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Recommendations on the diagnosis and treatment of urinary tract infection[☆]

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Abstract Urinary tract infection (UTI) is defined as the growth of microorganisms in a sterile urine culture in a patient with compatible clinical symptoms. The presence of bacteria without any symptoms is known as asymptomatic bacteriuria, and does not require any treatment. In neonates and infants, fever is the guiding sign to suspecting a UTI. Classic urinary tract symptoms become more important in older children. Urine cultures collected before starting antibiotics is always required for diagnosis. Clean-catch (midstream) specimens should be collected for urine culture. In the case of non-toilet-trained children, specimens must be obtained by urinary catheterisation, or suprapubic puncture in neonates and infants. Specimens collected by urine bag should not be used for urine culture. There are no significant differences in the clinical evolution and prognosis between oral versus short intravenous followed by oral antibiotic. Empirical antibiotic therapy should be guided by local susceptibility patterns. Second-generation cephalosporin (children under 6 years) and fosfomycin trometamol (over 6 years), are the empiric therapy recommended in this consensus. In the case of pyelonephritis,

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recommended antibiotic treatment are third-generation cephalosporins (outpatient care) or, if admission is required, aminoglycosides. Ampicillin should be added in infants less than 3 months old. Antibiotic de-escalation should be always practiced once the result of the urine culture is known.

Recomendaciones sobre el diagnóstico y tratamiento de la infección urinaria

Resumen La infección del tracto urinario se define como el crecimiento de microorganismos en orina recogida de forma estéril, en un paciente con síntomas clínicos compatibles. En ausencia de sintomatología el aislamiento de bacterias en urocultivo se denomina bacteriuria asintomática y no precisa tratamiento. En neonatos y lactantes el signo guía para sospechar una infección del tracto urinario es la fiebre. En niños continentes los síntomas urinarios clásicos cobran mayor importancia. El diagnóstico requiere siempre la recogida de urocultivo previo al inicio de tratamiento antibiótico. En niños continentes la muestra de orina para urocultivo se debe recoger por micción espontánea. En niños no continentes mediante sondaje vesical, pudiendo optar por punción suprapúbica en neonatos y lactantes pequeños. No se debe enviar para urocultivo una muestra recogida mediante bolsa adhesiva. No se han demostrado diferencias significativas en la evolución clínica y desarrollo de secuelas entre la administración antibiótica oral exclusiva frente a la intravenosa de corta duración seguida de administración oral. La selección de la antibioterapia empírica inicial se basará en el patrón local de susceptibilidad. En la cistitis este consenso recomienda el uso empírico de cefalosporinas de segunda generación en menores de 6 años y fosfomicina trometamol en mayores. La antibioterapia empírica recomendada en pielonefritis que no precisan ingreso son las cefalosporinas de tercera generación. En caso de precisar ingreso se recomiendan los aminoglucósidos. En menores de 3 meses se debe añadir ampicilina. Una vez conocido el resultado del cultivo se debe dirigir el tratamiento de continuación, tanto intravenoso como oral.

Introduction and definitions

Urinary tract infection (UTI) is defined as detection of microbial growth in a sample of urine obtained through sterile methods from an individual with symptoms compatible with infection.[1–5] Isolation of bacteria in urine culture in the absence of symptoms is defined as asymptomatic bacteriuria and does not require treatment.[1–5]

Based on the clinical presentation and the results of diagnostic tests, UTI can be further classified into acute pyelonephritis (upper UTI), or cystitis (lower UTI).[1–5]

A case of UTI is considered atypical and carries a higher risk of complications if any of the following apply: persistent fever of more of 48 hours' duration after initiation of appropriate antibiotherapy, development of sepsis, isolation of organism other than non-extended spectrum β-lactamase (ESBL)-producing *Escherichia coli*, acute kidney injury and/or detection of an abdominal or vesical mass.[1,3]

We defined recurrent UTI as 2 or more episodes of upper UTI, 1 episode of upper UTI plus 1 episode of lower UTI, or 3 or more episodes of lower UTI in one year.[1,3,4]

