# EAU GUIDELINES ON UROLOGICAL INFECTIONS

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## Introduction

The European Association of Urology (EAU) Urological Infections Guidelines Panel has compiled these clinical guidelines to provide medical professionals with evidence-based information and recommendations for the prevention and treatment of urological tract infections (UTIs). These guidelines also aim to address the important public health aspects of infection control and antimicrobial stewardship.

**Important notice:**
On 11 March 2019, the European Commission implemented stringent regulatory conditions regarding the use of fluoroquinolones due to their disabling and potentially long-lasting side effects. This legally binding decision is applicable in all European Union countries. National authorities have been urged to enforce this ruling and to take all appropriate measures to promote the correct use of this class of antibiotics.

## Classification

Urinary tract infections encompass a wide spectrum of clinical and pathologic conditions affecting various parts of the urinary tract. Each condition has its own unique epidemiology, natural history and diagnostic considerations. A precise distinction is crucial, as it significantly impacts treatment and prognosis. Therefore, standardised terminology is essential for effective communication on this subject. The Guidelines Panel propose a new classification scheme for UTIs aimed at enhancing consistency in clinical practice and providing a comprehensive framework for understanding various clinical presentations. The proposed classification does not use the terms 'uncomplicated' and 'complicated' anymore; instead, it emphasises the difference between localised and systemic UTIs identified by clinical signs and symptoms.

### Figure 1: Classification of UTI

**Localised UTI (i.e., cystitis)**

- Cytistis with typical signs/symptoms (e.g., frequency[1], urgency[2], suprapubic pain[3])
- No signs/symptoms of systemic infection
- Applies to all sexes[4]
- Risk factors may be present and should be addressed


**Systemic UTI**

- UTI with signs/symptoms of systemic infection (e.g., fever[5], chills[6])
- May also include typical local symptoms (e.g., for pyelonephritis[7] or prostatitis[8])
- Risk factors may be present and should be addressed

**Table 1: Localised and systematic signs and symptoms of UTI**

| Localised UTI[1] | Systemic UTI[1,2] |
|---|---|
| Dysuria (pain, burning, stinging) | Fever or hypothermia |
| Urgency | Rigors, shaking chills |
| Frequency | Delirium |
| Incontinence | Hypotension |
| Urethral purulence | Tachycardia |
| Pressure or cramping in the lower abdomen | Costovertebral angle pain/ tenderness |

1. *Recent onset of these localised and/or systemic signs and symptoms.*
2. *These signs and symptoms are possibly caused by a systemic UTI, but there may also be alternative explanations.*

## Risk factors

When managing UTIs, it is essential to consider risk factors that may predispose patients to a severe clinical course or treatment failure. Importantly, in the proposed classification, male sex alone is not considered as a risk factor, as it lacks support from contemporary literature. By identifying and addressing these risk factors early in the treatment process, clinicians can optimise patient care and improve treatment outcomes.

**Table 2: UTI risk factors***

| | | |
|---|---|---|
| Infants | Immunocompromised state | Male sex<br>• Prostatic involvement (e.g. benign prostatic obstruction, chronic bacterial prostatitis) |
| Geriatric or frail patients | Significant post void residual volume | |
| Anatomic or functional abnormalities of the urinary tract | Neurourological disease | Female sex<br>• Pregnancy<br>• Pelvic organ prolapse |
| | Previous antibiotic use | |
| Indwelling urinary catheters | Resistant organisms | |
| Stones | Urinary tract obstruction | Recent instrumentation |

**Both localised and systemic UTIs may be accompanied by risk factors that increase the likelihood of a challenging clinical course and jeopardise treatment success. Clinicians must be aware of these risk factors to adjust treatment if necessary.*

## Antimicrobial stewardship

Stewardship programs have two main sets of actions. The first set mandates use of recommended care at the patient level conforming to guidelines. The second set describes strategies to achieve adherence to the mandated guidance. These include persuasive actions, such as education and feedback, together with restricting availability linked to local formularies. The important components of antimicrobial stewardship programs are:

- regular training of staff in best use of antimicrobial agents;
- adherence to local, national or international guidelines;
- regular ward visits and consultation with infectious diseases physicians and clinical microbiologists;
- audit of adherence and treatment outcomes;

- regular monitoring and feedback to prescribers of their performance and local pathogen resistance profiles.

## Asymptomatic bacteriuria

Asymptomatic bacteriuria is defined as bacterial growth of $\geq 10^5$ CFU/mL in a midstream urine sample - confirmed in two consecutive samples in women and in one single sample in men.

| Recommendations for the management of asymptomatic bacteriuria | Strength rating |
|---|---|
| Do not screen or treat asymptomatic bacteriuria in the following conditions:<br>• women without risk factors;<br>• patients with well-regulated diabetes mellitus;<br>• post-menopausal women;<br>• elderly institutionalised patients;<br>• patients with dysfunctional and/or reconstructed lower urinary tracts;<br>• patients with renal transplants;<br>• patients prior to arthroplasty surgeries;<br>• patients with recurrent urinary tract infections. | Strong |
| Do not screen or treat asymptomatic bacteriuria in patients prior to cardiovascular surgeries. | Weak |
| Screen for and treat asymptomatic bacteriuria prior to urological procedures breaching the mucosa. | Strong |
| Screen for and treat asymptomatic bacteriuria in pregnant women with standard short course treatment or single dose fosfomycin trometamol*. | Weak |

** The Panel wishes to emphasise that most available studies have low methodological quality and are from the 1960s to 1980s. Diagnostic and treatment protocols and accessibility to medical services have dramatically changed since then. The quality of evidence for this recommendation is therefore low. In a newer study of higher methodological quality, the beneficial effects of antibiotic treatment are not as evident. Therefore, it is advisable to consult national recommendations for pregnant women.*

## Cystitis

Cystitis refers to inflammation of the bladder, typically characterised by symptoms such as urinary frequency, urgency, dysuria, suprapubic pain and sometimes gross haematuria. It occurs without any signs or symptoms of systemic infection, such as fever or chills, in both men and women.

