Chapter 3

Infections of the Urinary Tract

URINARY TRACT INFECTION

Urinary tract infection constitutes 0.9% of ambulatory care visits in the USA (≈ 6M/y) and is the most common bacterial infection.

The prevalence of UTI varies with age and sex. In the < 1 y group, prevalence in both sexes is ≈ 1% and is related to congenital urologic abnormalities. At 1 - 5 y, the prevalence increases in females but remains < 5%, while that in males is < 1%. In both sexes, infections are related to congenital urologic abnormalities, vesiculoureteral reflux and (in males) an intact foreskin. Prevalence rates remain the same in the 6 - 15 y age group, with nearly all infections related to vesiculoureteral reflux.

In the 16-35 y age group, prevalence in females increases to ≈ 20%; these infections are usually associated with sexual intercourse and involve organisms colonising the colon and perineum (other factors associated with increased frequency are first degree female relative with UTI, nonsecretor status, prior UTI, spermicide use and diaphragm use). In this age group, 14% of women with symptoms of urinary tract infection have a sexually transmitted disease, while only half are urine culture positive. Therefore, screening for sexually transmitted disease should also be performed. In men, prevalence remains at < 1% and is related to complicating factors. For both sexes, risk factors for complicated UTI include current or recent hospitalisation or residence in a long-term care facility, medullary sponge kidney, nephrocalcinosis, diabetes mellitus, exposure to nosocomial pathogens, functional (neurogenic bladder, vesicourethral reflux, foreign bodies) or anatomic abnormalities of the urinary tract (bladder outlet obstruction due to calculi, congenital anomaly, benign prostatic hypertrophy, stricture, tumour; nonobstructing calculi, bladder diverticula; obstruction in the upper urinary tract due to calculi, pelvicaliceal junction obstruction, renal cyst, ureteric stricture, tumour; presence of foreign body such as ureteral stent, urethral or urinary catheter, nephrostomy tube; surgically created ileal conduit), immunosuppression, pregnancy, recent antibiotic use, recent urinary tract instrumentation, renal transplantation, renal failure, symptoms for > 7 d, use of immunosuppressive drugs.

At 36 - 65 y, prevalence increases to 35% for females and 20% for males, the increase being due mainly to gynecologic surgery and bladder prolapse in both sexes, menopause in females, and prostatic hypertrophy in males.

Prevalence in the ≥ 65 y group is 40% for females and 35% for males. These infections are almost invariably complicated and relate to gynecologic surgery, bladder prolapse, prostatic hypertrophy, incontinence, catheterisation, debility, estrogen lack.

The dangers of evaluation and treatment are related mainly to age and renal status, low in the young and high in the elderly. Prognosis in boys is relatively bad without therapy because of the high incidence of abnormalities, especially obstructive uropathy. Prognosis in girls without therapy is related mainly to reflux, infection in the presence of reflux often damaging kidneys, causing clubbing and scarring, and therapy protecting the kidneys. Long-term antimicrobial prophylaxis is probably justified in young girls with nonrefluxing ureters who have had 3 or 4 recurrences of urinary tract infection. Surgical correction of ureterovesical reflux in girls with recurrent urinary tract infections is recommended only if good control of the infection cannot be obtained with antimicrobial therapy. In young and middle-aged males, prognosis without therapy is relatively bad because of the presence of anomalies. At least 25% of women with bacteriuria in early pregnancy develop acute pyelonephritis later in pregnancy and this group should be screened and bacteriuria eliminated. In other adult females, prognosis without therapy is good. Women with recurrent infections, repeated infections with the same organism which resists eradication, clinical evidence of pyelonephritis, infection by unusual organisms, poor response to treatment, or infections associated with persistent hematuria should be evaluated radiographically. In children and men, it is mandatory to look for surgically correctable abnormalities such as obstructive uropathy and stones.

