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Consensus conference

Nosocomial urinary tract infections (NUTI) in adult patients: Consensus conference 2002, short text ☆

Members of the Jury of the Consensus Conference on nosocomial urinary tract infections (NUTI) in adult patients *,[1]

1. Introduction

All the recommendations written out by this consensus conference were rated with letters corresponding to levels of recommendation and numbers corresponding to a confidence levels adapted from recommendations made by the Infectious Disease Society of America (IDSA) defined in Table 1 [1].

According to current definitions, around 40% of nosocomial infections are urinary tract infections (UTI). This is a real public health problem for all.

Table 1
Recommendations made by the IDSA*

Category	Definition
Degree of recommendation	
A	It is strongly recommended to
B	It is recommended to
C	It is possible to or not to
D	It is recommended not to
E	It is strongly recommended not to
Confidence level	
I	At least one good quality randomized assay
II	At least one non-randomized assay, or one cohort study, or one case/control study, or multicentric study, or a historic series, or at least reliable results from non-controlled studies
III	Expert's opinion, results from a clinical study, descriptive study, or conclusions made by a consensus of professionals

* Adapted from Kish [1].

UTI is a commonly used term. It has the advantage to immediately describe the site of infection. Nevertheless (especially in French), the usual term is not adequate since it suggests that the disease concerns only urines, which does not correspond to reality. Since Kass's publication in 1956, the practical definitions of UTI are based on bacterial count in urines. Is their presence necessarily synonymous of infection?

There are currently two groups of definitions (Conseil Supérieur d'Hygiène Publique in France and Centers for Diseases Control and Prevention in the USA). Furthermore, the very different circumstances of onset, the risk factors specific to the terrain, and modifications of bacterial ecology, both for the patient and his environment, make it mandatory to review these definitions.

2. Question I: definitions, physiopathology, biological and epidemiological diagnostic of nosocomial urinary tract infections

2.1. Definitions

2.1.1. Colonization

The urinary tract is normally sterile, except for the distal end of the urethra. Colonization is defined as the presence of

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one (or several) microorganism in the urinary tract without clinical manifestations. The concept of asymptomatic bacteriuria cannot be dissociated from that of colonization and corresponds to the same entity without linking it to a notion of threshold (colony forming units per milliliter). The term colonization is preferable to that of asymptomatic bacteriuria.

2.1.2. Urinary tract infection

UTI is the invasion of tissues by one (or several) microorganic species, inducing an inflammatory response as well as signs and symptoms whose nature and intensity vary according to the terrain. It includes:

- at least one of the following signs: fever (>38 °C), urinary urgency, pollakiuria, burning sensation or suprapubic pain on voiding, without any other cause, infectious or not;
- a positive uroculture.

The pertinence of clinical and biological data is to be assessed according to the various situations.

2.1.3. Nosocomial urinary tract infection

A UTI is said nosocomial (NUTI) when it is acquired in any healthcare institution or in a more general fashion, when it is related to patient management. The origin of nosocomial bacteria is endogenous (the patient's flora) in two thirds of the cases.

The same concepts can be applied to colonization.

2.2. Physiopathology

The urinary tract is normally sterile except for the flora in the last few centimeters of the distal urethra, which is varied and reflects both the digestive flora (enterobacteria, streptococci, anaerobic bacteria), the skin flora (coagulase negative staphylococci, corynebacteria), and genital flora (lactobacilli in female patients).

2.2.1. Infection mechanisms

2.2.1.1. Infection mechanisms of NUTI in non-catheterized patients. The main mechanism is the ascending way as in community infections.

2.2.1.2. Infection mechanisms of NUTI in catheterized patients. Four mechanisms are possible:

- acquisition on insertion of the urinary catheter;
- acquisition through the endoluminal way:
  - This way of contamination used to be predominant when using an 'open system'.
  - Of course, NUTIs remain possible, especially if the closed system is accidentally opened.
- Acquisition through the extraluminal or periurethral way:
  - Since the implementation of closed systems, this mode of contamination has been much more predominant. Bacteria of digestive origin colonize the perineum then migrate to the urethra and to the urinary bladder by capillarity in the thin mucous film next to the external catheter surface.
  - The daily incidence of NUTI in catheterized patients has greatly decreased with the use of closed systems, and ranges from 3% to 10% per catheter day according to settings, with a cumulative risk of 100% after 30 catheter days.
- Acquisition through the lymphatic or hematogeneous way:
  - This is a proved portal of entry but certainly a minor one.