Epidemiology and aetiology

Urinary tract infections are among the most frequent infections in the paediatric age group and can be particularly severe in infants aged less than 3 months.[1–6] Age and sex are key factors associated with the incidence of UTI, with a higher incidence in males up to 6 months of age and in females from 1 year of life.[1–7]

After an initial episode of UTI, the time interval used to differentiate between relapse and reinfection in case of recurrence is of 2 weeks.[8] The risk factors for recurrent UTI are: obstructive uropathy, bowel or bladder dysfunction, sexual activity in adolescents and use of indwelling urinary catheters.[1–8]

The different epidemiological studies conducted in the paediatric population of Spain have shown that *E. coli* is the most frequent aetiological agent,[7,9–11] with a prevalence ranging from 60% to 80%. Previous use of antibiotics or a history of urinary system abnormalities increase the probability of infection by other microorganisms,[9–11] such as *Proteus mirabilis* (6%–10%) and *Klebsiella pneumoniae* (3%–5%). Fewer than 2% of cases are caused by other

enterobacteria: *Klebsiella oxytoca*, *Enterobacter cloacae*, *Citrobacter* spp., *Serratia marcescens* and *Morganella morganii*. The most frequently involved gram-positive bacteria are *Enterococcus* species in infants aged less than 3 months and children with renal or urologic diseases, and *Staphylococcus saprophyticus* in female adolescents presenting with uncomplicated UTI.[9-11]

Clinical features. When should urinary tract infection be suspected?

Age is a determining factor, for the shorter the age of the patient, the more nonspecific the symptoms.[1-5,12]

In infants and young children that are not toilet-trained, the key finding is fever without a source.[1-5,12] The identification of a source of the fever does not exclude UTI, but reduces its likelihood.[1,4] In the absence of fever, the level of suspicion of UTI should be low.[1-5,12] The presence of other symptoms, such as prolonged jaundice or irritability in infants, food refusal, vomiting or weight faltering are not specific for UTI and could result from many other disease processes.[1-5,12] For this reason, a urine culture should only be requested when other, more frequent diseases characteristic of childhood have been ruled out. A positive result of urine culture in an infant or non-toilet-trained young child in whom the suspicion of UTI is low may only be indicative of asymptomatic bacteriuria, which does not require treatment or additional diagnostic tests.[1-5]

In toilet-trained children, classic urinary symptoms gain more importance.[1-5] Painful or frequent urination, a sense of incomplete bladder voiding, urinary urgency and/or suprapubic pain in the absence of fever are suggestive of lower UTI, although they, too, are nonspecific, as they can develop in other uropathies, such as voiding disorders or renal lithiasis.[1-5,12] If blood is present in the urine, the most frequent cause is UTI, although in this case further tests should be performed to rule out other possible causes.[1-5,12] The association of fever, pain in the region of the renal fossa, general malaise and/or chills are suggestive of pyelonephritis.[1-5,12]

Diagnosis

Methods for collection of urine specimens in children

In paediatric clinical practice, the management of UTI always includes collection of a sample for urine culture before initiating antibiotic treatment, as this later allows the selection of a targeted treatment based on the results of antimicrobial susceptibility testing.[13] The methods used to collect and store urine specimens have a significant impact on the results of culture. Urine samples can easily be contaminated by microorganisms from the genital and perineal regions, giving rise to false positives and to unnecessary antibiotic treatment and follow-up care.[14]

In toilet-trained children, collection of a midstream specimen of urine after cleaning the genital area, retracting the foreskin in boys or spreading the labia open in girls, is the method recommended,[15] with a sensitivity and specificity greater than 75%.