Causes of unresolved bacteriuria include bacterial resistance to the drug selected for treatment, development of resistance by initially susceptible bacteria, bacteriuria caused by two different bacterial species with mutually exclusive susceptibilities, rapid reinfection with a new resistant species during therapy for the original susceptible organism, azotemia, papillary necrosis from analgesic abuse, giant staghorn calculi in which the 'critical mass' of susceptible bacteria is too great for antimicrobial inhibition.

Causes of bacterial persistence include infected renal calculi, chronic bacterial prostatitis, unilateral infected atrophic pyelonephritis, infected pericalyceal diverticula, infected nonrefluxing ureteral stumps following nephrectomy for pyelonephritis, medullary sponge kidneys, infected urachal cysts, infected necrotic papillae from papillary necrosis.

ACUTE CYSTITIS: infection of the bladder accompanied by clinical symptoms; 1% of new episodes of illness in UK; 10 - > 50% of cases represent occult pyelonephritis; may be emphysematous in diabetics

Agents: *Escherichia coli* (89% of infections in pregnant women, 72% of all cases, 66% of recurrent infections, 58% of outpatient female, 48% of hospitalised female, 42% of outpatient male, 29% of hospitalised male patients), *Staphylococcus saprophyticus* (21% of outpatient female, 0.9% of hospitalised female, 0.7% of outpatient male, 0.4% of hospitalised male patients), *Klebsiella/ Enterobacter* (14% outpatient male, 12% hospitalised male and female, 8% outpatient female cases), *Proteus* (13% hospitalised male, 10% hospitalised female and outpatient male, 10% of recurrent infections, 3% of outpatient female cases), enterococci (12% hospitalised male, 9% outpatient male, 7% hospitalised female, 2% outpatient female cases), *Staphylococcus epidermidis* (6% outpatient male, 5% hospitalised male, 3% hospitalised female, 2% outpatient female cases), *Pseudomonas* (5% outpatient male, 4% hospitalised male, 0.9% hospitalised female, 0.1% outpatient female cases), *Staphylococcus aureus* (4% hospitalised male, 3% outpatient male, 0.7% hospitalised female, 0.6% outpatient female cases), *Streptococcus agalactiae* (2% hospitalised male and female, 0.8% outpatient female, 0.7% outpatient male cases; urinary tract abnormalities in 60%, chronic renal failure in 26%), yeasts (mainly *Candida albicans*; 0.9% hospitalised male, 0.7% hospitalised female, 0.3% outpatient female cases); *Corynebacterium urealyticum* (immunosuppressed, urologic procedures, previous antimicrobials, age > 66 y), *Actinobacillus actinomycetemcomitans* (in association with endocarditis), *Ureaplasma urealyticum*, *Gardnerella vaginalis*, *Mycoplasma hominis, Streptococcus mitis, Bacteroides fragilis, Agrobacterium tumefaciens* (non-functioning kidney), *Alcaligenes faecalis* (nosocomial), *Achromobacter xylosoxidans*, *Citrobacter*, *Enterobactre agglomerans, Serratia marcescens, Aeromonas* (occasional), *Haemophilus influenzae* (non-type b and nontypeable), *Schistosoma bovis, Mycobacterium avium-intracellulare* (rare cases in renal transplant recipients)

Diagnosis: frequency in 89% of cases, urgency in 82%, dysuria in 25%, suprapubic tenderness; dysuria and frequency without vaginal irritation gives probability of 90%; dipstick (nitrite sensitivity 25%, specificity 90%; leucocyte esterase); bacteria on Gram stain sensitivity 80%, specificity 90%; micro (leucocytes ± bacteria ± erythrocytes) and culture (30-40% > 10^5 cfu/mL) of midstream urine; culture of bladder aspiration urine for low counts and fastidious species in culture negative symptomatic patients; those with risk factors above (under **URINARY TRACT INFECTION)** should have serum creatinine concentration for baseline assessment of renal function and ultrasound examination of the urinary tract if structural anomaly or obstruction is suspected

