Common errors in diagnosis and management of urinary tract infection. II: Clinical management

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Introduction

Current treatment strategies in urinary tract infection (UTI) have been covered in the comprehensive reviews of Meyrier [1], Kim and Schaeffer [2], Kunin [3], Nicolle [4], Stamm and Hooton [5]. Appropriate management strategies designed for specific groups of patients with UTI can maximize therapeutic benefit while reducing cost and incidence of adverse reactions.

Diagnostic work-up

Urine analysis

Urine analysis is a prerequisite whenever UTI is suspected. The quality of urine analysis and diagnosis is as good as the care taken to obtain adequate urine samples. Common errors in diagnosis and classification of UTI have been discussed in a preceding article [6].

Imaging procedures

Traditionally the site of infection, i.e. lower or upper urinary tract, is diagnosed on the basis of clinical signs and symptoms, which may be quite inaccurate, however. Early reports [7] documented that 50% of women with asymptomatic bacteruria and a significant proportion of women with symptoms primarily related to bladder infection actually had upper UTI. Conversely, one-third of patients experienced typical symptoms of acute pyelonephritis although bacteria were demonstrable in the bladder only [8]. With the introduction of techniques to localize the site of infection more accurately, it was recognized that progressive renal damage rarely if ever occurs in uncomplicated UTI, even when renal involvement is present. Nevertheless it is useful to distinguish between upper and lower UTI because treatment differs. The question arises whether localization studies should be performed or whether it is sufficient to monitor the response to treatment. We propose that radiological imaging should be performed in patients with suspected complicated UTI to identify abnormalities predisposing to infection (Figure 1). This is important to recognize abnormalities which may affect management or predispose to renal damage. A rational diagnostic strategy is the cornerstone for both optimal clarification of UTI and saving of costs.

Conventional radiological techniques

Ultrasound is the method of choice especially for emergency imaging in patients with severe loin pain and fever. But a normal ultrasound alone does not give reassurance that the urinary tract is normal, because it does not permit to assess anatomical details of the pelvicalyceal system or to exclude minor ureteral dilatation. Upper urinary tract wall thickening [9] occurs in stone disease and vesicoureteral reflux (VUR) with UTI. Therefore, voiding cystourethrography is justified in cases of upper urinary tract wall thickening (Figure 1).

Plain abdominal radiographs permit recognition of renal stones, but intravenous urography remains the investigation of choice (Figure 1). It provides information on anatomical details of the calyces, renal pelvis and ureters, and on adequacy of bladder emptying. Routine performance of intravenous urography is unacceptable and intravenous urography should not be performed during acute infection because the results are poor and nephrotoxicity may be encountered. The procedure is indicated, however, when complicating factors such as obstruction, stones, papillary necrosis, or renal scars are suspected. Urography must not be performed during pregnancy (radiation hazard) and gives no information in patients with renal impairment.

Uroflowmetry and cystometry should be performed in patients with bladder outflow obstruction, stress incontinence or urge incontinence.

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**Clinical management of UTI**

Fig. 1. The roles of imaging procedures and urological evaluation in patients with urinary tract infection.

**DMSA scanning**

Renal cortical scintigraphy with [$^{99m}$Tc] dimercaptosuccinic acid (DMSA) represents a relative new technique to assess cortical damage secondary to UTI [10]. Particular in reflux nephropathy limitations occur in practical use. Renal cortical scanning is accurate and cost effective. It has been recommended as the primary imaging procedure for children presenting with acute UTI supplemented by voiding cystourethrography (Figure 1). Compared to ultrasonography DMSA scan has a 10-fold higher sensitivity to detect renal cortical changes [11].

In children with UTI planar scintigraphy was compared with SPECT using a triple-head gamma camera [12]. SPECT scanning was superior in detecting renal lesions. As a confounding factor it must be considered that uncorrected metabolic acidosis affects the pattern of isotope uptake [13].

