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European Association of Urology

Guidelines

European Association of Urology Guidelines on Urological Infections: Summary of the 2026 Guidelines

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Abstract

Background and objective: Urological infections significantly impact individuals' well-being and quality of life due to their widespread occurrence and diverse clinical manifestations. This work aims to provide evidence-based guidance on diagnosing, treating, and preventing urinary tract infections (UTIs) and male accessory gland infections, while addressing crucial public health aspects related to infection control and antimicrobial stewardship.

Methods: For the 2026 Urological Infections Guidelines, new and relevant evidence was identified, collated, and appraised through a structured assessment of the literature. Databases searched included Medline, EMBASE, and the Cochrane Library. Recommendations within the Guidelines were developed by the panels to prioritise clinically important care decisions. The strength of each recommendation is determined by the balance between desirable and undesirable consequences of alternative management strategies, the quality of the evidence (including certainty of estimates), and the nature and variability of patient values and preferences.

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EAU guidelines

Key findings and limitations: Key recommendations emphasise the importance of thorough medical history and physical examination for patients with urological infections. The guidelines stress the role of antimicrobial stewardship to combat the rising threat of antimicrobial resistance, providing recommendations for antibiotic selection, dosing, and duration based on the latest evidence. Key updates in the 2026 Urological Infections Guidelines summary include: comprehensive restructuring of the guideline framework in alignment with the new classification system for UTIs; the addition of a new chapter on the diagnosis and management of Herpes simplex virus; the addition of a new chapter on the diagnosis and treatment of fungal UTIs; and an update of the evidence and recommendations on periprocedural antibiotic prophylaxis for prostate biopsy.
Conclusions and clinical implications: This overview of the 2026 European Association of Urology (EAU) guidelines offers valuable insights into the classification, diagnosis, and treatment of urological infections and is designed to be effectively integrated into clinical practice.

ADVANCING PRACTICE

What does this study add?
The updated European Association of Urology Urological Infections Guidelines reflect the latest evidence in the diagnosis and treatment of urological infections, aiming to improve patient outcomes and quality of life.

Patient Summary
The EAU's Guidelines Panel on urological infections has issued an updated guideline emphasising diagnosis, treatment, and prevention, particularly focusing on antimicrobial stewardship in response to the escalating global threat of antimicrobial resistance.

1. Introduction

Urinary tract infections (UTIs) are among the most frequent bacterial infections, involving various medical specialties in their diagnosis, treatment, and prevention [1]. The clinical presentations of UTIs vary widely, from rather benign, localised infections to severe systemic UTIs and even urosepsis [2,3]. The European Association of Urology (EAU) Urological Infections Guidelines Panel has compiled these clinical guidelines to equip health care professionals with evidence-based insights and recommendations for diagnosing, treating, and preventing UTIs and male accessory gland infections. These guidelines also address crucial public health aspects such as infection control and antimicrobial stewardship.

It must be emphasised that clinical guidelines present the best evidence available to experts. However, following guideline recommendations will not necessarily result in the best outcome. Guidelines cannot substitute clinical expertise in tailoring treatment decisions for individual patients; instead, they serve as a framework, considering patients' personal values, preferences, and unique circumstances.

2. Methods

For the 2026 Urological Infections Guidelines, new evidence was identified, collated, and appraised through a structured assessment of the literature. Databases searched included Medline, EMBASE, and the Cochrane Library. Detailed search strategies are available on the EAU website: https://uroweb.org/guidelines/urological-infections/publications-appendices.

Recommendations within the Guidelines were developed by the panels to prioritise clinically important care decisions. The strength of each recommendation is determined by the balance between desirable and undesirable consequences of alternative management strategies, the quality of the evidence (including certainty of estimates), and the nature and variability of patient values and preferences. Strong recommendations are made when evidence quality is high and/or there is a favourable balance of benefits to harms and patient preferences. Weak recommendations are made when the evidence is of lower quality and/or benefits and patient preferences are less clear [1].

3. Guidelines

3.1. *Classification of UTIs*

UTIs encompass a wide spectrum of clinical and pathological conditions affecting various parts of the urinary tract. Each condition has its own unique epidemiology, natural history, and diagnostic considerations. A precise distinction

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is crucial as it significantly impacts treatment and prognosis.

The Guidelines Panel proposes 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 no longer uses the terms 'uncomplicated' and 'complicated.' Instead, it emphasises the difference between localised and systemic UTIs identified by clinical signs and symptoms (Fig. 1 and Table 1).

According to the new definition, UTIs can manifest as either localised (ie, cystitis) or systemic (eg, pyelonephritis, prostatitis) infections. Both conditions 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 and should address them accordingly.

This definition enables medical practitioners to distinguish between a localised UTI that can generally be treated on an outpatient basis and a more complex systemic UTI that may necessitate blood sampling, imaging, intravenous antimicrobial treatment, and hospitalisation.

Table 1 – Localised and systematic signs and symptoms of urinary tract infection

Localised UTI[a]	Systemic UTI[a,b]
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

UTI = urinary tract infection

[a] Recent onset of these localised and/or systemic signs and symptoms.

[b] These signs and symptoms are possibly caused by a systemic UTI, but there may also be alternative explanations.

3.2. *Asymptomatic bacteriuria in adults*

Asymptomatic bacteriuria (ABU) is common and corresponds to a commensal colonisation [4]. In an individual without urinary tract symptoms, ABU is defined as bacterial growth of $\geq 10^5$ CFU/ml in a midstream urine sample, confirmed in two consecutive samples in women [2] and in one single sample in men [3]. Cystoscopy and/or imaging of the upper urinary tract is not mandatory if the medical history is otherwise unremarkable. If persistent growth of urease-producing bacteria, that is, *Proteus mirabilis*, is detected, stone formation in the urinary tract must be excluded. In men, a digital rectal examination (DRE) has to be performed to investigate the possibility of prostate diseases. Clinical studies have shown that ABU may protect against superinfecting UTI, thus treatment of ABU should be performed only in cases of proven benefit for the patient to avoid the risk of selecting antimicrobial resistance and eradicating a potentially protective ABU strain (see Table 2) [5,6]. Treatment of ABU in pregnant women was found to be beneficial by meta-analysis of the available evidence; however, most 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; therefore, the quality of evidence for this recommendation is low. In a newer study of higher

Table 2 – Recommendations for the management of asymptomatic bacteriuria

Recommendations	Strength rating
Do not screen or treat asymptomatic bacteriuria in the following conditions: women without risk factors; patients with well-regulated diabetes mellitus; postmenopausal women; elderly institutionalised patients; patients with dysfunctional and/or reconstructed lower urinary tracts; patients with renal transplants; patients prior to arthroplasty surgeries; 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