Treatment: trimethoprim 300 mg orally daily for 3 d (non-pregnant women) or 14 d (men) or 4 mg/kg to 150 mg orally 12 hourly for 5 days (children), cephalexin 500 mg orally 12 hourly for 5 d (non-pregnant women) or 10 d (pregnant women) or 14 d (men) or 12.5 mg/kg to 500 mg orally 12 hourly for 5 d (children), amoxycillin-clavulanate 500/125 mg orally 12 hourly for 5 d (non-pregnant women) or 10 d (pregnant women) or 14 d (men) or 12.5/3.1 mg/kg to 500/125 mg orally 12 hourly for 5 d (children), nitrofurantoin 50 mg orally 6 hourly for 5 d (non-pregnant women) or 10 d (pregnant women) or 14 d (men), cotrimoxazole 4/20 mg/kg to 160/800 mg orally 12 hourly for 5 d (children); if resistant to all above agents, norfloxacin 400 mg orally 12 hourly for 3 d (non-pregnant women) or 14 d (men), levofloxacin 250 mg daily for 3 d (non-pregnant women)

Remote Areas:

Children ≤ 10 y: gentamicin 5 mg/kg i.m. single dose, cefaclor syrup orally 8 hourly for 7-10 d, cotrimoxazole orally 12 hourly for 7-10 d, trimethoprim orally daily for 7-10 d

Females > 10 y: nitrofurantoin 200 mg orally as single dose, trimethoprim 600 mg orally as single dose or 300 mg orally daily for 3 d

Males > 10 y: cephalexin 500 mg orally 8-12 hourly for 7-14 days, amoxycillin-clavulanate 250/125 mg orally 8 hourly for 7-14 d, trimethoprim 300 mg orally daily for 7-14 d

Recurrent Infection: trimethoprim 6 mg/kg to 300 mg orally once daily for 10-14 d, amoxycillin-clavulanate 10/2.5 mg/kg to 250/125 mg orally 8 hourly for 10-14 d; if resistance to both above agents, norfloxacin 400 mg orally 12 hourly (not in children or pregnant) or hexamine hippurate 1 g orally twice daily for 10-14 d (+ ascorbic acid 1 g orally twice daily if urine alkaline); recent promising trials of multivalent pessary vaccine

Klebsiella: cefotaxime 1 g i.v. 12 hourly (child: 25 mg/kg i.v. 8 hourly), norfloxacin 400 mg orally 12 hourly (not pregnant or child)

***Pseudomonas aeruginosa*:** norfloxacin 400 mg orally 12 hourly (not pregnant or child), tobramycin 1.3 mg/kg (child: 1.5-2.5 mg/kg) 8 hourly, ceftazidime 500 mg (child: 50 mg/kg) i.v. daily in divided doses

Burkholderia cepacia: imipenem

***Corynebacterium urealyticum*:** vancomycin

***Candida* (High Risk Patient with Localised Infection):** fluconazole 5 mg/kg to 200 mg orally daily for 7 d

Prophylaxis:

Recurrent Infections in Females Related to Sexual Intercourse: nitrofurantoin 50 mg orally or cephalexin 250 mg orally or trimethoprim 150 mg orally within 2 h after intercourse; cranberry juice

Recurrent Cystitis Not Related to Sexual Intercourse: nitrofurantoin 1 mg/kg to 50 mg orally nightly for 3-6 mo, cephalexin 12.5 mg/kg to 250 mg orally nightly for 3-6 mo, trimethoprim 4 mg/kg to 150 mg orally nightly for 3-6 mo, cotrimoxazole 4 + 20 mg/kg to 160 + 800 mg orally nightly (children if suitable trimethoprim formulation not available); intravaginal estrogen in postmenopausal women

Cirrhotic Patient with Gastrointestinal Bleeding: norfloxacin 400 mg orally commencing 1 h before endsocopy and then 12 hourly for 1-2 d or if oral therapy not feasible ciprofloxacin 400 mg i.v. at time of induction and then 12 hourly for 1-2 d

Acute Pyelonephritis: inflammatory process of the renal parenchyma; 0.07% of new episodes of illness in UK