**Voiding cystourethrography**

Ultrasonography and DMSA scan are valuable screening procedures for initial work-up and for follow-up of children with vesicoureteral reflux (VUR), but voiding cystourethrogram is the method of choice to establish the diagnosis of VUR (Figure 1). VUR is the major risk factor for UTI during childhood. It is present in up to 40% of children with recurrent UTI. Voiding cystourethrography is recommended for infants less than 1 year of age and all children who have UTI with systemic signs of infection. Cystosonography with echocontrast, using galactose suspension as an echocontrast medium, is a promising novel imaging technique to detect and grade VUR without ionising radiation [14]. Voiding cystourethrography is rarely necessary in adults with UTI, because the result will not affect patient management, although VUR appears to be more common in adults than was previously suspected. The renal transplant recipient with recurrent or chronic UTI should undergo a voiding cystourethrogram, however, since VUR into the graft and/or native kidneys may affect graft function or maintain chronic infection respectively.

**Computed tomography**

Although CT scanning is the most precise method to identify infection involving the renal parenchyma, one has to consider potential nephrotoxicity of contrast media. CT without contrast enhancement is of limited diagnostic value. CT scanning is rarely necessary in routine cases, but permits detection of microabscesses within the renal parenchyma and extension of the infection into the perinephric space (Figure 1). CT is more sensitive than sonography and permits detection of lesions below 2 cm in diameter. CT scanning may also point to cyst infection in patients with poly-
cystic disease, although differentiation between pus and blood is usually not possible.

Cystoscopy

Cystoscopy is not indicated in patients with uncomplicated UTI. In patients with recurrent UTI, cystoscopy should be performed to exclude bladder pathology and to detect urethral narrowing. This is obligatory in elderly patients with haematuria to exclude bladder cancer. Also the renal transplant recipient with recurrent UTI and haematuria should undergo this procedure because of the relative high incidence of certain bladder tumours, such as ‘nephrogenic adenomas’. It is obvious that cystoscopy is only performed when the urine obtained before is sterile. The patients undergoing cystoscopy should receive a single dose of an antibiotic to prevent iatrogenic infection.

Management of the patient with UTI

Management of uncomplicated UTI

All symptomatic patients with UTI should receive antimicrobial therapy (Figure 2) but it is unclear for how long. In women with uncomplicated lower UTI, 3-day empirical therapy, i.e. administration of trimethoprim without bacterial culture or resistance testing, is highly effective, inexpensive, and well tolerated. Uncomplicated UTI is defined as bacteriuria in the absence of anatomical or functional abnormalities of the urinary tract, immunosuppression, diabetes mellitus or analgesic abuse. Acute onset of symptoms without significant bacteriuria (in the past called ‘urethral syndrome’ or more recently ‘low-count bacteriuria’) may be a transitional phase of UTI in which the urethra is the primary site of colonization and inflammation [6]. Studies have shown that at least 50% of these patients have bladder infection so that antimicrobial therapy is clearly indicated. The ‘urethral syndrome’ is clinically indistinguishable from sexually transmitted diseases, i.e. urethritis caused by Chlamydia trachomatis, Neisseria gonorrhoea or Herpes simplex virus, from vaginal infection with Candida albicans or trichomonas, and from bladder infection with fastidious micro-organisms, i.e. Ureaplasma urealyticum, lactobacilli and other aerobic micro-organisms. The role of the latter as urinary pathogens remains controversial, however.

Short-term treatment (one drug dose for 1–3 days) is usually sufficient in uncomplicated lower UTI (Figure 2). Controlled trials indicate that treatment for 3 days in uncomplicated lower UTI provides an optimal balance between efficacy and incidence of adverse effects, compared to single-dose therapy or treatment for 7–10 days. There is no doubt that

Fig. 2. Clinical management of uncomplicated urinary tract infection (UTI) in adults.
The recurrence of UTI is greater after short-term compared to long-term treatment [5,15,16]. The cure rate is also influenced by the uropathogen that causes UTI: single-dose therapy is ineffective for *Staphylococcus saprophyticus*, but effective for *E. coli* infection. In women with recurrent attacks, failure to eradicate urinary infection, and especially persistent vaginal or periurethral colonization, is associated with frequent attacks and morbidity. Approximately 80% of women suffering from acute uncomplicated UTI can be cured after a 7–10-day antibiotic regimen, up to 100% after 3 weeks. The choice of the antibiotic must be based on its probable effectiveness against uropathogenic bacteria, lack of side-effects, acceptability to the patient, and cost. Trimethoprim (TMP) and co-trimoxazole (trimethoprim–sulphamethoxazole; TMP/SMX) are among the most widely used antibiotics. These drugs have remained popular because they are well tolerated and are relatively inexpensive. In uncomplicated UTI, particularly in community-acquired infections, TMP/SMX is still an accepted first-line therapy. The sensitivity of the most frequent uropathogens may be less than 85% in some geographical areas, however. Side-effects are mostly due to the sulphonamide component. Several studies have indicated superiority of TMP/SMX to ampicillin, possibly because it is more effective in reducing faecal, vaginal and periurethral colonization [17]. Arguments for combination with SMX include the lower risk of development of drug resistance. Arguments against SMX include frequent allergic reactions so that in many centers TMP monotherapy is preferred.

