



Recommendations

Preoperative urine culture in urology: Indications and management – The 2026 French guidelines



Maxime Vallée^{a,b,c,*}, Stessy Kutchukian^a, Hugo Crespin^d, Nadia Abid^e,
Matthieu Boisson^{c,f,g}, Patrick Coloby^{c,h}, Julien Derdevetⁱ, Aurélien Dinh^{c,j}, Diana Kassab^{l,k},
Olivia Keita-Perse^l, Eric Kipnis^{m,n,o}, Matthieu Lafaurie^p, Marc Leone^q,
Martine Pestel-Caron^{c,r}, Albert Sotto^{c,s}, Valentine Berti^{t,v}, Omar Karray^{c,h},
Franck Bruyère^{c,u} for the, AFU working group

^a Department of Urology and kidney transplantation, Centre Hospitalier Universitaire, 2, rue de la Milétrie, 86000 Poitiers, France

^b Université de Poitiers, unité INSERM U1070, PHAR2, 86000 Poitiers, France

^c Membre du Comité d'Infectiologie de l'Association Française d'Urologie (CIAFU), Association Française d'Urologie, 11, rue Viète, 75017 Paris, France

^d Department of Urology, University Hospital of Tours, Tours, France

^e Urology Department, Hospices Civils de Lyon, Lyon, France

^f INSERM U1070, PHAR2, Université de Poitiers, Poitiers, France

^g Service d'anesthésie-Réanimation et Médecine Péri-Opératoire, CHU de Poitiers, Poitiers, France

^h Department of Urology, CH Nord Ouest Val d'Oise, Pontoise, France

ⁱ Internal Medicine Department, French National Sickle Cell Referral Center, Hôpital Européen Georges Pompidou, Assistance Publique-Hôpitaux de Paris, Paris, France

^j Infectious Disease Department, University Hospital R.-Poincaré, AP-HP, Garches, France

^k Methodologist-project manager, Association Française d'Urologie, Paris, France

^l Service d'Épidémiologie et d'Hygiène Hospitalière, Centre Hospitalier Princesse Grace, French Society for Hospital Hygiene, Monaco

^m CHU Lille, Department of Anesthesiology, Critical Care and Perioperative medicine, Lille, France

ⁿ University Lille, CNRS, Inserm, Lille University Hospital, Institut Pasteur de Lille, U109 - UMR 9017, Lille, France

^o CILL Center for Infection and Immunity of Lille, 59000 Lille, France

^p Département de Maladies infectieuses et tropicales, Hôpital Saint-Louis-Lariboisière, AP-HP, Paris, France

^q Department of Anesthesiology and Intensive Care Medicine, Nord Hospital, Assistance Publique Hôpitaux Universitaires de Marseille, Aix Marseille University, Marseille, France

^r Univ Rouen Normandie, Univ Caen Normandie, INSERM, Normandie Univ, DYNAMICURE UMR 1311, CHU Rouen, Department of Microbiology, 76000 Rouen, France

^s VBIC, INSERM U1047, Université Montpellier, Service des Maladies Infectieuses et Tropicales, Clinique du Pied Diabétique Gard Occitanie, CHU Nîmes, Nîmes, France

^t Laboratoire de Bactériologie, Hôpital Bichat, AP-HP Nord, Paris, France

^u Head of Urology department, CHUV, rue du Bugnon, 46, Lausanne, Switzerland

^v Infection, Antimicrobials, Modelling, Evolution (IAME), INSERM UMR 1137, Université Paris Cité, Paris, France

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ABSTRACT

Introduction: Before interventional or surgical procedures, urine culture (UC) is often carried out and probabilistic antibiotic therapy is often prescribed without any real justification. Reducing the inappropriate UC use will contribute to limit antibiotic consumption and antibiotic resistance. The aim of this work was to provide guidelines on: i) UC role in the diagnosis of asymptomatic bacteriuria before urological procedures in adults, depending on the procedure and patient risk factors; ii) how to perform the UC test; and iii) management of patients with positive UC.

Methods: A systematic review of studies published between January 2000 and June 2025 was performed in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses criteria. The guidelines were developed by a multidisciplinary task force following the “formalized consensus of experts” method proposed by the national French Haute Autorité de Santé (two rounds of iterative quotations and reviewing by independent experts).

Results: In total, 84/732 publications met the inclusion criteria. Preoperative UC is no longer recommended before radical prostatectomy, radical cystectomy, cystoscopy, intravesical instillations, artificial urinary

* Corresponding author.

E-mail addresses: maxime.vallee@chu-poitiers.fr (M. Vallée), stessy.kutchukian@gmail.com (S. Kutchukian), hugo.crespin1@gmail.com (H. Crespin), nadia.abid@chu-lyon.fr (N. Abid), matthieu.boisson@chu-poitiers.fr (M. Boisson), pcoloby@me.com (P. Coloby), julien.derdevet@gmail.com (J. Derdevet), aurelien.dinh@aphp.fr (A. Dinh), dkassab@afu.fr (D. Kassab), olivia.keita-perse@chpg.mc (O. Keita-Perse), ekipnis@gmail.com (E. Kipnis), matthieu.lafaurie@aphp.fr (M. Lafaurie), marc.leone@ap-hm.fr (M. Leone), martine.pestel-caron@chu-rouen.fr (M. Pestel-Caron), albert.sotto@chu-nimes.fr (A. Sotto), valentine.berti@aphp.fr (V. Berti), omar.karray@ght-novo.fr (O. Karray), franck.bruyere@gmail.com (F. Bruyère).

sphincter implantation, and penile prosthesis implantation. Bacterial colonization treatment should be initiated 48 h before surgery and may be discontinued on surgery day or continued for up to 48 h post-surgery. First-line agents for the perioperative management of bacterial colonization of urine include fosfomycin trometamol, nitrofurantoin, pivmecillinam and trimethoprim.