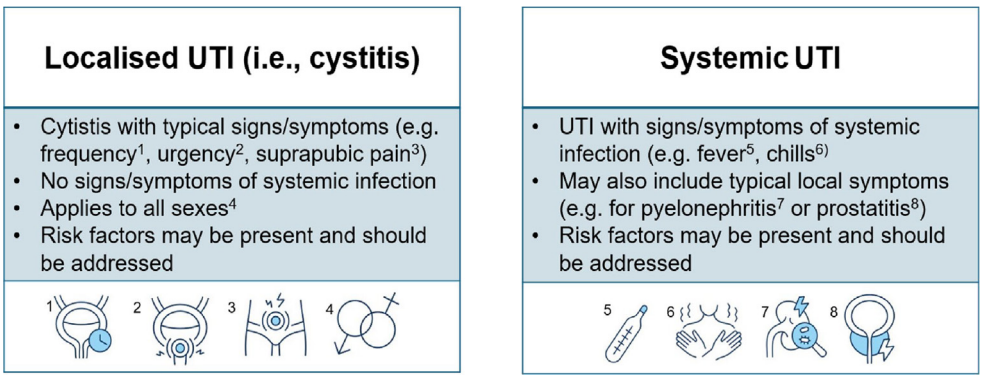

Fig. 1 – Classification of UTI. UTI = urinary tract infection.

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methodological quality, the beneficial effects of antibiotic treatment are not as evident [7]. Therefore, it is advisable to consult national recommendations for pregnant women.

3.3. Cystitis in women

Cystitis in women is defined as a symptomatic lower UTI limited to the bladder, in the absence of systemic symptoms or signs such as fever, chills, flank pain, or malaise. Risk factors include sexual intercourse, use of spermicides, a new sexual partner, a mother with a history of cystitis, and a history of cystitis during childhood. The diagnosis of cystitis can be made with a high probability based on a focused history of lower urinary tract symptoms (dysuria, frequency, and urgency) and the absence of vaginal discharge [8,9]. In elderly women, genitourinary symptoms are not necessarily related to cystitis [10,11]. In patients presenting with typical symptoms of cystitis, urine analysis (ie, urine culture, dipstick testing) leads only to a minimal increase in diagnostic accuracy [12]. However, if the diagnosis is unclear, dipstick analysis can increase the likelihood of a cystitis diagnosis [13,14]. Taking a urine culture is recommended in patients with atypical symptoms, as well as those who fail to respond to appropriate antimicrobial therapy [15,16].

When deciding on the management of cystitis, several therapeutic options are available.

These can be broadly divided into two groups: nonantibiotic treatments and antibiotic treatments.

Patient preferences should always be appropriately considered. This is particularly relevant for nonantibiotic strategies, which may involve accepting a higher symptom burden and a slightly increased risk of complications such as pyelonephritis. Recommendations for the diagnosis and treatment of cystitis in women are presented in Table 3. Suggested regimens for antimicrobial therapy in cystitis are presented in Table 4.

Table 3 – Recommendations for the diagnosis and treatment of cystitis in women

Recommendations	Strength rating
Diagnosis	
Diagnose cystitis in women who have no other risk factors for systemic urinary tract infections based on: a focused history of lower urinary tract symptoms (dysuria, frequency, and urgency); the absence of vaginal discharge.	Strong
Use urine dipstick testing for the diagnosis of acute cystitis.	Weak
Urine cultures should be done in the following situations: Suspected systemic urinary tract infection. Symptoms that do not resolve or recur within 4 wk after completion of treatment. Women who present with atypical symptoms. Patients at high risk for infection with antimicrobial-resistant pathogens. Pregnant women.	Strong
Nonantibiotic treatment	
Advise female patients on the possibility of antibiotic-sparing approaches for the treatment and prevention of acute cystitis. Patients should be fully informed on the level of evidence for the various approaches.	Strong
Use nonantibiotic therapy options as an alternative to antibiotic treatment in non-geriatric patients. Shared decision-making with the patients is essential.	Strong
Antimicrobial treatment	
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 4 – Suggested regimens for antimicrobial therapy in cystitis

Antimicrobial	Daily dose	Duration of therapy	Comments
First-line women			
Fosfomycin trometamol	3 g SD	1 d	
Nitrofurantoin macrocrystal[a]	50–100 mg q.i.d	5 d	
Nitrofurantoin monohydrate/macrocrystals[a]	100 mg b.i.d	5 d	
Nitrofurantoin macrocrystal prolonged release[a]	100 mg b.i.d	5 d	
Pivmecillinam	400 mg t.i.d	3–5 d	
Nitroxoline	250 mg t.i.d	5 d	
Alternatives			
Cefadroxil	500 mg b.i.d	3 d	
Cefpodoxime	100 mg b.i.d	3 d	
If the local resistance pattern for E. coli is <20%			
Trimethoprim	200 mg b.i.d	5 d	Not in the first trimester of pregnancy
Trimethoprim-sulfamethoxazole	160/800 mg b.i.d	3 d	Not in the last trimester of pregnancy
Treatment in men			
Trimethoprim-sulfamethoxazole	160/800 mg b.i.d	7 d	

SD = single dose; b.i.d = twice daily; t.i.d = three times daily; qid = four times daily.
[a] Recommended in young men without involvement of the prostate (eg, acute bacterial prostatitis), regarding the duration, there are no evidence-based data for nitrofurantoin.

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Table 5 – Age-related associations of recurrent cystitis in women

Young and premenopausal women	Postmenopausal and elderly women
• Sexual intercourse • Use of spermicide • A new sexual partner • A mother with a history of cystitis • History of cystitis during childhood • Blood group antigen secretory status	• History of cystitis before menopause • Urinary incontinence • Atrophic vaginitis due to oestrogen deficiency • Cystocele • Increased postvoid urine volume • Blood group antigen secretory status • Urine catheterisation and functional status • Deterioration in elderly institutionalised women

Routine post-treatment urinalysis or urine cultures in asymptomatic patients are not indicated [17]. In women whose symptoms do not resolve by the end of treatment, and in those whose symptoms resolve but recur within 2 wk, urine culture and antimicrobial susceptibility testing should be performed [18]. For therapy in this situation, one should assume that the infecting organism is not susceptible to the agent originally used. Retreatment with a 7-d regimen using another agent should be considered [18].