In case of treatment failure, or also as first-line therapy in community acquired infections, administration of fluoroquinolones is indicated. The most commonly used substances are ciprofloxacin which acts more as a bacteriostatic agent and ofloxacin. The latter is slowly metabolized and cumulates in renal failure. Particularly in the elderly this may lead to gastrointestinal or CNS side-effects. Norfloxacin 800 mg once-a-day is as effective and safe as norfloxacin 400 mg twice-a-day in a 7–10-day treatment schedule [18], but norfloxacin penetrates poorly into tissues. The new quinolone antibiotics levofloxacin and sparflaxin have improved activity against Gram-positive pathogens compared to older fluoroquinolones. They can be administered once daily [19]. Fosfomycin trometamol is a useful alternative for single-dose therapy of uncomplicated UTI [20]. Its activity is higher than that of other commonly used antimicrobial agents in the treatment of uncomplicated UTI. Single-dose treatment is at least as effective as a 3–7-day treatment schedule. A potential disadvantage is the fact that *Pseudomonas aeruginosa* and Acinobacter spp. are more resistant to fosfomycin trometamol compared to fluoroquinolones.

Oral cephalosporins are a useful alternative if fluoroquinolones cannot be used because of drug resistance or side-effects. Cephalosporins of the third generation are highly effective against enterobacteria, but their efficacy against *Staphylococci* is insufficient, and both *Pseudomonas* and enterococci are not sensitive at all. Aminopenicillins without or with beta-lactamase inhibitor (e.g. ampicillin/amoxycillin, amoxycillin—calvulanic acid, ampicillin—sulbactam) are less effective than fluoroquinolones or oral cephalosporins for UTI with enterobacteria. They also often lead to selection of *Klebsiella*. Aminopenicillins are therefore not recommended as first-line therapy in uncomplicated UTI.

Uncomplicated UTI, including uncomplicated upper UTI, is usually not life-threatening, so that intravenous treatment is not indicated.

**Management of asymptomatic bacteriuria**

The significance of asymptomatic bacteriuria (presence of $\geq 10^5$ c.f.u./ml of the same bacterial species in two consecutive midstream urine samples) remains controversial. There is no consensus on indications for treatment. With advancing age, prevalence and incidence of asymptomatic bacteriuria increase. Postmenopausal oestrogen deficit and decreased vaginal lactobacilli colonization favour vaginal colonization with potential uropathogenic bacteria. This may partly account for the generally higher incidence of bacteriuria in elderly women as opposed to elderly men. In general there is little evidence that routine treatment of positive cultures is required, except during pregnancy and in children (Figure 3). Patients should be warned that they may develop symptoms in the future and should be educated in prophylactic measures. Treatment of asymptomatic bacteriuria in the elderly patients is also controversial [21]: no difference in the overall mortality was found whether the patients were treated or not [22]. In polymorbid bedridden elderly patients antibiotic treatment may be considered because of the risk of urosepsis.

**Recurrent UTI: relapse vs reinfection**

It is not difficult to eradicate bacteria with a drug to which the microbes are susceptible. The real challenge in the management of UTI is to manage recurrent infections [23]. In general, frequent recurrence of UTI is defined as more than four events every year, but each patient appears to have an unique pattern of recurrence (sporadic or multiple episodes, with or without relation to sexual intercourse). The concepts of relapse and reinfection have undergone re-evaluation [24]. These two types of recurrent infection can only be distinguished by properly timed sequential urine cultures. Relapsing infection is defined as prompt recurrence with the same organism following treatment. Relapse implies that there has been a failure to eradicate the infection. Relapses with the same organism are mainly due to inadequate duration of therapy and therefore treatment should be prolonged to 2–6 weeks. Particularly after single-dose therapy persistent vaginal and periurethral colonization favours rapid recurrent infection with the same organism. Relapses are more frequent when urological abnormalities or other complicating factors are present. The decision
Fig. 3. Management of asymptomatic bacteriuria in adults.

for radiological and urological evaluation depends on the individual circumstances, including type of organism and frequency of recurrence.