Conclusions: These guidelines describe the recommended UC indications for urological patients to personalize their management and avoid unnecessary urine cultures and antibiotic treatments.

R É S U M É

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Colonisation urinaire
Antibioprophylaxie

Introduction : Avant chirurgie urologique, un examen cytotobactériologique des urines (ECBU) est fréquemment réalisé et une antibiothérapie probabiliste est souvent prescrite sans réelle justification. La justification scientifique amenant au dépistage et au traitement de la colonisation urinaire n'est à l'heure actuelle pas établie et contribue au mésusage des traitements antibiotiques et à l'antibiorésistance. L'objectif de ce travail était d'établir des recommandations concernant : i) la place de l'ECBU dans le dépistage de la bactériurie asymptomatique avant chirurgie urologique, en fonction du type d'intervention et des facteurs de risque des patients ; ii) les modalités de réalisation de l'ECBU pré-opératoire ; iii) la prise en charge des patients présentant un ECBU positif.

Méthodes : Une revue systématique de la littérature portant sur les études publiées entre janvier 2000 et juin 2025 a été réalisée conformément aux critères PRISMA (*Preferred Reporting Items for Systematic Reviews and Meta-Analyses*). Les recommandations ont été élaborées par un groupe de travail multidisciplinaire selon la méthode du « consensus formalisé d'experts » proposée par la Haute Autorité de Santé (deux tours itératifs de cotation et de relecture par des experts indépendants).

Résultats : Au total, 84 publications sur 732 ont satisfait aux critères d'inclusion. L'ECBU préopératoire n'est plus recommandé avant prostatectomie totale, cystectomie totale, cystoscopie, instillations endovésicales, implantation de sphincter urinaire artificiel ou d'implants péniens. Lorsqu'une antibiothérapie est indiquée, celle-ci sera débutée 48 h avant le geste chirurgical et sera poursuivie au minimum à J0 et au maximum 48 h après le geste, soit un total de 3 à 5 j de traitement péri-opératoire. Les traitements de première intention pour la prise en charge périopératoire de la colonisation urinaire incluent la fosfomycine trométamol, la nitrofurantoïne, le pivmécillinam et le triméthoprim.

Conclusion : Ces recommandations précisent les indications de l'ECBU avant chirurgie urologique afin de personnaliser leur prise en charge et d'éviter un dépistage et un traitement inutile de la colonisation urinaire.

1. Introduction

Urinary tract infection (UTI) is the second most frequent community-acquired infection type after respiratory tract infection. It is the leading cause of healthcare-associated infections in hospitals, particularly in postoperative care [1]. In urological patients, healthcare-associated urinary tract infections progress to urosepsis in almost 25% of cases [2]. Asymptomatic bacteriuria (or bacterial colonization of urine) is defined by the presence of bacteria in the urine without clinical manifestations that might suggest a urinary tract infection. Asymptomatic bacteriuria (ABU) is common [3]. It is estimated that ABU concerns 1–5% of healthy pre-menopausal women and 2–10% of pregnant women. In healthy > 70-year-old adults, this proportion increases to 11–16% in women and 4–19% in men [4]. ABU occurs in 9–27% of women and 0.7–11% of men with diabetes and in 23–89% of patients with spinal cord injury [4]. In the recent French TOCUS cohort, preoperative ABU was identified in 35% of patients undergoing urological surgery [5]. In urological procedures, urine culture (UC) is often carried out without a precise rationale. When UC is performed before surgery, probabilistic antibiotic therapy is prescribed without any real justification. Yet, in Europe, the incidence of highly resistant urinary tract infections is increasing [6]. For instance, in 2022, in France, ~8.4% of *Escherichia coli* isolates were resistant to third-generation cephalosporins [7]. Their emergence is largely linked to the unjustified or inappropriate use of antibiotics [1]. Reducing the inappropriate UC use will help to reduce antibiotic consumption and antibiotic resistance. In France, there is no national guideline on this subject. Therefore, to reduce inequalities and the risk of loss of opportunity for some patients, and given the new recently published findings, it was deemed necessary to standardize practices by drawing up guidelines using a rigorous and well-defined method. The Infectious Diseases Committee of AFU (CIAFU) decided to conduct a systematic review of the literature and develop recom-

mendations to define i) UC role in the diagnosis of ABU before interventional or surgical urological procedures in adults, depending on the urological procedure and patient risk factors; ii) how to perform a UC test; and iii) management of patients with positive perioperative UC.

2. Methods

2.1. Evidence acquisition

These guidelines were based on a systematic review performed following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) criteria [8]. The protocol was registered in the International Prospective Register of Systematic Reviews (PROSPERO) database (CRD 420251066603).

2.2. Literature search

A systematic literature search was performed in PubMed/Medline® to identify reports (in French or English) on interventional and surgical management of urological adult patients, published between January 2000 and November 2024 (see full report on <https://www.urofrance.org/themereco/infectiologie/>). The full search strategy is in **Supplementary Table S1**. Selection was based on the PICOS criteria: i) population (P): Adults (men or women) likely to benefit from interventional or surgical urological procedures; ii) intervention (I): Cytobacteriological examination of urine; iii) compared intervention (C): Placebo, sign/symptom surveillance, urine dipstick test, inflammation biomarkers, CT imaging; ultrasonography; iv) outcome (O): Sensitivity, specificity, receiver operating characteristic curve-area under the curve, positive predictive value, negative predictive value, postoperative positive UC test rates, prophylactic antibiotics used, UC

positivity, postoperative infection rates, bacteria found, consistency with preoperative UC; v) study design (S): meta-analysis, randomized controlled trial, prospective non-randomized study, retrospective study. Literature data were completed by literature monitoring (up to June 2025), consultation of the websites of international organizations (e.g., European Association of Urology, American Urological Association.), search of systematic reviews in the Cochrane Library database, and suggestions from the working group members, particularly on studies not indexed in Medline® at the time of the bibliographic search.