| **Recommendations for the diagnostic evaluation of cystitis** | **Strength rating** |
|---|---|
| Diagnose cystitis in women who have no other risk factors for systemic urinary tract infections (UTIs) based on:<br>• a focused history of lower urinary tract symptoms (dysuria, frequency and urgency);<br>• the absence of vaginal discharge or irritation. | Strong |
| Use urine dipstick testing for diagnosis of acute cystitis. | Weak |

| | |
|---|---|
| Urine cultures should be done in the following situations:<br>• Suspected systemic UTI.<br>• Symptoms that do not resolve or recur within four weeks after the completion of treatment.<br>• Women who present with atypical symptoms.<br>• Patients at high risk for infection with antimicrobial-resistant pathogens.<br>• Pregnant women. | Strong |

| **Recommendations for the management of cystitis** | **Strength rating** |
|---|---|
| **Non-antibiotic management** | |
| Advise female patients on the possibility of an antibiotic-sparing approach for the treatment and prevention of acute and recurrent cystitis. Patients should be fully informed on the level of evidence for the different approaches. | Strong |
| Use non-antibiotic therapy options as an alternative to antibiotic treatment in non-geriatric patients. Shared decision-making with the patients is essential. | Strong |
| **Antimicrobial therapy** | |
| Prescribe fosfomycin trometamol, pivmecillinam, nitrofurantoin or nitroxoline as first-line treatment for cystitis in women. | Strong |
| Do not use aminopenicillins or fluoroquinolones to treat cystitis. | Strong |

| Table 3: Suggested regimens for antimicrobial therapy in cystitis | | | |
|---|---|---|---|
| **Antimicrobial** | **Daily dose** | **Duration of therapy** | **Comments** |
| ***First-line women*** | | | |
| Fosfomycin trometamol | 3 g SD | 1 day | |
| Nitrofurantoin macrocrystal | 50-100 mg four times a day | 5 days | |
| Nitrofurantoin monohydrate/ macrocrystals* | 100 mg b.i.d | 5 days | |
| Nitrofurantoin macrocrystal prolonged release* | 100 mg b.i.d | 5 days | |
| Pivmecillinam | 400 mg t.i.d | 3-5 days | |
| Nitroxoline | 250 mg t.i.d. | 5 days | |
| ***Alternatives*** | | | |
| Cefadroxil | 500 mg b.i.d | 3 days | |
| Cefpodoxime | 100 mg b.i.d | 3 days | |
| ***If the local resistance pattern for E. coli is < 20%*** | | | |
| Trimethoprim | 200 mg b.i.d | 5 days | Not in the first trimester of pregnancy |
| Trimethoprim-sulfamethoxazole | 160/800 mg b.i.d | 3 days | Not in the last trimester of pregnancy |
| ***Treatment in men*** | | | |
| Trimethoprim-sulfamethoxazole | 160/800 mg b.i.d | 7 days | Restricted to men, fluoroquinolones can also be prescribed in accordance with local susceptibility testing. |

*SD = single dose; b.i.d = twice daily; t.i.d = three times daily.*

** Recommended in young males without involvement of the prostate, regarding the duration, there is no evidence-based data for nitrofurantoin.*

## Recurrent cystitis

Recurrent cystitis is defined by at least three episodes of cystitis per year or two episodes of cystitis in the last six months.

| **Recommendations for the diagnostic evaluation and treatment of recurrent cystitis** | **Strength rating** |
|---|---|
| Diagnose recurrent cystitis by urine culture. | Strong |
| Do not perform an extensive routine workup (e.g., cystoscopy, full abdominal ultrasound) in women younger than 40 years of age with recurrent cystitis and no risk factors. | Weak |
| Advise pre-menopausal women regarding increased fluid intake, as it might reduce the risk of recurrent cystitis. | Weak |
| Use vaginal oestrogen replacement in post-menopausal women to prevent recurrent cystitis. | Strong |
| Use immunomodulatory prophylaxis to reduce recurrent cystitis in women in the context of well-regulated clinical trials. | Weak |
| Advise patients on the use of a local or oral probiotic containing strains of proven efficacy for vaginal flora regeneration to prevent cystitis. | Weak |

| | |
|---|---|
| Advise patients on the use of a combination of xyloglucan, hibiscus and propolis, or *Centaurii herba*, *Levistici radix* and *Rosmarini folium* to reduce recurrent cystitis episodes and reduce antibiotic use. | Weak |
| Advise patients on the use of cranberry products for symptom relief in acute cystitis and to prevent recurrence; however, patients should be informed that the quality of evidence underpinning this is low with contradictory findings. | Strong |
| Use D-mannose to reduce recurrent cystitis episodes, but patients should be informed of the overall weak and contradictory evidence of its effectiveness. | Weak |
| Use methenamine hippurate to reduce recurrent cystitis episodes in women without abnormalities of the urinary tract. | Strong |
| Use endovesical instillations of hyaluronic acid or a combination of hyaluronic acid and chondroitin sulphate to prevent recurrent cystitis in patients where less invasive preventive approaches have been unsuccessful. Patients should be informed that further studies are needed to confirm the results of initial trials. | Weak |
| Use continuous or post-coital antimicrobial prophylaxis to prevent recurrent cystitis when non-antimicrobial interventions have failed. Counsel patients regarding possible side effects. | Strong |

| | |
|---|---|
| Consider self-administered short-term antimicrobial therapy for patients with good compliance. | Strong |

## Pyelonephritis

Pyelonephritis is suggested by fever (> 38°C), chills, flank pain, nausea, vomiting or costovertebral angle tenderness, with or without the typical symptoms of cystitis. Pregnant women with acute pyelonephritis need special attention, as this kind of infection may not only have an adverse effect on the mother with anaemia, renal and respiratory insufficiency, but also on the unborn child with more frequent pre-term labour and birth.

| **Recommendations for the diagnostic evaluation and treatment of pyelonephritis** | **Strength rating** |
|---|---|
| **Diagnostic evaluation** | |
| Perform urinalysis (e.g. using a dipstick method), including the assessment of white and red blood cells and nitrite, for routine diagnosis. | Strong |
| Perform urine culture and antimicrobial susceptibility testing in patients with pyelonephritis. | Strong |
| Perform imaging of the urinary tract to exclude urgent urological disorders. | Strong |
| **Treatment** | |
| Treat patients with pyelonephritis not requiring hospitalisation with short course fluoroquinolones as first-line treatment. | Strong |
| Treat patients with pyelonephritis requiring hospitalisation with an intravenous antimicrobial regimen initially. | Strong |

| | |
|---|---|
| Switch patients initially treated with parenteral therapy, who improve clinically and can tolerate oral fluids, to oral antimicrobial therapy. | Strong |
| Do not use nitrofurantoin, oral fosfomycin and pivmecillinam to treat pyelonephritis. | Strong |