Reinfection is more frequent than relapse, i.e. 80% of recurrent infections. It is defined as eradication of bacteriuria by appropriate treatment, followed after variable time interval by infection with a different organism. In young women recurrent infections are mostly reinfections. Reinfection is due to persistence of factors predisposing to reinvasion of the urinary tract. Urological evaluation is not routinely indicated because of the rarity of urological abnormalities. One of the most likely risk factors for UTI is recent sexual intercourse; another is use of diaphragms and spermicides. Women and general practitioners have similar beliefs about the ‘causes’ of urinary tract symptoms. Both are aware of the association with sexual intercourse, but fail to communicate about this during consultation.

The major problem in women with recurrent UTI is vaginal colonization with uropathogens. Supportive measures against recurrent UTI (Table 1) include high fluid intake and frequent voiding to maintain bacterial clearance throughout the day. Healthy women who drink less and void infrequently at work have a 2.2-fold higher risk of UTI. Because bacterial washout is less overnight, low-dose prophylaxis with antimicrobials should be prescribed at bedtime (Figure 4). Trimethoprim [1–5], co-trimoxazole [1–5] and nitrofurantoin [1–5] are the most commonly used drugs, because side-effects or selection of resistant strains are unusual. For prophylaxis (in contrast to treatment of factors predisposing to reinvasion of the urinary tract), prescription of nitrofurantoin is safe because a relatively low and non-toxic dose is administered (1/8 of the therapeutic dose) if the patient has normal renal function. For long-term prophylaxis, the cost of oral cephalosporins and fluorochinolones is prohibitive.

Recurrence rates are significantly greater after shorter periods of prophylaxis, therefore administration of drugs should be continued for 6–12 months (Figure 4), particularly in patients with very frequent symptomatic recurrences.

If UTI recurs after sexual intercourse, the use of diaphragm and spermicidal agents has to be reviewed. The use of spermicide-coated condoms increases the risk of UTI caused by S. saprophyticus, the second most common cause of UTI in young women. Furthermore, pre- or post-coital administration of a single dose of an antimicrobial agent is recommended (Figure 4).

Sex hormones influence the female lower urinary tract. Oestrogen deficiency, particularly when it is prolonged, causes urogenital complaints including frequency, nocturia, incontinence, and the ‘urge syndrome’. These may coexist with vaginal symptoms, i.e.
dryness, itching, and burning. In women aged 55–85 years about 48% report such urogenital complaints. Intravaginal administration of oestriol (Table 1) significantly reduces the incidence of UTI in postmenopausal women with recurrent UTI [25], probably by modifying the vaginal flora.

A vaginal pH of 5 or less protects against vaginal and urogenital infections. In premenopausal women weekly vaginal instillation of *Lactobacillus casei* for 1 year lowered the rate of UTI by approximately 80% [26] but does not prevent all urogenital infections (Table 1). It is also likely that soaps for cleaning the genital tract may impair the milieu and the balance of the respective flora. Other possible risk factors for invasion are certain practices, such as the use of diapers and bubble baths (Table 1).

Cranberry juice (*Vaccinium macrocarpon*) inhibits the expression of P-fimbriae of *E. coli* by preventing proper attachment of the fimbrial subunits or by preventing the expression of normal fimbrial subunits [27]. At least two inhibitors of lectin-mediated adherence of uropathogens to eucaryotic cells *in vitro* were found in cranberry juice [28]. One is fructose, which inhibits the adherence of type 1 fimbriated *E. coli*, the other is a substance (or substances) which inhibits binding of P-fimbriated *E. coli*. Whether there is a clinical role for cranberry juice, as suggested by adherents of ‘natural medicine’, remains controversial.