2.2.1.3. Particular cases.

- UTI after cystoscopy or other intravesical procedures;
- UTI with a suprapubic catheter;
- UTI with a penile sheath;
- UTI after extracorporeal lithotrities.

2.2.2. Factors promoting NUTI

2.2.2.1. The role of catheters and other devices in the promotion of UTI.

- Degradation of the vesical defense means: through a mechanical action on the endothelium and on the layer of acid mucopolysaccharides.
- Dysfunction of the urinary transit: with an almost permanent minimal residue.
- Production of a biofilm: a film of bacterial origin, which is deposited along all the catheter surface and protects the bacteria against immune defenses and antibiotics.

2.2.2.2. Role of hand carriage. Hand carriage (by the personnel, the patient or even his family) is a proved factor for the diffusion of nosocomial bacteria.

2.3. Biological diagnostic

2.3.1. Cytobacteriological examination of urine (CBEU)

2.3.1.1. Conditions for the collection, storage, and transportation of urine. Suprapubic puncture gives the most representative samples of intravesical urine. Other sampling methods (sampling in the middle of the stream, by direct puncture of the specific urinary catheter operculum, collection with urinary catheter for incontinent female patients, with penian sheath for male patients), less invasive and more adapted to the various clinical settings, may be used with an acceptable level of reliability. For these, the sampling conditions may have a bearing on the sampling contamination level (need for an adequate washing of external genital organs for non-catheterized patients, disinfection of the catheter's operculum). It is even more important to respect adequate conditions of transportation and storage (rapidity: less than 2 h at room temperature) to avoid contamination, which

makes CBEU interpretation difficult. The storage of urines at 4 °C for 24 h is an alternative without influence on bacteriuria.

2.3.1.2. Interpretation. The threshold of urinary bacteria and yeast quantification with the usual method is 10^3 cfu ml^{-1}. Thus, bacteriuria or candiduria is significant if it is $\geq 10^3$ cfu ml^{-1}, strictly respecting sampling, transportation, and urinalysis conditions.

The qualitative term pyuria, because of its lack of precision, must be replaced by a quantitative measure of leucocytes (leucocyturia).

Leucocyturia (direct examination quantification of urinary leucocytes after homogenization of urines) is not necessary in a catheterized patient (D-II).

In a symptomatic non-catheterized patient, the association of bacteriuria $\geq 10^3$ cfu ml^{-1} with leucocyturia $\geq 10^4$ ml^{-1} is strongly suggestive of infection (A-II).

2.3.2. Using the urinary reagent strip

The main advantages of screening with a urinary reagent strip are that it may be performed at the patient's bedside and its negative predictive value (NPV).

The urinary reagent strip cannot be used to screen for bacteriuria in a catheterized patient (E-II).

The urinary reagent strip in a old non-catheterized patient is a reliable method providing conditions of use are respected (B-II).

2.4. Epidemiology

Available epidemiological data presents several drawbacks:

- the studied populations and methods used are heterogeneous;
- there is no distinction between urinary infection and colonization.

Furthermore, there is no data on some populations, for example: medicalized old people's home, hospitalization at home.

2.4.1. Prevalence

The results of two national surveys, in 1996 and 2001, give prevalence rates of 2.8% and 2.6%, respectively. This puts NUTIs at the first rank of nosocomial infections at 36.3% and 42.7% of NUTIs, respectively. This data is comparable to international rates. But these global figures do dot discriminate between infection and colonization.

Furthermore, it should be stressed that more than 75% of reported so-called 'infections' remain asymptomatic.

Long stays institutions for old people and those, which admit patients neurological disorders, have a high rate of NUTIs and are a reservoir for MRB.

In surgery units, NUTI are more frequently found after urological surgery. The generalization of the control procedure on preoperative sterility of urines combined to a reasonable use of antibioprophylaxis has induced a dramatic decrease of these NUTIs.

2.4.2. Incidence

Surveys on incidence are difficult to carry out. But they are more reliable and should thus be promoted.

2.4.3. Bacterial and fungal epidemiology of NUTIs

Even if *Escherichia coli* remains predominant in most studies, its relative frequency is much lower than in community infections, and a higher rate of other microorganisms, especially *Enterococcus* sp., *Pseudomonas* sp., *Staphylococcus* sp., and yeasts.

Three points should be stressed:

- a wider range of species is noted than in community UTIs;
- more strains are resistant to antibiotics;
- the prevalence of yeast infection is increasing.