**Table 4: Suggested regimens for empirical oral antimicrobial therapy in pyelonephritis**

| Antimicrobial | Daily dose | Duration of therapy | Comments |
|---|---|---|---|
| Ciprofloxacin | 500-750 mg b.i.d | 7 days | Fluoroquinolone resistance should be less than 10%. |
| Levofloxacin | Standard dosage: 500 mg oral q.d<br><br>High dosage: 500 mg oral b.i.d | 5 days | |
| Trimethoprim sulfamethoxazole | 160/800 mg b.i.d | 14 days | If such agents are used empirically, an initial intravenous dose of a long-acting parenteral antimicrobial (e.g. ceftriaxone) should be administered. |
| Cefpodoxime | 200 mg b.i.d | 10 days | |
| Ceftibuten | 400 mg q.d | 10 days | |

*b.i.d = twice daily; q.d = every day.*

| Table 5: Suggested regimens for empirical parenteral antimicrobial therapy in pyelonephritis | | |
|---|---|---|
| **Antimicrobials** | **Daily dose** | **Comments** |
| ***First-line treatment*** | | |
| Ciprofloxacin | 400 mg b.i.d | |
| Levofloxacin | Standard dosage: 500 mg oral q.d<br>High dosage: 500 mg oral b.i.d | |
| Cefotaxime | 2 g t.i.d | Not studied as monotherapy in acute pyelonephritis. |
| Ceftriaxone | Standard dosage: 2 g IV q.d<br>High dosage: 2 g IV b.i.d | Lower dose studied, but higher dose recommended. |
| ***Second-line treatment*** | | |
| Cefepime | Standard dosage: 1 g IV t.i.d or 2 g IV b.i.d<br>High dosage: 2 g IV t.i.d | Lower dose studied, but higher dose recommended. |
| Piperacillin/ tazobactam | Standard dosage: 4.5 g t.i.d<br>High dosage: 4.5 g q.i.d prolonged infusion | |
| Gentamicin | 6-7 mg/kg q.d | Not studied as monotherapy in acute pyelonephritis. |
| Amikacin | 25-30 mg/kg q.d | |

| *Last-line alternatives* | | |
|---|---|---|
| Imipenem/ cilastatin | Standard dosage: 0.5 g IV q.i.d over 30 minutes<br>High dosage: 1 g IV q.i.d over 30 minutes | Consider only in patients with early culture results indicating the presence of multi-drug resistant organisms. |
| Meropenem | 1 g t.i.d | |
| Ceftolozane/ tazobactam | 1.5 g t.i.d | |
| Ceftazidime/ avibactam | 2.5 g t.i.d | |
| Cefiderocol | 2g t.i.d | |
| Meropenem-vaborbactam | 2 g t.i.d | |
| Plazomicin | 15 mg/kg o.d | |

*b.i.d = twice daily; IV = intravenous; t.i.d = three times daily; q.d = every day; q.i.d = four times daily; o.d = once daily.*

## Systemic UTIs

Systemic UTIs are infections that originate from various organs of the urinary tract. In contrast to localised UTIs (i.e., cystitis), these infections present typically with systemic signs and symptoms of infection. Local signs and symptoms of infection may also be present. Examples of systemic UTIs include pyelonephritis, acute prostatitis and urosepsis. Catheter-associated UTIs might present as localised as well as systemic infections.

| Recommendations for the treatment of systemic UTIs | Strength rating |
|---|---|
| Use the following antimicrobials as empirical intravenous treatment for systemic UTI:<br>• Amoxicillin plus an aminoglycoside.<br>• A second-generation cephalosporin plus an aminoglycoside.<br>• A third-generation cephalosporin. | Strong |
| Use ciprofloxacin, provided that:<br>• The local resistance percentages are < 10%.<br>• The patient has contraindications for third-generation cephalosporins or aminoglycosides.<br>• The patient has a hypersensitivity for beta-lactam antimicrobials. | Strong |
| Do not use ciprofloxacin and other fluoroquinolones for the empirical treatment of systemic UTI in patients from urology departments or when patients have used fluoroquinolones in the last six months. | Strong |
| Manage any urological abnormality and/or underlying complicating factors. | Strong |

## Catheter-associated UTIs

Catheter-associated UTI (CA-UTI) refers to UTIs occurring in a person whose urinary tract is currently catheterised or has been catheterised within the past 48 hours.

| Recommendations for diagnostic evaluation of CA-UTIs | Strength rating |
|---|---|
| Do not carry out routine urine culture in asymptomatic catheterised patients. | Strong |
| Do not use pyuria as sole indicator for CA-UTI. | Strong |
| Do not use the presence or absence of odorous or cloudy urine alone to differentiate catheter-associated asymptomatic bacteriuria from CA-UTI. | Strong |

| Recommendations for disease management and prevention of CA-UTIs | Strength rating |
|---|---|
| Treat symptomatic CA-UTI according to the recommendations for localised and systemic UTI. | Strong |
| Take a urine culture prior to initiating antimicrobial therapy in catheterised patients in whom the catheter has been removed. | Strong |
| Do not treat catheter-associated asymptomatic bacteriuria in general. | Strong |
| Treat catheter-associated asymptomatic bacteriuria prior to traumatic urinary tract interventions (e.g. transurethral resection of the prostate). | Strong |
| Replace or remove the indwelling catheter before starting antimicrobial therapy. | Strong |
| Do not apply topical antiseptics or antimicrobials to the catheter, urethra or meatus. | Strong |
| Do not use prophylactic antimicrobials to prevent CA-UTIs. | Strong |

| | |
|---|---|
| Do not routinely use antibiotic prophylaxis to prevent clinical UTI after urethral catheter removal. | Weak |
| The duration of catheterisation should be minimal. | Strong |
| Use hydrophilic-coated catheters to reduce CA-UTI. | Strong |
| Do not routinely use antibiotic prophylaxis to prevent clinical UTI after urethral catheter removal or in patients performing intermittent self-catheterisation. | Weak |

## Urosepsis

The urosepsis section of the guidelines is currently under review, and an updated version will be published in the 2027 edition. In the interim, users are advised to refer to the Surviving Sepsis Campaign Guidelines 2021 from the Society of Critical Care Medicine.