Agents: *Escherichia coli* (may, rarely, cause acute renal failure, especially when NSAIDs administered), *Proteus*, *Staphylococcus aureus, Staphylococcus saprophyticus,* other coagulase negative staphylococci, *Enterococcus faecalis, Pseudomonas aeruginosa, Stenotrophomonas maltophilia* (associated with hospitalisation and antimicrobial therapy), *Salmonella* (in renal transplant recipients), *Campylobacter*, *Streptococcus agalactiae*, *Mycoplasma hominis* (rare), others

Diagnosis: dysuria, fever and chills, loin pain, costovertebral tenderness, nausea and vomiting, bacteremia, suprapubic tenderness ± urgency, frequency; leucocytosis present or absent; increased ESR; C-reactive protein present; blood procalcitonin elevated; micro (bacteria ± leucocytes ± erythrocytes ± leucocyte casts) and culture of urine; note that renal bacteriuria may be intermittent and low colony counts may be significant; counterimmunoelectrophoresis of serum; radioimmunoassay (sensitivity 96%, specificity 100%); blood cultures (positive in 41% of cases of ascending pyelonephritis); those with risk factors above (under **Urinary Tract Infection)** should have serum creatinine concentration for baseline assessment of renal function and ultrasound examination of the urinary tract if structural anomaly or obstruction is suspected

Treatment: ultrasonogram and cystogram in child with first episode

***Stenotrophomonas maltophilia, Campylobacter*:** cotrimoxazole

Others:

Severe: gentamicin (< 10 y: 7.5 mg/kg; child ≥ 10 y: 6 mg/kg; adult: 4-6 mg/kg) + amoxy(ampi)cillin 50 mg/kg to 2 g i.v. 6 hourly for 10-14 d (cephalothin 25-50 mg/kg to 2 g i.v. 4-6 hourly if mild penicillin hypersensitivity; gentamicin alone if severe penicillin hypersensitivity)

Elderly, Renal Failure, Previous Adverse Reaction to Aminoglycoside: ceftriaxone 25 mg/kg to 1 g i.v. daily, cefotaxime 25 mg/kg to 1 g i.v. 8 hourly for 10-14 d

Mild to Moderate (Not *Pseudomonas aeruginosa*): cephalexin 12.5 mg/kg to 500 mg orally 6 hourly for 10 d (safe in pregnancy), amoxycillin-clavulanate 22.5/3.2 mg/kg to 875/125 mg orally 12 hourly for 10 d (probably safe in pregnancy), trimethoprim 4 mg/kg to 150 mg orally 12 hourly for 10 d (safety in pregnancy not established), cotrimoxazole 4 + 20 mg/kg to 160 + 800 mg orally 12 hourly for 10 d (children where suitable trimethoprim formulation not available)

***Pseudomonas aeruginosa* and Other Organisms Resistant to All Above**

Agents: norfloxacin 10 mg/kg to 400 mg orally 12 hourly for 10 d or ciprofloxacin 10 mg/kg to 500 mg 12 hourly for 10 d (both drugs safety not established in pregnancy; not in children unless microbiologically necessary)

Penicillin Allergic Patient with Gram Positive Cause: vancomycin

colchicine or single dose cyclophosphamide may protect against chronic pyelonephritis in acute obstructive pyelonephritis

Prophylaxis (Cirrhotic Patient with Gastrointestinal Bleeding): norfloxacin 400 mg orally commencing 1 h before endsocopy and then 12 hourly for 1-2 d or if oral therapy not feasible ciprofloxacin 400 mg i.v. at time of induction and then 12 hourly for 1-2 d

Dysuria-Frequency Syndrome (Acute Urethral Syndrome)

Agents: *Chlamydia trachomatis*, *Neisseria gonorrhoeae*, Gram negative bacilli including *Haemophilus influenzae*; may result from acute cystitis, urethritis or vaginitis

