopausal women without neurological diseases, the main risk factors for suffering rUTI are urinary incontinence, previous gynaecological surgery, presence of diabetes mellitus, a cystocele, residual urine and a history of rUTI before menopause (**B-II**).
- The role of sexual activity is less relevant as a predisposing factor for recurrence in postmenopausal women (**B-II**).

What is the effectiveness of topical vaginal estrogens preventing rUTI?

Recommendations:

- Oral administration of estrogen does not reduce rUTI (**E-I**).
- Vaginal estrogen significantly reduces rUTI (**A-II**).
- It is not known whether antibiotic prophylaxis is more efficacious than vaginal creams (**C-II**).
- Vaginal estrogen administration is the prophylaxis of choice when associated with vaginal atrophy and should always be considered in all postmenopausal patients (**C-III**).

Are vaccines useful in the prevention of rUTI?

Recommendations:

- Oral and intranasal vaccines (OM-89) made from uropathogenic bacterial extracts are moderately effective in preventing rUTI (**B-II**).
- There are no adequate studies assessing the effectiveness of other commercialised preparations (**C-III**).

Other prevention strategies

Recommendations:

- There is insufficient evidence to recommend vaginal application of lactobacilli as a strategy for preventing rUTI (**B-II**).
- D-mannose is effective in preventing rUTI (**A-II**). Its effectiveness is similar to nitrofurantoin for this indication (**A-II**).

Conflict of interest

The authors declare no conflicts of interest.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.eimc.2016.11.005.