In children that are not toilet trained, collection of a sample by means of transurethral catheterization (TUC) is usually the preferred method, as it is simple, minimally invasive and associated with very low rates of contamination.[13] Suprapubic aspiration (SPA), preferably guided by ultrasound, is a very reliable method, especially in newborns and young infants, particularly suited to avoid perineal contamination. This technique requires specialised skills, which may limit its applicability in everyday clinical practice.[13]

Non-invasive methods for use in non-toilet-trained children include use of a collection bag adhered to the perineum or a sterile collection pad inserted in the diaper. Samples obtained by these means should never be submitted for culture. With either method, the rate of contamination is high even with optimal sterile technique (>50%–60%). Nevertheless, they may be useful for urinalysis with a urine test strip or urine sediment examination as an initial screening to rule out UTI.[16,17] Collection of a ''clean catch'' or ''midstream'' sample and adaptations of these approach with application of standard stimulation techniques are promising and useful for initial screening. However, this approach still requires validation in studies with larger samples to establish the actual rates of contamination and its usefulness for sample collection for the purpose of bacterial culture.[18,19]

In short, in case of clinical suspicion of UTI in a toilet-trained child, a midstream urine specimen should be collected for performance of a urinalysis with a urine test strip or urine sediment examination and, if the results suggest the presence of UTI, performance of urine culture from the same specimen. In non-toilet-trained children, the initial screening could be performed in specimens collected in an adhesive bag, without need of changing the bag every 30 min, as these samples are not used for urine culture. If the results of the urine test strip or sediment examination are abnormal, a new specimen should be collected by catheter, which would be the only one to be submitted for culture. Another option in newborns and infants is performance of SPA by experienced staff, preferably guided by ultrasound (Table 1).

Whatever the collection method, the urine sample must be processed immediately or be stored at a temperature of 4 °C for a maximum of 24 h to prevent the proliferation of contaminant bacteria.[13]

Interpretation of the urine test strip and sediment examination

Explained in Table 2.[20-22]

Interpretation of urine culture

Urine culture is essential for both the diagnosis and the targeted treatment of UTI.[1-5,12,13,15] It is a quantitative method, and the currently available guidelines are not in agreement when it comes to the applicable cut-off points.[3-5,13,15,23-25] Our working group defines significant bacteriuria as any number of colony-forming units (CFU) in samples obtained by SPA, a count of 10 000 CFU/mL or higher in samples obtained

Table 1 Methods for collection of urine specimens for culture from children with suspected urinary tract infection.

	Method	Observations
Toilet-trained children	Midstream urine sample	Perineal cleaning
	Suprapubic aspiration[a]	Reference method
Non-toilet-trained children	Urethral catheterization[b]	Gold standard
	''Clean catch'' and adaptations using standardised stimulation techniques	When the previous methods are not feasible or for screening

[a] Requires specific training and is invasive. Consider whether urethral catheterization is a possible alternative or as the first-line method in newborns and infants based on level of expertise.
[b] Minimally invasive method associated with low rates of contamination. In case of infection of the genitalia, severe phimosis, significant labial fusion or failed catheterization, consider suprapubic aspiration.

Table 2 Interpretation of urine test strip or urine sediment analysis for diagnosis of urinary tract infection.

Method	Test	Information
Urine test strip	LE	Sen: 83% (67–94%)
		Spe: 78% (64–92%)
		Indicative of urinary tract infection and painful urination
		- False positives: Kawasaki disease, appendicitis, gastroenteritis, lithiasis, fever
		- False negatives: short time elapsed from onset, diminished inflammatory response, neutropenia, highly diluted urine
	Nitrites	Sen: 53% (15–80%)
		Spe: 98% (90–100%)
		Indicative of gram-negative bacilli
		- False negatives: urine in bladder for less than 4 h (the time it takes for conversion of nitrates to nitrites), infection by bacteria that do not convert nitrates to nitrites (*Enterococcus* spp., *Pseudomonas* spp.)
	LE + nitrites	Increases PPV
Microscopic analysis	Pyuria	Sen: 73% (32–100%)
		Spe: 81% (45–98%)
		≥5 WBCs/HPF in centrifuged urine or ≥10 WBCs/HPF in non-centrifuged urine
	Bacteriuria	Sen: 81% (16–99%)
		Spe: 83% (11–100%)
		Presence of any bacteria per HPF
	Pyuria + bacteriuria	Sen: 66%
		Spe: 99%