2.4.4. Resistance to antibiotics

The rate of MRB is higher among nosocomial strains than in community strains. It can be a matter of great concern in some circumstances: for example: patients admitted to hospital with spine injuries, patients in institutions.

2.4.5. Morbidity, mortality, and cost induced by NUTIs

NUTIs are often asymptomatic (>75%).

Their attributed over-mortality is only the marker of associated co-morbidity. Two recent large studies did not report any over-mortality.

The over cost remains important.

The main matter of concern is that they constitute a microbial reservoir.

3. Question II: who should be treated, when, and how?

3.1. Who should be treated?

3.1.1. Urinary colonization

This is not an indication for a systematic antibiotic treatment, whether the patient is catheterized or not, diabetic, aged, or presenting with a urinary bladder dysfunction due to neurological disorders (A-I).

Nevertheless treatment of urinary colonization may be necessary in some specific cases:

- when it leads to a risk of morbidity and mortality in: neutropenic, immunodepressed, and pregnant patients (A-II);
- patients in a preoperative situation: surgery and urological explorations, implanting prostheses (A-II);
- patients carrying a joint, vascular, or cardiac prosthesis, when undergoing invasive procedures (C-III);
- in case of MRB epidemic in a hospital unit, after consulting the CLIN (Committee for the Prevention of Nosocomial Infections) (B).

3.1.2. All bacterial NUTIs

All bacterial NUTIs should be treated, whether the patient is harboring a urinary catheter or not (A).

3.2. How and when to treat?

3.2.1. Removing an obstruction and preventing a vesical residue

These are two essential elements for the therapeutic management of NUTIs (A-III).

3.2.2. Antibiotherapy

The reasonable choice of antibiotherapy depends on the nature of the micro-organism(s) and its (their) susceptibility to antibiotics (A-II).

UTIs rarely bear on the vital prognosis (A-II).

Antibiotherapy must be postponed and initiated according to antibiogram data, when there is no severity sign nor specific terrain (B).

In case of severe parenchymatous infection (pyelonephritis, prostatitis, orchi-epididymitis), the immediate empirical treatment must rely on data from direct examination and the knowledge of local ecology. This treatment should be systematically reviewed after obtaining antibiogram data. It is mandatory to choose an antibiotic with the narrowest possible spectrum, so as to prevent the selection of resistant bacteria (A-III).

Antibiotic combinations should be used to treat UTIs presenting with severity signs (septic shock) or due to some bacteria (*Pseudomonas aeruginosa*, *Serratia marcescens*, or *Acinetobacter baumanii*).

This bitherapy should be limited to the initial period presenting the higher risk (A-III). Aminopenicillins are active on most enterococci in France.

Ureidopenicillins without adding beta-lactamase inhibitors are usually active on enterococci. They are recommended when they are active on enterobacteria and *P. aeruginosa* (according to the antibiogram).

Fluoroquinolones are not active on enterococci. Despite their efficiency on gram-negative bacteria responsible for some NUTIs, their use should be limited so as to check the emergence of resistance.

Broad-spectrum cephalosporins, and the combination of aureidopenicillin with a beta-lactamase inhibitor, should be systematically tested along with ceftazidime and aztreonam on *P. aeruginosa*, to offer alternatives to carbapenems whose selection pressure is significant.

3.2.3. The length of treatment

This depends on the infection site. The treatment should be short for UTIs without parenchymatous infection or on patients not carrying a urinary catheter (inferior or equal to 7 d). Pyelonephritis or orchi-epididymitis requires a 10–14 d treatment. Acute prostatitis should be treated for at least 3 weeks (A-II).

3.2.4. Diuresis

A daily diuresis of 1.5 l should be maintained. Hyperdiuresis is not necessary (E-II).

3.2.5. Urinary catheters

The urinary catheter should be removed, or changed when drainage is mandatory. When confronted to a neurological dysfunction of the urinary bladder and/or a distended urinary bladder, intermittent catheterizing is better than permanent catheterizing (A-II).

The best time to remove or change the urinary catheter considering the initiation of antibiotherapy is a matter of controversy (C-III).

Irrigation/lavage should be banned when treating a UTI whether the patient is catheterized or not (E-I).

3.2.6. Nosocomial candiduria (A-I)

There is no indication for systematic antifungal treatment in *Candida* sp. colonization. Removing or changing the urinary catheter is mandatory in *Candida* sp. infections or in patients at risk: neutropenic, after a renal transplantation, when an endovascular or bone and joint prosthesis is implanted, when undergoing urological surgery. Any antibacterial antibiotherapy should be interrupted if it is not mandatory.

