CASE 1

Short case number: 3.14.1
Category: Renal and Urinary Systems
Discipline: Medicine_nephrology
Setting: Urban: General Practice.
Topic: Urinary tract Infection.

Case

25 year old, Loretta Willis presents to your general practice. She has had 2 days of stinging and burning when passing urine. She has tried the Ural recommended by her local pharmacist, but her symptoms have not resolved. She is concerned that she has another urinary tract infection.

Questions

1. What further history would you take and why?
2. What are the features of history and clinical examination that support a diagnosis of urinary tract infection?
3. What are the risk factors that need to be explored in patients presenting with recurrent urinary tract infections?
4. What investigations are used in the assessment of the renal tract and when and why are they used?
5. Outline the clinical spectrum of urinary tract infections. How do these clinical presentations differ?
6. Describe the pathogenesis of urinary tract infection due to the different causative micro-organisms.
7. Loretta is diagnosed with an E-coli urinary tract infection; outline your management plan, including any recommendations/ advice that you would provide.
8. Loretta continues to present with further urinary tract infections, outline your assessment and management plan.

Suggested reading:

- Colledge NR, Walker BR, Ralston SH, Penman ID, editors. Davidson's Principles and Practice of Medicine. 22nd edition. Edinburgh: Churchill Livingstone; 2014. Chapter 17.

ANSWERS

1. **What further history would you take and why?**

   Further history would involve the presence of previous infections - her age at onset, the frequency and severity. Have the previous UTIs been confirmed to exclude other possibilities such as trigonitis or interstitial cystitis, has she had any imaging to exclude a predisposing cause and any renal involvement? Has she had any recent diarrhoea or does she have chronic diarrhoea ? If she has been prescribed antibiotics in the past has she been compliant and taken the full course to prevent the risk of developing resistance? Has she had any adverse reactions to previous treatment? Is she aware of the appropriate precautions with adequate daily fluid intake, hygiene, pre- and post-coital voiding and does she adhere to these recommendations? Is there a history of other infections to suggest an underlying immune deficiency and has she had any other blood tests in this regard? Does she have any children and if so were there any problems with the delivery e.g.. forceps rotation with possible effect on the bladder, is there any stress or urge incontinence and has she been shown pelvic floor exercises?

2. **What are the features of history and clinical examination that support a diagnosis of urinary tract infection?**

   UTI can be strongly suspected on the basis of the patient's symptoms.
   These include abrupt onset of frequency of micturition, dysuria (pain or stinging during micturition), suprapubic "pressure", discomfort or pain during and after voiding , nocturia (initial or increase in frequency), strangury (intense desire to pass more urine after micturition), incontinence of urine, a bloated sensation, cramping in the pelvic area or back, the urine has a strong odour, looks cloudy or contains blood.
   Clinical examination may reveal fever, rigors, lower abdominal discomfort and loin pain when the renal angle is balloted posteriorly. The latter findings are more suggestive of complicated UTI or pyelonephritis.
   In males, phimosis (inability to retract a tight foreskin over the glans) or prostatomegaly and in females, vaginal prolapse may be evident to explain the UTI. Urinalysis looking for the presence of blood, white blood cells (neutrophils), nitrites, protein, glucose. Symptoms may vary in different age groups e.g. infants and young children may present with fever of otherwise unknown origin, signs of feeding difficulties, lassitude, frequent and offensive urine or cloudy urine noted by parents, vomiting and apparent abdominal pain . In the elderly symptoms may include mental changes or confusion, nausea or vomiting, abdominal pain.
   Prevalence of asymptomatic bacteriuria rises with age (in institutional care it rises to ≈ 40% in women and 30% in men).Contributory factors include an increased prevalence of underlying structural abnormalities, post-menopausal oestrogen deficiency and increased residual urine in women and prostatic hypertrophy with reduced bactericidal activity of prostatic secretions in men.