Diagnosis: dysuria, frequency, urgency, ≥ 8 leucocytes/μL in first void urine specimen; growth of ≥ 10^2 of an aerobic Gram negative bacillus from a midstream urine culture; culture and immunofluorescence of urethral swab; note that patients with pyuria, renal symptoms, proteinuria and microscopic hematuria but sterile cultures or colony counts of 10^4/μL may

also have occult renal infection, perhaps with intermittent renal bacteriuria (culture of suprapubic aspirate may be necessary to eliminate this possibility)

Treatment:

***Neisseria gonorrhoeae*:** see **GONORRHOEA** in Chapter 4

***Chlamydia trachomatis*:** tetracycline, doxycycline, erythromycin (pregnancy: erythromycin)

Gram Negative Bacilli (Including *Haemophilus influenzae*): cotrimoxazole

Management of Women with Recurrent Nonvenereal Attacks of Dysuria-Frequency Syndrome:

Precipitated by Sexual Intercourse: scrupulous hygiene; lubricants; bladder emptying after intercourse; alternative positions; pillow under buttocks; nitrofurantoin 50 mg after intercourse; psychosexual history

Precipitated by Psychological Stress: counselling; psychosexual history; consider short course of a sedative or (if indicated) antidepressive therapy

Precipitated by Cold Weather: warm underclothing; trousers rather than skirts or dresses

Precipitated by Allergies: psychosexual history; avoid known allergens; consider antihistamines or desensitisation

Related to Menopause: psychosexual history; dienestrol pessaries (1 nightly for 1 week every 3 mo); dienestrol cream; pentovis (2 capsules twice daily for 2 w)

Related to Menstruation: scrupulous hygiene; a simple diuretic for a few days before a period starts; trial of oral contraceptives

DYSURIA WITHOUT FREQUENCY

Agents: herpes genitalis, urethritis (in 82% of gonococcal, 73% of non-gonococcal, 67% of *Haemophilus influenzae*, 75% of *Haemophilus parainfluenzae),* vaginitis (in 18% of trichomonal, 12% of other)

Diagnosis and Treatment: see Chapter 4

FREQUENCY WITHOUT DYSURIA occurs in prostatic abscess and vulvovaginal candidiasis

ASYMPTOMATIC BACTERIURIA: presence of bacteria in the urine in the absence of clinical symptoms; prevalence varies from 0.001% in infants to 25-50% in female nursing home residents; 20-60% of women with bacteriuria in early pregnancy develop acute pyelonephritis later in pregnancy and routine screening in populations in which the prevalence of asymptomatic bacteriuria is $\geq$ 5% is recommended; patients undergoing urological procedures producing mucosal bleeding should be screened beforehand and treated if positive

Agents: 60-89% *Escherichia coli*, 8% *Klebsiellla*, 0.7% *Proteus*; *Streptococcus agalactiae*, *Enterococcus, Salmonella* (in renal transplant recipients), *Citrobacter*, mixed infections

Diagnosis: cloudy urine; micro (leucocytes, bacteria, leucocyte casts present or absent) and culture of urine (pure culture $\geq 10^8$/L consistent with bacteriuria); note that, particularly in the absence of leucocytes, this condition may represent contamination, even if a pure growth of a single organism is obtained; in cases of doubt, particularly where multiple organisms, single organisms with a high probability of extraneous source (eg., *Proteus vulgaris, Citrobacter),* or a succession of different organisms in repeat specimens, are isolated, a suprapubic aspiration may be necessary

Treatment: depends on patient's age and available safe agents; avoid repeated or prolonged courses of therapy in asymptomatic elderly females; neonates and preschool children should be treated and investigated for vesicoureteric reflux and other anatomical abnormalities; pregnant women should be treated because of risk of developing pyelonephritis; men < 60 y should be treated and investigated for chronic prostatitis; young children with vesicoureteric reflux and patients with genitourinary abnormalities that may become secondarily infected, nonfunctioning renal segments, medullary sponge kidneys, polycystic kidneys, calculi, ureteral obstruction, prostatic hyperplasia, increased intrarenal voiding pressure, renal papillary necrosis, valvular heart disease, prosthesis or diabetes or who are immunocompromised, or those growing fungi, mycobacteria, *Klebsiella*, *Proteus mirabilis* or *Staphylococcus aureus* or undergoing genitourinary instrumentation or manipulation should be treated and investigated; others (including diabetics) do not require treatment