3.4. *Recurrent cystitis*

Recurrent cystitis is defined by at least three episodes of cystitis per year or two episodes of cystitis in the last 6 mo. Recurrent cystitis negatively impacts patient quality of life, leading to a reduction in the quality of social and sexual relationships, self-esteem, and capacity for work [19]. Risk factors for recurrent cystitis are presented in Table 5 [4,10,20]. Initial diagnosis of recurrent cystitis should be confirmed by urine culture. An extensive routine workup, including cystoscopy, imaging, and so on, is not routinely recommended because the diagnostic yield is low [21].

Prevention of recurrent cystitis includes counselling regarding avoidance of risk factors, nonantimicrobial measures, and antimicrobial prophylaxis [18,22]. These interventions should be attempted in this order. Recommendations for the diagnosis and treatment of recurrent cystitis are presented in Table 6.

3.5. *Systemic UTIs*

Systemic UTI should be suspected in patients presenting with dysuria, urinary frequency, urgency, or suprapubic pain, accompanied by fever, chills, flank pain, or pelvic/perineal pain, or when patients appear clinically unwell. Systemic UTI may also be considered in patients with unexplained fever or sepsis.

Evaluation should include a thorough clinical assessment to rule out other potential causes of illness. Physical examination should assess for costovertebral angle tenderness and abdominal or suprapubic tenderness. In females, a pelvic examination may be necessary, particularly when symptoms do not clearly suggest a UTI, to evaluate for cervical motion tenderness or uterine tenderness, which could indicate pelvic inflammatory disease or sexually transmitted disease. In biological men presenting with pelvic or perineal pain, a DRE is essential to assess for tenderness or swelling of the prostate, which may suggest acute prostatitis.

Routine blood tests should always be considered in patients presenting with systemic signs and symptoms of infection. In patients with systemic UTIs, the primary goal of imaging is to identify underlying conditions that may delay therapeutic response or require intervention. Initial imaging should be performed by ultrasound. In cases of hydronephrosis, or if obstruction of the upper urinary tract is suspected, cross-sectional imaging (computed tomography [CT], magnetic resonance imaging [MRI]) should be carried out. In patients who are severely ill and in patients exhibiting persistent clinical symptoms despite 48 to 72 h of appropriate antimicrobial therapy, cross-sectional imaging (CT, MRI) should be performed [23,24].

Table 6 – Recommendations for the diagnostic evaluation and treatment of recurrent cystitis

Recommendations	Strength rating
Diagnose recurrent cystitis by urine culture.	Strong
Do not perform an extensive routine workup (eg, cystoscopy, full-abdominal ultrasound) in women younger than 40 yr of age with recurrent cystitis and no risk factors.	Weak
Advise women who are premenopausal regarding increased fluid intake, as it might reduce the risk of recurrent cystitis.	Weak
Use vaginal oestrogen replacement in women who are postmenopausal to prevent recurrent cystitis.	Strong
Use immunomodulatory prophylaxis to reduce recurrent cystitis in women in the context of a well-regulated clinical trial.	Weak
Advise patients on the use of local or oral probiotics 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 for whom 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 postcoital antimicrobial prophylaxis to prevent recurrent cystitis when nonantimicrobial interventions have failed. Counsel patients regarding possible side effects.	Strong
Consider self-administered short-term antimicrobial therapy for patients with good compliance.	Strong

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Table 7 – Recommendations for the treatment of systemic urinary tract infections

Recommendations	Strength rating
Use the following antimicrobials as empirical intravenous treatment for systemic UTI: Amoxicillin plus an aminoglycoside. A second-generation cephalosporin plus an aminoglycoside. A third-generation cephalosporin.	Strong
Use ciprofloxacin, provided that: The local resistance percentages are <10%. The patient has contraindications for third-generation cephalosporins or aminoglycosides. The patient has a hypersensitivity to beta-lactam antimicrobials.	Strong
Do not use ciprofloxacin or other fluoroquinolones for the empirical treatment of systemic UTI in patients from urology departments or when patients have used fluoroquinolones in the last 6 mo.	Strong
Manage any urological abnormality and/or underlying complicating factors.	Strong

UTI = urinary tract infection.

Empiric antimicrobial therapy should be initiated without delay, with subsequent modifications based on antimicrobial susceptibility testing results (Table 7). Identified or suspected anatomical abnormalities should be thoroughly evaluated and managed as indicated. Antimicrobial therapy duration generally ranges from 5 to 10 d, based on clinical response and the selected agent. For patients with symptomatic improvement within 48–72 h, recommended durations are 5–7 d for fluoroquinolones, 7–10 d for trimethoprim-sulfamethoxazole [25], and 7–10 d for beta-lactams. Systematic reviews and meta-analyses show similar cure rates with shorter courses ($\leq$ 7 d) for systemic UTIs, mostly based on fluoroquinolone trials comparing 5- or 7-d regimens with longer treatments [26–28]. However, in males with systemic UTIs, 7 d of antibiotic treatment is inferior to 14 d [28,29]. Limited data exist for other antibiotics, but beta-lactam studies, primarily with older agents, showed no clear benefit from extending treatment beyond 10 d [30,31].

3.6. *Pyelonephritis*

Pyelonephritis is suggested in case of fever (>38 °C), chills, flank pain, nausea, vomiting, or costovertebral angle tenderness, with or without the typical symptoms of cystitis [32]. It is vital to differentiate as soon as possible between pyelonephritis with or without risk factors, such as obstructive pyelonephritis, as the latter can rapidly lead to urosepsis.

Urinalysis, including the assessment of white and red blood cells and nitrite, is recommended for routine diagnosis [33]. In addition, urine culture and antimicrobial susceptibility testing should be performed in all cases of pyelonephritis. Evaluation of the upper urinary tract with ultrasound (US) should be performed to investigate urinary tract obstruction or renal stone disease in patients with a history of urolithiasis, renal function disturbances, or a high urine pH [34]. Additional investigations, such as a contrast-enhanced CT scan or excretory urography, should be considered if the patient remains febrile after 72 h of treatment, or immediately if there is deterioration in clinical status [34]. For the diagnosis of complicating factors in pregnant women, US or MRI should be used preferentially to avoid radiation risk to the foetus [34].

Fluoroquinolones and cephalosporines are the only antimicrobial agents that can be recommended for oral empirical treatment of pyelonephritis [35]. Patients with pyelonephritis requiring hospitalisation should be treated initially with an intravenous antimicrobial regimen, for example, a fluoroquinolone, an aminoglycoside (with or without ampicillin), or an extended-spectrum cephalosporin or penicillin/tazobactam [25]. Recommendations for the diagnosis and treatment of pyelonephritis are presented in Table 8. Suggested regimens for empirical oral and parental antimicrobial therapy in pyelonephritis are presented in Tables 9 and 10, respectively. Patients initially treated with parenteral therapy who improve clinically and can tolerate oral fluids may transition to oral antimicrobial therapy [36].