Candiduria may be a marker for disseminated candidosis in ICU patients presenting with several colonized sites.

4. Question III: prevention guidelines

4.1. General indications

The indications for an indwelling vesical catheter and its duration must be limited and reassessed every day (A-II).

The isolation of infected or colonized catheterized patients is recommended (A-II).

The efficacy of a program for the epidemiological surveillance and prevention of infections has been proved (B-II).

It is strongly recommended to disinfect hands with instant hand sanitizer (A-II).

It is recommended to promote hand disinfection by implementing a continuous education program (A-II).

Wearing non-sterile gloves permanently, without changing between patients is to be banned (E-II).

4.2. For catheterized patients

It is mandatory to use closed systems (A-II).

Implanting a permanent catheter must be performed under strict asepsis (hand disinfection, sterile gloves, sterile tools) (C-III).

Daily washing must be performed with a soft medical soap (B-II).

Urine bags must be kept below the patient for gravity flow (B-III).

Routine and programmed catheter change is not recommended (D-III).

Lavage/irrigation (outside of urological procedures) is not recommended (E-II).

Antibiotic coated catheters (minocycline-rifampicin) have not proved their efficacy (E-I).

Silver coated catheters have not proved their efficacy (D-III).

It is not necessary to instillate antiseptics in urine bags (D-III).

Adding an 'antimicrobial' to the lubrificator when inserting the catheter is not necessary (D-III).

4.3. Alternatives to indwelling catheters

The suprapubic catheter as an alternative to permanent/implanted long-term catheterizing has not proved its superiority (D-III).

The penile sheath as an alternative to permanent/implanted catheterizing is preferable when medically possible (B-III).

Intermittent catheterizing is preferable to using indwelling catheters (C-III).

Suprapubic ultrasonography is preferable to catheterizing to measure the vesical residue (B-III).

4.4. Specificity of elderly patients

There are very few scientific reports on the prevention of NUTIs in geriatrics. Most recommendations are expert advice.

Behavioral rehabilitation for elderly patients should be promoted (B-III).

It is preferable to use intermittent catheterizing rather than indwelling catheters in elderly patients when possible (B-III).

4.5. Specificity of patients with a neurological dysfunction of the urinary bladder

Adaptation of the voiding mode is essential (A-II).

Aseptic auto catheterizing is preferable to hetero catheterizing (B-II).

Self or prelubrificated catheters can be used for auto catheterizing (B-III).

Disinfecting the meatus before auto catheterizing is not necessary (D-III).

Antibioprophylaxis is not recommended in auto-catheterized patients (E-II).

Cranberry juice may prevent UTIs in patients with neurological disorders (C-III).

Ascorbic acid may prevent UTIs in patients with neurological disorders (C-III).

The suprapubic catheter may be an alternative to indwelling catheterizing in patients with spinal trauma or a neurological dysfunction of the urinary bladder (B-II).

Intermittent catheterizing is preferable to indwelling catheterizing in patients with spinal trauma or a neurological dysfunction of the urinary bladder (B-II).

Intravesical inoculation of non-pathogenic *E. coli* is under assessment for the prevention of urinary colonization in patients with a neurological dysfunction of the urinary bladder.

4.6. Nosocomial urinary tract infection in surgery

Indwelling catheterizing is not recommended when performing a Caesarean section (D-III).

Intermittent catheterizing is preferable to indwelling catheterizing in patients after orthopedic prosthetic surgery (B-II).

Suprapubic catheterizing is preferable short term indwelling catheterizing immediately after surgery(except for urological surgery) (B-II).

Antibioprophylaxis is not recommended for diagnostic cystoscopy (E-I).

It is necessary to screen and treat urinary colonization before a diagnostic procedure of the lower urinary tract (A-II).

Antibioprophylaxis is necessary for the endoscopic prostatectomy (A-I).

It is necessary to screen and treat urinary colonization before removing a double J catheter (JJ) (A-III).

Antibioprophylaxis has not been proved necessary when removing a double J catheter (JJ) (C-III).

Antibioprophylaxis is not necessary for prostate biopsy (A-II).

Antibioprophylaxis should not be prescribed in case of endocorporeal lithotritis with sterile urine (D-II).

Reference

[1] Kish MA. Guide to development of practice guidelines. Clin Infect Dis 2001;32:851–4.