HPF, high-power field; LE, leucocyte esterase; PPV, positive predictive value; Sen, sensitivity; Spe, specificity; WBC, white blood cell.

by catheter and a count of 100 000 CFU/mL or higher in midstream urine samples (Table 3). Nevertheless, these results must always be interpreted taking into account the clinical context.[1–5,12,13,15]

Other laboratory tests

Patients with clinical presentations compatible with cystitis do not usually require further diagnostic tests.[1–6] In febrile infants and older children with symptoms compatible with pyelonephritis, blood tests can be performed to assess renal function and the potential presence of severe bacterial infection. In infants younger than 3 months or patients with suspected sepsis or poor general health, performance

Table 3 Criteria for definition of clinically significant bacteriuria.

Collection method	Colony count (CFU/mL)
Suprapubic aspiration	Any
Urinary catheter	≥10 000
Midstream	≥100 000
	Consider 10 000–50 000 if there is a high clinical suspicion of UTI (fever + pyuria–bacteriuria or patients with renal disease)

CFU, colony-forming units.

of blood culture is recommended, and performance of lumbar puncture should be considered.[1–6]

Diagnostic imaging

Sonography
A sonogram is only indicated during the acute episode in patients with UTI that require admission, with suspected complications or with recurrent UTI. In other cases, an ultrasound examination is either not indicated or can be deferred.[1–6,26]

Scintigraphy
Renal scarring can be detected by scintigraphy during the acute phase of infection,[27] although scarring is only permanent in 15% of cases. For this reason, performance of this test is not recommended during the acute phase, save in exceptional cases where microbiological tests cannot confirm the diagnosis suspected based on the symptoms[1–6] (for instance, in patients that received antibiotics before collection of a urine sample and that require confirmation of diagnosis).

Other imaging tests
Used solely for the assessment of complications,[1–6] such as xanthogranulomatous pyelonephritis or renal abscess.

Treatment

The objective of antibiotherapy is to achieve symptom relief, prevent sepsis and reduce the risk of complications.[3–5] It must be initiated early after collection of adequate specimens for culture.[3–5] Early treatment is particularly important in patients with febrile UTI, toxic appearance, immunodeficiencies or known renal or urinary system anomalies.[3–5]

Although there are regional variations, more than 60% of *E. coli* isolates in Spain are resistant to amoxicillin or ampicillin, and 20%–40% to cotrimoxazol,[9,28] so we recommend against the use of any of these antibiotics for empirical treatment of UTI.

In recent years, the prevalence of resistance to first-generation cephalosporins and amoxicillin–clavulanic acid has been increasing in Spain, reaching percentages of more than 15% in some areas, although there is wide variability between regions.[9,28] Therefore, these should also not be used as first-line empirical therapy. The antibiotics that continue to demonstrate significant antimicrobial activity are second- and third-generation cephalosporins, fosfomycin and aminoglycosides.[9,28] Due to the limited use of quinolones in paediatrics, *E. coli* strains isolated in children tend to be more sensitive to this group of antibiotics compared to strains isolated in adults,[9,28] although the proportion resistant to ciprofloxacin can be as high as 15%–20%. It is important to keep in mind the intrinsic resistance of *Enterococcus faecalis* to cephalosporins and aminoglycosides, so we recommend the addition of ampicillin in patients aged less than 3 months or if gram-positive cocci are detected.[3]

Another alarming phenomenon is the progressive increase in the prevalence of ESBL-producing bacteria isolated from community samples, especially of *E. coli* and *Klebsiella*

Table 4 Indications for hospital admission and intravenous antibiotherapy.

