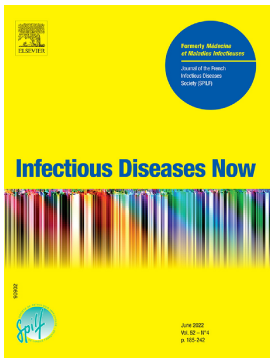

Updated guidelines for management of community-acquired urinary tract infections in adult men by the French infectious disease society (SPILF)

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Updated guidelines for management of community-acquired urinary tract infections in adult men by the French infectious disease society (SPILF)

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I declare that this article has been written without AI assistance.

These guidelines address acute community-acquired urinary tract infections (UTIs) in adult men. The following situations are not covered: pediatric UTIs, UTIs in immunocompromised patients, catheter-associated UTIs (vesical, ureteral, or nephrostomy), neurogenic bladder, nosocomial UTIs, chronic and recurrent UTIs. This update defines nosological entities, including confirmation of the existence of

cystitis in men. Definitions are provided in the first chapter. Epidemiological and bacterial resistance data specific to male UTIs—previously scarce and fragmented—are presented in the second chapter. Pharmacokinetic and pharmacodynamic data for antibiotics used in male UTIs are comprehensively reviewed and summarized in the third section. Treatment recommendations for each entity are detailed in the fourth chapter. The final chapter outlines investigations to be considered after UTI in men and situations requiring urological referral.
This document presents a concise text, and brief supporting arguments regarding key points have been added. Four clinical vignettes summarizing the diagnosis and management of cystitis, pyelonephritis, and epididymo-orchitis are presented at the end of this recommendation (Figures 1, 2, 3 and 4).
Comprehensive texts are co-published alongside these guidelines and constitute an extended rationale.

1. METHODOLOGY

1.1 Study Design

These guidelines were developed using the RAND/UCLA Appropriateness Method [1]. Work was organized into five thematic groups: 1) nosology and diagnosis, 2) bacteriological epidemiology; 3) pharmacodynamics and pharmacokinetics; 4) antibiotic therapy; and 5) additional investigations. Only sections 1, 4, and 5 were subjected to the RAND/UCLA consensus process.

1.2 Literature Review and Expert Panel

A multidisciplinary expert panel was convened in coordination with the participating scientific societies (in alphabetical order: Association Française d'Urologie, AFU; Collège National des Généralistes Enseignants, CNGE; Société Française de Gériatrie et Gérontologie, SFGG; Société Française de Microbiologie, SFM; Société Française de Médecine d'Urgence, SFMU; Société Française de Pharmacologie et Thérapeutique, SFPT; Société Nationale Française de Médecine Interne, SNFMI; Société de Pathologie Infectieuse de Langue Française, SPILF). Each group conducted a literature review and produced working documents with proposed recommendations.

1.3 RAND/UCLA Consensus Process (Table S1)

The RAND/UCLA method combines literature review and collective expert judgment through a two-round rating process [1].

Each proposal was rated individually by experts on a 1–9 scale (1=inappropriate, 9=appropriate), yielding three levels of appropriateness using the following definitions:

- Appropriate (A): panel median ≥7
- Uncertain (U): panel median of 4–6
- Inappropriate (I): panel median ≤3

In the RAND/UCLA method, the highest extreme value and the lowest extreme value are excluded.

The strengh of agreement was expressed as strong (+) and weak (-). For each item, agreement was assessed based on the position of the interval defined by the minimum and maximum ratings on the scale:

- Strong agreement (+) was assigned if the entire range of ratings fell within the predefined bounds (e.g., 1–3 for "inappropriate" or 7–9 for "appropriate").
- Weak agreement (-) was assigned if the rating interval spanned multiple categories (e.g., 1–4 or 6–8), indicating divergent or ambiguous panel opinions.

Disagreement was defined as ≥3 experts rating in opposite extremes (1–3 and 7–9).

The successive rating rounds were carried out using the following procedure:

- First round: Anonymous, independent rating for initial arbitration.
- Plenary discussion: Presentation of results and structured discussion of uncertain or opposed proposals, followed by reformulation.
- Second round: Re-rating after modifications to produce the final text.

1.4 Grading of Recommendations

Recommendations were graded according to the French National Authority for Health (HAS) classification [2]:

Grade	Level of Evidence
A	High-quality randomized trials, meta-analyses
B	Lower-quality randomized trials, cohort/case-control studies
C	Retrospective studies, case series, studies with bias
AE	Expert opinion in the absence of sufficient data

2. DIAGNOSIS OF ACUTE COMMUNITY-ACQUIRED BACTERIAL URINARY TRACT INFECTIONS IN MEN

2.1 Definitions

2.1.1 Urinary colonization

- Defined by detection of one or more microorganisms on urinalysis (urine culture), regardless of concentration or leukocyturia, in the absence of UTI symptoms [AE, A+].
- Screening and treatment of urinary colonization is not indicated, except prior to certain urological procedures [AE, A+].
- Cloudy urine or foul-smelling urine alone are not clinical signs of UTI in men [AE, A+].
- Macroscopic hematuria or acute urinary retention alone are not clinical signs of UTI in men [AE, A+].

- In acute urinary retention without UTI signs or sepsis of unknown etiology, urgent urinary drainage is indicated, but treatment of urinary colonization is not recommended [AE, A-].

2.1.2 Bacteriuria of indeterminate clinical significance

- In the presence of documented bacteriuria associated with nonspecific systemic symptoms (altered mental status, confusion, acute dependence, sudden deterioration, organ decompensation, unsteady gait or tendency to fall) and in the absence of clinical signs of cystitis, it is proposed to use the term "bacteriuria of indeterminate clinical significance" [C, A+].

This situation is more frequently observed in individuals over 75 years of age [3].

- In the event of bacteriuria of indeterminate clinical significance and in the absence of sepsis, clinical monitoring without antibiotic treatment is recommended [AE, A+].
- In the event of bacteriuria of indeterminate clinical significance associated with predictive signs of sepsis, using a simple score predictive of sepsis*, differential diagnoses should be ruled out; if no other etiology explains the clinical picture, a potential diagnosis of urinary sepsis should be considered [AE, A+].

* Clinical score composed of 6 variables (1 point per variable)

- Age > 65 years
- Temperature > 38°C
- Systolic blood pressure ≤ 110 mmHg
- Heart rate > 110/min
- Peripheral oxygen saturation ≤ 95%
- Recent-onset altered mental status

If clinical score ≥ 3 = ≥ 40% risk of progression to sepsis [4].

Distinguishing between colonization and infection can be challenging in elderly patients presenting with bacteriuria associated with nonspecific systemic signs or isolated fever [5]. In patients over 75 years of age, those with nonspecific systemic signs suggestive of urinary sepsis often lack local signs of urinary tract infection, and even in the presence of bacteremia, fever may be absent [3,6,7].

2.2 Urine Dipstick

- Not recommended for diagnosing UTI [C, A-].

Urine dipsticks are unhelpful for clinical decision-making and their broad use of dipsticks may cause significant harms by promoting overdiagnosis [and occasional underdiagnosis) of UTI [8,9].

2.3 Urine Culture (UC)

- Not recommended:

  - In isolated acute urinary retention [AE, A-].
  - In nonspecific systemic symptoms in the elderly without UTI signs, fever, or signs of sepsis [AE, A-].
  - After a clinically successful antibiotic treatment [AE, A+].
- Recommended before initiating antibiotic therapy for any suspected UTI [AE, A+].
- Urine culture should be performed in accordance with the European Federation of Laboratory Medicine (EFLM) best practice guidelines (2023) [10].
- For midstream urine samples, the significant thresholds supporting a clinical suspicion of UTI in men are: leukocyturia > 30×10^3/mL and monobacterial bacteriuria ≥ 10^3 CFU/mL for main uropathogens [10] [C, A+].
- Clinical signs of UTI take precedence over leukocyturia and bacteriuria thresholds [AE, A+].
- The clinical context must be specified on the urine culture request form [AE, A+].

2.4 Acute Cystitis

- Cystitis in men exists [C, A+].

Cystitis in men has been depicted in a recent prospective study [11] and in many retrospective studies [12,13]. Molecules presumed to be ineffective in prostatitis treatment have demonstrated their effectiveness in treating afebrile men in retrospective studies conducted in primary care [14, 15]. Male cystitis is now recognized in numerous international guidelines [16–18].

- The diagnosis of bacterial cystitis is based on the presence of acute local symptoms combined with a positive UC without chills, rigors, fever or sepsis [C, A+].
- The clinical presentation of bacterial cystitis typically involves a combination of the following symptoms: urethral burning during micturition, increased urinary frequency, urinary urgency, dysuria, nocturia, and suprapubic pain [19,20]; these symptoms may be accompanied by macroscopic hematuria [C, A+].
- Failure of appropriately conducted treatment for cystitis should prompt investigation for prostatitis or consideration of alternative urological diagnoses [AE, A+].
- UC is the only recommended test to confirm cystitis and guide antibiotic treatment [AE, A+].
- Routine blood sampling for diagnostic purposes (including PSA measurement, inflammatory markers, and blood cultures) is not recommended in men presenting with clinical signs of cystitis [AE, A+].

2.5 Acute Prostatitis

- The diagnosis of acute prostatitis is based on the presence of cystitis symptoms combined with fever or sepsis, and a positive UC [C, A+]**.**
- A routine digital rectal examination is not recommended except in cases of diagnostic uncertainty between cystitis and prostatitis, or between pyelonephritis and prostatitis [AE, A-].

The clinical diagnosis of prostatitis may be difficult in patients with pauci-symptomatic forms, pre-existing voiding or storage dysfunction, cognitive impairment, etc. Pain at digital rectal examination may contribute to the diagnosis of prostatitis but is variable, having been reported in 39 to 70% of acute prostatitis [21].

- PSA measurement is not recommended for the diagnosis of acute prostatitis or for deciding on antibiotic treatment or monitoring patients receiving antibiotics for this infection [C, A+].

In the context of acute prostatitis, elevated PSA levels are observed variably (in 30% to 60% of cases [22–25]. PSA elevation does not correlate with the presence or severity of clinical signs of prostatitis [24,25].

- Renal function assessment is not recommended for men with acute prostatitis managed in an outpatient setting, provided that there are no risk factors for acute renal failure (such as chronic kidney disease, urological history, dehydration, or high-risk medications including diuretics, Angiotensin-Converting Enzyme (ACE) inhibitors, non-steroidal anti-inflammatory drugs (NAIDs), aminoglycosides, etc.) [AE, A+].

- Measurement of inflammatory markers and blood cultures are not recommended for men with acute prostatitis managed in an outpatient setting [C, A+].

While blood cultures are positive in 16–22% of hospitalized men with febrile urinary tract infections, they contribute to the microbiological diagnosis in only about 5% of cases [21, 26–28].