2.3. Study selection

The inclusion and exclusion criteria were defined before the study. Only studies on adult patients receiving interventional or surgical urological care, without age limit, were included. Publications deemed ineligible were: i) studies on children; ii) non-specified urological care, studies on antibiotic therapy without UC, or studies on antibiotic treatment efficacy or adverse effects; iii) health economic studies because they depend largely on the country's healthcare system; iv) experimental studies in animals or in vitro; v) studies on clinical practices or epidemiology; vi) case reports, general reviews, editorials, letters, or comments.

Studies were selected by the methodologist (DK) using these criteria, after reading the abstract. The selection was independently validated by the steering committee (MV, FB, HC, JD, OK, SK, VB) and then by the whole working group. The full text of the selected publications was read. After an initial round of data extraction by the steering committee, article selection was confirmed by two other authors (MV and DK) and disagreements were resolved through discussion with the working group.

2.4. Project methodology

This project was carried out by the CIAFU with a multidisciplinary task force that included urologists, microbiologists, experts in bacteriology and hygiene, infectious diseases physicians, nephrologists, anesthesiologists, emergency physicians, and other healthcare professionals involved in the management of urological patients. These guidelines were developed according to the “formalized consensus of experts” methods proposed by the French Higher Health Authority (Haute Autorité de Santé, HAS) that involves two rounds of iterative quotations and a reviewing process by independent experts [9]. The methodological quality of the selected studies was analyzed using dedicated grids. The level of evidence (LOE) of each study and its conclusions was assessed after taking into account the result consistency. These conclusions and the working group members' arguments were used to define the recommendations as follows: i) the recommendation is the clinical practice unanimously acknowledged as the reference by the experts; ii) if a clinical practice was considered acceptable on the basis of literature data and expert opinion, but was not unanimously acknowledged as the reference, it is indicated that it can be discussed/proposed; iii) in the absence of expert consensus, no recommendation is proposed. The classification of conclusions by LOE (LOE1 is the highest; LOE4 the lowest) and the recommendations grading [grade A is the highest; grade C the lowest; Expert Agreement (EA) in the absence of data] are based on the grid proposed by the French HAS [10]. In November 2025, the document was reviewed using the Appraisal of Guidelines for Research and Evaluation II tool [11] by 49 independent experts from all medical and surgical specialties involved in the management of adults patients who are candidates for interventional or surgical urological management (33 urologists, 3 microbiologists, 3 experts in bacteriology and hygiene, 2 infectious diseases physicians, 2 nephrologists, 2 anesthesiologists, 2 radiologists, 1 emergency physician, 1 nurse and 1 patient representative). Their comments were incorporated in the final

version of the guideline in November 2025. The complete document, including the project rationale, methodology, detailed study analysis, conclusions, recommendations and review process, can be consulted on Urofrance (<https://www.urofrance.org/themereco/infectiologie/>).

3. Results and guidelines

The study selection is outlined in the PRISMA flow diagram (Fig. 1). In total, 732 publications were screened for eligibility and 144 were retrieved. After full-text reading, literature monitoring and working group suggestions, 84 studies were retained for analysis. The systematic review corresponding to the detailed analysis will be available in a future report. The guidelines on UC indications before an interventional or surgical urological procedure are summarized in Table 1.

3.1. UC role in the diagnosis of asymptomatic bacteriuria before interventional or surgical urological procedures in adults, depending on the urological procedure and patient risk factors

For this clinical question, the following studies were included for analysis: 9 recommendations [1,12–19], 4 systematic reviews/meta-analyses [20–23], 8 prospective studies [24–31], 3 comparative studies [32–34], 31 observational studies [5,35–64], and 8 retrospective studies [65–72].

3.1.1. Conclusions based on the data analysis

Several systematic reviews and original studies suggest that the risk of postoperative infection depends on the urological procedure type, but also on other factors that are intrinsic (e.g., age, sex, obesity, history of infection, comorbidities) [33] (LOE4) and extrinsic to the patient (e.g., comorbidities, treatments) and on the perioperative conditions (e.g., intervention duration, antibiotic prophylaxis, enhanced recovery after surgery program) [20] (LOE not applicable) [21] (LOE4) [66] (LOE4) [33] (LOE4) [5] (LOE3) [61,73] (LOE4).

3.1.1.1. Radical prostatectomy. Treatment of ABU does not reduce the risk of UTI after radical prostatectomy. The American Society of Anesthesiologists (ASA) score [74] and the duration of postoperative catheterization independently predict post-surgery infections [31] (LOE4).

An epidemiological study found that 25% of patients undergoing radical prostatectomy had positive UC at the time of catheter removal, despite the administration of prophylactic fluoroquinolones. Potentially virulent microorganisms were frequently identified, and resistance to ciprofloxacin was common [39] (LOE4).

3.1.1.2. Endoscopic prostate surgery. The incidence of urinary tract infections following transurethral resection of the prostate (TURP) is low. There is no increased risk of UTI in the absence of antibiotic prophylaxis in patients without leukocyturia or urinary catheter before surgery [43] (LOE2). However, another study suggests that UC before TURP is beneficial because a pre-TURP positive UC is associated with higher risk of bleeding [65] (LOE2). Men who undergo holmium laser enucleation of the prostate (HoLEP) are less likely to develop postoperative urinary tract infections than those who undergo TURP. However, the risk of postoperative UTI is similar for first-time TURP, second-time TURP and laser photoselective vaporization of the prostate (PVP) [63] (LOE4).