CHRONIC BACTERIURIA: more or less continued presence of bacteria in the urine, due to inability to eradicate infection or to recurrent infections; possible causes include chronic pyelonephritis, chronic bacterial prostatitis (creatine and creatinine are usually increased), infected renal or bladder stones, bladder diverticulum, renal abscess, indwelling catheter

Agents: *Proteus* and *Staphylococcus saprophyticus* in infected stones; *Proteus*, *Providencia stuartii, Morganella morganii* and numerous others in indwelling catheter; mixed infections

Diagnosis: urine micro and culture (in patients with indwelling catheter, only if signs of systemic infection); prostatic localisation test for suspected chronic bacterial prostatitis

Treatment: correction of underlying cause if possible; antimicrobial treatment as indicated by susceptibility of isolates (note that clearing of infection from a patient with an indwelling catheter is virtually impossible; antimicrobial treatment

should be restricted to acute episodes; a single 2 mg/kg dose of gentamicin given 30-60 minutes before changing catheter may help control infections; amdinocillin may be used in short term; most important factor is preventing blockage by encouraging adequate fluid intake and changing catheter regularly or immediately if poorly functioning or obstructed; suprapubic cather should be considered for long-term use)

Prophylaxis: nitrofurantoin 2.5 mg/kg to maximum 100 mg orally nightly (safe in pregnancy), trimethoprim 2 mg/kg to maximum 150 mg orally nightly (not in pregnancy)

Hemolytic Uremic Syndrome: most common cause of acute renal failure in children (mainly < 10 y); mortality ≈ 5%, sequelae in ≈ 50%; 24 cases in Australia in 1999

Agents: *Escherichia coli* (usually 0157:H7; also 0111); also *Streptococcus pneumoniae, Salmonella typhi, Shigella, Proteus,* variety of other bacteria, viruses and drugs

Diagnosis: microangiopathic hemolytic anemia (hematocrit < 30%), thrombocytopenia (platelet count ≤ 160,000/μL) and acute renal failure (blood urea nitrogen ≥ 20 mg/dL) after respiratory or gastrointestinal symptoms or bacteremia; elevated serum aminotransferases, triglycerides, bilirubin and uric acid, reduced serum protein, albumin, C3 and C4; feces culture on 0.5% sorbitol MacConkey agar (within 6 d of onset of diarrhoea) + serotyping; enzyme immunoassay; blood cultures

Treatment: red blood cells or platelet transfusions as required, dialysis if required, plasma exchange; avoid antimicrobials and antimotility agents

Genitourinary Tuberculosis: 0.6% of tuberculosis cases

Agent: *Mycobacterium tuberculosis*

Diagnosis: Ziehl-Neelsen stain and culture of urine on Lowenstein-Jensen or similar medium; red cells and neutrophilia present in urine in urinary tuberculosis; proteinuria without elevated cells occurs in non-urinary tuberculosis; tuberculin test; interferon gamma assay; ELISPOT

Treatment: isoniazid 10 mg/kg to 300 mg orally once daily or 15 mg/kg to 600 mg orally 3 times weekly for 6 mo [+ pyridoxine 25 mg (breastfed baby 5 mg) orally with each dose] + rifampicin 10 mg/kg to 600 mg orally once daily 1 h before breakfast or 15 mg/kg to 600 mg orally 3 times a week for 6 mo + pyrazinamide 25-35 mg/kg to 2 g orally once daily or 50 mg/kg to 3 g orally 3 times weekly for 2 mo (6 mo if not known to be susceptible to isoniazid and rifampicin) + ethambutol 15 mg/kg orally daily (not < 6 y or plasma creatinine > 160 μM/L; regular ocular monitoring) or 30 mg/kg orally 3 times weekly for 2 mo or until known to be susceptible to isonazid and rifampicin (to 6 mo); relief of ureteric obstruction if required