- Imaging is recommended in the following situations:

- In emergency settings :
    - If sepsis or septic shock is present: Perform an abdominal-pelvic CT scan with and without contrast, ideally including a delayed phase (use of contrast should be carefully considered in cases of acute renal failure) [AE, A+].
    - If acute urinary retention is suspected: Use a bladder scanner or suprapubic ultrasound; if urinary retention is confirmed, proceed with urgent urinary drainage [AE, A+].
- In case of poor clinical response after 72 hours of appropriate antibiotic therapy:
  defined by persistent fever or worsening urinary symptoms,
  imaging is recommended to investigate a potential prostatic abscess (using preferentially contrast-enhanced MRI or CT scan, or transrectal prostate ultrasound, depending on availability) [AE, A+].

During febrile urinary tract infections in men, acute urinary retention is reported in 10–25% of hospitalized patients [27].

2.6 Acute pyelonephritis

- The diagnosis of acute pyelonephritis is based on the presence of fever or sepsis, spontaneous or percussion-induced lumbar pain, symptoms of cystitis and a positive UC.
- Symptoms of cystitis may be absent [29] [C, A+].

- A first-line abdominal-pelvic CT scan with and without contrast, including a delayed phase, is systematically recommended (use of contrast should be carefully considered in cases of acute renal failure) [AE, A-].

This imaging should be performed [AE, A+]:

- Systematically within 48–72 hours to check for uropathy

- While awaiting CT imaging, if acute urinary retention is suspected, a bladder scan or suprapubic ultrasound should be performed urgently to confirm retention and proceed if necessary with urinary drainage [AE, A+].

- In emergency settings :

  - sepsis or septic shock
  - uncontrolled pain
  - suspicion of urinary tract obstruction (by stone, tumor…)
  - endo-ureteral material
  - acute renal failure

Pyelonephritis is rare in men and may more commonly reveal underlying urinary tract disorders [30] [AE, A+].

- Routine renal function assessment is not recommended for men with acute pyelonephritis managed in an outpatient setting, provided there are no risk factors for acute renal failure (chronic kidney disease, urological history, dehydration, or high-risk medications including diuretics, ACE inhibitors, NSAIDs, aminoglycosides, or indication of urgent abdominal-pelvic CT-scan…) [AE, A-].

- Measurement of inflammatory markers and blood cultures is not recommended for community-acquired acute pyelonephritis managed in an outpatient setting [AE, A+].

2.7 Acute epididymitis/orchitis

- The diagnosis of epididymitis or orchitis is defined by the acute onset of swelling and spontaneous or palpation-induced pain in the epididymis or testis. The primary emergency differential diagnosis is testicular torsion [20] [C, A+].

  Other associated clinical signs may include: fever, hydrocele, scrotal erythema and edema, symptoms of cystitis, or urethral discharge [31].

- UC is systematically recommended [AE, A+].
- In sexually active men, regardless of age, a first-void urine sample for nucleic acid amplification testing (NAAT/PCR) to detect *Chlamydia trachomatis* and *Neisseria gonorrhoeae* is also recommended. A comprehensive sexually transmitted infection (STI) evaluation should be performed based on individual risk factors [C, A+] *[31]*.
- Routine scrotal ultrasound is not recommended for acute epididymitis or orchitis [AE, A+].

- Scrotal ultrasound is recommended in the following situations [AE, A+]:

  - Diagnostic uncertainty
  - Suspected abscess
  - Persistent fever or worsening local symptoms after 72 hours of appropriate antibiotic therapy [32].

3. EPIDEMIOLOGY OF MALE URINARY TRACT INFECTIONS

- Only limited data specifically detail the epidemiology of male UTIs. The most recent available data come from a retrospective observational study conducted in Germany between 2015 and 2020. The most widely identified pathogenic bacteria in cultures were *Escherichia coli* (38.4%)**,** *Enterococcus faecalis* (16.5%, predominantly in polymicrobial cultures)**,** *Proteus mirabilis* (9.3%), and *Klebsiella pneumoniae* (7.7%) [33].
- No French data specifically detailing the epidemiology of community-acquired UTIs in men have been published over the past 10 years. As a result, retrospective data on the epidemiology of bacterial species isolated from midstream urine cultures in men with community-acquired infections were compiled from medical biology laboratory (MBL) data between 2019 and 2023 (drawn from three sources: emergency departments of 15 hospitals, private MBL group, and the national PRIMO mission), as well as from primary care data recorded in the AntibioClic antibiotic prescribing support tool between 2017 and 2024 [34–36].

3.1 Epidemiology of bacterial species isolated from midstream urine cultures in men with community-acquired infections in France

Analysis of data from both hospital and private laboratories confirms a predominance of *E. coli* [39–40%), *E. faecalis* (13–15%), *K. pneumoniae* (6–8%), and *P. mirabilis* (5–6%) among the main bacterial species isolated from midstream urine cultures (ECBU) in men in France with community-acquired infections (Table 1).

3.2 Antibiotic resistance epidemiology of the four main bacterial species isolated from UC in men with community-acquired infections in France, between 2019 and 2023.

- The antibiotic resistance rates observed among the three main Enterobacterales species isolated from midstream urine cultures in men with community-acquired infections in France (*E. coli*, *K. pneumoniae*, and *P. mirabilis*) are presented in Table 2.

- The overall resistance rates for these three Gram-negative bacilli, weighted by prevalence, are approximately 53–59% for amoxicillin**,** 29–32% for amoxicillin-clavulanate**,** 5–11% for parenteral third-generation cephalosporins (3GC), 16–19% for fluoroquinolones**,** and 28–31% for trimethoprim-sulfamethoxazole (SXT).
- The prevalence of ESBL-producing strains ranges from approximately 2 to 8.4% for *E. coli*, 11.0 to 22.8% for *K. pneumoniae*, and 1.0 to 1.3% for *P. mirabilis*.
- Among men over 65 years of age residing in long-term care facilities, the rate of resistance to 3GC is estimated at 15–18% for *E. coli* and 32–36% for *K. pneumoniae* (PRIMO data) [35].
- Prevalence of carbapenemase-producing strains remains low, at approximately 0.1% for *E. coli* and 0.3% for *K. pneumoniae*, and occurs only exceptionally for *P. mirabilis*.
- Lastly, *E. faecalis* strains remain uniformly susceptible to amoxicillin. Resistance rates are below 1% for vancomycine, linezolid and nitrofurantoin, and below 5% for levofloxacin.

4. PHARMACOKINETICS AND PHARMACODYNAMICS OF ANTIBIOTICS IN THE MALE URINARY TRACT

4.1 Introduction

- Pharmacokinetic and pharmacodynamic (PK/PD) data on antibiotics within the male urinary tract are scarce, and their interpretation is complex.
- Many parameters are insufficiently known:
    - the intratissue localization of bacteria and the penetration of antibiotics within the different organs (kidney, prostate, testis, epididymis, bladder) and (vascular, interstitial, intracellular) compartments of the male urinary tract.
    - the relative contribution of each factor enhancing prostatic penetration (lipophilicity, low molecular weight, weak ionization, poor plasma protein-binding) [37]
    - numerous factors that may influence antibacterial efficacy in situ (local immunity, physicochemical characteristics of the environment (pH, iron availability, oxidative stress, etc.), and bacterial-specific characteristics [38,39].
- Existing studies may lead to conflicting results according to methodological characteristics:
    - Dosage performed in uninfected patients (i.e. without local inflammation) [40].
    - Sampling schedule (early, or at steady state)
    - Analytical techniques [40-42]
    - Matrix in which the measurements were performed (often a tissue homogenate that combines all compartments) [39, 43, 44]
- Plasma concentrations are generally considered a good predictive marker of concentrations within the renal tissue [45]. Older studies suggest that antibacterial efficacy within the bladder lumen requires high urinary concentrations [46]. However, the impact of intracellular bladder

reservoirs, in which bacteria do not divide ("persisters") and are protected from antibiotic activity may also play a role [47–49]. Very limited data are available for other organs.

Despite these limitations, based on literature analysis and given the physicochemical properties of major antibiotic molecules, experts propose guidelines to assist clinicians.

4.2 Beta-Lactams

- In the prostate, the pharmacokinetic characteristics of beta-lactams and beta-lactamase inhibitors are contrasting, with satisfactory diffusion into the interstitium but very limited diffusion into prostatic fluids and no intracellular penetration. Experimental data confirm good diffusion of beta-lactams into the interstitium. Among these agents, amoxicillin and mecillinam exhibit the pharmacokinetic profiles most favorable for intra-prostatic diffusion. Among carbapenems, ertapenem is theoretically disadvantaged compared to meropenem and imipenem in terms of physicochemical properties.
- Renal diffusion is satisfactory, with tissue concentrations close to plasma levels.
- Urinary concentrations are very high for most beta-lactams.
- Data regarding diffusion into the testis or epididymis are very limited.
- In patients at risk of underdosing (such as those with increased renal clearance, obesity, or sepsis), and in cases of infections caused by bacteria with high MICs, we recommend high doses and continuous or prolonged infusion administration, according to PK/PD modeling.

4.3 Fosfomycin, Trimethoprim-Sulfamethoxazole (SXT) and Fluoroquinolones

The pharmacokinetic profile and physicochemical properties of these antibiotics appear highly favorable, particularly in the prostate, seminal fluid, epididymis, bladder, and urine. Fosfomycin, SXT and fluoroquinolones diffuse into both the interstitial compartment and intracellular space.

4.4 Nitrofurantoin

The pharmacokinetic profile of nitrofurantoin does not appear suitable for treating prostatic, renal, or epididymo-testicular infections. Its concentrations in the interstitial and intracellular sectors seem negligible.

4.5 Aminoglycosides

The pharmacokinetic profile of aminoglycosides is generally favorable for treating renal or bladder infections. Their diffusion is adequate in the interstitial sector but absent in the intracellular sector. For prostatic infections, on the other hand, available data are insufficient to form an opinion.

4.6 Other antibiotic classes (glycopeptides, lipoglycopeptides, daptomycin, oxazolidinones, streptogramins)

Available data are insufficient to provide recommendations regarding these molecules.

5. THERAPEUTIC MANAGEMENT OF MALE URINARY TRACT INFECTIONS

Antibiotic choices and dosages are based on literature data, epidemiological data, and pharmacokinetic (PK) and pharmacodynamic (PD) data presented in specific chapters of these recommendations. They incorporate antibiotic stewardship principles and aim to promote treatment adherence by favoring the simplest therapeutic regimens. It should be noted that most antibiotics recommended for the treatment of male cystitis do not currently have marketing authorization (AMM) for this indication.

Treatment dosages are summarized in Table 3.

5.1 Treatment of Acute Cystitis

Only one randomized placebo-controlled study, describing several limitations, has demonstrated the non-inferiority of a 7-day treatment with SXT or ciprofloxacin compared to a 14-day treatment of male UTIs without signs of prostatic involvement [11]. The efficacy of other treatments for male cystitis, using narrower-spectrum antibiotics (nitrofurantoin, trimethoprim, and pivmecillinam) has been reported in retrospective cohort studies involving tens of thousands of patients [50–57]. The efficacy of oral fosfomycin (fosfomycin-trometamol) in this indication has been reported in several observational studies with smaller sample sizes [58-63]. Many international guidelines have long since integrated these different treatments for male cystitis [16].