In pregnant women with pyelonephritis, outpatient management with appropriate parenteral antimicrobials may also be considered, provided symptoms are mild and close follow-up is feasible [37,38]. In more severe cases of pyelonephritis, hospitalisation and supportive care are usually required. After clinical improvement, parenteral therapy can also be switched to oral therapy for a total

Table 8 – Recommendations for the diagnosis and treatment of pyelonephritis

Recommendations	Strength rating
Diagnosis	
Perform urinalysis (eg, using the 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

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Table 9 – Suggested regimens for empirical oral antimicrobial therapy in pyelonephritis

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

b.i.d = twice daily; q.d = once daily.

Table 10 – 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 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 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 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 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 min High dosage: 1 g IV q.i.d over 30 min	Consider only in patients with early culture results indicating the presence of multidrug-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	2 g t.i.d	
Meropenem-vaborbactam	2 g t.i.d	
Plazomicin	15 mg/kg q.d	

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

treatment duration of 7 to 10 d. In men with febrile UTI, pyelonephritis or recurrent infection, or whenever a complicating factor is suspected, a minimum treatment duration of 2 wk is recommended, preferably with a fluoroquinolone, since prostatic involvement is frequent [39].

3.7. *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 h. CA-UTIs are the leading cause of secondary health care-associated bacteraemia. Approximately 20% of hospital-acquired bacteraemias arise from the urinary tract, and the mortality associated with this condition is approximately 10% [40]. The incidence of bacteriuria associated with indwelling catheterisation is 3–8% per d (268–272). The duration of catheterisation is the most important risk factor for the development of a CA-UTI [41,42].

Signs and systemic symptoms compatible with CA-UTI include new onset or worsening of fever, rigours, altered mental status, malaise, or lethargy with no other identified cause, as well as flank pain, costovertebral angle tenderness, acute haematuria, pelvic discomfort, and, in those whose catheters have been removed, dysuria, urgent or frequent urination, and suprapubic pain or tenderness [43]. In a person with a catheter, the presence or absence of odorous or cloudy urine alone should not be used to differentiate CA-ABU from CA-UTI [43,44].

Microbiologically, CA-UTI is defined by microbial growth of $\geq 10^3$ colony-forming units (CFU)/ml of one or more bacterial species in a single catheter urine specimen or in a midstream voided urine specimen from a patient whose urethral, suprapubic, or condom catheter has been removed within the previous 48 h [44]. In patients with catheters, pyuria is not diagnostic for CA-UTI. The presence, absence, or degree of pyuria should not be used to differentiate CA-ABU from CA-UTI. Pyuria accompanying CA-ABU should

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not be interpreted as an indication for antimicrobial treatment. The absence of pyuria in a symptomatic patient suggests a diagnosis other than CA-UTI [44].

A systematic review of 19 different interventions to reduce UTI, including catheter discontinuation and limiting catheterisation in nursing home residents, reported successful CA-UTI reduction and reduced catheter usage [45]. A meta-analysis of seven studies investigating randomised controlled trials (RCTs) comparing hydrophilic-coated to polyvinyl chloride (PVC, standard) catheters for intermittent catheterisation found a statistically lower risk ratio (0.84) for the frequency of UTI in the hydrophilic catheter group [46]. A meta-analysis showed overall benefit for the use of prophylaxis for the reduction of infective complications after catheter removal. However, results from individual trials were inconsistent, with five out of seven trials indicating the possibility of no benefit [47]. A subsequent RCT found no benefit of antibiotic prophylaxis for the reduction of infective complications at up to 4 wk after catheter removal [48].

Recommendations for diagnosis, disease management, and prevention of CA-UTI are outlined in Table 11.

3.8. Urethritis

Urethritis can arise from infectious or noninfectious causes. It is important to differentiate urethral inflammation from other lower UTIs. Urethral infections are commonly transmitted through sexual contact. It is crucial to differentiate between gonococcal urethritis (GU) and nongonococcal urethritis (NGU). NGU is a nonspecific diagnosis with various infectious aetiologies, including *Chlamydia trachomatis, Mycoplasma genitalium, Ureaplasma urealyticum,* and *Trichomonas vaginalis.* The role of *Ureaplasma spp.* in causing urethritis is debated, with recent data suggesting that *U. urealyticum*, but not *U. parvum*, is an aetiological agent in NGU [49]. Symptoms of urethritis include mucopurulent or purulent discharge, dysuria, and urethral pruritus, although many urethral infections are asymptomatic.

In cases of severe urethritis, empirical treatment should commence upon diagnosis. However, if symptoms are mild, it is advisable to delay treatment until guided by the results of the nucleic acid amplification tests (NAAT). All sexual partners at risk should be assessed and treated while maintaining patient confidentiality [50,51].

The recommendations for the diagnosis and treatment of urethritis are presented in Table 12. Suggested regimens for antimicrobial therapy for urethritis are shown in Table 13.

3.9. Bacterial prostatitis

Prostatitis is a frequent diagnosis, yet fewer than 10% of cases are confirmed to have bacterial infection. Enterobacterales are the primary pathogens in acute bacterial prostatitis (ABP) [53]. Chronic bacterial prostatitis (CBP) encompasses a broader spectrum of species, which may include atypical microorganisms [54]. Urologists are advised to utilise the classification proposed by the National Institute of Diabetes, Digestive, and Kidney Diseases (NIDDK) of the National Institutes of Health (NIH), which distinguishes bacterial prostatitis, with confirmed or suspected infection, from chronic pelvic pain syndrome (CPPS) [55–57]. ABP usually presents abruptly with voiding symptoms and distressing but poorly localised pain. It is often associated with malaise and fever. CBP is defined by symptoms that persist for at least 3 mo [58–60]. The predominant symptoms are pain at various locations, including the perineum, scrotum, penis, and inner part of the leg, as well as lower urinary tract symptoms (LUTS) [55–57].

In ABP, parenteral administration of high doses of bactericidal antimicrobials, such as broad-spectrum penicillins, a third-generation cephalosporin, or fluoroquinolones, is recommended [61]. For initial therapy, any of these antimicrobials can be combined with an aminoglycoside [53,58–71]. Ancillary measures include adequate fluid intake and urine drainage. After normalisation of infection parameters, oral therapy can be substituted and continued for a total of 4 to 4 wk [72].

Table 11 – Recommendations for diagnosis, disease management, and prevention of catheter-associated urinary tract infection.