3.1.1.3. Urethrotomy, urethroplasty. Patients with preoperative ABU, many comorbidities (high Charlson index) and history of urethroplasty are at risk of complications, including a higher risk (3.5%) of urinary tract infections, after urethroplasty [47] (LOE4). According to

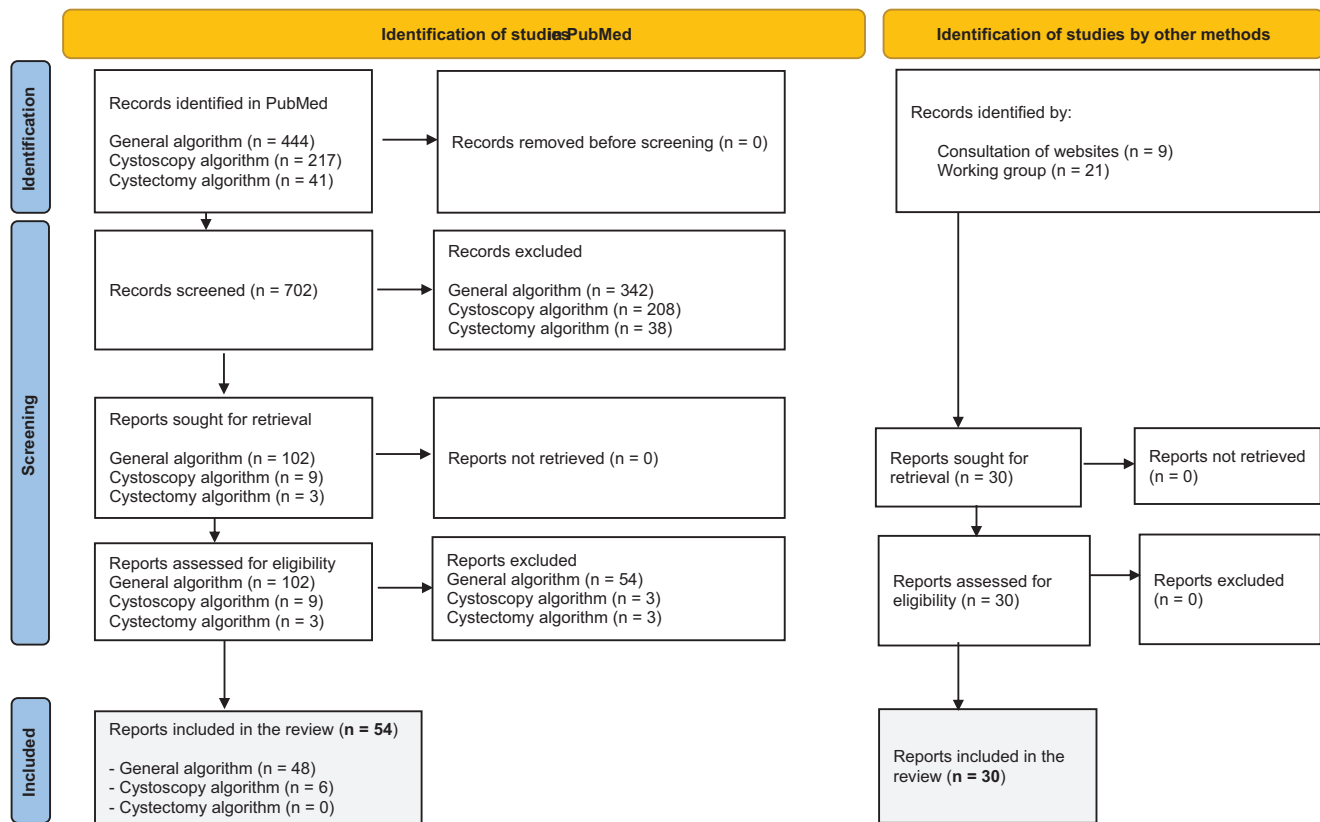


Fig. 1. PRISMA flowchart of the systematic review.

a systematic review on the different antibiotic therapy protocols used in urethroplasty and prostate surgery, ABU is systematically screened and treated [23].

3.1.1.4. Cystectomy. No significant association was found between a positive preoperative urine culture and the risk of postoperative UTI following cystectomy for cancer [25] (LOE4). Methicillin-resistant *Staphylococcus aureus* (MRSA) remains the main pathogen isolated in surgical site infections after total cystectomy by laparotomy. Preoperative antibiotic therapy does not seem to prevent surgical site infections in patients with a positive UC in which MRSA was identified [37] (LOE4).

3.1.1.5. Transurethral resection of bladder tumor (TURBT). Preoperative bacteriuria may be associated with the risk of postoperative infection following TURBT, although evidence remains inconclusive [44] (LOE4).

3.1.1.6. Cystoscopy. There is no proven benefit of antibiotic therapy in patients with ABU before cystoscopy; the infection rate is low and without severe consequences [26–29,51,52,54,55] (LOE3).

3.1.1.7. Artificial urinary sphincter and penile implant placement. There is no proven link between preoperative ABU and postoperative infections in patients undergoing artificial urinary sphincter or penile implant placement [68] (LOE4). There is no correlation between preoperative UC and the bacteriology of prosthetic infections. The postoperative infection rates were similar in patients with treated positive UC, negative UC and with unknown UC [68] (LOE4). The postoperative infection rate in patients who underwent penile prosthesis or artificial urinary sphincter implantation (without available preoperative UC) is low (1.5%) [70] (LOE4).

3.1.1.8. Prolapse and urinary incontinence in women. In women undergoing surgery for pelvic organ prolapse and urinary incontinence, the incidence of post-operative urinary tract infections is higher when the pre-operative UC is positive (versus sterile UC) [41] (LOE3).

3.1.1.9. Bacillus Calmette-Guérin (BCG) therapy. In prospective cohort studies on BCG therapy for bladder cancer, the rates of febrile urinary tract infections were low (< 2%) in patients with untreated ABU. None presented severe sepsis directly related to ABU [62] (LOE4) [52–55,58] (LOE3). BCG is a “bactericidal immunomodulator” according to Herr, who observed bacterial clearance in 66% of cases after BCG therapy, compared with only 18% after cystoscopy alone. According to Herr and Bourgi et al, ABU may be protective because the response rate and recurrence-free survival rate are better in patients with ABU. Several studies suggest that “unnecessary” treatment of ABU could be harmful by increasing the risk of tumor recurrence, urinary microbiota disruption and bacterial resistance [62] (LOE4) [53] (LOE3) [52] (LOE3).