5.1.1 Empirical Antibiotic Therapy

- If cystitis symptoms are well-tolerated and the diagnosis is uncertain, it is recommended to await the UC results before initiating antibiotic treatment according to the microbiological documentation and antibiogram [AE, A+].
- Otherwise, oral empirical antibiotic treatment, in alphabetical order: fosfomycin-trometamol OR nitrofurantoin OR pivmecillinam [C, A-].

5.1.2 Antibiotic Therapy After Documentation

- The antibiotic empirically initiated according to the above recommendation should be continued if the uropathogen is susceptible (including in cases of extended-spectrum beta-lactamase-producing Enterobacterales) and tolerance is good [AE, A+].
- Otherwise, antibiotic therapy should be adjusted as follows:

  By alphabetical order: amoxicillin, fosfomycin-trometamol, nitrofurantoin, pivmecillinam, trimethoprim [AE, A-].

5.1.3 Treatment duration

Seven days for all recommended antibiotics, except for fosfomycin-trometamol: one dose on day 1, one dose on day 3, and one dose on day 5 (D1-D3-D5) [C, A+].

5.2 Management of a patient with acute prostatitis or pyelonephritis

5.2.1 Criteria for referral to an emergency hospital service

5.2.1.1 Risk of sepsis or septic shock

Use the clinical score detailed in chapter 2.1.2.

5.2.1.2 Suspected or confirmed urinary obstruction

- Certain situations should prompt urgent investigation for urinary tract obstruction (lower: acute urinary retention; upper: obstructive acute pyelonephritis), such as a history of (congenital or acquired) uropathy, history of urinary lithiasis, intense and/or persistent pain despite usual analgesics [AE, A+].
- In case of confirmed obstruction, the patient should be transferred to an appropriate care facility, and urgent drainage or urinary diversion is recommended [AE, A+].

5.2.1.3 Other criteria for hospital evaluation

- Inability to take oral medication with risk of non-compliance and dehydration (dysphagia, nausea, vomiting, delirium, agitation, social context, isolation) [AE, A+].
- Functional decline preventing home care [AE, A+].
- Decompensation of comorbidities requiring hospitalization (uncontrolled diabetes, acute renal failure, dehydration, cardiac decompensation, etc.) [AE, A+].
- Uncontrolled pain [AE, A+].

5.2.2 A specialized consultation with an urologist or infectious diseases specialist (in-person or telemedicine) is recommended during acute episode management

- In case of underlying uropathy (malformation, history of urinary lithiasis, solitary kidney, reflux, etc.) [AE, A+].
- For assistance in choosing empirical antibiotic therapy in case of previous history or infection with multidrug-resistant bacteria [AE, A+].

5.2.3 In case of outpatient management

- Ensure that the relevant criteria for good therapeutic compliance and home monitoring are met [AE, A+].

- Propose a follow-up consultation or teleconsultation for reassessment within 48–72 hours [AE, A+].

5.2.4 Antibiotic Treatment

5.2.4.1 Empirical antibiotic therapy

5.2.4.1.1 Absence of signs of sepsis or septic chock

- If treatment is initiated in a hospital setting: cefotaxime or ceftriaxone [B, A-].

- If treatment is initiated on an outpatient basis: ceftriaxone OR oral fluoroquinolone (in alphabetical order: ciprofloxacin or levofloxacin) (if no fluoroquinolone use in the past six months and if oral efficacy is not compromised by nausea, vomiting, malabsorption, or uncertain compliance) [B, A-] [64,65].

5.2.4.1.2 Sepsis

Cefotaxime or ceftriaxone

plus a single dose of amikacin [C, A-].

5.2.4.1.3 Septic Shock*

- No risk factors for infection with 3GC-resistant Enterobacterales (3GC-R) **:
  cefotaxime OR ceftriaxone
  plus a single dose of amikacin [AE, A-].

- At least one risk factor for infection with 3GC-R Enterobacterales**: Imipenem OR meropenem plus a single dose of amikacin [AE, A+].

*Sepsis with hemodynamic failure requiring a vasopressor and lactate level > 2 mmol/L

**Risk factors for infection with 3GC-R Enterobacterales:
- Residing in a nursing home
- Infection and/or colonization with 3GC-R Enterobacterales in the past three months
- Travel abroad in the past three months
- Use of fluoroquinolones, amoxicillin-clavulanate, or 3GC in the past three months

Resistance data collected for this update from urine cultures in men show a high rate of 3GC-R Enterobacterales in men living in nursing homes. This situation has consequently been added to the documented risk factors for infection with 3GC-R Enterobacterales. Additionally, amikacin is proposed in this context of severe infection due to its rapid bactericidal activity, preserved activity against most Enterobacterales (including ESBL and carbapenemase producers), and safety in a single dose.

5.2.4.2 Step-down antibiotic therapy according to antibiogram results

5.2.4.2.1 Oral step-down possible (susceptible uropathogen and no contraindications)

5.2.4.2.1.1 Acute Pyelonephritis

In order of preference: amoxicillin, SXT, amoxicillin-clavulanate, fluoroquinolone (in alphabetical order: ciprofloxacin OR levofloxacin OR ofloxacin), cefixime [C, A-].

5.2.4.2.1.2 Acute Prostatitis

In order of preference: SXT, fluoroquinolone (ciprofloxacin OR levofloxacin OR ofloxacin) [B, A+].

If resistance or contraindication to SXT and fluoroquinolones, and after defervescence:
In order of preference: fosfomycin-trometamol, amoxicillin, amoxicillin-clavulanate [C, A-].

Specific data on acute pyelonephritis or prostatitis in men are rare, and the distinction between these two entities is not always clearly established in the literature. For febrile urinary tract infections in men (encompassing both entities), the efficacy of fluoroquinolones and SXT has been reported [26,66-69]. Intravenous beta-lactams, either as initial treatment or for a prolonged duration, have likewise been shown to be effective in this indication [70]. The efficacy of oral beta-lactam step-down therapy after intravenous antibiotic treatment has been reported as non-inferior to oral step-down with fluoroquinolones or SXT for the treatment of urinary bacteremia (study including 90% men, but with retrospective design) [71]. Literature data indicate that oral fosfomycin is effective in treating acute prostatitis [72-74]. Data regarding pivmecillinam for febrile urinary tract infections in men include few patients, and it appears premature to recommend this treatment [75-77].

5.2.4.2.2 Oral step-down not possible (resistant uropathogen or contraindication)

5.2.4.2.2.1 Acute pyelonephritis

Enterobacterales susceptible to 3GCs: cefotaxime or ceftriaxone [B, A-].

5.2.4.2.2.2 Acute prostatitis

Enterobacterales susceptible to 3GCs: cefotaxime or ceftriaxone [B, A-].

5.3 Acute pyelonephritis and acute prostatitis caused by Enterobacterales resistant to 3GCs

- Resistance due to cephalosporinase hyperproduction and for susceptible bacteria: cefepime OR temocillin, if susceptible [B, A-].
- Resistance due to ESBL production
  First choice, in alphabetical order, if susceptible: cefoxitin [only if *E. coli* or *Proteus*] OR piperacillin-tazobactam OR temocillin
  Default option: carbapenem (in alphabetical order: ertapenem OR imipenem OR meropenem) [C, A-].

Several studies have demonstrated the efficacy of non-carbapenem beta-lactams (temocillin, piperacillin/tazobactam, cefoxitin) in treating febrile urinary tract infections caused by ESBL-producing Enterobacterales [78-84].

5.3.1 Step-down oral treatment

5.3.1.1 Acute pyelonephritis

In order of preference: SXT, amoxicillin-clavulanate, fluoroquinolone (in alphabetical order ciprofloxacin OR levofloxacin OR ofloxacin) [C, A-].

5.3.1.2 Acute prostatitis

In order of preference: SXT, fluoroquinolone (in alphabetical order: ciprofloxacin OR levofloxacin OR ofloxacin), fosfomycin-trometamol [C, A-].

5.3.2 If Oral Treatment Not Possible (Resistant Uropathogen or Contraindication)

Intravenous treatment, in order of preference: narrower spectrum beta-lactams (in alphabetical order: cefoxitin [only if *E. coli* or *Proteus*], piperacillin-tazobactam or temocillin) or carbapenem (in alphabetical order: ertapenem, imipenem or meropenem) [C, A+].

If outpatient treatment Ertapenem (single daily injection) IV, IM or SC may be more convenient.

5.4 Acute pyelonephritis and acute prostatitis caused by *Enterococcus*

- Amoxicillin [AE, A+].
- Contraindication or resistance to amoxicillin: seek specialized advice [AE, A-].

5.5 Acute prostatitis and pyelonephritis and allergy contraindicating all Beta-Lactams

5.5.1 Empirical Therapy

5.5.1.1 Absence of signs of sepsis or septic chock

Ciprofloxacin or levofloxacin orally (or intravenously if oral efficacy is compromised: nausea, vomiting, malabsorption, uncertain compliance, etc.) if no fluoroquinolone use in the last six months [B, A+].

5.5.1.2 If contraindication to fluoroquinolones

Single dose of amikacin

5.5.1.3 If sepsis, septic shock

Single dose of amikacin AND fluoroquinolone (IV ciprofloxacin OR IV levofloxacin) and seek specialized advice [AE, A+].

5.5.2 Oral Step-Down Therapy

In order of preference: SXT, fluoroquinolone (ciprofloxacin OR levofloxacin OR ofloxacin), fosfomycin-trometamol (only for prostatitis) [AE, A-].

5.5.3 If Oral Step-Down Not Possible

Seek specialized advice.

5.6 Duration of antibiotic treatment

5.6.1 Acute Pyelonephritis

- Seven days if treated with parenteral beta-lactam and/or fluoroquinolone and/or SXT [AE, A-].
- Ten days if oral step-down involves an antibiotic other than fluoroquinolone or SXT [AE, A-].
- Five days if treated exclusively with aminoglycoside [C, A-].

5.6.2 Acute prostatitis

14 days [A, A+].

Two randomized studies including men alone compare two treatment durations for febrile urinary tract infection [26,67]. The non-inferiority of 14 days versus 28 days of ciprofloxacin in 72 men was demonstrated in a monocentric study [67]. In the multicenter randomized Prostashort study including 240 patients, infection a 7-day treatment was found to be inferior to a 14-day treatment [26]. In a multicenter randomized study (200 patients), the non-inferiority of 7 days versus 14 days of antibiotics was not demonstrated in terms of early clinical cure for "pyelonephritis" (the definition applied could not really discriminate between pyelonephritis and prostatitis in men) [68]. Subgroup analysis showed that clinical efficacy was lower in men treated for seven days compared to those treated for 14 days [68].