Recommendations	Strength rating
Diagnosis	
Do not carry out routine urine culture in patients who have a catheter but are asymptomatic.	Strong
Do not use pyuria as the sole indicator for catheter-associated UTI.	Strong
Do not use the presence or absence of odorous or cloudy urine alone to differentiate catheter-associated asymptomatic bacteriuria from catheter-associated UTI.	Strong
Disease management and prevention	
Treat symptomatic catheter-associated UTI according to the recommendations for localised and systemic UTI.	Strong
Take a urine culture prior to initiating antimicrobial therapy in patients with catheter, 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 (eg, 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 catheter-associated 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 catheter-associated UTIs.	Strong
Do not routinely use antibiotic prophylaxis to prevent clinical UTI after urethral catheter removal or in patients performing intermittent self-catheterisation.	Weak

UTI = urinary tract infection.

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Table 12 – Recommendations for the diagnostic evaluation and antimicrobial treatment of urethritis

Recommendations	Strength rating
Perform a Gram stain of urethral discharge or a urethral smear to preliminarily diagnose gonococcal urethritis.	Strong
Perform a validated 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 while maintaining patient confidentiality.	Strong

NAAT = nucleic acid amplification test.

Table 13 – Suggested regimens for antimicrobial therapy for urethritis

Pathogen	Antimicrobial	Dosage & duration of therapy	Alternative regimens
Neisseria gonorrhoeae	Ceftriaxone Doxycycline	1–2 g IM or IV [a], SD100 mg b.i.d, p.o 7 d	• Azithromycin 1 g p.o, SD, if*M. genitalium* has been excluded • Azithromycin 4-d regimen: Day 1 1 g; Days 2–4: 500 mg p.o if*M. genitalium* cannot be ruled out • Cefixime 400 mg p.o, SD plus Azithromycin 1 g p.o, SD • Gentamicin 240 mg i.m, SD plus Azithromycin 2 g p.o, SD • Gemifloxacin 320 mg p.o, SD plus Azithromycin 2 g p.o, SD • Spectinomycin 2 g i.m, SD • Fosfomycin trometamol 3 g p.o on days 1, 3, and 5In case of doxycycline allergy, in combination with ceftriaxone: Azithromycin 4-d regimen: Day 1 1 g; Days 2–4: 500 mg p.o
Chlamydia trachomatis	Doxycycline	100 mg b.i.d, p.o for 7 d	• Azithromycin 1 g p.o, SD, if*M. genitalium* has been excluded • Azithromycin 4-d regimen: Day 1 1 g; Days 2–4: 500 mg p.o if*M. genitalium* cannot be ruled out • Levofloxacin 500 mg p.o, q.d 7 d • Ofloxacin 200 mg p.o, b.i.d 7 d
Mycoplasma genitalium	Azithromycin	4-d regimen: Day 1 1 g; Days 2–4: 500 mg p.o	In case of macrolide resistance: • Moxifloxacin 400 mg q.d, p.o 7 d
Ureaplasma urealyticum	Doxycycline	100 mg b.i.d, p.o7 d	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 = every day; p.o = orally; IM = intramuscular; IV = intravenously.

[a] 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 [52].

Fluoroquinolones are recommended as first-line agents in the empirical treatment of CBP because of their favourable pharmacokinetic properties [61], their generally good safety profile, and antibacterial activity against Gram-negative pathogens, including *Pseudomonas aeruginosa* and *C. trachomatis* [73,74].

Approximately 10% of men with ABP will experience urinary retention [75], which can be managed by urethral or suprapubic catheterisation. However, low-level evidence suggests that suprapubic catheterisation can reduce the risk of development of CBP [76].

In case of prostatic abscess, both drainage and conservative treatment strategies appear feasible [77]; if the abscess cavities are <1 cm in diameter, conservative treatment might be effective, while larger abscesses are better treated by single aspiration or continuous drainage [78].

Table 14 outlines the recommendations for the diagnosis and disease management of bacterial prostatitis. Suggested regimens for antimicrobial therapy for CBP are shown in Table 15.

3.10. Acute infective epididymitis

Epididymitis is a prevalent condition and can manifest as acute, chronic, or recurrent episodes [79]. Acute epididymitis is clinically characterised by pain, swelling, and increased temperature of the epididymis, potentially involving the testis and scrotal skin. In up to 90% of cases, the condition is caused by the migration of pathogens from the urethra or bladder, which can be identified through appropriate diagnostics [80]. The predominant pathogens isolated are *Enterobacterales*, *C. trachomatis,* and *N. gonorrhoeae* [81]. Fig. 2 outlines the diagnostic and treatment algorithm for men with acute epididymitis (see Table 16).

3.11. Fournier's gangrene

Fournier's gangrene is an aggressive and frequently fatal polymicrobial soft tissue infection of the perineum, perianal region, and external genitalia [82]. Fournier's gangrene is typically accompanied by painful swelling of the scrotum or perineum and characterised by severe inflammation

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Table 14 – Recommendations for the diagnosis and disease management of bacterial prostatitis

Recommendations	Strength rating
Diagnosis	
Do not perform prostatic massage in 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 Mycoplasma in patients with 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
Disease management	
ABP	
Treat ABP according to the recommendations for systemic UTIs.	Strong
CBP	
Prescribe a fluoroquinolone (eg, ciprofloxacin, levofloxacin) as first-line treatment for CBP.	Strong
Prescribe a macrolide (eg, azithromycin) or a tetracycline (eg, doxycycline) if intracellular bacteria have been identified as the causative agent of CBP.	Strong
Prescribe metronidazole in patients with *T. vaginalis* CBP.	Strong

ABP = acute bacterial prostatitis; CBP = chronic bacterial prostatitis; UTI = urinary tract infection.

Table 15 – Suggested regimens for antimicrobial therapy for chronic bacterial prostatitis

Antimicrobial	Daily dose	Duration of therapy	Comments
Fluoroquinolone	Optimal oral daily dose	4–6 wk	
Doxycycline	100 mg b.i.d	10 d	Only for *C. trachomatis* or mycoplasma infections
Azithromycin	500 mg q.d	Up to 3 wk	Only for *C. trachomatis* infections
Metronidazole	500 mg t.i.d	14 d	Only for *T. vaginalis* infections

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

and infection spreading along fascial planes, often leading to rapid tissue destruction and sepsis [82]. Surgical debridement should be early (< 24 h) and complete, as delayed and/or inadequate surgery may result in higher mortality [82]. Immediate empiric parenteral antibiotic treatment should be given that covers all probable causative organisms and can penetrate inflammatory tissue. This can then be refined, guided by microbiological culture. Suggested regimens for antimicrobial therapy for Fournier's gangrene of mixed microbiological aetiology are presented in Table 17 [83].