It is suggested that local immunity is deficient in patients with recurrent UTI. Providing antibodies, especially against adhesins, appears to be an appealing strategy. Attempts to increase antibody concentrations in the urine with an oral vaccine failed. Vaccination by parenteral injection caused appreciable side-effects. Treatment with suppositories containing a whole-cell vaccine, made from six heat-killed uropathogenic *E. coli* strains and four other isolates, at 3-weekly intervals, significantly reduced the rate of reinfection [29]. However, antibody levels increased only in animal studies, so that efficacy of local immunization still remains in doubt.

Some patients continue to have chronic bacteriuria despite intensive treatment. Usually anatomical or functional abnormalities of the urinary tract are then found. Such patients may develop tolerance to the circulating endotoxins elaborated by these uropathogens so that febrile and leukocytic responses are attenuated. If the underlying problem cannot be resolved (such as protracted indwelling urinary catheter, renal or bladder calculi, cystocele), repeated courses of potentially toxic antibiotics are not indicated. These should be kept in reserve until the patient develops symptoms or even life-threatening sepsis (Figure 3).

Recurrent infections with urea-splitting organisms, such as *Proteus mirabilis*, are frequently associated with the development of struvite calculi, but also *Klebsiella* and other Proteus species. Elimination of chronic infections with urea-splitting bacteria is not possible unless all struvite calculi are removed by surgery or lithotripsy.

**Management of complicated UTI**

Complicated UTI encompasses a broad spectrum of clinical conditions. It is impossible to give all-inclusive recommendations for their management. We restrict comment to antibiotic treatment. Because of widespread resistance of uropathogenic microbes to ampicillin, amoxicillin, sulphonamides, and first-generation cephalosporins, these drugs are not attractive for empirical therapy of complicated UTI. In general, such infections should be treated using broad-spectrum antibiotics. Fluoroquinolones are especially useful in the outpatient management of complicated infections. Unfortunately, resistance has emerged even against this relatively new class of drugs, which is probably explained by the indiscriminate and excessive use of these antimicrobials. Quinolones have a broad antimicrobial spectrum, high potency, and so far still exhibit a low incidence of microbial resistance. Some quinolones are available as both parenteral and oral formulations, making possible an early switch from
parenteral to oral therapy. Other favourable characteristics include high oral bioavailability, extensive tissue penetration, and in the case of some of the newer quinolones, long elimination half-lives. According to their in vitro activity, all fluoroquinolones except rufloxacin showed similarly low rates of resistance (about 15%) against uropathogens [30].

The presence of complicated UTI should be suspected if bacteriuria does not resolve or if clinical signs and symptoms persist after 48–72 h of antibiotic drug therapy. Careful patient monitoring and repeated culture tests (including blood cultures) during and after treatment are required (Figure 2). Ultrasonography must be performed to exclude obstruction and this may be complemented, according to clinical circumstances, by plain abdominal radiography, computed tomography, or intravenous urography.

The renal-transplant recipient

In renal-transplant recipients UTI is the most common form of bacterial infection [31]. It is important to promptly diagnose UTI in renal-transplant patients, because—in the worst case—unrecognized bacterial infection may lead to graft loss. The typical microorganisms causing post-transplant UTI are the enteric Gram-negative bacilli and enterococci. In addition, Corynebacterium urealyticum (group D2) has been recognized as a potential new pathogen [32] which may be responsible for up to 10% of cases (vs less than 2% of UTI in the general population). This observation is clinically important because C. urealyticum is difficult to isolate and is not sensitive to conventional oral antibiotics. The antimicrobial of choice is vancomycin.

Pyelonephritis of the graft is a serious complication of UTI, particularly in the transplanted diabetic. Because the transplant has lost its nerve connections, UTI may be completely painless. UTI may provoke rejection episodes and can be complicated by papillary necrosis. It is obvious that in the early post-transplant period even low-count bacteriuria and asymptomatic bacteriuria should be treated for a sufficient period of time (Figure 3). In several centres even a routine prophylactic antibiotic regimen is prescribed throughout the first 3–6 months post-transplantation [33] although we are not in favour of this approach. The most commonly used protocols include TMP/SMX in a dose adjusted to renal function. Patients who are allergic can be treated with any of the oral quinolones, such as ciprofloxacin or norfloxacin. Apart from high-dose immunosuppression, indwelling bladder catheters favour the development of UTI. There is still discussion at what time point catheters should be removed.