- Age <3 months[a]
- General malaise or toxic appearance
- Immunosuppression
- Vomiting, dehydration, poor oral tolerance
- Obstructive uropathy and/or vesicoureteral reflux (grades IV–V only)
- Correct follow-up could not be guaranteed
- Failure of oral treatment (persistent fever or poor general health after 48 h of appropriate antibiotherapy)

[a] Outpatient treatment can be considered in infants aged 2–3 months in good general health, with presence of gram-negative bacilli in urine and that can be monitored closely.

species, which are resistant to most beta-lactam antibiotics with the exception of the carbapenems.[9,28]

Other emerging mechanisms of drug resistance, such as the production of AmpC beta-lactamases or carbapenemases, have been found mainly in hospital settings, so we will not address them in the present document.

Route of administration

Most children can receive oral treatment on an outpatient basis, although they should undergo a clinical re-evaluation after 48 h of treatment.[3–5,29] Table 4 presents the criteria for hospital admission[3–5,29] proposed by the working group.

In the absence of criteria for hospital admission, there are no significant differences in the mean duration of fever, the rate of recurrence or the incidence of permanent renal scarring between patients that only receive oral treatment and patients that receive short-term intravenous antibiotherapy followed by oral antibiotherapy. Therefore, in patients that have started intravenous antibiotherapy, we recommend switching to oral treatment once the patient's condition allows it, always selecting the drugs based on the results of antimicrobial susceptibility testing.[29]

Selection of antibiotic agents

Whenever possible, the initial empirical antibiotherapy should be selected based on local susceptibility patterns, avoiding antibiotics corresponding to proportions of resistance greater than 10% or 15%, so prescribing clinicians should be knowledgeable of bacterial susceptibility to different antimicrobials in their region. We now proceed to present our recommendations for antibiotherapy, which are summarised in Table 5.

Cystitis
Based on the local resistance patterns in Spain, second-generation oral cephalosporins are the recommended treatment in children aged less than 6 years. Possible alternatives include fosfomycin calcium or amoxicillin–clavulanic acid.[1–5,9,28] We recommend prescription of short courses lasting 3–5 days, since compared to longer courses there is no increased risk of recurrence, but there is a reduction in the risk of adverse events and of

Table 5 Empirical antibiotherapy for urinary tract infection in children.

Type	Empirical antibiotherapy	Duration
Lower or uncomplicated urinary tract infection (cystitis)	Children <6 years - Cefuroxime axetil: 15 mg/kg/day, every 12 h - Fosfomycin calcium: 80–100 mg/kg/day, every 8 h - Amoxicillin–clavulanate (4:1 ratio): 35–40 mg/kg/day of amoxicillin, every 8 h	3–5 days
	Children ≥6 years - Fosfomycin trometamol: Children 6–12 years: one 2 g packet as single dose Children >12 years: one 3 g packet as single dose - Any of the antibiotics used in children aged <6 years	Single dose
Upper urinary tract infection or acute pyelonephritis	Not admitted to hospital: - Cefixime: 16 mg/kg/day, every 12 h the first day, and 8 mg/kg/day, every 12 h thereafter. This scheme is not authorised in the summary of product characteristics (off-label use) - Ceftibuten[a]: 9 mg/kg/day, every 24 h Admitted to hospital: Age <3 months - Ampicillin 100 mg/kg/day every 6 h + gentamicin[b] 5 mg/kg/day every 24 h - Alternative: ampicillin 100 mg/kg/day every 6 h + cefotaxime 150 mg/kg/day, every 6–8 h Older than 3 months - Gentamicin[b] 5 mg/kg/day, every 24 h - Cefotaxime: 150 mg/kg/day, every 6–8 h - Ceftriaxone: 50–75 mg/kg/day, every 12 h	7–10 days[c]

ESBL, extended spectrum beta-lactamase.

[a] Exceptional use, in case cefixime is out of stock.

[b] In case of potential involvement of ESBL-producing bacteria, amikacin 20 mg/kg/day every 24 h.