3.1.1.10. Nephrectomy. Preoperative UC (positive or sterile) and preoperative antibiotic therapy do not seem to reduce the risk of infection (surgical site infection or urinary tract infection) after partial or total nephrectomy for cancer [61,64] (LOE3) (LOE4).

3.1.1.11. Kidney transplantation. A positive UC in the recipient before a living-donor kidney transplantation is a factor associated with postoperative UTI [36]. Colonization of the preservation fluid collected during transplantation does not appear to be associated with the risk of pyelonephritis. Indeed, the microorganisms found and their resistance profile in recipients with postoperative pyelonephritis do not correspond to the micro-

Table 1
Guidelines summary.

Interventional or surgical urological procedure	Indication for urine culture before the interventional or surgical urological procedure (Yes/No) References (level of evidence)/(grade of recommendation)
Urine culture indicated	
Transurethral resection of the prostate (TURP)	Yes [ElMalik et al., 2000] (LOE2)/Grade B
Treatment of benign prostate hyperplasia using other techniques: holmium (HoLEP), thulium (ThuLEP), greenlight (GreenLEP), bipolar (BIPOLAP) laser enucleation	Yes/Grade EA
Transurethral resection of the bladder (TURB)	Yes [Kohada et al., 2019] (LOE4) [Kutchukian et al., 2024] (LOE3)/Grade C
Ureteropelvic junction obstruction treatment	Yes , as for JJ → see CIAFU recommendations [Bey et al., 2021]
Urethroplasty	Yes [Noble et al., 2022] (LOE4)/Grade C
Ureteropelasty	Yes/Grade EA
Diagnostic or therapeutic ureteroscopy	Yes [Martov et al., 2015] (LOE2) [Sohn et al., 2013] (LOE4)/Grade B → See 2023 CIAFU guidelines [Raynal et al., 2023]
Urethrotomy	Yes [Noble et al., 2022] (LOE4)/Grade C
Percutaneous nephrolithotomy	Yes/Grade A , and if possible pyelic urine [Yang et al., 2022] (LOE4) [Amier et al., 2022] (LOE4)/Grade C → see 2023 CIAFU guidelines [Abid et al., 2023]
Urine culture not indicated	
Radical prostatectomy	No [Bourgi et al., 2025b] (LOE4)/Grade C
Simple prostatectomy	No/Grade EA
Treatment of benign prostatic hyperplasia using other techniques: intraprostatic implant placement (UROLIFT) and prostatic artery embolization	No/Grade EA
Transperineal prostate biopsy	No → see 2022 CCAFU guidelines [Ploussard et al., 2022]
Transrectal prostate biopsy	No → see 2021 CIAFU guidelines [Bruyere et al., 2021]
Partial, total or subtrigonal cystectomy, regardless of the type of diversion	No [Haider et al., 2019] [Kyoda et al., 2010] (LOE4)/Grade C
Cystoscopy	No [Herr 2012b] [Herr 2013] [Herr 2015] [Herr 2016] (LOE3 → LOE2 because of several concordant studies)/Grade B
Treatment of urinary incontinence: implantation of an artificial urinary sphincter	No [Kavoussi et al., 2017] (LOE4)/Grade C
Intravesical therapeutic instillations (e.g., BCG, chemotherapy, hyaluronic acid, chondroitin sulfate)	No [Bourgi et al., 2025a] (LOE4) [Herr 2012a] [Herr 2012b] [Herr 2013] [Herr 2016] [Herr 2020] (LOE3 → LOE2 because of several concordant studies)/Grade B
Sacral neuromodulation	No/Grade EA
Partial or total nephrectomy or nephroureterectomy	No [Bruyere et al., 2025] (LOE3) [Ayoub et al., 2024] (LOE4)/Grade C
Adrenalectomy	No/Grade EA
Renal artery embolization	No/Grade EA
Kidney biopsy and thermal ablation of kidney tumor	No/Grade EA
Placement or replacement of an intraperitoneal dialysis catheter	No/Grade EA
Retrograde urethrocytography	No/Grade EA
Penile implant placement	No [Kavoussi et al., 2017] (LOE4)/Grade C
Testicular prosthesis placement	No/Grade EA
Scrotal or penile surgery without prosthesis	No/Grade EA
Botulinum toxin A injection	No/Grade AE
Radiotherapy, brachytherapy	No/Grade AE
Placement of stents in the prostate	No/Grade AE
Insertion, removal, or replacement of a urinary catheter, suprapubic catheter	No/Grade EA
The working group did not reached a decision for the following indications	
Treatment of benign prostatic hyperplasia using other techniques: steam thermotherapy	No consensus
High-intensity focused ultrasound (HIFU)	No consensus
Treatment of prolapsus in women and treatment of urinary incontinence in women and men	No consensus
Macroplastique® or Deflux® injection	No consensus
Kidney transplantation	No consensus
Extracorporeal shock wave lithotripsy	No consensus
Not assessed in this guideline	
Inserting or changing a nephrostomy tube, mono J or JJ	see [Bey et al., 2021]
Urodynamic study	see [Egrot et al., 2018]

EA: expert agreement; LOE: level of evidence.

organisms identified in the preservation fluid [30] (LOE3). The presence of ABU is associated with early UTI after kidney transplantation [69] (LOE4).