Beyond the high risk immediate post-operative period, UTI is supposed to be more benign. Nevertheless, out of concern for renal transplant function and patient survival one should be rather liberal with the administration of antibiotics, even in patients with low-count or asymptomatic bacteriuria. Dickenmann and Thiel [34] found that a majority of women with abnormal voided urine samples did not need antimicrobials. The authors favour diagnostic single bladder catheterization because it is a simple and safe method for the diagnosis or exclusion of UTI in female transplant recipients, where the risk of acute bladder infection is high and the voided urine samples non-conclusive. After single-dose antibiotic therapy with 500 mg ciprofloxacin, given immediately after catheterization, no infectious complications occurred. When treatment is indicated one should keep in mind that some anti-infective drugs may exhibit nephrotoxic synergy when used with cyclosporin. Any interaction that leads to modified cyclosporin concentrations is of potential clinical importance. Co-trimoxazole may affect the pharmacokinetics and pharmacodynamics of cyclosporin [35]. Consequently cyclosporin concentrations must be monitored. It is obvious that drug dosage has to be adjusted to graft function. UTI developing within the first 3 months after transplantation should be treated with a 4–6-week course of oral antibiotics; later on, in the absence of pyelonephritis or bacteremia a shorter 10–14-day course is recommended.

Reccurrent UTI is frequent in the renal transplant recipient. Relapse mostly indicates that antibiotics were administered over a too short period, a common error which can be easily avoided by treating every episode of recurrence for at least 3 weeks. Patients with frequent episodes of reinfection should be further investigated to exclude urological abnormalities or neurogenic bladder (Figure 1). One must also not forget that the native kidneys may be the source of UTI, particularly when vesicoureteral reflex is demonstrable into the native ureter. DMSA scintigraphy with tomography is useful to detect renal scars related to urological disease in transplant kidneys. Although it cannot replace graft biopsy in the evaluation of deteriorating graft function, it points to the need of thorough urological investigation [36]. In patients with normal urinary tract prophylactic treatment for at least 1 year is advised. In patients with recurrent UTI, cystoscopy is also indicated to exclude uroepithelial carcinoma, particularly in analgesic abusers [37].

Pregnancy

UTI often complicates pregnancy. The spectrum ranges from asymptomatic bacteriuria to severe pyelonephritis [38]. Pregnancy predisposes to ascending UTI and papillary necrosis. Predisposing factors include dilatation of the renal collecting system and enhancement of bacterial growth because of altered composition of urine. In 25% of pregnant patients with asymptomatic bacteriuria symptomatic upper UTI develops, mostly in the third trimester and affecting the right kidney. Therefore, routine screening is justified particularly in high-risk populations. Symptomatic UTI increases maternal and fetal morbidity and mortality. Therefore treatment is indicated (Figure 3). Single-dose therapy is not recommended. Treatment for at least 7 days significantly reduces the risk of developing pyelonephritis. Antimicrobials which are safe and used routinely include cephalexin, ampicillin, amoxycillin, and nitro-
furantoin. Symptomatic upper UTI is a serious condition which should be treated with intravenous antibiotics in the hospital.

When renal scarring is present, reflux should be excluded and if necessary corrected before planned pregnancy to minimize maternal and fetal morbidity. When scarring is not present, women with a history of reflux are at increased risk for pyelonephritis but this is true whether or not ureterocystostomy has been performed. Such pregnant women with a history of reflux may benefit from prophylactic antibiotics, however [39].

Diabetes mellitus

The prevalence of asymptomatic bacteriuria in diabetes mellitus is high, particularly in diabetic women. It is not clear, however, whether asymptomatic bacteriuria should be treated (Figure 3). Although the organisms isolated are those usually isolated in UTI of non-diabetic patients, they are not equally sensitive to the usual antibacterial agents. Uncomplicated UTI in diabetic patients should be treated for at least 10 days. In diabetic renal transplant recipients continuation of therapy for 3 weeks is advisable.