3.12. Management of human papillomavirus in men

Human papillomavirus is one of the most frequently sexually transmitted viruses, encompassing both oncogenic (low- and high-risk variants) and nononcogenic viruses. The most important information regarding diagnosis and therapy can be found in Fig. 3. For further details, please refer to the extended EAU Guidelines on Urological Infections: https://uroweb.org/guidelines/urological-infections.

3.13. Herpes simplex virus

Genital herpes (GH) is a highly prevalent, sexually transmitted, lifelong viral infection caused by infection with the herpes simplex virus (HSV), which exists in two types: HSV-1 and HSV-2. GH accounts for up to 60% of genital ulcers, with approximately one-third caused by HSV-1 and two-thirds by HSV-2 [84]. Recommendations for the diagnosis and treatment of HSV infection are outlined in Table 18. Treatment regimens for genital HSV infection are shown in Table 19. For further details, please refer to the extended EAU Guidelines on Urological Infections: https://uroweb.org/guidelines/urological-infections.

3.14. Genitourinary tuberculosis

Although tuberculosis (TB) is one of the most common infectious diseases worldwide, its extrapulmonary manifestation, genitourinary TB (GUTB), is often underestimated by urologists, especially in nonendemic regions such as Europe. Risk factors include primary infection and latent tuberculosis infection, diabetes, advanced age, low body mass index, oncological comorbidities, immunosuppression (including human immunodeficiency virus [HIV]), renal failure, and poor socioeconomic conditions. The risk of reactivation is estimated to be up to 15% during one's lifetime [85]. Diagnosing GUTB is challenging and relies on a high level of suspicion of infection based on patient history; microbiological, molecular, and histological testing; and imaging findings (Table 20). Combination drug therapy is the first-line treatment for GUTB (Table 20). The World Health Organization (WHO) advises a daily 6-mo regimen for newly diagnosed extrapulmonary TB, involving an initial intensive phase of 2 mo with isoniazid, rifampicin, pyrazinamide, and ethambutol, followed by a 4-mo continuation phase with isoniazid and rifampicin [86]. In cases of

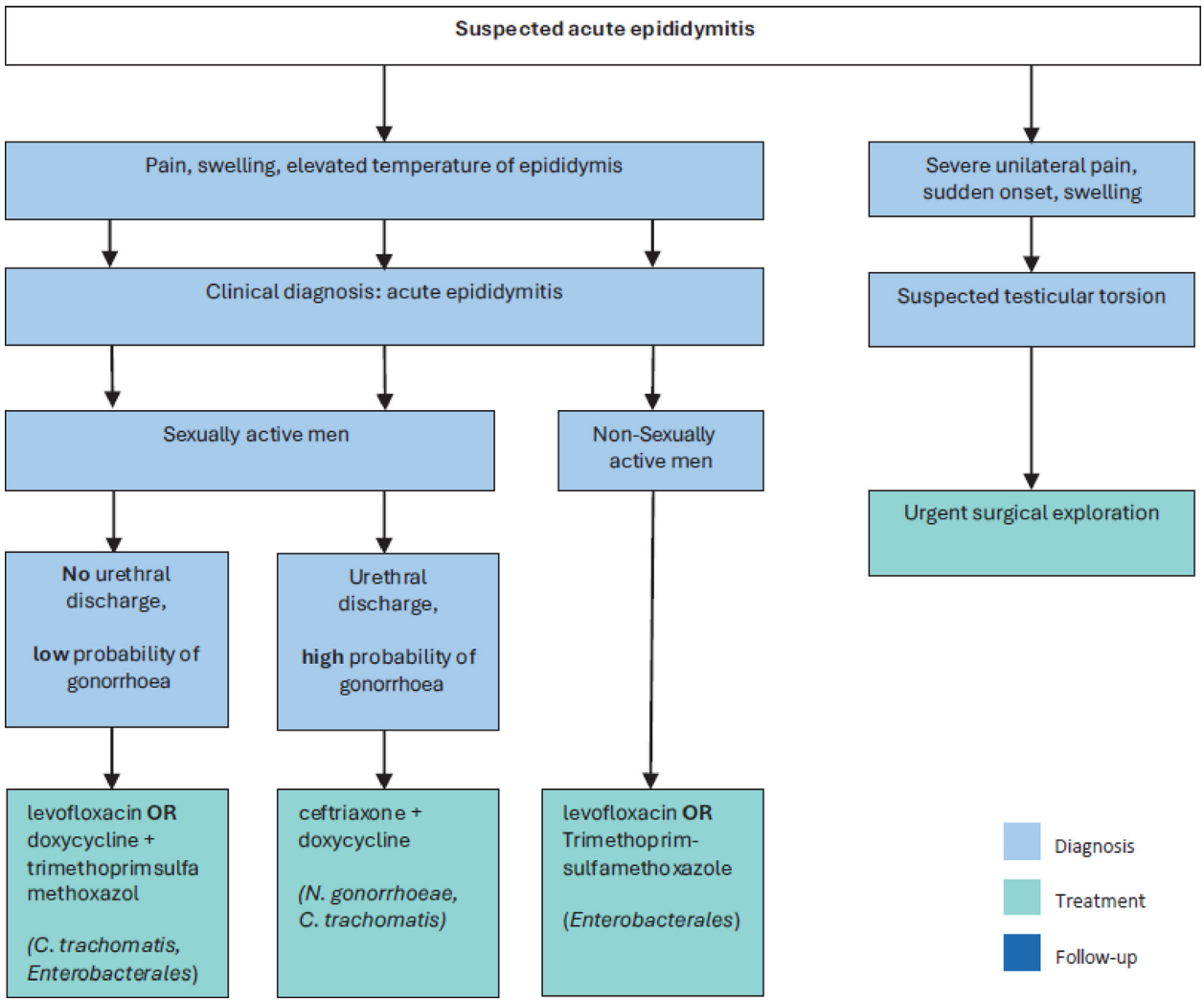

Fig. 2 – Diagnostic and treatment algorithm for men with acute epididymitis. i.m. = intramuscular; i.v. = intravenously. * Despite the lack of randomised controlled trials, there is increasing evidence that intravenous treatment with ceftriaxone is safe and effective for the treatment of gonorrhoeal infections and avoids the discomfort of an intramuscular injection for patients [52].