## Urethritis

Inflammation of the urethra presents usually with subjective symptoms (dysuria, alguria, burning, itching and pain around the distal urethra and external urethral meatus) and clinical signs (urethral discharge, erythema around the external urethral meatus and inguinal lymphadenopathy). These symptoms and signs must be distinguished from other infections of the lower urinary tract.

| **Recommendations for the diagnostic evaluation and antimicrobial treatment of urethritis** | **Strength rating** |
|---|---|
| Perform a Gram stain of urethral discharge or a urethral smear to preliminarily diagnose gonococcal urethritis. | Strong |

| | |
|---|---|
| Perform a validated nucleic acid amplification test (NAAT) on a first-void urine sample or urethral smear prior to empirical treatment to diagnose chlamydial and gonococcal infections. | Strong |
| If possible, delay treatment until the results of the NAATs are available to guide treatment choice in patients with mild symptoms. | Strong |
| Perform a urethral swab culture prior to initiation of treatment in patients with a positive NAAT for gonorrhoea, to assess the antimicrobial resistance profile of the infective strain. | Strong |
| Use a pathogen-directed treatment based on local resistance data. | Strong |
| Sexual partners should be treated whilst maintaining patient confidentiality. | Strong |

**Table 6: Suggested regimens for antimicrobial therapy for urethritis**

| Suspected | Antimicrobial | Dosage & duration of therapy | Alternative regimens |
|---|---|---|---|
| Gonococcal infection | Ceftriaxone<br>Doxycycline | 1-2 g i.m. or IV*, SD<br>100 mg b.i.d, p.o. 7 days | In case of doxycycline allergy, in combination with ceftriaxone:<br>Azithromycin 4-day regimen: Day 1 1 g; Days 2–4: 500 mg p.o. |
| Non-Gonococcal infection | Doxycycline | 100 mg b.i.d, p.o. 7 days | Azithromycin 4-day regimen: Day 1 1 g; Days 2–4: 500 mg p.o. |

| Table 7: Regimens for antimicrobial therapy for urethritis with causing pathogen detected | | | |
|---|---|---|---|
| **Pathogen** | **Antimicrobial** | **Dosage & duration of therapy** | **Alternative regimens** |
| *Neisseria gonorrhoeae* | Ceftriaxone<br>Doxycycline | 1-2 g i.m. or IV*, SD<br>100 mg b.i.d, p.o. 7 days | • Azithromycin 1 g p.o., SD, if *M. genitalium* has been excluded<br>• Azithromycin 4-day regimen: Day 1 1 g; Days 2–4: 500 mg p.o. if *M. genitalium* cannot be ruled out<br>• Cefixime 400 mg p.o., SD plus Azithromycin 1 g p.o. SD<br>• Gentamicin 240 mg i.m. SD plus Azithromycin 2 g p.o. SD<br>• Gemifloxacin 320 mg p.o. SD plus Azithromycin 2 g p.o. SD<br>• Spectinomycin 2 g i.m. SD<br>• Fosfomycin trometamol 3 g p.o. on days 1, 3 and 5<br><br>In case of doxycycline allergy, in combination with ceftriaxone: Azithromycin 4-day regimen: Day 1 1 g; Days 2–4: 500 mg p.o. |

| | | | |
|---|---|---|---|
| *Chlamydia trachomatis* | Doxycycline | 100 mg b.i.d, p.o. for 7 days | • Azithromycin 1 g p.o., SD, if *M. genitalium* has been excluded<br>• Azithromycin 4-day regimen: Day 1 1 g; Days 2–4: 500 mg p.o. if *M. genitalium* cannot be ruled out<br>• Levofloxacin 500 mg p.o. q.d. 7 days<br>• Ofloxacin 200 mg p.o. b.i.d., 7 days |
| *Mycoplasma genitalium* | Azithromycin | 4-day regimen: Day 1 1 g; Days 2–4: 500 mg p.o. | In case of macrolide resistance:<br>• Moxifloxacin 400 mg q.d. p.o. 7 days |
| *Ureaplasma urealyticum* | Doxycycline | 100 mg b.i.d, p.o. 7 days | Azithromycin 1 g p.o. SD |
| *Trichomonas vaginalis* | Metronidazole | 1.5-2 g p.o. SD | Tinidazole 2 g p.o. SD |

*SD = single dose; b.i.d = twice daily; q.d = everyday; p.o. = orally, i.m. = intramuscular; IV = intravenous.*
** Despite the lack of RCTs there is increasing evidence that intravenous treatment with ceftriaxone is safe and effective for the treatment of gonorrhoeal infections and avoids the discomfort of an intramuscular injection for patients.*

## Bacterial prostatitis

Bacterial prostatitis is a clinical condition caused by bacterial pathogens. It is recommended that urologists use the classification suggested by the National Institute of Diabetes, Digestive and Kidney Diseases of the National Institutes of Health, in which bacterial prostatitis, with confirmed or suspected infection, is distinguished from chronic pelvic pain syndrome.

| Recommendations for the diagnosis of bacterial prostatitis | Strength rating |
|---|---|
| Do not perform prostatic massage in acute bacterial prostatitis (ABP). | Strong |
| Take a mid-stream urine dipstick to check nitrite and leukocytes in patients with clinical suspicion of ABP. | Weak |
| Take a mid-stream urine culture in patients with ABP symptoms to guide diagnosis and tailor antibiotic treatment. | Weak |
| Take a blood culture and a total blood count in patients presenting with ABP. | Weak |
| Perform accurate microbiological evaluation for atypical pathogens, such as *Chlamydia trachomatis* or Mycoplasmata, in patients with chronic bacterial prostatitis (CBP). | Weak |
| Perform the Meares and Stamey 2- or 4-glass test in patients with CBP. | Strong |
| Perform transrectal ultrasound in selected cases to rule out the presence of prostatic abscess. | Weak |
| Do not routinely perform microbiological analysis of the ejaculate alone to diagnose CBP. | Weak |

| Recommendations for the disease management of bacterial prostatitis | Strength rating |
|---|---|
| **Acute bacterial prostatitis (ABP)** | |
| Treat ABP according to the recommendations for systemic UTIs. | Strong |

| Chronic bacterial prostatitis (CBP) | |
|---|---|
| Prescribe a fluoroquinolone (e.g. ciprofloxacin, levofloxacin) as first-line treatment for CBP. | Strong |
| Prescribe a macrolide (e.g. azithromycin) or a tetracycline (e.g. doxycycline) if intracellular bacteria have been identified as the causative agent of CBP. | Strong |
| Prescribe metronidazole in patients with *T. vaginalis* CBP. | Strong |