5.7 Management of a Patient with Epididymitis or Orchitis

The current scientific rationale defining antibiotic treatment for epididymo-orchitis is poorly supported. Two old, double-blind, randomized controlled studies in hospitalized patients evaluated treatment efficacy (85,86]. The first, involving 159 patients, showed more treatment failures with pivampicillin (40% failure rate) as compared to ciprofloxacin (20%) [85]. The second found no efficacy in 18 patients treated with SXT compared to 17 patients receiving lactose powder for five days [86]. There have been no recent prospective or retrospective cohort studies.

In international guidelines, the recommended empirical treatment for uncomplicated epididymo-orchitis (excluding sexually transmitted infections) is most often a fluoroquinolone [64,87-93]. The alternative proposed antibiotic therapy is SXT, and occasionally amoxicillin-clavulanate [64,87,91]. The usual recommended treatment duration is 10 to 14 days, but without precise justification for these durations. Treatment of epididymo-orchitis linked to sexually transmitted infections is not addressed in these guidelines.

5.7.1 Empirical Antibiotic Therapy

- If treatment is initiated in a hospital setting: cefotaxime OR ceftriaxone [AE, A+].
- If treatment is initiated on an outpatient basis: ceftriaxone OR fluoroquinolone (ciprofloxacin OR levofloxacin) [AE, A+] (if no fluoroquinolone use in the past six months and if oral efficacy is not compromised by nausea, vomiting, malabsorption, or uncertain compliance).

5.7.2 Step-down therapy

5.7.2.1 Oral step-down possible (susceptible uropathogen and no contraindications)

- In order of preference: SXT, fluoroquinolone (ciprofloxacin OR levofloxacin OR ofloxacin) [AE, A+].

- If resistance or contraindication to SXT and fluoroquinolones: beta-lactam (initial treatment recommended parenterally), in order of preference: amoxicillin, amoxicillin-clavulanate, cefixime [AE, A-].

5.7.2.2 Oral step-down not possible (resistant uropathogen or contraindication)

- Enterobacterales susceptible to 3GCs: cefotaxime or ceftriaxone.
- Enterobacterales resistant to 3GCs :
    - Resistance due to cephalosporinase hyperproduction and for susceptible bacteria: cefepime OR temocillin [AE, A+].
    - Resistance due to ESBL production:

      Intravenous treatment, in order of preference: narrower spectrum beta-lactams (by alphabetical order: cefoxitin [only if *E. coli* or *Proteus*], piperacillin-tazobactam, temocillin) or carbapenem (by alphabetical order: ertapenem, imipenem, meropenem) [AE, A+].

5.7.2.3 No microbiological documentation

Continue the initiated empirical treatment or consider oral step-down, in order of preference: SXT, fluoroquinolone (ciprofloxacin, levofloxacin, or ofloxacin) [AE, A+].

5.7.3 Treatment duration:

10 days for all recommended antibiotics [AE, A+].

6. WHICH INVESTIGATIONS SHOULD BE PERFORMED AFTER A FIRST EPISODE OF MALE URINARY TRACT INFECTION?

- Occurrence of a male urinary tract infection should systematically prompt the search for at least one predisposing factor. The main hypothesis underlying this approach is that whatever the initial diagnosis, a urinary tract infection may be secondary to an underlying etiology and should lead to identification of anatomical or functional abnormalities in the urinary tract [94].
- No national or international recommendations or literature define the etiological work-up to be performed after occurrence of a first episode of male UTI. In some cases, imaging studies performed during the acute phase of the infection may help to identify the factor(s) predisposing to the infection. The proposals below are therefore primarily based on expert opinions and should be adapted according to the information collected during the initial assessment at the time of the urinary tract infection. They are summarized in the decision algorithm (Figure 5).
- This algorithm was designed to identify the most common etiologies (benign prostatic hyperplasia, urethral stricture, etc.) using simple, non-invasive, low-cost, and primary care-accessible examinations. There are numerous etiologies to consider, and prostatic pathology should not systematically be incriminated [95]. The indicator threshold values proposed in the

algorithm (Figure 1) are given for guidance and allow for objectively determination of the need to consult a urologist to avoid delaying etiological management.
- The etiological work-up is based on simple clinical data collected by the primary care physician in the weeks following the urinary tract infection, supplemented by ultrasound of the urinary tract. A second-line assessment, including an urological consultation and more specialized additional tests, is justified only in the cases specified below.

6.1 First-Line Assessment

6.1.1 Clinical Examination

- It is recommended to systematically conduct a targeted medical history to identify macroscopic hematuria or lower urinary tract symptoms (LUTS) that existed before the infection or having appeared since the infection [AE, A-].

- It is recommended to supplement the medical history with calculation of the International Prostate Symptom Score (IPSS) (https://www.urofrance.org/fileadmin/medias/scores/score-IPSS.pdf) and completion of a voiding diary if LUTS are reported by the patient [96] [AE, A-].

- It is recommended to systematically perform a digital rectal examination after the infectious episode so as to estimate the volume and consistency of the prostate [AE, A-].

LUTS are categorized as follows [107]:

- *Storage-phase LUTS (formerly known as irritative symptoms): urgency, daytime and nocturnal frequency, nocturia, urgency incontinence.*
- *Voiding-phase LUTS (formerly known as obstructive symptoms): hesitancy or straining to void, weak or intermittent stream, prolonged micturition.*
- *Post-micturition LUTS: terminal dribbling and persistent sensation of incomplete bladder emptying.*

6.1.2 Biological Tests

- It is not recommended following a male urinary tract infection to systematically measure PSA levels [AE, A+].
- If PSA measurement is deemed necessary, it should be performed at least three months after the infection, taking into account the indications mentioned in the current recommendations of the French Association of Urology [97] [AE, A+].

  There is no link between a first episode of male UTI and prostate cancer. Following acute prostatitis, PSA levels can remain elevated for three months without correlation to inflammation or prostate size [98]. PSA levels are not associated with a risk of recurrence of male urinary tract infection [99].

6.1.3 Imaging

It is systematically recommended to perform an ultrasound of the urinary tract with measurement of post-void residual urine (PVR) [AE, A+].

6.2 Second-Line Assessment

A urological consultation is recommended in cases of pyelonephritis, initial urinary retention, macroscopic hematuria, IPSS > 7, induration on digital rectal examination, PVR > 100 ml, recurrent UTI, age<40 years and/or urological abnormalities on imaging [AE, A+].

REFERENCES

1. Fitch K, Bernstein SJ, Aguilar MD, Bootman JL, Anderson JE, Lyles A, et al. The RAND/UCLA Appropriateness Method User's Manual. Santa Monica, CA: RAND Corporation; 2001.
2. Haute Autorité de Santé (HAS) [Internet]. 2013. Niveau de preuve et gradation des recommandations de bonne pratique [Level of evidence and grading of good practice recommendations] (cited June 10, 2026). Available from: https://www.has-sante.fr/jcms/c_1600564/fr/niveau-de-preuve-et-gradation-des-recommandations-de-bonne-pratique-etat-des-lieux
3. Johnson JR, Drekonja DM. Bacteriuria/pyuria of clinically undetermined significance (BPCUS): common, but currently nameless. Am J Med. 2017;130(5):e201-e204. doi:10.1016/j.amjmed.2016.12.015
4. Loots FJ, Smits M, Hopstaken RM, Jenniskens K, Schroeten FH, van den Bruel A, et al. New clinical prediction model for early recognition of sepsis in adult primary care patients: a prospective diagnostic cohort study of development and external validation. Br J Gen Pract. 2022;72:e437-e445. doi:10.3399/BJGP.2021.0580
5. Infections urinaires sans fièvre chez les hommes [Urinary tract infections without fever in men]. Prescrire. 2022;42(469):833-840. [In French].
6. Laborde C, Bador J, Hacquin A, Barben J, Putot S, Manckoundia P, et al. Atypical presentation of bacteremic urinary tract infection in older patients: frequency and prognostic impact. Diagnostics. 2021;11(3):523. doi:10.3390/diagnostics11030523
7. Advani SD, Turner NA, North R, Moehring RW, Vaughn VM, Scales CD, et al. Proposing the "Continuum of UTI" for a nuanced approach to diagnosis and management of urinary tract infections. J Urol. 2024;211(5):690-698. doi:10.1097/JU.0000000000003890
8. Koeijers JJ, Kessels AGH, Nys S, Bartelds A, Donker G, Stobberingh EE, et al. Evaluation of the nitrite and leukocyte esterase activity tests for the diagnosis of acute symptomatic urinary tract infection in men. Clin Infect Dis. 2007;45(7):894-896. doi:10.1086/521260
9. Bodilsen J, Nielsen H, Leis JA. Revisiting diagnostics: discarding the urine dipstick is way overdue. Clin Microbiol Infect. 2025;31(10):1623-1625. doi:10.1016/j.cmi.2025.01.010
10. Kouri TT, Hofmann W, Falbo R, Oyaert M, Schubert S, Gertsen JB, et al. The EFLM European Urinalysis Guideline 2023. Clin Chem Lab Med. 2024;62(9):1653-1678. doi:10.1515/cclm-2023-1200
11. Drekonja DM, Trautner B, Amundson C, Kuskowski M, Johnson JR, Rector TS, et al. Effect of 7 vs 14 days of antibiotic therapy on resolution of symptoms among afebrile men with urinary tract infection: a randomized clinical trial. JAMA. 2021;326(4):324-331. doi:10.1001/jama.2021.10440
12. Fernández-García S, Moragas Moreno A, Giner-Soriano M, Morros R, Ouchi D, García-Sangenís A, et al. Urinary tract infections in men in primary care in Catalonia, Spain. Antibiotics. 2023;12(11):1611. doi:10.3390/antibiotics12111611
13. Sætre H, Skow M, Vik I, Høye S, Emilsson L, Sundvold A, et al. Acute cystitis in men—a nationwide study from primary care: antibiotic prescriptions, risk factors, and complications. BJGP Open. 2024;8(2):BJGPO.2023.0207. doi:10.3399/BJGPO.2023.0207
14. Montelin H, Forsman KJ, Tängdén T, Al-Emran H, Melander E, Mölstad S, et al. Retrospective evaluation of nitrofurantoin and pivmecillinam for the treatment of lower urinary tract infections in men. PLoS One. 2019;14(1):e0211098. doi:10.1371/journal.pone.0211098
15. Ingalsbe ML, Wojciechowski AL, Smith KA, Mergenhagen KA, Trautner BW, Blevins J, et al. Effectiveness and safety of nitrofurantoin in outpatient male veterans. Ther Adv Urol. 2015;7(4):186-193. doi:10.1177/1756287215589418
16. Soudais B, Ribeaucoup F, Schuers M, Lefebvre E, Etienne M, Pellerin L, et al. Guidelines for the management of male urinary tract infections in primary care: a lack of international consensus—a systematic review of the literature. Fam Pract. 2023;40(1):152-175. doi:10.1093/fampra/cmac070