Urinary Fungal Infections: pelvic infection (including acute uteropelvic obstruction) occurs particularly in diabetics, while parenchymal disease is more common in leukemia and chronic granulomatous disease; mortality rate 57% in pediatric patients

Agents: *Candida*, *Torulopsis glabrata, Aspergillus*, *Penicillium citreum, Cryptococcus neoformans,* phycomycetes

Diagnosis: micro and culture of urine; sonography; in *Candida* infections, urethral, vulval, vaginal swabs may be necessary to exclude genital infection

Treatment: in diabetics, primary effort should be towards stabilising diabetes, though bladder irrigation with amphotericin B 5-10 mg/L or single dose of amphotericin B may be used if necessary (also with indwelling catheter); if renal insufficiency is present, radiography should be performed, any obstruction found relieved and cultures repeated; if infection persists or any evidence of pyelonephritis and/or papillary necrosis is found, infection should be treated with flucytosine or amphotericin B; immunocompromised and paediatric patients, even if asymptomatic, should be treated with flucytosine or fluconazole 5 mg/kg to 200 mg orally daily for 7 d or amphotericin B

Urinary Viral Infections

Agents: *human rubella virus* and *human cytomegalovirus* (prenatal), *measles virus, mumps virus*, *Simplexvirus*, virus agent of other generalised viral infections, ? *Lymphocryptovirus* in infectious mononucleosis, *human adenovirus 11* (acute hemorrhagic cystitis in immunosuppressed patients), polyomaviruses in renal transplant recipients

Diagnosis: viral culture of urine; serology

Treatment: non-specific

Urinary Schistosomiasis

Agent: *Schistosoma haematobium*

Diagnosis: hematuria, dysuria, pyuria, chyluria; ova in urine, scrapings of lesions in bladder wall; severe iron deficiency anemia, eosinophilia, raised ESR; serology

Treatment: praziquantel 20 mg/kg orally for 2 doses after food 4 h apart

Post-Streptococcal Glomerulonephritis: immune mediated glomerulonephritis usually occurring 5-10 d after an upper respiratory infection or longer after the onset of a skin infection
Agents: almost invariably *Streptococcus pyogenes* (respiratory infections caused by a single type; skin infections caused by several types), occasionally Group C and Group G streptococci
Diagnosis: hematuria + edema, with hypertension and azotemia in more severe cases; anti-streptolysin O test (normal in ≈ 50% of cases (especially following skin infection); peaks at 2-4 w; false positives due to activity of other substances neutralising hemolytic properties of streptolysin O (eg., serum β-lipoprotein in liver disease) and bacterial growth in serum specimens); anti-deoxyribonuclease B (consistently elevated; rises later than ASOT, peaks at 4-6 w and remains elevated longer than ASOT; magnitude of response may be suppressed by antimicrobial therapy; detergents, heavy metals, azide and other chemicals interfere with enzyme and colour reaction); C'4 decreased (distinguishes from hypocomplementemic)
Treatment: supportive
Quartan Malarial Nephropathy (Malarial Nephrosis, Malaria Nephrosis, Nephrotic Syndrome of Quartan Malaria, Quartan Nephrosis): relatively rare complication of *malariae* malaria, especially in children
Agent: *Plasmodium (Plasmodium) malariae*
Diagnosis: glomerulonephritis with generalised edema, severe proteinuria and hypoproteinemia
Treatment: usually fatal
Genitourinary Myiasis: infestation of bladder, urethra and/or vagina by larvae of certain flies; rare
Agents: *Calliphora vomitoria, Chrysomya bezziana, Chrysomya chloropyga, Chrysomya putoria, Piophila, Wohlfahrtia*
Diagnosis: abdominal pain, dysuria, frequent urination, haematuria; may be urethral obstruction
Treatment: removal of larvae