**Table 8: Suggested regimens for antimicrobial therapy for chronic bacterial prostatitis**

| Antimicrobial | Daily dose | Duration of therapy | Comments |
|---|---|---|---|
| Floroquinolone | Optimal oral daily dose | 4-6 weeks | |
| Doxycycline | 100 mg b.i.d | 10 days | Only for *C. trachomatis* or mycoplasma infections |
| Azithromycin | 500 mg o.d | 3 weeks | Only for *C. trachomatis* infections |
| Metronidazole | 500 mg t.i.d | 14 days | Only for *T. vaginalis* infections |

*b.i.d = twice daily; o.d = once daily; t.i.d = three times daily.*

## Acute infective epididymitis

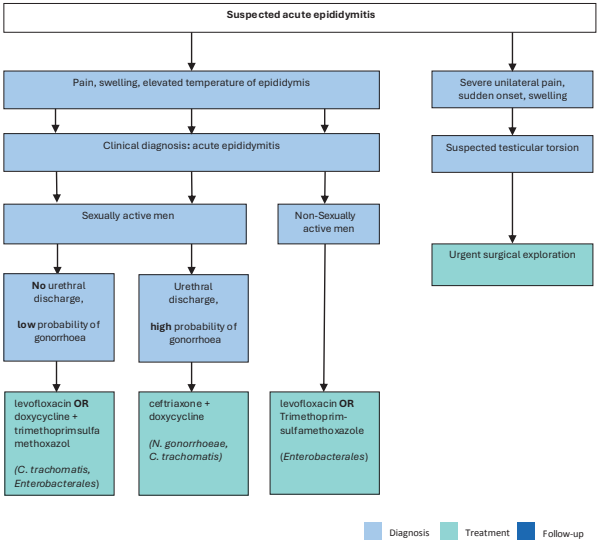
Acute epididymitis is clinically characterised by unilateral pain, palpable swelling and increased temperature of the epididymis, which worsen over several days. The testis and scrotal skin may be involved. The pain is typically localised to the posterior aspect of the testis affected. Acute epididymitis is generally caused by sexually transmitted infections (STIs) or Enterobacterales. Pathogens migrate from the urethra or bladder and can be identified by appropriate diagnostics in up to 90% of patients.

| Recommendations for the diagnosis and treatment of acute infective epididymitis | Strength rating |
|---|---|
| Obtain a mid-stream urine and a first-voided urine for pathogen identification by culture and nucleic acid amplification test. | Strong |
| Initially prescribe a single antibiotic or a combination of two antibiotics active against *Chlamydia trachomatis* and *Enterobacterales* in young sexually active men; in older men without sexual risk factors only Enterobacteriaceae have to be considered. | Strong |
| If gonorrhoeal infection is likely, give single dose ceftriaxone 500 mg intramuscularly or intravenously* in addition to a course of an antibiotic active against *Chlamydia trachomatis.* | Strong |
| Adjust antibiotic agent when pathogen has been identified and adjust duration according to clinical response. | Weak |

| | |
|---|---|
| Follow national policies on reporting and tracing/treatment of contacts for sexually transmitted infections. | Strong |

** Despite the lack of RCTs, there is increasing evidence that intravenous treatment with ceftriaxone is safe and effective for the treatment of gonorrhoeal infections and avoids the discomfort of an intramuscular injection for patients.*

## Figure 2: Diagnostic and treatment algorithm for men with acute epididymitis



## Fournier's gangrene

Fournier's gangrene is an aggressive and frequently fatal polymicrobial soft tissue infection of the perineum, peri-anal region and external genitalia. It is an anatomical sub-category of necrotising fasciitis with which it shares a common aetiology and management pathway.

| Recommendations for the disease management of Fournier's gangrene | Strength rating |
|---|---|
| Start treatment for Fournier's gangrene with broad-spectrum antibiotics on presentation, with subsequent refinement according to culture results and clinical response. | Strong |
| Commence repeated surgical debridement for Fournier's gangrene within 24 hours of presentation. | Strong |
| Do not use adjunctive treatments for Fournier's gangrene, except in the context of clinical trials. | Weak |

**Table 9: Suggested regimens for antimicrobial therapy for Fournier's gangrene of mixed microbiological aetiology**

| Antimicrobial | Dosage |
|---|---|
| Piperacillin-tazobactam (prolonged infusion) plus Vancomycin | 4.5 g q.i.d or t.i.d IV<br>15 mg/kg b.i.d |
| Imipenem-cilastatin | Standard dosage:<br>0.5 g IV q.i.d over 30 minutes<br>High dosage:<br>1 g IV q.i.d over 30 minutes |
| Meropenem | 1 g t.i.d IV |
| Ertapenem | 1 g o.d |
| Gentamicin | 6-7 mg/kg IV q.d |

| | |
|---|---|
| Cefotaxime plus metronidazole or clindamycin | 2 g q.i.d IV<br>500 mg q.i.d IV<br>600-900 mg t.i.d IV |
| Cefotaxime plus fosfomycine plus metronidazole | 2 g q.i.d IV<br>5 g t.i.d IV<br>500 mg q.i.d IV |

*b.i.d = twice daily; IV = intravenous; o.d = once daily; q.i.d = four times daily; q.d = every day; t.i.d = three times daily.*

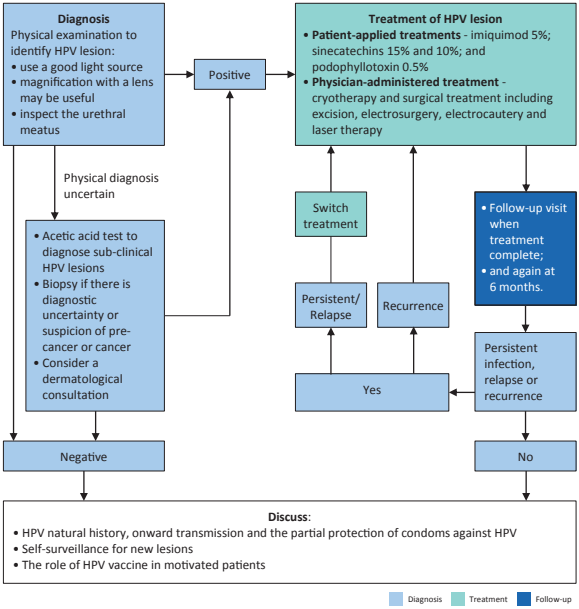
## Management of Human papillomavirus in males

Human papillomavirus (HPV) is one of the most frequently sexually transmitted viruses encompassing both oncogenic (low- and high-risk variants) and non-oncogenic viruses.