[c] Standard duration of treatment: 7–10 days. May be prolonged to 2 weeks in young infants or up to 3 weeks if the patient develops complications or is responding poorly. In hospitalised patients, intravenous antibiotherapy should be maintained until the patient is afebrile, in good general health and has developed adequate oral tolerance, and the results of urine culture and antibiotic susceptibility testing are available, usually 48–72 h after treatment initiation.

selection of resistant strains.[1–5,9,28] Any of the previously mentioned antimicrobials may be used in children aged more than 6 years, although based on the spectrum, efficacy and ease of administration, the preferable option is fosfomycin-trometamol given as a single dose.[1–5,9,28]

Pyelonephritis

Outpatient treatment. We recommend treatment with third-generation cephalosporins.[1–5,9,28] It is also possible to use second-generation cephalosporins, but only if the local prevalence of resistance is of less than 10%–15% and keeping in mind that all other things being equal, they achieve lower concentrations in the renal parenchyma. Patients allergic to cephalosporins may be treated with intramuscular gentamycin or oral ciprofloxacine[1–5,9,28] in geographical areas where the proportion of resistance is less than 15%. Fosfomycin should not be used as monotherapy in these patients, as this poses a risk of development of antimicrobial resistance.

Intravenous treatment. For otherwise healthy children that require hospital admission, we recommend treatment with an aminoglycoside (usually gentamycin) administered as a single dose after verifying normal renal function.[1–5,9,28] This recommendation is based on the low prevalence of antimicrobial resistance, the low cost of treatment and the narrow spectrum of activity. In infants aged less than 3 months, ampicillin should be added to the empirical treatment[1–5,9,28] to cover the possibility of infection by *Enterococcus* species.

An alternative option is the use of third-generation cephalosporins, which should be the first-line treatment in patients with sepsis, meningitis, renal failure or a history of renal or urologic impairment, a personal history of ototoxicity or a family history of neurosensory toxicity in the mother's side.[1–5,9,28] Yet another option is the use of second-generation cephalosporins.

Patients with infection or previous colonisation by ESBL-producing bacteria can be treated with aminoglycosides, preferably amikacin, based on the local patterns of resistance, and, in severe cases, with carbapenems.[1–5,9,28]

Once the results of culture are known, they guide the selection of the agents used to continue antibiotherapy, whether intravenous or oral.[1–5,9,28] After performance

of susceptibility testing, of the possible antibiotics, the clinician will select those with the highest penetration of the renal parenchyma and urine, lowest toxicity, narrowest spectrum and that are best tolerated by patients.

A follow-up urine culture is not necessary if the patient exhibits a favourable clinical response to treatment.[1–5,9,28]

Follow-up. When is it necessary? Prognosis and prevention. Chemoprophylaxis

At present, follow-up in specialty care and performance of a renal sonogram are only recommended in infants aged less than 6 months with a first episode of UTI or patients with atypical or recurrent UTI.[1,4,26] In children with abnormal sonographic findings or atypical or recurrent UTI, we recommend the additional performance of a voiding cystourethrogram or a contrast-enhanced ultrasound of the bladder, especially if the patient is aged less than 6 months.[1,4] In cases of atypical or recurrent UTI, a follow-up renal scintigraphy is recommended 4–6 months after the episode, especially in children aged less than 3 years.[1,4] In any case, the performance of imaging tests after a UTI and the need for follow-up in specialty care services remain controversial, and therefore decisions regarding these aspects must be made on a case-by-case basis.[1,4,30]

The prognosis of a first UTI that responds well to treatment in the first 48 h is excellent. The risk factors associated with renal scarring are: atypical UTI, recurrent UTI, obstructive uropathy and delay of 48–72 h or greater in the initiation of appropriate antibiotherapy.[1,4]

The measures recommended for prevention of new episodes of UTI include: avoiding poor voiding habits (such as voluntary urine retention) and inadequate fluid intake and correction of constipation and bladder or bowel disorders. There is no evidence supporting any other measures, such as frequent diaper changes or the consumption of probiotics or cranberry juice. There is also insufficient evidence to support circumcision, although it could be considered in boys with recurrent UTIs.[1,4]

The use of chemoprophylaxis has been decreasing. It has not been proven to achieve a reduction in UTI recurrence or renal scarring, whereas it is proven that the selective pressure exerted by antimicrobial use is associated with an increased risk of infection by multidrug-resistance pathogens. Chemoprophylaxis should only be contemplated on a case-to-case basis in patients with obstructive uropathies, selecting the antibiotic with the narrowest-possible spectrum (trimethoprim or cotrimoxazole) and administering only 25% of the effective dose as a single dose at night.[1,4]

Conclusions and summary of recommendations

We assessed the quality of the evidence and determined the strength of the recommendations applying the evidence grading system for clinical practice guidelines of the Infectious Diseases Society of America and the United States Public Health Service, summarised in Table 6.