3.1.1.12. Ureteroscopy. In patients with leukocyturia without microorganisms, the occurrence of febrile UTI is rare; the benefit of antibiotic therapy has not been demonstrated [75] (LOE3). Isolated leukocyturia, without bacteriuria or symptoms, is not significantly associated to post-ureteroscopy infection. Treatment of a urinary tract infections in the month preceding ureteroscopy is associated with an increased risk of postoperative UTI [56] (LOE4). The risk of postoperative sepsis is higher in patients undergoing ureteroscopy after ureteral stent placement. Longer stent dwelling time, sepsis following stent placement, and female sex are independent risk factors of post-procedure infection [57] (LOE4). In patients undergoing rigid

ureteroscopy for stone removal, the infection or fever rate is < 2.2%, including in patients without antibiotic prophylaxis. Specific risk factors were female sex, Crohn's disease, cardiovascular disease, high stone volume, and ASA score ≥ II. Routine preoperative antibiotic therapy in patients with negative urine culture does not reduce the risk of febrile UTI [42] (LOE2). In flexible ureteroscopy, the risk of infection is estimated at 6.7% [45] (LOE4). Some factors increase the risk of infection: recent history of urinary tract infection, prolonged ureteral stent dwelling time, long surgery time, polymicrobial UC, comorbidities (e.g., high ASA score, obesity) [38] (LOE4) [45] (LOE4) [5] (LOE3). Polymicrobial UC is significantly associated to postoperative UTI within 30 days after flexible ureteroscopy. This suggests that polymicrobial UC should be managed, although no high-level evidence study has shown that antibiotic therapy reduces this risk [45] (LOE4).

3.1.1.13. Percutaneous nephrolithotomy (PCNL). The risk of infection is higher in patients with ABU before PCNL. A positive UC is an independent risk factor of postoperative infection and septic shock after PCNL. The identification of some bacterial species improves risk stratification (e.g., *E. coli*, *Enterococcus faecalis*, *Klebsiella pneumoniae*) [49] (LOE4). Female sex, presence of endo-urinary devices, prolonged surgery time, large or struvite stones, and high comorbidity score increase the risk of postoperative infection [49] (LOE4) [34] (LOE4). High preoperative serum creatinine concentration and detection of multidrug-resistant bacteria in preoperative UC are associated with sepsis following PCNL [34] (LOE4). Intraoperative renal UC shows better concordance with stone culture than preoperative UC [76] (LOE4). The risk of septic shock after PCNL generally ranges between 0.5 and 2.5%, but may be higher, particularly in patients with stones larger than 35 mm or with struvite stones [60] (LOE4). Preoperative leukocyturia may predict sepsis occurrence after PCNL [48] (LOE4). Preoperative ABU is not a risk factor of fever after minimally invasive PCNL [72] (LOE4). Positive preoperative UC, female sex, and nephrostomy tube insertion are associated with post-PCNL fever [67] (LOE4). After mini-PCNL, patients with lithiasis are at high risk of severe infection, particularly women and individuals with diabetes. A negative UC does not completely eliminate the risk of septic shock [40] (LOE4). However, another study suggests that preoperative bacteriuria is not a risk factor of urosepsis after mini-PCNL [71] (LOE4).

3.1.2. Working group discussion

Studies published before 2006 should be considered with caution because the concept of ABU did not exist before 2006. Therefore, the working group agrees to recommend screening and treatment of ABU prior to urethroplasty. The working group emphasizes that the recommendations must comply with the regulatory framework in force. The following recommendations concern the indication for preoperative UC in the absence of clinical signs of infection. Patients with clinical signs of infection before surgery are outside the scope of these recommendations. The indication for UC must be specified on the prescription. In specific cases (e.g., immunocompromised patients), the clinician may decide not to follow the present recommendations if justified and following multidisciplinary discussion. This shared decision-making process must be documented and must take into account the patient's clinical condition. According to HAS: “Good practice recommendations do not exempt healthcare professionals from exercising their judgment in the care of patients that must be what they deem most appropriate, based on their own observations and the patient's preferences”. When, for a given urological procedure, the literature data were insufficient and there was no risk to the patient, the working group preferred to recommend against ABU screening before the procedure in order to avoid unnecessary antibiotic use.

3.1.3. Recommendations

R1. When UC is not recommended before urological surgery, it is recommended not to treat ABU, regardless of whether an endo-urinary devices is present or not (Grade EA).

R1.bis. In the event of a urinary tract infection, the working group suggests postponing surgery until the infection has cleared (Grade EA).

3.1.3.1. Radical prostatectomy. R2. In the absence of a proven link between preoperative ABU and postoperative infection, it is recommended not to perform ABU screening before radical prostatectomy (Grade C).

3.1.3.2. Endoscopic prostate surgery. R3. It is strongly recommended to carry out preoperative UC and to treat any ABU before any endoscopic

ablative surgery for prostate hyperplasia, such as TURP (Grade B) or PVP/HOLEP/Aquabeam (Grade EA).

3.1.3.3. Prostate enucleation by laparotomy, laparoscopy, or robot-assisted laparoscopy. R4. In the absence of a proven link between preoperative ABU and postoperative infection, it is recommended not to perform ABU screening before prostate enucleation by laparotomy, laparoscopy, or robot-assisted laparoscopy for the treatment of benign prostatic hyperplasia (Grade EA).

3.1.3.4. Minimally invasive treatments for benign prostatic hyperplasia. R5.1. It is recommended not to screen for ABU before minimally invasive treatment of benign prostatic hyperplasia (Urolift®, ITind®) (Grade EA).

R5.2. In the absence of data and consensus within the working group, it is not possible to recommend or not recommend ABU screening or treatment before water vapor therapy for prostate hyperplasia (Rezüm®) (Grade EA).

R5.3. It is recommended not to screen for ABU before endovascular treatment of benign prostatic hyperplasia (prostatic artery embolization) (Grade EA).

3.1.3.5. Urethroplasty, urethrotomy, and ureteroplasty. R6. It is recommended to perform a preoperative UC and to treat ABU before urethroplasty (Grade C), urethrotomy or ureteroplasty (Grade EA).