| Recommendations | Strength rating |
|---|---|
| **Treatment of anogenital warts** | |
| Use self-administered imiquimod 5% cream applied to all external warts overnight three times each week for 16 weeks for the treatment of anogenital warts. | Strong |
| Use self-administered sinecatechins 15% or 10% applied to all external warts three times daily until complete clearance, or for up to 16 weeks for the treatment of anogenital warts. | Strong |
| Use self-administered podophyllotoxin 0.5% self-applied to lesions twice daily for three days, followed by four rest days, for up to four or five weeks for the treatment of anogenital warts. | Strong |

| | |
|---|---|
| Use cryotherapy or surgical treatment (excision, electrosurgery, electrocautery and laser therapy) to treat anogenital warts based on an informed discussion with the patient. | Strong |
| **Male circumcision** | |
| Discuss male circumcision with patients as an additional one-time preventative intervention for HPV-related diseases. | Strong |
| **Therapeutic HPV vaccination** | |
| Offer HPV vaccine to males after surgical removal of high-grade anal intraepithelial neoplasia. | Weak |
| **Prophylactic HPV vaccination** | |
| Offer early HPV vaccination to boys with the goal of establishing optimal vaccine-induced protection before the onset of sexual activity. | Strong |
| Apply diverse communication strategies in order to improve HPV vaccination knowledge in young adult males. | Strong |

## Figure 3: Diagnostic and treatment algorithm for the management of HPV in men




## Herpes Simplex Virus

Genital herpes is a highly prevalent sexually transmitted. This lifelong viral infection is caused by the Herpes simplex virus (HSV), which exists in two types: HSV-1 and HSV-2. Both HSV-1 and 2 result in chronic infection, with frequent reactivations and subclinical shedding, leading to a high risk of transmission to sexual partners. Diagnosis can be challenging, as ulcerative lesions may be absent during evaluation. When present, the lesions are typically painful, erythematous, vesicular and recurrent. Less common presentations include nodular, hypertrophic, verrucous, vegetative or exophytic lesions.

| Recommendations | Strength rating |
|---|---|
| Obtain a comprehensive medical history, including history of previous sexual contacts, from all patients presenting with genital ulcers potentially related to HSV. | Strong |
| Confirm the diagnosis with a clinical swab and type-specific virologic testing, such as polymerase chain reaction or culture, from the lesion. | Strong |
| Treat the first clinical episode of genital HSV infection. | Strong |

**Table 10: Treatment regimens for genital HSV infection**

| Antimicrobials | Dosage |
|---|---|
| ***Recommended therapy and dose for first clinical episode HSV*** | |
| Aciclovir | 400 mg orally t.i.d for 10 days OR 200 mg orally five times daily for 10 days. |
| Valaciclovir | 500 mg orally b.i.d for 10 days. |
| ***Recommended therapy and dose for recurrent genital HSV*** | |
| Aciclovir | 400 mg orally t.i.d for 5 days OR 800 mg b.i.d for 5 days OR 800 mg t.i.d for 2 days. |
| Valaciclovir | 500 mg orally b.i.d for 3 days. |

*b.i.d. = twice daily; t.i.d = three times daily.*

## Genitourinary tuberculosis (TB)

Genitourinary TB can affect all genitourinary organs and is almost always secondary due to the hematogenous spread of chronic latent TB infection. Diagnosis relies on a high suspicion of infection based on patient history; microbiological, molecular and histological testing; and imaging findings. Patients generally present with non-specific urological complaints for which no obvious cause is identified. Due to lack of high-quality evidence, the Panel are unable to give a recommendation on surgical treatment and imaging diagnostics at this time.

| Recommendations for diagnosis and treatment of genitourinary tuberculosis (GUTB) | Strength rating |
|---|---|
| **Diagnosis** | |
| Take a full medical history, including history of previous tuberculosis (TB) infection (pulmonary and extrapulmonary), form all patients presenting with persistent non-specific genitourinary symptoms and no identifiable cause. | Strong |
| Perform smear microscopy on urine, semen, tissue specimens, discharged or prostatic massage fluid using Ziehl–Neelsen (ZN) or auramine staining in patients with suspected GUTB. | Weak |
| Perform acid-fact bacilli culture on three midstream, first-void urine samples on three consecutive days for *M. tuberculosis* isolation in patients with suspected GUTB. | Strong |
| Use a recommended PCR test system in addition to microbiological reference standard (MRS) in urine specimens as a diagnostic test in patients with signs and symptoms of GUTB. | Weak |
| Use imaging modalities in combination with culture and/or PCR to aid in the diagnosis of GUTB and to assess the location and extent of damage to the genitourinary system. | Weak |

| Treatment | |
|---|---|
| Use medical treatment as first-line treatment for GUTB. | Strong |
| Use a daily six-month regimen for treatment of newly diagnosed GUTB. This should include an intensive phase of two months with isoniazid, rifampicin, pyrazinamide and ethambutol, followed by a continuation phase of four-months with isoniazid and rifampicin. | Strong |
| Treat multidrug-resistant TB with an individualised treatment regime that includes at least five effective tuberculosis medicines during the intensive phase, including pyrazinamide and four core second-line tuberculosis medicines. | Strong |

**Table 11: Treatment regimens for newly diagnosed GUTB and MDR-TB**

| Antimicrobials | Dosage |
|---|---|
| ***Six month regimen for treatment of newly diagnosed GUTB*** | |
| Intensive two month phase | |
| Isoniazid | 5 mg/kg q.d; max daily dosage 300 mg |
| Rifampicin | 10 mg/kg q.d; max daily dosage 600 mg |
| Pyrazinamide | 25 mg/kg q.d; max daily dosage 2000 mg |
| Ethambutol | 15–20 mg/kg q.d; max daily dosage ranging from 800 mg to 1600 mg depending on body weight |
| Continuation four month phase | |
| Isoniazid | 5 mg/kg q.d; max daily dosage 300 mg |
| Rifampicin | 10 mg/kg q.d; max daily dosage 600 mg |

| *Treatment regimen for multi-drug resistant TB* | |
|---|---|
| Treat multi-drug resistant TB with an individualised treatment regime that includes at least five effective tuberculosis medicines during the intensive phase, including pyrazinamide and four core second-line tuberculosis medicines*. | |
| Group A<br>Fluoroquinolones | Levofloxacin, Moxifloxacin and Gatifloxacin |
| Group B<br>Second-line injectables | Amikacin, Capreomycin, Kanamycin and Streptomycin** |
| Group C<br>Other second-line agents | Ethionamide/Prothionamide, Cycloserine/ Terizidone, Linezolid and Clofazimine |
| Group D<br>Add-on agents (not part of the core MDR-TB regime) | D1: Pyrazinamide, Ethambutol and high-dose isoniazid<br>D2: Bedaquiline and Delamamid<br>D3: p-aminosalicylic acid, Imipenem-cilastatin, Meropenem, Amoxicillin-clavulanate and Thioacetazone*** |