Table 16 – Recommendations for the diagnosis and treatment of acute infective epididymitis

Recommendations	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 *Enterobacterales* have to be considered.	Strong
If gonorrhoeal infection is likely, give single-dose ceftriaxone 1000 mg intramuscularly or intravenously[a] in addition to a course of an antibiotic active against *Chlamydia trachomatis*.	Strong
Adjust the antibiotic agent when the pathogen has been identified and adjust the duration according to clinical response.	Weak
Follow national policies on reporting and tracing/treatment of contacts for sexually transmitted infections.	Strong

[a] Despite the lack of randomised controlled trials, 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 [52].

multidrug-resistant TB (ie, resistance to rifampicin and isoniazid), a personalised treatment approach is recommended, incorporating at least five effective tuberculosis medications during the intensive phase, including pyrazinamide and four core second-line TB medicines [87]. For detailed treatment regimens for newly diagnosed GUTB

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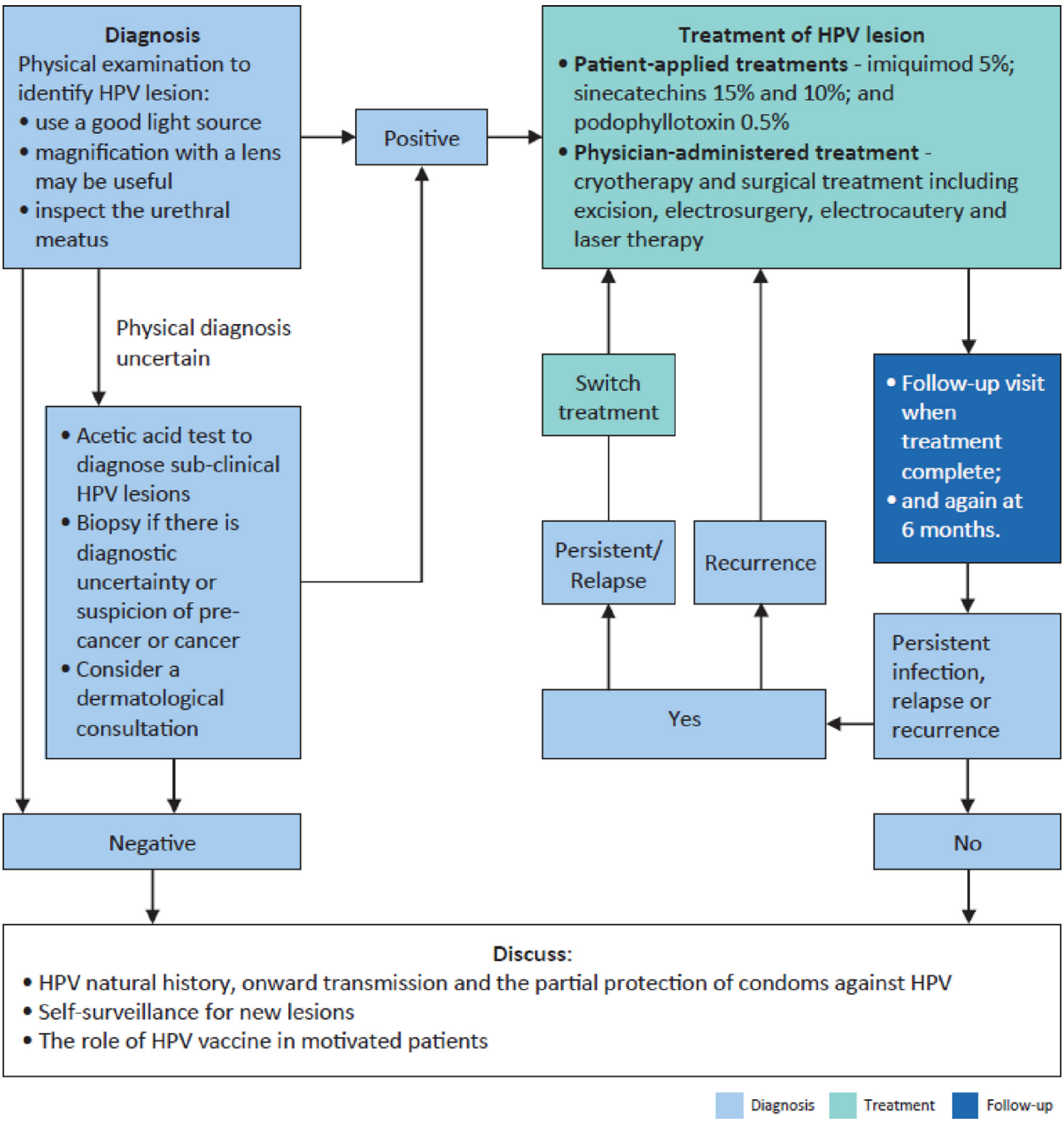

Fig. 3 – Diagnostic and treatment algorithm for the management of HPV in men. HPV = human papillomavirus.

and multidrug-resistant TB, please refer to the extended EAU Guidelines on Urological Infections: https://uroweb.org/guidelines/urological-infections.

3.15. *Fungal urinary tract infection*

Only 2–11% of patients with funguria present with symptoms of a UTI [88,89]. *Candida albicans* is the predominant fungal uropathogen, accounting for 50–70% of all urinary fungal isolates, while *Candida glabrata* and *Candida tropicalis* together account for 10–35%. However, their prevalence varies depending on geographic region and patient population [88,90]. The diagnostic standard is urine culture, although colony count thresholds distinguishing colonisation from infection remain undefined [91,92]. Similar to bacterial UTIs, a cut-off of $\geq 10^5$ colony-forming units/ml is frequently reported in studies [93–98]. Susceptibility testing should be performed, particularly in *non-albicans Candida*. Imaging is reserved for patients with symptoms to identify the site of infection and complications. Funguria in patients without symptoms generally requires no antifungal treatment, but treatment should be considered in patients with neutropenia, in infants with birth weights <1500 g, or before urological intervention breaching the mucosa [99,100]. Treatment depends on the isolated species and its susceptibility pattern: recommended agents

Table 17 – Suggested regimens for antimicrobial therapy for Fournier's gangrene of mixed microbiological aetiology

Antimicrobial	Dosage
Piperacillin-tazobactam plus vancomycin	4.5 g q.i.d. or t.i.d, IV 15 mg/kg b.i.d
Imipenem/cilastatin	Standard dosage: 0.5 g IV q.i.d over 30 min High dosage: 1 g IV q.i.d over 30 min
Meropenem	1 g t.i.d. IV
Ertapenem	1 g q.d
Gentamicin	6–7 mg/kg IV q.d
Cefotaxime plus metronidazole or clindamycin	2 g q.i.d IV 500 mg q.i.d IV 600–900 mg t.i.d IV
Cefotaxime plus fosfomycin plus metronidazole	2 g q.i.d IV 5 g t.i.d IV 500 mg q.i.d IV

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

Table 18 – Recommendations for the diagnosis and treatment of herpes simplex virus infection

Recommendations	Strength rating
Obtain a comprehensive medical history, including a 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 PCR or culture, from the lesion.	Strong
Treat the first clinical episode of genital HSV infection.	Strong