17. Trautner BW, Gupta K, Amaya D, Hull RA, Potoski BA, Patel PK, et al. Complicated urinary tract infections (cUTI): clinical guidelines for treatment and management. IDSA. 2025. [In press].
18. Bonkat G, Wagenlehner F, Cai T, Geerlings S, Medina-Polo J, Köves B, et al. Classification of urinary tract infections in 2025: moving beyond uncomplicated and complicated. Eur Urol Open Sci. 2025;75:44-47. doi:10.1016/j.euros.2025.04.001
19. Koeijers JJ, Verbon A, Kessels AGH, Bartelds A, Donker G, Nys S, et al. Urinary tract infection in male general practice patients: uropathogens and antibiotic susceptibility. Urology. 2010;76(2):336-340. doi:10.1016/j.urology.2010.01.045
20. Kranz J, Bartoletti R, Bruyère F, Cai T, Geerlings S, Köves B, et al. European Association of Urology Guidelines on Urological Infections: summary of the 2024 Guidelines. Eur Urol. 2024;86(1):27-41. doi:10.1016/j.eururo.2024.03.001
21. Etienne M, Chavanet P, Sibert L, Michel F, Levesque H, Lorcerie B, et al. Acute bacterial prostatitis: heterogeneity in diagnostic criteria and management. Retrospective multicentric analysis of 371 patients diagnosed with acute prostatitis. BMC Infect Dis. 2008;8:12. doi:10.1186/1471-2334-8-12
22. Gamé X, Vincendeau S, Palascak R, Milcent S, Fournier R, Houlgatte A. Total and free serum prostate specific antigen levels during the first month of acute prostatitis. Eur Urol. 2003;43(6):702-705. doi:10.1016/S0302-2838(03)00089-9
23. Tchetgen MBN, Oesterling JE. The effect of prostatitis, urinary retention, ejaculation, and ambulation on the serum prostate-specific antigen concentration. Urol Clin North Am. 1997;24(2):283-291. doi:10.1016/S0094-0143(05)70340-8
24. Battikhi MNG, Hussein I, Al-Qudah A, Al-Azzam S, Al-Najjar M, Al-Khateeb B, et al. Age-specific reference ranges for prostate specific antigen-total and free in patients with prostatitis symptoms and patients at risk. Int Urol Nephrol. 2007;38(3-4):559-564. doi:10.1007/s11255-006-0009-9
25. Arjunlal TS, Deepanjali S, Manikandan R, Medha R, Rajendran R, Sathishkumar K, et al. Frequency and clinical significance of prostatic involvement in men with febrile urinary tract infection: a prospective observational study. F1000Res. 2020;9:617. doi:10.12688/f1000research.23221.1
26. Lafaurie M, Chevret S, Fontaine JP, Mongiat-Artus P, de Lastours V, Escaut L, et al. Antimicrobials for 7 or 14 days for febrile urinary tract infection in men: a multicenter noninferiority double-blind, placebo-controlled, randomized clinical trial. Clin Infect Dis. 2023;76(12):2154-2162. doi:10.1093/cid/ciad045
27. Smithson A, Chico C, Sanchez M, Netto C, Bastida MT, Etienne M, et al. Blood cultures for men with febrile urinary tract infection. J Clin Microbiol. 2010;48(7):2662. doi:10.1128/JCM.00633-10
28. Etienne M, Pestel-Caron M, Chapuzet C, Bourgeois I, Chavanet P, Caron F. Should blood cultures be performed for patients with acute prostatitis? J Clin Microbiol. 2010;48(5):1935-1938. doi:10.1128/JCM.01804-09
29. Jang W, Jo H, Kim B, Kwon KT, Ryu S, Wie SH, et al. Comparison of the clinical characteristics of community-acquired acute pyelonephritis between male and female patients. J Infect Chemother. 2021;27(7):1013-1019. doi:10.1016/j.jiac.2021.02.010
30. Bastida Vilá MT, Martínez Martínez JA, López Onrubia P, Ribera Tello L, Expósito Aguilera M, Gómez-García M, et al. Bacteremic urinary infection in men: comparative study with bacteremic pyelonephritis in women. Med Clin (Barc). 1997;109(9):321-323. [In Spanish].
31. Pilatz A, Hossain H, Kaiser R, Mankertz A, Schüttler CG, Domann E, et al. Acute epididymitis revisited: impact of molecular diagnostics on etiology and contemporary guideline recommendations. Eur Urol. 2015;68(3):428-435. doi:10.1016/j.eururo.2015.02.036
32. Çek M, Sturdza L, Pilatz A, Wagenlehner F, Tenke P, D'Anzeo G, et al. Acute and chronic epididymitis. Eur Urol Suppl. 2017;16(4):124-131. doi:10.1016/j.eursup.2017.02.005

33. Salm J, Salm F, Arendarski P, Kramer TS, Behnke M, Kola A, et al. High antimicrobial resistance in urinary tract infections in male outpatients in routine laboratory data, Germany, 2015 to 2020. Euro Surveill. 2022;27(30):2101012. doi:10.2807/1560-7917.ES.2022.27.30.2101012
34. Reissier S, Penven M, Amara M, Dortet L, Riverain E, Caspar Y, et al.; GMC study group. Bacterial epidemiology and antibiotic resistance rates in male urinary tract infections in France, 2019-2023. Infect Dis Now. 2025;55(7):105123. doi:10.1016/j.idnow.2025.105123
35. Medqual [Internet]. n.d. Données de la mission PRIMO [PRIMO mission data] (cited June 10, 2026). Available from: https://medqualville.antibioresistance.fr/ [In French].
36. Delory T, Le Bel J, Lariven S, Peiffer-Smadja N, Lescure FX, Bouvet E, et al. Computerized decision support system (CDSS) use for surveillance of antimicrobial resistance in urinary tract infections in primary care. J Antimicrob Chemother. 2022;77(2):524-530. doi:10.1093/jac/dkab392
37. Charalabopoulos K, Karachalios G, Baltogiannis D, Charalabopoulos A, Giannakopoulos X, Sofikitis N. Penetration of antimicrobial agents into the prostate. Chemotherapy. 2003;49:269-279. doi:10.1159/000074526
38. Lupo F, Rousseau M, Canton T, Ingersoll MA, Kline KA, Damoiseaux R, et al. The immune system fails to mount a protective response to Gram-positive or Gram-negative bacterial prostatitis. J Immunol. 2020;205:2763-2777. doi:10.4049/jimmunol.2000587
39. Amoura A, Pistien C, Chaligné C, Dion S, Magnan M, Bridier-Nahmias A, et al. Variability in cell division among anatomical sites shapes Escherichia coli antibiotic survival in a urinary tract infection mouse model. Cell Host Microbe. 2024;32:900-912.e4. doi:10.1016/j.chom.2024.04.015
40. Nix DE, Goodwin SD, Peloquin CA, Rotella DL, Schentag JJ, Nightingale CH, et al. Antibiotic tissue penetration and its relevance: models of tissue penetration and their meaning. Antimicrob Agents Chemother. 1991;35(10):1947-1952. doi:10.1128/AAC.35.10.1947
41. Cafaro A, Barco S, Pigliasco F, Russo C, Mariani M, Mesini A, et al. Therapeutic drug monitoring of glycopeptide antimicrobials: an overview of liquid chromatography-tandem mass spectrometry methods. J Mass Spectrom Adv Clin Lab. 2024;31:33-39. doi:10.1016/j.jmsacl.2023.12.003
42. Landersdorfer CB, Bulitta JB, Kinzig M, Holzgrabe U, Sörgel F, Drusano GL, et al. Penetration of antibacterials into bone: pharmacokinetic, pharmacodynamic and bioanalytical considerations. Clin Pharmacokinet. 2009;48(2):89-124. doi:10.2165/00003088-200948020-00002
43. Müller M, Dela Peña A, Derendorf H, Lesko LJ, Jusko WJ, Drusano GL, et al. Issues in pharmacokinetics and pharmacodynamics of anti-infective agents: distribution in tissue. Antimicrob Agents Chemother. 2004;48(5):1441-1453. doi:10.1128/AAC.48.5.1441-1453.2004
44. Mouton JW, Theuretzbacher U, Craig WA, Tulkens PM, Derendorf H, Cars O. Tissue concentrations: do we ever learn? J Antimicrob Chemother. 2007;61(2):235-237. doi:10.1093/jac/dkm476
45. Frimodt-Møller N. Correlation between pharmacokinetic/pharmacodynamic parameters and efficacy for antibiotics in the treatment of urinary tract infection. Int J Antimicrob Agents. 2002;19(6):546-553. doi:10.1016/S0924-8579(02)00105-X
46. Frimodt-Møller N, Maigaard S, Madsen PO. Effect of urine concentration versus tissue concentration of ampicillin and mecillinam on bacterial adherence in the rat bladder. Invest Urol. 1981;18(5):322-325.
47. Anderson GG, Martin SM, Hultgren SJ, Gordon JI, Martens EC, Hayashi JM, et al. Host subversion by formation of intracellular bacterial communities in the urinary tract. Microbes Infect. 2004;6(11-12):1094-1101. doi:10.1016/j.micinf.2004.05.023
48. Schilling JD, Mulvey MA, Hultgren SJ, Martin SM, Martens EC, Gordon JI, et al. Dynamic interactions between host and pathogen during acute urinary tract infections. Urology. 2001;57(1 Suppl):56-61. doi:10.1016/S0090-4295(01)01130-X