** Drugs should be chosen as follows: 1 from group A, 1 from group B, and at least 2 from group C. If the minimum number of five TB medicines cannot be composed from drugs included in Groups A to C, an agent from group D2 and other agents from group D3 may be added to bring the total to five.*
***Streptomycin can substitute other injectable drugs if none of these agents can be used and if the strain is shown not to be resistant.*
***Thioacetazone should not be used if the patient is HIV seropositive.*

## Fungal UTI

The presence of fungi in urine represents a spectrum of clinical conditions from asymptomatic colonisation to a systemic infection, such as life-threatening urosepsis. Most fungal UTIs present as localised UTIs (i.e. cystitis). Only 2–11% of patients with funguria present with symptoms of a UTI. The prevalence of funguria is considerably higher in hospital-acquired settings than in outpatient environments. Treatment depends on the isolated species and its susceptibility pattern.

| Recommendations for the diagnosis and treatment of fungal UTIs | Strength rating |
|---|---|
| Take a full medical history, including UTI symptoms and risk factors for fungal UTI. | Strong |
| Perform urine culture for species identification and susceptibility testing, particularly in non-albicans *Candida* UTI. | Strong |
| Replace indwelling catheters or stents for significant clearance of funguria. | Weak |
| Treat localised fungal UTI with a two-week course of oral fluconazole. | Strong |
| A treatment duration of less than two weeks can be used in localised fungal UTI (i.e. cystitis) without risk factors. | Weak |
| Treat fluconazole-resistant *Candida* spp. in localised UTI with amphotericin B deoxycholate instillations, amphotericin B deoxycholate instillations IV, flucytosine or capsofungin, taking in account comorbidities and kidney function. | Strong |
| Treat fluconazole-resistant *Candida* spp. in systemic UTI with amphotericin B deoxycholate instillations IV, flucytosine or capsofungin, taking in account comorbidities and kidney function. | Strong |

| Table 12: Treatment regimens for fungal UTIs | | | |
|---|---|---|---|
| **Localised fungal UTI** | | | |
| **Pathogens** | **Antimicrobial** | **Dose & duration of therapy** | **Renal function correction** |
| Fluconazole-susceptible species | Fluconazole | • 200 mg/day p.o. for two weeks<br>• 800 mg/day p.o. for susceptible *C. glabrata* | • CrCl < 50 mL/min: Reduce dose by 50%<br>• Dialysis patients: Administer a full dose 3 times weekly after dialysis |
| Fluconazole-resistant species | Amphotericin B deoxycholate | Bladder instillations: 200 ml/L in a 100 ml infusion bag of 5% glucose, three times daily for seven days | No dosage adjustment required |
| | Flucytosine | • 25 mg/kg p.o. or IV 4 times daily for two weeks<br>• Can be used as monotherapy for *C. glabrata* | • CrCl 21–40: 25 mg/kg b.i.d<br>• CrCl 10–20: 25 mg/kg daily<br>• CrCl < 10: 25 mg/kg Q 48h<br>• Dialysis: 25–50 mg/kg Q 48–72h after dialysis |
| | Amphotericin B deoxycholate | • 0.3–0.6 mg/kg/day IV for 1–7 days<br>• Used with or without flucytosine for *C. glabrata* | No dosage adjustment required |
| | Caspofungin | 70 mg IV day 1, then 50 mg daily for 2–3 weeks | No dosage adjustment required |

| Systemic fungal UTI | | | |
|---|---|---|---|
| Fluconazole-susceptible species | Fluconazole | • 200–400 mg/day p.o. for two weeks<br>• 800 mg/day p.o. for two weeks for susceptible *C. glabrata*<br>• Severe infections: Consider a loading dose of 400/800 mg on first day | • CrCl < 50 mL/min: Reduce dose by 50%<br>• Dialysis: Administer a full dose 3 times weekly after dialysis |
| Fluconazole-resistant species | Amphotericin B deoxycholate | • 0.3–0.6 mg/kg/day IV for 1–7 days.<br>• Used with or without flucytosine for C. glabrata | No dosage adjustment required |
| | Flucytosine | • 25 mg/kg p.o. or IV 4 times daily for two weeks<br>• Generally used in combination with Amphotericin B | • CrCl 21–40 mL/min: 25 mg/kg b.i.d<br>• CrCl 10–20 mL/min: 25 mg/kg daily<br>• CrCl < 10 mL/min: 25 mg/kg Q 48 h<br>• Dialysis: 25–50 mg/kg/dose every 48–72 hours after dialysis |
| | Caspofungin | 70 mg IV day 1, then 50 mg daily for two to three weeks | No dosage adjustment required |

*b.i.d = twice daily; CrCl = creatinine clearance; IV = intravenous; p.o. = orally.*

## Peri-procedural antibiotic prophylaxis

The available evidence enabled the Panel to make recommendations concerning urodynamics, cystoscopy, stone procedures (extracorporeal shockwave lithotripsy, ureteroscopy and percutaneous neprolithotomy), transurethral resection of the prostate, transurethral resection of the bladder, and prostate biopsy. For nephrectomy and prostatectomy, the scientific evidence was too weak to enable the Panel to make recommendations either for or against antibiotic prophylaxis.