HSV = herpes simplex virus; PCR = polymerase chain reaction

Table 19 – Treatment regimens for genital herpes simplex virus infection

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

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

Table 20 – Recommendations for the diagnosis and treatment of genitourinary tuberculosis

Recommendations	Strength rating
Diagnosis	
Take a full medical history, including history of previous TB infection (pulmonary and extrapulmonary), from all patients presenting with persistent nonspecific genitourinary symptoms and no identifiable cause.	Strong
Perform smear microscopy on urine, semen, tissue specimens, and discharged or prostatic massage fluid using ZN or auramine staining in patients with suspected GUTB.	Weak
Perform an acid-fast bacilli culture on three mid-stream 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 the 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 6-mo regimen for treatment of newly diagnosed GUTB. This should include an intensive phase of 2 mo with isoniazid, rifampicin, pyrazinamide, and ethambutol, followed by a continuation phase of 4 mo with isoniazid and rifampicin.	Strong
Treat multidrug-resistant TB with an individualised treatment regimen including at least five effective tuberculosis medicines during the intensive phase, including pyrazinamide and four core, second-line tuberculosis medicines.	Strong

GUTB = genitourinary tuberculosis; MRS = microbiological reference standard; PCR = polymerase chain reaction; TB = tuberculosis; ZN = Ziehl-Neelsen

include fluconazole, amphotericin B deoxycholate, and oral flucytosine, with weight-based dosing critical for efficacy [99,101]. Species-specific resistance must be considered. Treatment regimens for fungal UTIs are shown in Table 21.

3.16. *Peri-procedural antibiotic prophylaxis*

Urological surgeons should prioritise and vigilantly maintain an aseptic environment to minimise the risk of infections originating from both endogenous (patient microbiome) and exogenous (nosocomial or health care-associated) sources. This entails employing proper methods for instrument cleaning and sterilisation, implementing regular and thorough cleaning protocols for operating rooms and recovery areas, and ensuring meticulous disinfection of any potential sources of contamination. They should also have knowledge of local pathogen prevalence for each type of procedure, their antibiotic susceptibility profiles, and virulence to establish written local guidelines.

The available evidence enabled the panel to make recommendations concerning urodynamics, cystoscopy, stone procedures (extracorporeal shockwave lithotripsy, ureteroscopy, and percutaneous nephrolithotomy), transurethral resection of the prostate, and transurethral resection of the bladder. For nephrectomy and prostatectomy, the scientific evidence was too weak to allow the panel to make recommendations either for or against antibiotic prophylaxis (Table 22).

4. Conclusions

This summary of the EAU Guidelines on Urological Infections provides current insights into diagnosing, treating,

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Table 21 – Treatment regimens for fungal urinary tract infections

Pathogens	Antimicrobial	Dose & Duration of therapy	Renal function correction
Localised fungal UTI			
Fluconazole-susceptible species	Fluconazole	• 200 mg/day p.o for two weeks • 800 mg/day p.o for susceptible *C. glabrata*	• CrCl < 50 mL/min: Reduce dose by 50% • Dialysis patients: Administer a full dose three 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. • 0.3–0.6 mg/kg/day IV for one to seven daysUsed with or without flucytosine for *C. glabrata*	No dosage adjustment required
	Flucytosine	• 25 mg/kg p.o or IV 4 times daily for two weeksCan be used as monotherapy for *C. glabrata*	• CrCl 21–40: 25 mg/kg b.i.d • CrCl 10–20: 25 mg/kg daily. • CrCl < 10: 25 mg/kg Q 48h.Dialysis: 25–50 mg/kg Q 48–72h after dialysis.
	Caspofungin	70 mg IV day 1, then 50 mg daily for two to three weeks.	No dosage adjustment required
Systemic fungal UTI			
Fluconazole-susceptible species	Fluconazole	• 200–400 mg/day p.o for two weeks • 800 mg/day p.o for two weeks for susceptible *C. glabrata* • Severe infections: Consider a loading dose of 400/800 mg on first day	• CrCl < 50 mL/min: Reduce dose by 50% • Dialysis: Administer a full dose three times weekly after dialysis
Fluconazole-resistant species	Amphotericin B deoxycholate	• 0.3–0.6 mg/kg/day IV for one to seven days.Used with or without flucytosine for *C. glabrata*	No dosage adjustment required
	Flucytosine	• 25 mg/kg p.o or IV four times daily for two weeks • Generally used in combination with Amphotericin B	• CrCl 21–40 mL/min: 25 mg/kg b.i.d • CrCl 10–20 mL/min: 25 mg/kg daily • CrCl < 10 mL/min: 25 mg/kg Q 48 hDialysis: 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; UTI = urinary tract infection; p.o. = orally.

Table 22 – Suggested regimens for antimicrobial prophylaxis prior to urological procedures

Procedure	Prophylaxis recommended	Antimicrobial
Urodynamics	No	N/A
Cystoscopy	No	
Extracorporeal shockwave lithotripsy	No	
Ureteroscopy	Yes	Trimethoprim
Percutaneous nephrolithotomy	Yes (single dose)	Trimethoprim-sulfamethoxazole
Transurethral resection of the prostate	Yes	Cephalosporin group 2 or 3
Transurethral resection of the bladder	Yes, in patients who have a high risk of suffering postoperative sepsis.	Aminopenicillin plus a beta-lactamase inhibitor
Transperineal prostate biopsy[a]	Omit perioperative antibiotic prophylaxis in patients without risk factors for infectious complications.	
Transrectal prostate biopsy [a]	Yes	Targeted prophylaxis - based on rectal swab or stool culture. Augmented prophylaxis - two or more different classes of antibiotics[b]. Alternative antibiotics • fosfomycin trometamol[c] (eg, 3 g before and 3 g 24–48 h after biopsy) • cephalosporin (eg ceftriaxone 1 g IM; cefixime 400 mg p.o. for 3 d starting 24 h before biopsy) • aminoglycoside (eg, gentamicin 3 mg/kg IV; amikacin 15 mg/kg IMh)

NA = not applicable.
[a] Do not use fluoroquinolones for prostate biopsy. This recommendation is in line with the European Commission final decision on EMEA/H/A-31/1452.
[b] Option 2 is against antibiotic stewardship programmes
[c] 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.

and preventing urological infections, facilitating their integration into clinical practice, with a particular focus on antimicrobial stewardship in response to the escalating global threat of antimicrobial resistance. The full version is available online (https://uroweb.org/guidelines/urological-infections).

Author contributions: Jennifer Kranz had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Study concept and design: Bonkat, Kranz.

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