49. Jacobsen SM, Stickler DJ, Mobley HLT, Shirtliff ME, Lockatell CV, Himpsl SD, et al. Complicated catheter-associated urinary tract infections due to Escherichia coli and Proteus mirabilis. Clin Microbiol Rev. 2008;21(1):26-59. doi:10.1128/CMR.00019-07
50. Platteel TN, Beets MT, Teeuwissen HA, ten Doesschate T, van de Wijgert JH, Venekamp RP, et al. Nitrofurantoin failure in males with an uncomplicated urinary tract infection: a primary care observational cohort study. Br J Gen Pract. 2023;73(728):e204-e210. doi:10.3399/BJGP.2022.0540
51. Germanos GJ, Trautner BW, Zoorob RJ, Salemi JL, Drekonja D, Gupta K, et al. No clinical benefit to treating male urinary tract infection longer than seven days: an outpatient database study. Open Forum Infect Dis. 2019;6(6):ofz216. doi:10.1093/ofid/ofz216
52. Wolterink I, Verheij T, Platteel T, van den Bruel A, Stam A, van de Pol A. Nitrofurantoin failure in elderly men: a retrospective observational study. Antibiotics. 2020;9(5):211. doi:10.3390/antibiotics9050211
53. Kornfält Isberg H, Hedin K, Melander E, Mölstad S, Cronberg O, Engström S, et al. Different antibiotic regimes in men diagnosed with lower urinary tract infection—a retrospective register-based study. Scand J Prim Health Care. 2020;38(3):291-299. doi:10.1080/02813432.2020.1794840
54. Tandan M, Duane S, Cormican M, Murphy AW, Vellinga A, Akrami K, et al. Reconsultation and antimicrobial treatment of urinary tract infection in male and female patients in general practice. Antibiotics. 2016;5(3):31. doi:10.3390/antibiotics5030031
55. Jansåker F, Boel JB, Frimodt-Møller N, Knudsen JD, Hansen KH, Hertz FB, et al. Retrospective study of men with E. coli UTI treated with an oral antibiotic, and risk for a new prescription or hospital admission due to UTI. Scand J Prim Health Care. 2020;38(1):101-103. doi:10.1080/02813432.2019.1705040
56. Jansåker F, Boel JB, Thønnings S, Hertz FB, Hansen KH, Frimodt-Møller N, et al. Pivmecillinam compared to other antimicrobials for community-acquired urinary tract infections with Escherichia coli, ESBL-producing or not—a retrospective cohort study. Infect Drug Resist. 2019;12:1691-1702. doi:10.2147/IDR.S208846
57. Crellin E, Mansfield KE, Leyrat C, Nitsch D, Douglas IJ, Root A, et al. Trimethoprim use for urinary tract infection and risk of adverse outcomes in older patients: cohort study. BMJ. 2018;360:k341. doi:10.1136/bmj.k341
58. Seroy JT, Grim SA, Reid GE, Wellington T, Clark NM, Bonomo RA, et al. Treatment of MDR urinary tract infections with oral fosfomycin: a retrospective analysis. J Antimicrob Chemother. 2016;71(9):2563-2568. doi:10.1093/jac/dkw202
59. Matthews PC, Barrett LK, Warren S, Stoesser N, Snelling M, Scarborough M, et al. Oral fosfomycin for treatment of urinary tract infection: a retrospective cohort study. BMC Infect Dis. 2016;16(1):556. doi:10.1186/s12879-016-1892-5
60. Pullukcu H, Tasbakan M, Sipahi OR, Yamazhan T, Aydemir S, Ulusoy S. Fosfomycin in the treatment of extended spectrum beta-lactamase-producing Escherichia coli-related lower urinary tract infections. Int J Antimicrob Agents. 2007;29(1):62-65. doi:10.1016/j.ijantimicag.2006.08.024
61. Qiao LD, Zheng B, Chen S, Yang Y, Zhang K, Guo HF, et al. Evaluation of three-dose fosfomycin tromethamine in the treatment of patients with urinary tract infections: an uncontrolled, open-label, multicentre study. BMJ Open. 2013;3(12):e004157. doi:10.1136/bmjopen-2013-004157
62. Bonfiglio G, Mattina R, Lanzafame A, Cammarata E, Tempera G, Di Stefano R, et al. Fosfomycin tromethamine in uncomplicated urinary tract infections: a clinical study. Chemotherapy. 2005;51(2-3):162-166. doi:10.1159/000084480
63. Senol S, Tasbakan M, Pullukcu H, Sipahi OR, Sipahi H, Yamazhan T, et al. Carbapenem versus fosfomycin tromethanol in the treatment of extended-spectrum beta-lactamase-producing Escherichia coli-related complicated lower urinary tract infection. J Chemother. 2010;22(5):355-357. doi:10.1179/joc.2010.22.5.355

64. European Association of Urology (EAU) [Internet]. 2025. EAU Guidelines on Urological Infections [cited June 10, 2026]. Available from: https://uroweb.org/guidelines/urological-infections
65. Caron F, Galperine T, Flateau C, Azria R, Bonacorsi S, Bruyère F, et al. Practice guidelines for the management of adult community-acquired urinary tract infections. Med Mal Infect. 2018;48(5):327-358. [In French]. doi:10.1016/j.medmal.2018.04.003
66. Peterson J, Kaul S, Khashab M, Fisher AC, Kahn JB, Hull RA, et al. A double-blind, randomized comparison of levofloxacin 750 mg once-daily for five days with ciprofloxacin 400/500 mg twice-daily for 10 days for the treatment of complicated urinary tract infections and acute pyelonephritis. Urology. 2008;71(1):17-22. doi:10.1016/j.urology.2007.08.035
67. Ulleryd P, Sandberg T. Ciprofloxacin for 2 or 4 weeks in the treatment of febrile urinary tract infection in men: a randomized trial with a 1 year follow-up. Scand J Infect Dis. 2003;35(1):34-39. doi:10.1080/0036554021000035881
68. van Nieuwkoop C, van der Starre WE, Stalenhoef JE, van Aartrijk AM, van der Reijden TJ, Vollaard AM, et al. Treatment duration of febrile urinary tract infection: a pragmatic randomized, double-blind, placebo-controlled non-inferiority trial in men and women. BMC Med. 2017;15(1):70. doi:10.1186/s12916-017-0836-5
69. Lojanapiwat B, Nimitvilai S, Bamroongya M, Jirajariyavej S, Tiradechavat C, Malithong A, et al. Oral sitafloxacin vs intravenous ceftriaxone followed by oral cefdinir for acute pyelonephritis and complicated urinary tract infection: a randomized controlled trial. Infect Drug Resist. 2019;12:173-181. doi:10.2147/IDR.S192008
70. Edlund C, Ternhag A, Ståhlgren GS, Edquist P, Balkhed ÅÖ, Athlin S, et al. The clinical and microbiological efficacy of temocillin versus cefotaxime in adults with febrile urinary tract infection, and its effects on the intestinal microbiota: a randomised multicentre clinical trial in Sweden. Lancet Infect Dis. 2022;22(3):390-400. doi:10.1016/S1473-3099(21)00430-0
71. Sutton JD, Stevens VW, Chang NCN, Khader K, Timbrook TT, Spivak ES, et al. Oral β-lactam antibiotics vs fluoroquinolones or trimethoprim-sulfamethoxazole for definitive treatment of Enterobacterales bacteremia from a urine source. JAMA Netw Open. 2020;3(10):e2020166. doi:10.1001/jamanetworkopen.2020.20166
72. Wald-Dickler N, Lee TC, Tangpraphaphorn S, Butler-Wu SM, Wang N, Degener T, et al. Fosfomycin vs ertapenem for outpatient treatment of complicated urinary tract infections: a multicenter, retrospective cohort study. Open Forum Infect Dis. 2022;9(1):ofab620. doi:10.1093/ofid/ofab620
73. Sojo-Dorado J, López-Hernández I, Rosso-Fernandez C, Morales IM, Palacios-Baena ZR, Hernández-Torres A, et al. Effectiveness of fosfomycin for the treatment of multidrug-resistant Escherichia coli bacteremic urinary tract infections: a randomized clinical trial. JAMA Netw Open. 2022;5(1):e2137277. doi:10.1001/jamanetworkopen.2021.37277
74. Seo JW, Kim DY, Yoon Y, Lyu YS, Na YS, Moon DS, et al. Effect of oral fosfomycin compared to the intravenous beta-lactam/beta-lactamase inhibitor or carbapenem in step-down treatment of patients with complicated urinary tract infection due to extended-spectrum beta-lactamase (ESBL) producing Enterobacteriaceae: a multicenter, open-label, randomized controlled, non-inferiority trial. Open Forum Infect Dis. 2023;10(Suppl 2):ofad500.002. doi:10.1093/ofid/ofad500.002
75. Jansåker F, Frimodt-Møller N, Benfield TL, Knudsen JD, Hansen KH, Hertz FB, et al. Mecillinam for the treatment of acute pyelonephritis and bacteremia caused by Enterobacteriaceae: a literature review. Infect Drug Resist. 2018;11:761-771. doi:10.2147/IDR.S154842
76. Hansen BÅ, Grude N, Lindbæk M, Stenstad T, Sundvold A, Haldorsen IS, et al. The efficacy of pivmecillinam in oral step-down treatment in hospitalised patients with E. coli bacteremic urinary tract infection; a single-arm, uncontrolled treatment study. BMC Infect Dis. 2022;22(1):478. doi:10.1186/s12879-022-07456-9

77. Jernelius H, Zbornik J, Bauer CA. One or three weeks' treatment of acute pyelonephritis? A double-blind comparison, using a fixed combination of pivampicillin plus pivmecillinam. Acta Med Scand. 1988;223(5):469-477. doi:10.1111/j.1600-0436.1988.tb02280.x
78. HAS [Internet]. 2019. Antibiothérapie des infections à entérobactéries et à Pseudomonas aeruginosa chez l'adulte : place des carbapénèmes et de leurs alternatives [Antibiotic therapy for Enterobacteriaceae and Pseudomonas aeruginosa infections in adults: role of carbapenems and their alternatives] (updated March 13, 2023; cited June 10, 2026). Available from: https://www.has-sante.fr/jcms/c_2968915/fr/antibiotherapie-des-infections-a-enterobacteries-et-a-pseudomonas-aeruginosa-chez-l-adulte-place-des-carbapenemes-et-de-leurs-alternatives [In French].
79. Stefanos SS, Sakaan S, Samarin M, Gelfand MS, Cleveland KO, Gant J, et al. Assessing clinical cure of empirical piperacillin/tazobactam for ESBL urinary tract infections (ACCEPT-UTI). JAC Antimicrob Resist. 2023;5(3):dlad055. doi:10.1093/jacamr/dlad055
80. Karaiskos I, Giamarellou H. Carbapenem-sparing strategies for ESBL producers: when and how. Antibiotics. 2020;9(2):61. doi:10.3390/antibiotics9020061
81. Delory T, Gravier S, Le Pluart D, Gaube G, Simeon S, Davido B, et al. Temocillin versus carbapenems for urinary tract infection due to ESBL-producing Enterobacteriaceae: a multicenter matched case-control study. Int J Antimicrob Agents. 2021;58(1):106361. doi:10.1016/j.ijantimicag.2021.04.012
82. Dinh A, Duran C, Singh S, Tesmoingt C, Bouabdallah L, Hamon A, et al. Real-life temocillin use in Greater Paris area, effectiveness and risk factors for failure in infections caused by ESBL-producing Enterobacterales: a multicentre retrospective study. JAC Antimicrob Resist. 2022;5(1):dlac132. doi:10.1093/jacamr/dlac132. Erratum in: JAC Antimicrob Resist. 2023;5(1):dlad002. doi:10.1093/jacamr/dlad002.
83. Senard O, Lafaurie M, Lesprit P, Nguyen Y, Lescure X, Therby A, et al. Efficacy of cefoxitin versus carbapenem in febrile male urinary tract infections caused by extended spectrum beta-lactamase–producing Escherichia coli: a multicenter retrospective cohort study with propensity score analysis. Eur J Clin Microbiol Infect Dis. 2020;39(1):121-129. doi:10.1007/s10096-019-03710-8
84. Harris PNA, Tambyah PA, Lye DC, Mo Y, Lee TH, Yilmaz M, et al. Effect of piperacillin-tazobactam vs meropenem on 30-day mortality for patients with E coli or Klebsiella pneumoniae bloodstream infection and ceftriaxone resistance: a randomized clinical trial. JAMA. 2018;320(10):984-994. doi:10.1001/jama.2018.12842
85. Chen L, Hua J, Hong SJ, Yuan CY, Jing RC, Luo XY, et al. Comparison of the relative efficacy of β-lactam/β-lactamase inhibitors and carbapenems in the treatment of complicated urinary tract infections caused by ceftriaxone-non-susceptible Enterobacterales: a multicentre retrospective observational cohort study. J Antimicrob Chemother. 2023;78(3):710-718. doi:10.1093/jac/dkad001
86. Eickhoff T, Frimodt-Møller N, Walter S, Frimodt-Møller C, Naber KG, Bjerklund-Johansen TE, et al. A double-blind, randomized, controlled multicentre study to compare the efficacy of ciprofloxacin with pivampicillin as oral therapy for epididymitis in men over 40 years of age. BJU Int. 1999;84(7):827-834. doi:10.1046/j.1464-410x.1999.00227.x
87. Redfern TR, English PJ, Baumber CD, McGhie D. The aetiology and management of acute epididymitis. Br J Surg. 1984;71(9):703-705. doi:10.1002/bjs.1800710914
88. Street EJ, Joyce A, Wilson J, Clinical Effectiveness Group, British Association for Sexual Health and HIV. BASHH UK guideline for the management of epididymo-orchitis, 2010. Int J STD AIDS. 2011;22(7):361-365. doi:10.1258/ijsa.2011.011085
89. Ludwig M. Diagnosis and therapy of acute prostatitis, epididymitis and orchitis. Andrologia. 2008;40(2):76-80. doi:10.1111/j.1439-0272.2007.00824.x
90. Khastgir J. Advances in the antibiotic management of epididymitis. Expert Opin Pharmacother. 2022;23(9):1103-1113. doi:10.1080/14656566.2022.2066040