| Recommendations for peri-procedural antibiotic prophylaxis | Strength rating |
|---|---|
| Do not use antibiotic prophylaxis to reduce the rate of symptomatic urinary infection following:<br>• urodynamics;<br>• cystoscopy. | Strong |
| Do not use antibiotic prophylaxis for extracorporeal shockwave lithotripsy in patients with sterile urine. Prescribe antibiotic prophylaxis only in the case of suspected or diagnosed infected stones or bacteriuria. | Strong |
| Use antibiotic prophylaxis to reduce the rate of symptomatic urinary infection following ureteroscopy. | Weak |
| Use single-dose antibiotic prophylaxis to reduce the rate of clinical urinary infection following percutaneous nephrolithotomy. | Strong |
| Use antibiotic prophylaxis to reduce infectious complications in men undergoing transurethral resection of the prostate. | Strong |

| | |
|---|---|
| Use antibiotic prophylaxis to reduce infectious complications in high-risk patients undergoing transurethral resection of the bladder. | Weak |
| Perform prostate biopsy using the transperineal approach due to the lower risk of infectious complications and better antibiotic stewardship. | Strong |
| Omit perioperative antibiotic prophylaxis in transperineal biopsy in patients without risk factors for infectious complications. | Weak |
| Use rectal cleansing with povidone-iodine in men prior to transrectal prostate biopsy. | Strong |
| Do not use fluoroquinolones for prostate biopsy, in line with the European Commission final decision on EMEA/H/A-31/1452. | Strong |
| For antibiotic prophylaxis in transrectal biopsy*, and from an antimicrobial stewardship perspective, the following options are recommended**:<br>• First option: Targeted prophylaxis based on rectal swab or stool culture.<br>• Second option: Augmented prophylaxis (using two or more different classes of antibiotics). | Strong |

**The indication of fosfomycin trometamol for prostate biopsy has been withdrawn in Germany, as the manufacturers did not submit the necessary pharmacokinetic data in support of this indication. Urologists are advised to check their local guidance in relation to the use of fosfomycin trometamol for prostate biopsy.*

***While most studies have been performed using fluoroquinolones, the applicability of these findings to non-fluoroquinolone antibiotics remains unclear.*

The Panel have decided not to make recommendations for specific agents for particular procedures, those listed below represent possible choices only. Urologists should choose a specific antimicrobial based on their knowledge of local pathogen prevalence for each type of procedure, their antibiotic susceptibility profiles and virulence.

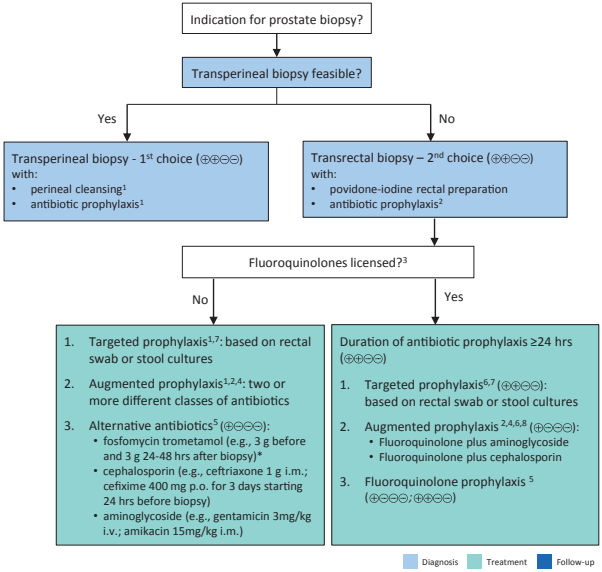
**Table 13: Suggested regimens for antimicrobial prophylaxis prior to urological procedures**

| Procedure | Prophylaxis recommended | Antimicrobial |
|---|---|---|
| Urodynamics | No | |
| Cystoscopy | No | |
| Extracorporeal shockwave lithotripsy | No | |
| Ureteroscopy | Yes | Trimethoprim<br>Trimethoprim-sulfamethoxazole<br>Cephalosporin group 2 or 3<br>Aminopenicillin plus a beta-lactamase inhibitor. |
| Percutaneous nephrolithotomy | Yes (single dose) | |
| Transurethral resection of the prostate | Yes | |
| Transurethral resection of the bladder | Yes, in patients who have a high risk of suffering postoperative sepsis. | |

| | | |
|---|---|---|
| Transrectal prostate biopsy | Yes | 1. Targeted prophylaxis - based on rectal swab or stool culture.<br>2. Augmented prophylaxis - two or more different classes of antibiotics*.<br>3. Alternative antibiotics<br>• fosfomycin trometamol** (e.g. 3 g before and 3 g 24-48 hrs after biopsy)<br>• cephalosporin (e.g. ceftriaxone 1 g i.m.; cefixime 400 mg p.o. for 3 days starting 24 hrs before biopsy)<br>• aminoglycoside (e.g. gentamicin 6-7 mg/kg IV q.d; amikacin 25-30 mg/kg IV q.d). |

*i.m.=intramuscular; IV = intravenous; p.o.=orally; q.d = every day.*
**Note: option 2 is against antibiotic stewardship programmes*
***The indication of fosfomycin trometamol for prostate biopsy has been withdrawn in Germany as the manufacturers did not submit the necessary pharmacokin,etic data in support of this indication. Urologists are advised to check their local guidance in relation to the use of fosfomycin trometamol for prostate biopsy.*

## Figure 4: Prostate biopsy workflow to reduce infectious complications




*Suggested workflow on how to reduce post biopsy infections.*
*i.m. = intramuscular; IV = intravenous; p.o. = orally.*

1. *Two systematic reviews including non-RCTs and two RCTs describe comparable rates of post-biopsy infection in patients with and without antibiotic prophylaxis.*
2. *Be informed about local antimicrobial resistance.*
3. *Banned by European Commission due to side effects.*
4. *Contradicts principles of antimicrobial stewardship.*
5. *Fosfomycin trometamol (4 RCTs), cephalosporins (2 RCTs), aminoglycosides (2 RCTs).*
6. *Only one RCT comparing targeted and augmented prophylaxis.*
7. *Originally introduced to use alternative antibiotics in case of fluoroquinolone resistance.*

8. *Various schemes: fluoroquinolone plus aminoglycoside (4 RCTs), and fluoroquinolone plus cephalosporin (1 RCT).*

*Levels of evidence. High certainty: (⊕⊕⊕⊕) very confident that the true effect lies close to that of the estimate of the effect. Moderate certainty: (⊕⊕⊕⊖) moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different. Low certainty: (⊕⊕⊖⊖) Confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect. Very low certainty: (⊕⊖⊖⊖) very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of effect.*
*Figure reproduced from Pilatz et al., with permission from Elsevier.*

**The indication of fosfomycin trometamol for prostate biopsy has been withdrawn in Germany, as the manufacturers did not submit the necessary pharmacokinetic data in support of this indication. Urologists are advised to check their local guidance in relation to the use of fosfomycin trometamol for prostate biopsy.*

*This short booklet text is based on the more comprehensive EAU Guidelines accessible on the website: http://www.uroweb.org/guidelines.*