3.1.3.6. Ureteroscopy. R7. It is strongly recommended to carry out a preoperative UC and to treat ABU before ureteroscopy (Grade B).

3.1.3.7. Percutaneous nephrolithotomy. R8. It is strongly recommended to carry out a preoperative UC and to treat ABU before percutaneous nephrolithotomy (Grade A).

3.1.3.8. Extracorporeal lithotripsy. R9. In the absence of data and consensus within the working group, it is not possible to recommend or not recommend ABU screening or treatment before extracorporeal lithotripsy (Grade EA).

3.1.3.9. Cystoscopy. R10. It is strongly recommended not to screen for ABU before cystoscopy, regardless of the indication (Grade B).

3.1.3.10. Transurethral resection of bladder tumor. R11. It is recommended to perform a preoperative UC and to treat ABU before TURBT (Grade C).

3.1.3.11. Partial or total cystectomy. R12. It is recommended not to screen for ABU before cystectomy, regardless of the indication (Grade EA).

3.1.3.12. Therapeutic intravesical instillations. R13. It is strongly recommended not to screen for or treat ABU before intravesical chemotherapy instillations (e.g., mitomycin C, epirubicin or hyaluronic acid, chondroitin sulfate) (Grade EA) or BCG therapy (Grade B).

R13.bis. It is recommended not to screen for ABU before intravesical injections of botulinum toxin A (Grade EA).

3.1.3.13. Kidney transplantation (living or deceased donor). R14.1. In the absence of data and consensus within the working group, it is not possible to recommend or not recommend ABU screening or treatment before kidney transplantation (AE).

3.1.3.14. Total or partial nephrectomy/nephroureterectomy. R14.bis. It is recommended not to screen for ABU before total or partial nephrectomy (Grade C) or before nephroureterectomy (Grade EA).

3.1.3.15. Artificial urinary sphincter, penile implant, testicular prosthesis. R15.1. It is recommended not to perform ABU screening before implantation of an artificial urinary sphincter (Grade C).

R15.2. It is recommended not to perform ABU screening before penile implant placement (Grade C).

R15.3. It is recommended not to perform ABU screening before a testicular prosthesis implantation (Grade EA).

3.1.3.16. Prolapse surgery in women or urinary incontinence treatment in women and men (excluding sphincter) with and without device insertion. R16. In the absence of sufficient data and consensus within the working group, it is not possible to recommend or not recommend ABU screening or treatment before pelvic organ prolapse surgery in women or urinary incontinence management (both sexes) with/without device placement (Grade EA).

3.1.3.17. Catheter change (bladder catheter, suprapubic catheter). R17. It is recommended not to perform ABU screening before changing or removing a urinary catheter or suprapubic catheter (Grade EA).

3.2. How to perform a UC test

For this clinical question, the following studies were included for analysis: 1 recommendation [77], 2 systematic reviews/meta-analyses [21,78], and 7 observational studies [79–85].

3.2.1. Conclusions based on the data analysis

In patients undergoing PCNL, positive stone culture is associated with an increased incidence of infections even in individuals with sterile preoperative UC. The incidence decreases when antibiotic therapy is adapted to the stone culture [83] (LOE4). Gram staining of stones is not sensitive enough to detect a positive culture and may fail to detect up to 62% of infected stones. However, when positive, Gram staining accurately predicts a positive culture in 86% of cases [79] (LOE4). The results of kidney stone culture, pyelographic UC, and preoperative UC are often discordant [80,81,83] (LOE2 to LOE4). In the presence of ABU, preoperative treatment in patients undergoing nephrostomy who are at high risk of urosepsis before PCNL may reduce the risk of postoperative infectious complications. Stone culture also is important because many patients at high risk of infection will have positive stone cultures [32] (LOE4).

3.2.2. Working group discussion

It is worthy to note that according to the best practices in medical microbiology [77]:

- Cytological analysis is useful if urine is collected naturally, but not useful in the presence of endo-urinary devices;
- The bacteriuria threshold does not affect the interpretation of ABU;
- In the case of mono- or bi-microbial UC, it is recommended to perform antibiograms for the species that can acquire antibiotic resistance: *Enterobacteriaceae*, *Pseudomonas*, *Enterococcus*, *Staphylococcus*, and *Candida*.
- In the case of polymicrobial UC (≥ 3 bacterial species), the risk of infection in a patient who is not a carrier of devices appears to be low. In the absence of leukocyturia and clinical signs, it is not recommended to perform an antibiogram or antifungalgram. In the presence of leukocyturia, a UC may be performed if the surgical procedure can be postponed. If it is not possible to perform a control test, or if the results are identical among the different control tests, bacterial identification and antibiograms should be performed.

According to the 2024 classification by the European Urinalysis Guidelines, bacterial species are categorized in four groups based on

their level of pathogenicity: primary pathogens, secondary pathogens, doubtful pathogens, and contaminants [77].

The working group reiterates that samples for UC should be taken in accordance with the best practices recommended by the Société Française de Microbiologie. In patients with polymicrobial UC, in the absence of data and experts consensus, the working group cannot conclude on the utility of an antibiogram for all bacterial species found (Grade EA). However, the working group points out that several arguments suggest the usefulness of treating a patient with polymicrobial UC before surgery with endo-urinary devices. The working group recommends to perform a UC within 10 days before surgery. However, in exceptional cases where there are organizational difficulties, this period may be extended to 15 days.

3.2.3. Recommendations

The recommendations must comply with the regulatory framework in force.

R1. Urinalysis is the gold standard method for detecting ABU (Grade A).

R2. It is strongly recommended not to use urine test strips to screen for ABU (Grade B).

R3. It is recommended to perform preoperative UC within 10 days before surgery when indicated (Grade EA).

R4. If a preoperative UC is recommended, only the bacterial culture results should be taken into account; Gram staining and leukocyturia values cannot be used to predict the final result of the bacterial culture (Grade C).