91. Luzzi GA, O'Brien TS. Acute epididymitis. BJU Int. 2001;87(8):747-755. doi:10.1046/j.1464-4096.2001.00747.x
92. Aotearoa New Zealand [Internet]. n.d. Epididymo-Orchitis [cited June 10, 2026]. Available from: https://sti.guidelines.org.nz/syndromes/epididymo-orchitis/
93. Kutchukian S, Chapelle C, Vallée M, Bruyère F, Fourcade A, Larré S, et al. Prise en charge des prostatites aiguës [Management of acute prostatitis]. EMC - Urologie. 2023;41(4):1-8. [In French]. Article 18-520-A-10.
94. EAU [Internet]. 2026. EAU Guidelines on Non-Neurogenic Male Lower Urinary Tract Symptoms (LUTS) [updated March 2026; cited June 10, 2026]. Available from: https://uroweb.org/guidelines/management-of-non-neurogenic-male-luts
95. Abrams P, Cardozo L, Fall M, Griffiths D, Rosier P, Uludag O, et al. The standardisation of terminology of lower urinary tract function: report from the Standardisation Sub-committee of the International Continence Society. Neurourol Urodyn. 2002;21(2):167-178. doi:10.1002/nau.10053
96. Ploussard G, Baboudjian M, Barret E, Brureau L, Fiard G, Fromont G, et al. Recommandations françaises du comité de cancérologie de l'AFU – Actualisation 2024–2026: cancer de la prostate – diagnostic et prise en charge de la maladie localisée [French recommendations from the AFU oncology committee – 2024-2026 update: prostate cancer – diagnosis and management of localized disease]. Prog Urol. 2024;34(7):F394-F441. [In French].
97. Bruyère F, Amine Lakmichi M. Intérêt de l'utilisation du PSA dans la prise en charge des prostatites: revue de la littérature [The value of PSA in the management of prostatitis: a literature review]. Prog Urol. 2013;23(16):1377-1381. [In French]. doi:10.1016/j.purol.2013.08.007
98. Monzón H, Gisbert L, Salvadó M, Puyol M, Xercavins M, Gasós A, et al. Short versus long course therapy in the treatment of febrile urinary tract infections in men based on serum PSA values. Eur J Intern Med. 2022;106:97-102. doi:10.1016/j.ejim.2022.09.012

Figure 1. **Summary vignette for the management of bacterial cystitis in men**

Figure 2. Summary vignette for the management of acute prostatitis

Figure 3. Summary vignette for the management of acute pyelonephritis in men

Figure 4. Summary vignette for the management of acute epididymitis and orchitis

Figure 5. Decision algorithm for identifying and managing the most common uropathies possibly predisposing to urinary tract infection.
IPSS: International Prostate Symptom Score

Table 1. Epidemiology of bacterial species isolated from midstream UC in men with community-acquired infections in France, between 2019 and 2023.

Bacterial species	Hospital Centers* (Emergency Departments)	Private MBLs**
E. coli	15,322 (40.0%)	7,952 (39.2%)
E. faecalis	5,046 (13.2%)	2,962 (14.6%)
K. pneumoniae	3,001 (7.8%)	1,265 (6.2%)
P. mirabilis	2,208 (5.8%)	937 (4.6%)
Other Enterobacterales	5,628 (14.7%)	3,269 (16.1%)
Other Gram-positive cocci	4,007 (10.5%)	2,827 (13.9%)
Other Gram-negative bacilli (non-Enterobacterales)	2,046 (5.3%)	926 (4.6%)
Other species***	1,021 (2.7%)	157 (0.8%)
Total	**38,279 (100%)**	**20,295 (100%)**

*Aggregated data from bacteriology laboratories of university hospitals in Rennes, Nantes, Grenoble, Limoges, Tours, Caen, Besançon, Henri-Mondor, Kremlin-Bicêtre, general hospitals in Versailles, Suresnes, Saint-Joseph, Mantes-la-Jolie, Antibes, and the military teaching hospital Bégin.

**Aggregated data from the private MBL group Atoutbio.

***Aggregated data for species with *frequency < 0.5%.*

Table 2. Prevalence (%) of antibiotic resistance among *E. coli*, *K. pneumoniae*, and *P. mirabilis* isolated from midstream urine cultures in men in France with community-acquired infections (data from MBL).

	Percentage of resistant isolates by antibiotic or antibiotic class (%)											
Bacterial species	**AMX**	**AMC**	**MEC**	**PTZ**	**FOX**	**3GC**	**TEM**	**FQ**	**AMI**	**FOS**	**SXT**	**FT**
E. coli	**47-53.5**	**24-35.7**	**6.8-8.9**	**5.9-6.8**	**2.2-2.5**	**4.7-9.3**	***7.3***	**16.3- 20.2**	**0.4-0.7**	**1.4-1.5**	**25.4-31.5**	**0.4-0.7**
***E. coli* ESBL**	***100***	***55.3***	**14.7**	**11.5**	***5.1***	***100***	***15.4***	***78.8***	***3.6***	***4.3***	***61.6***	***3.0***
K. pneumoniae	**100**	**20.1-33**	**	**13.4-17.3**	**	**10.8-24.5**	***9.2***	**15.3-27.1**	**0.9-1.8**	*	**20.3-26.8**	**15.6-53.2**
P. mirabilis	**39.7-42.3**	**10.4-14.4**	*	**0.5-0.8**	**	**1.3-1.5**	***1.7***	**13.9-16.6**	**0.7-0.8**	*	**29.5-33.5**	**100**

AMX: amoxicillin; AMC: amoxicillin–clavulanic acid; MEC: mecillinam; PTZ: piperacillin–tazobactam; FOX: cefoxitin; 3GC: parenteral third-generation cephalosporins; TEM: temocillin; FQ: fluoroquinolones; AMI: amikacin; FOS: fosfomycin; SXT: trimethoprim–sulfamethoxazole; FT : nitrofurantoin; ESBL: extended-spectrum β-lactamase.

Data in italics are derived from a single source (emergency departments of 15 French hospitals).
Data are expressed as min-max values according to the source.
* *Antibiotic tested on a number of isolates insufficient to provide robust data.*
** *Absence of a defined clinical breakpoint.*
Color coding / resistance levels : > 20% :10-20%; :<10%

Table 3. Antibiotic dosages for treatment of acute urinary tract infections in men

Antibiotic	Cystitis	Pyelonephritis	Prostatitis*	Sepsis/Septic Shock
Nitrofurantoin	100 mg tid	NR		NR
Trimethoprim	300 mg od	NR		NR
TMP-SMX (160-800)	1 pill bid			NR
Ofloxacin	200 mg bid			NR
Levofloxacin	500 mg od			NR
Ciprofloxacin	500 mg bid			NR
Fosfomycin-trometamol	3 g (1 dose) every other day	NR	3 g (1 dose) od or every other day if poor digestive tolerance.	NR
Amoxicillin	1 g tid			NR
Amoxicillin-clavulanate	1 g tid			NR
Pivmecillinam	400 mg bid	NR		NR
Cefixime	NR	200 mg bid		NR
Piperacillin-tazobactam	NR	4,5 g tid		NR
Temocillin	NR	2 g/ tid		NR
Cefoxitin	NR	6 g/d		NR
Cefixime	NR	200 mg bid		NR
Cefotaxime	NR	1 g tid		2 g tid
Ceftriaxone	NR	1 g od		2 g od
Imipenem	NR	500 mg tid		1 g tid
Meropenem	NR	1 g tid		2 g tid
Ertapenem	NR	1 g od		NR
Amikacin	NR	30 mg/kg/day		

NR: not recommended; TMP-SMX**: trimethoprim–sulfamethoxazole; tid: three times a day; bid: twice a day; od: once a day**

The dosages of antibiotics for treatment of acute epididymitis and orchitis are identical to those used in treatment of acute prostatitis.***

Statement for studies in humans and animals

Not relevant

Highlights

- Cystitis in men is an existing pathology
- Antibiotic treatment duration is usually seven days for cystitis, and 14 days for prostatitis
- Fluoroquinolones and SXT-TMP are not the only antibiotics penetrating into the prostate

Bacterial Cystitis in Men

DIAGNOSTIC

❖ Positive clinical signs

- ✓ urethral burning during micturition, increased urinary frequency, urinary urgency,
- ✓ dysuria, nocturia, and suprapubic pain
- ✓ these symptoms may be accompanied by macroscopic hematuria

⚠ routine digital rectal examination not recommended

❖ Negative clinical signs

⚠ no fever, no chills, no sepsis

⚠ cloudy or foul-smelling urine or macroscopic hematuria or acute urinary retention, when alone, are not clinical signs of UTI: UC is not recommended in these situations

❖ Only recommended test: Urine culture (UC)

- ✓ significant thresholds : leukocyturia > 30 × 10^6/mL and monobacterial bacteriuria ≥ 10^3 CFU/mL

❗ Clinical signs of UTI take precedence over leukocyturia and bacteriuria thresholds