A positive urine culture is not proof of UTI. In the absence of symptoms, isolation of bacteria in urine culture is known as asymptomatic bacteriuria, a condition that does not

Table 6 Quality and strength of evidence grading system for clinical practice guidelines of the Infectious Diseases Society of America and the United States Public Health Service.

Strength of recommendation
A. → Good evidence to support a recommendation for or against use
B. → Moderate evidence to support a recommendation for or against use
C. → Poor evidence to support a recommendation
Quality of evidence
I. → Evidence from ≥1 properly randomised, controlled trial
II. → Evidence from ≥1 well-designed clinical trial, without randomisation, from cohort or case-controlled analytic (preferably from >1 centre); from multiple time series; or from dramatic results from uncontrolled experiments
III. → Evidence from opinions of respected authorities, based on clinical experience, descriptive studies or reports of expert committees

require treatment. *Quality of evidence: II. Strength of recommendation in favour: B.*

In infants and toddlers who are not toilet trained, the key symptom for suspicion of UTI is fever. In toilet-trained children, the classic urinary symptoms become more important. *Quality of evidence: I. Strength of recommendation in favour: A.*

In every case, diagnosis requires confirmation by a urine culture of a sample collected before initiation of antibiotherapy, which allows subsequent targeted treatment based on the results of antimicrobial susceptibility testing. *Quality of evidence: I. Strength of recommendation in favour: A.*

In toilet-trained children, the urine sample used for culture should be a midstream urine specimen. *Quality of evidence: I. Strength of recommendation in favour: A.*

In infants and children who are not toilet trained, the specimen for urine culture should be obtained by urinary catheter; suprapubic aspiration is also an option in newborns and young infants. *Quality of evidence: II. Strength of recommendation in favour: B.*

Samples collected with a urine bag should not be submitted for culture. *Quality of evidence: I. Strength of recommendation against: A.*

In patients that do not meet the criteria for hospital admission, there is no evidence of significant differences in clinical outcomes or the development of sequelae based on the exclusive use of oral antibiotherapy versus short-term intravenous antibiotherapy followed by oral treatment. *Quality of evidence: II. Strength of recommendation in favour: B.*

The selection of antibiotics for empirical treatment should be based on the local susceptibility pattern. *Quality of evidence: I. Strength of recommendation in favour: A.*

The recommended empirical oral antibiotherapy in cases of cystitis is a second-generation cephalosporin in children aged less than 6 years and fosfomycin trometamol in older

children. *Quality of evidence: III. Strength of recommendation in favour: B.*

We recommend the use of third-generation cephalosporins for empirical treatment of patients with pyelonephritis that do not require hospital admission. In patients with pyelonephritis admitted to hospital, we recommend treatment with aminoglycosides. Ampicillin should be added in patients aged less than 3 months. *Quality of evidence: III. Strength of recommendation in favour: B.*

A follow-up urine culture is not necessary in patients that respond well to treatment. *Quality of evidence: I. Strength of recommendation in favour: A.*

Authorship

Roi Piñeiro Pérez coordinated the writing of the entire document and was directly involved in writing the following sections: *Introduction, Clinical Features, Follow-up* and *Conclusions*, in addition to performing a final revision of the entire document.

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Cristina Calvo coordinated the writing of the entire document and was directly involved in writing the following sections: *Introduction, Diagnosis* and *Conclusions*, in addition to performing a final revision of the entire document.

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Conflicts of interest

The authors have no conflicts of interest to declare.

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