Complications of UTI are more frequent in diabetic patients, e.g. intrarenal abscess (not uncommonly painless due to autonomic polyneuropathy), corticomedullary abscess, and renal carbuncle. Emphysematous pyelonephritis, a potentially life-threatening complication of upper UTI, is rare, but 90% of cases occur in diabetic patients. Escherichia coli is the most common causative pathogen. Because of the frequency and severity of UTI in diabetes mellitus prompt diagnosis and early therapy is warranted. In patients with febrile unresponsive UTI, ultrasonography and CT scanning are warranted to identify upper urinary tract complications early on (Figure 2). The potential nephrotoxicity of radiocontrast must be considered.

Miscellaneous

Catheter-related bacteriuria

In hospitalized patients with catheter-associated bacteriuria the risk of Gram-negative bacteraemia is increased 5-fold [40]. Prolonged bladder catheterization leads to significant bacteriuria in more than 90% of the patients. Asymptomatic patients should not be treated as this simply promotes the emergence of resistance (Figure 3). Prevention is therefore the best option and this includes sterile insertion and care of the catheter, prompt removal when the catheter is no longer required, and use of closed drainage systems with dependent drainage positioned below the bladder level. The number of disconnections of the system correlates with the presence of contamination and infection. Specimen collection should be performed by needle aspiration of the distal catheter. Attention has focused on preconnected collecting tube units, disinfectants in bags, disinfectant-impregnated catheters, and periurethral antimicrobial creams [39]. Condom catheters also represent a significant risk factor for UTI. Antimicrobials should be administered when symptoms of UTI develop or when there is evidence of bacteraemia (Figure 3). A generally accepted strategy against catheter-associated UTI includes catheter removal followed by short course antibacterial treatment [41].

UTI in men

The high incidence of UTI in the new born period reflects the higher incidence of congenital urinary tract abnormalities in males. Later on, infections in males most frequently occur after the age of 40 and are often associated with prostatic obstruction of the urinary tract. Circumcision may confer protection against UTI. It is postulated that circumcision converts a ‘cul-de-sac’ that is a reservoir of organisms capable of causing ascending UTI into a surface colonized by physiological skin flora. The presence of antibacterial agent in prostatic secretion along with the male’s greater urethral length may protect against ascension of urinary pathogens.

Uncomplicated UTI is rare in men. It is occasionally seen in uncircumcised individuals, HIV infection, or homosexual males practising anal intercourse. Men are less likely than women to contaminate voided urine specimens and therefore lower colony counts (≥10^3 CFU/ml) are diagnostic of significant bacteriuria. Since most of the infections are complicated (anatomical or urological abnormalities, recent catheterization or urological instrumentation, and surgery), thorough evaluation of the urinary tract is warranted. This is particularly important if UTI is accompanied by fever or haematuria, or if recurrent infections occur at close intervals and involve the same strain. Bacterial prostatitis is the most common cause of acute complicated or chronic recurrent UTI. Acute prostatitis is usually associated with typical clinical symptoms and may result urinary retention. Prostatitis can be diagnosed by examining expressed prostatic secretions and the first 10 ml of urine collected after prostatic massage using microscopy and bacterial cultures. Rectal palpation is necessary for the diagnosis, but trauma to the prostate, including prostatic massage, must be avoided because of the risk of bacteraemia.

In general E.coli and Enterobacteriaceae are the predominating uropathogens. In elderly men Proteus, Klebsiella, Serratia, Pseudomonas, and Enterococci are increasingly prevalent. Uncomplicated lower UTI is usually treated with the commonly used antibiotics, adopting at least a 7-day course instead of short-term therapy (Figure 2). In patients with symptomatic complicated UTI, and particularly with septicaemia, broad-spectrum antibiotics must be used which are also effective against Enterococci spp. and Pseudomonas. Regimes include ampicillin plus gentamicin, imipenem-cilastatin, or third-generation cephalosporins with antipseudomonal activity. Less severely ill patients can be treated with any of the newer fluoroquinolones. The
duration of therapy should be sufficiently long, e.g. 21
days, depending on the clinical setting and response
to therapy. Acute prostatitis usually responds to co-trimoxazole, cephalosporins, or 
fluoroquinolones. Treatment should be continued for 4 weeks to avoid 
chronic bacterial prostatitis. For detail we refer to two 
recent articles [42,43].

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