- urine dipstick
- blood sampling
- imaging

not recommended

ANTIBIOTIC THERAPY

Empirical treatment

If cystitis symptoms are well-tolerated, it is recommended to await the results of the UC

Fosfomycin-trometamol OR Pivmecillinam OR Nitrofurantoin

Antibiotic therapy after documentation

Empirical treatment if effective and well-tolerated is to be continued, even in case of ESBL–producing Enterobacterale

Fosfomycin-trometamol (FT)	3g at D1, D3 and D5
Pivmecillinam	400 mg bid
Nitrofurantoin	100 mg tid
Amoxicillin	1000 mg tid
Trimethoprim	300 mg od

Duration of antibiotic therapy : 7 days (except for FT)

▶ Follow-up UC if clinically successful treatment not recommended

Figure 1

Acute Pyelonephritis in Men

DIAGNOSTIC

❖ Positive clinical signs

- ✓ fever (or systemic signs of infection [chills, rigors] or sepsis)
- ✓ spontaneous or percussion-induced lumbar pain
- ✓ +/- symptoms of cystitis

⚠ routine digital rectal examination not recommended
(except in cases of diagnostic uncertainty with prostatitis)

⚠ symptoms of cystitis may be absent

❖ Diagnostic tests

❑ Urine culture (UC)

significant thresholds: leukocyturia > 30 × 10^6/mL and monobacterial bacteriuria ≥ 10^3 CFU/mL

❗ Clinical signs of UTI take precedence over leukocyturia and bacteriuria thresholds

- urine dipstick
- PSA measurement
- blood cultures *
- inflammatory markers
- serum creatinine */**

not recommended

* unless hospital management, ** unless known risk factors for renal failure (chronic kidney disease, urological history, dehydration, medications such as Non-Steroidal Antiinflammatory Drugs, Angiotensin-Converting Enzyme Inhibitors, aminoglycosides…)

❑ First-line abdominal-pelvic CT scan, with and without contrast, including a delayed phase, systematically recommended

- *In emergency settings*: if sepsis or septic shock - uncontrolled pain - suspicion of urinary tract obstruction (stone, tumor…) - ureteral stent - acute renal failure
- *Otherwise, within 48–72 hours* to check for uropathy

TREATMENT

Empirical antibiotic therapy

- Sepsis or septic schock
- Suspected/confirmed urinary obstruction
- Functional decline due to infection, decompenstion of comorbidity, Inability to take oral medication Uncontrolled pain

→ refer to an emergency department

No sepsis, no septic schock

Hospitalized patient: ceftriaxone OR cefotaxime

Outpatients: ceftriaxone OR oral levofloxacin* oral ciprofloxacin *

- if no fluoroquinolone use in the past six months and if oral efficacy is not compromised by nausea, vomiting, malabsorption, or uncertain compliance)

Antibiotic therapy after documentation

In order of preference

- Amoxicillin	1 g tid
- Sulfamethoxazole-trimethoprim (SXT)	800/160 mg bid
- Amoxicillin-clavulanic acid	1 g tid
- Oral fluoroquinolone (FQ),in alphabetic order	
- ofloxacin	200 mg bid
- OR levofloxacin	500 mg od
- OR ciprofloxacin	500 mg bid
- Cefixime	200 mg bid

Total duration of antibiotic therapy

7 days if FQ and/or parenteral Beta-lactam and/or SXT ; 10 days otherwise

Follow-up UC if clinically successful treatment not recommended

Figure 2

Acute Pyelonephritis in Men

DIAGNOSTIC

❖ Positive clinical signs

- ✓ fever (or systemic signs of infection [chills, rigors] or sepsis)
- ✓ spontaneous or percussion-induced lumbar pain
- ✓ +/- symptoms of cystitis

⚠ routine digital rectal examination not recommended
(except in cases of diagnostic uncertainty with prostatitis)

⚠ symptoms of cystitis may be absent

❖ Diagnostic tests

❑ Urine culture (UC)

significant thresholds: leukocyturia > 30 × 10^6/mL and monobacterial bacteriuria ≥ 10^3 CFU/mL

! Clinical signs of UTI take precedence over leukocyturia and bacteriuria thresholds

- urine dipstick
- PSA measurement
- blood cultures*
- inflammatory markers
- serum creatinine*/**

} not recommended

* unless hospital management, ** unless known risk factors for renal failure (chronic kidney disease, urological history, dehydration, medications such as Non-Steroidal Antiinflammatory Drugs, **Angiotensin-Converting Enzyme inhibitors**, aminoglycosides…)

❑ First-line abdominal-pelvic CT scan, with and without contrast, including a delayed phase, systematically recommended

- ***In emergency settings*: If sepsis or septic shock - uncontrolled pain - suspicion of urinary tract obstruction (stone, tumor…) - ureteral stent - acute renal failure**
- *Otherwise, within 48–72 hours* to check for uropathy

TREATMENT

Empirical antibiotic therapy

Sepsis or septic schock
Suspected/confirmed urinary obstruction
Functional decline due to infection, decompenstion of comorbidity,
Inability to take oral medication
Uncontrolled pain
→ refer to an emergency department

No sepsis, no septic schock

Hospitalized patient: ceftriaxone OR cefotaxime
Outpatients: ceftriaxone OR oral levofloxacin* oral ciprofloxacin*

- if no fluoroquinolone use in the past six months and if oral efficacy is not compromised by nausea, vomiting, malabsorption, or uncertain compliance)

Antibiotic therapy after documentation

In order of preference

- Amoxicillin	1 g tid
- Sulfamethoxazole-trimethoprim (SXT)	800/160 mg bid
- Amoxicillin-clavulanic acid	1 g tid
- Oral fluoroquinolone (FQ),in alphabetic order	
- ofloxacin	200 mg bid
- OR levofloxacin	500 mg od
- OR ciprofloxacin	500 mg bid
- Cefixime	200 mg bid

Total duration of antibiotic therapy
7 days If FQ and/or parenteral Beta-lactam and/or SXT ; 10 days otherwise

▶ Follow-up UC if clinically successful treatment not recommended

Figure 3

Acute Epididymitis/Orchitis

DIAGNOSTIC

❖ Positive clinical signs

- ✓ acute onset of testicular and/or epididymal swelling
- ✓ spontaneous or palpation-induced pain
- ✓ Other associated clinical signs may include: fever, hydrocele, scrotal erythema and edema, symptoms of cystitis, or urethral discharge

❖ Diagnostic tests

❑ Urine culture (UC)

significant thresholds : leukocyturia > 30 × 10^6/mL and monobacterial bacteriuria ≥ 10^3 CFU/mL

❗ Clinical signs of UTI take precedence over leukocyturia and bacteriuria thresholds

❑ PCR *Chlamydia trachomatis*, PCR *Neisseria gonorrhoeae* (first-void urine sample): in sexually active men, regardless of age.

❑ A comprehensive sexually transmitted infection (STI) evaluation should be performed based on individual risk factors

🚫 Systematic ultrasound not recommended

❑ Scrotal ultrasound if:

- diagnostic uncertainty
- suspected abscess
- poor clinical response after 72 hours of appropriate antibiotic therapy (persistent fever or worsening local symptoms)

TREATMENT

Empirical antibiotic therapy

Hospitalized patient: ceftriaxone OR cefotaxime

Outpatients: ceftriaxone OR oral levofloxacin* oral ciprofloxacin*

- if no fluoroquinolone use in the past six months and if oral efficacy is not compromised by nausea, vomiting, malabsorption, or uncertain compliance)

Antibiotic therapy after documentation

1st choice sulfamethoxazole-trimethoprim (SXT)	800/160 mg bid
2nd choice oral fluoroquinolone in alphabetical order	
- Ofloxacin	200 mg bid
- OR levofloxacin	500 mg od
- OR ciprofloxacin	500 mg bid
If resistance or contraindication and after defervescence on parenteral Beta-lactam	
In order of preference	
- Amoxicillin	1 g tid
- Amoxicillin-clavulanic acid	1 g tid
- Cefixime	200 mg bid

No microbiological documentation: Continue the initiated empirical treatment or consider oral step-down, in order of preference: SXT, fluoroquinolone (ciprofloxacin, levofloxacin, or ofloxacin)

Total duration of antibiotic therapy: 10 days

Figure 4

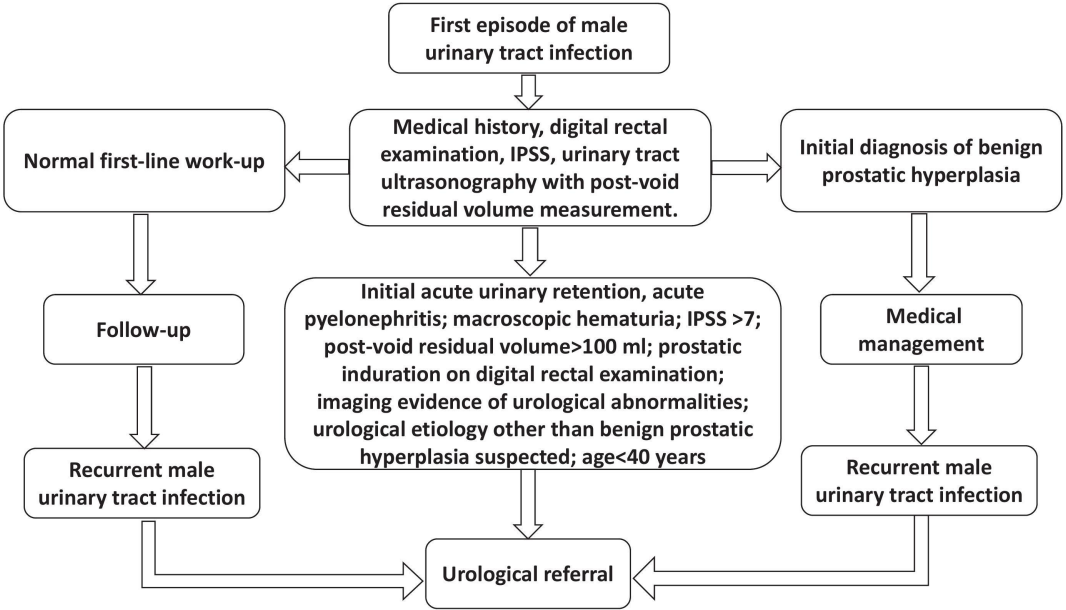
First episode of male urinary tract infection
Medical history, digital rectal examination, IPSS, urinary tract ultrasonography with post-void residual volume measurement.
Normal first-line work-up
Initial diagnosis of benign prostatic hyperplasia
Follow-up
Initial acute urinary retention, acute pyelonephritis; macroscopic hematuria; IPSS >7; post-void residual volume>100 ml; prostatic induration on digital rectal examination; imaging evidence of urological abnormalities; urological etiology other than benign prostatic hyperplasia suspected; age<40 years
Medical management
Recurrent male urinary tract infection
Recurrent male urinary tract infection
Urological referral

Figure 5