R5. In some complex situations (e.g., PCNL, infected stones), it is recommended to perform an intraoperative UC using renal pelvic urine, or failing that, a stone culture, in order to adjust the antibiotic therapy to limit the risk of postoperative sepsis (Grade C).

R6. In the event of a preoperative **mono- or bi-microbial** UC, it is recommended to perform antibiograms for the species found in accordance with the best practices in medical microbiology (see 3.2.2) (Grade EA).

R7. In the event of **polymicrobial** UC (≥ 3 organisms), in the absence of data and consensus within the group, it is not possible to recommend or not to recommend repeating the UC or performing an antibiogram for all bacterial species found (Grade EA).

R8. In the absence of literature data and consensus, it is not possible to decide on the sampling method to be used in the event of urinary diversion (e.g., nephrostomy, Bricker procedure).

3.3. Patient management in case of positive perioperative UC

For this clinical question, the following studies were included for analysis: 1 systematic reviews/meta-analyses [86], 4 prospective studies [87–90], 1 comparative study [91], 5 observational studies [73,75,92–94] and 1 retrospective study [95].

3.3.1. Conclusions based on the data analysis

In patients with ABU before urological surgery, no difference has been found between short (≤ 5 days) and long perioperative antibiotic therapy in terms of infectious complication prevention. Short antibiotic therapy (≤ 5 days) appears to be effective and safe [73] (LOE3) [90] (LOE2). In patients undergoing PCNL and at medium-high risk of sepsis (struvite stones or use of intraoperative endo-urethral devices), a 7-day course of antibiotic therapy before surgery may reduce the risk of sepsis [87] (LOE2). The risk of post-ureteroscopy infection persists even after treatment of a positive urine culture, but antibiotic therapy appears to reduce the complication severity. Only the duration of preoperative JJ stent placement appears to significantly influence the occurrence of infectious complications within 30 days after surgery [94] (LOE4). The low concordance between the microorganisms identified in preoperative

and postoperative UC calls into question its reliability as the sole predictive tool (Kutchukian et al., 2024) [94] (LOE4).

3.3.2. Working group discussion

The scientific literature does not provide a definitive answer on the appropriate approach to manage preoperative ABU. For decades, it was dogmatically accepted that the presence of preoperative ABU increased the risk of postoperative infection and therefore, needed to be treated systematically. However, this has been demonstrated only for few surgery types, notably TURP, flexible ureteroscopy and PCNL. Recent data from the French multicenter TOCUS cohort on ABU screening before urological procedures [5,73] confirm the association between positive preoperative UC (mono-, bi- or poly-microbial) and occurrence of postoperative febrile infectious complications. However, these studies also show that perioperative antibiotic therapy does not reduce this risk for all urological surgical procedures and that extending treatment beyond five days does not further limit the risk of infection. Therefore, this association does not necessarily reflect a risk factor, and many other and unstudied confounding factors could explain the occurrence of a positive UC. This suggests that a positive UC does not necessarily constitute a risk factor, thus possibly explaining the antibiotic therapy failure in limiting the infection risk. In any case, perioperative mortality in the TOCUS cohort remained low (0.25% at 30 days of which 0.125% was indirectly related to an infectious complication), thus not supporting a “maximalist” approach without evidence at the population level. Moreover, it has been clearly demonstrated that antibiotic resistance is a direct cause of high mortality worldwide (1.1 to 1.3 million deaths per year) [6,96,97]. Furthermore, antibiotic resistance is directly linked to antibiotic consumption [98]. In the absence of any proven benefit of systematic screening for ABU and given the now well-known and real consequences of antibiotic resistance, the working group decided to take a different stance from that of the literature when the level of evidence was too low.

3.3.3. Recommendations

The recommendations must comply with the regulatory framework in force.

R1. In patients with ABU and indication for antibiotic treatment, it is recommended to initiate the appropriate antibiotic treatment, regardless of the isolated microorganism quantity (Grade EA).

R2. When antibiotic therapy is indicated, it is recommended to be initiated 48 h before the surgical procedure and continued at least until the day of surgery (day 0) and for no more than 48 h postoperatively, resulting in a total duration of 3 to 5 days of perioperative treatment (Grade C).

R3. It is recommended to treat ABU before percutaneous nephrolithotomy. However, the lack of applicability of published data in France and the lack of consensus within the working group do not allow defining the duration of preoperative antibiotic treatment (see R2) (Grade EA).

R4. Whenever possible, and even in the presence of multidrug-resistant bacteria (e.g., extended-spectrum beta-lactamase- or carbapenemase-producing Enterobacterales, MRSA), it is recommended to prescribe molecules that are easy to use, effective (active according to the results of the antibiogram and with good diffusion in urine), with few adverse effects and low ecological impact, with a preference for oral treatments (Grade EA). The following antibiotics are recommended for the treatment of perioperative ABU (in alphabetical order):

- first-line: fosfomycin trometamol (day 2/day 0 before surgery), nitrofurantoin, pivmecillinam, and trimethoprim;
- second-line: amoxicillin, cotrimoxazole;
- third-line: amoxicillin plus clavulanic acid;

- fourth-line: fluoroquinolones; cefixime;
- fifth line: other antibiotics.

R4bis. In the absence of data and consensus within the working group, it is not possible to recommend or not recommend treatment of preoperative urinary tract colonization by fungi (Grade EA).

R5. In patients with polymicrobial UC, in the absence of data and consensus within the group, it is not possible to recommend or not recommend antibiotic treatment (Grade EA).

R6. If a decision is made to treat a patient with polymicrobial UC and in the absence of identification or antibiogram for each bacterial strain, the following molecules are recommended (in alphabetical order): fosfomycin-trometamol, nitrofurantoin, pivmecillinam, and trimethoprim (Grade EA).

Disclosure of interest

The authors declare that they have no competing interest.

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Appendix A. Supplementary data

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