3. **What are the risk factors that need to be explored in patients presenting with recurrent urinary tract infections?**

Incomplete bladder emptying – bladder outflow obstruction, neurological problems (e.g. multiple sclerosis, diabetic neuropathy), gynaecological abnormalities (e.g. uterine prolapse), vesico-ureteric reflux.
Foreign bodies - urethral catheter or ureteric stent
Loss of host defences - atrophic urethritis and vaginitis in post-menopausal women, diabetes mellitus
In women, recurrent infections are common and further investigation is only justified if infections are frequent (three or more per year) or unusually severe. Men and children with recurrent infections, and patients with signs of pyelonephritis or systemic infection should also be investigated.

4. **What investigations are used in the assessment of the renal tract and when and why are they used?**

INVESTIGATION	INDICATIONS
Culture of MSU, or urine obtained by suprapubic aspiration	All patients
Microscopic examination or cytometry of urine for white and red cells	All patients
Dipstick examination of urine for nitrite and leucocyte esterase	All patients
Dipstick examination of urine for blood, protein and glucose	All patients
Full blood count	Infants, children, adults with acute pyelonephritis or prostates
Plasma urea, electrolytes, creatinine	Infants, children, acute pyelonephritis, recurrent UTI
Blood culture	Fever, rigors or evidence of septic shock
Pelvic examination	Women with recurrent UTI
Rectal examination	Men (to examine prostate)

Renal ultrasound or CT	To identify obstruction, cysts calculi Infants, children, men after single UTI Women who have (1) acute pyelonephritis, (2) recurrent UTI after antibiotic therapy, (3) UTI or asymptomatic bacteriuria in pregnancy
Micturating cysto- urethrogram (MCU) or radioisotope study to identify and assess severity of vesico-ureteric reflux or impaired bladder emptying	Selected infants and children to look for reflux and renal scars
Cystoscopy	Patients with haematuria or a suspected bladder lesion

5. Outline the clinical spectrum of urinary tract infections. How do these clinical presentations differ?

A. Asymptomatic bacteriuria. Defined as $> 10^5$ /ml organisms in the urine of apparently healthy asymptomatic patients. Approx. 1% of children under the age of 1, 1% of schoolgirls, 0.03% of schoolboys and men, 3% of non-pregnant adult women and 5% of pregnant women have asymptomatic bacteriuria. It is increasingly common in those aged over 65.There is no evidence that this condition causes renal scarring in adults who are not pregnant and have a normal urinary tract, and in general, treatment is not indicated. Up to 30% of patients will develop symptomatic infection within 1 year. In infants and pregnant women, treatment is required and investigation is indicated. Where the urinary tract is abnormal, asymptomatic bacteriuria is also more significant and may require intervention.

B. Symptomatic acute urethritis and cystitis (previously described)

C. Acute pyelonephritis. The kidneys are infected in a minority of patients with lower urinary tract infection or bacteriuria. Acute renal infection (pyelonephritis) presents as a classic triad of unilateral or bilateral loin pain, fever and tenderness over the kidneys. Renal infection is almost always caused by organisms ascending from the bladder and the bacterial profile is the same as for lower urinary tract infection. The renal medulla may be particularly susceptible to infection because of the low oxygen tension, high osmolality and high concentrations of H^+ and ammonia, which impair leucocyte function. Pain may radiate to the iliac fossae and suprapubic area. About 30% have dysuria due to associated cystitis. Fever is usually present and may be associated with rigors, vomiting and hypotension. Rarely, acute pyelonephritis is associated with papillary necrosis. Predisposing factors include diabetes mellitus, chronic urinary obstruction, analgesic nephropathy and sickle-cell disease. The differential diagnosis includes acute appendicitis, diverticulitis, cholecystitis and salpingitis.

D. Acute prostatitis. It can be caused by the same bacteria that are associated with UTI or ,more commonly, may be non-bacterial (no organisms cultured from urine). Clinical features include frequency, dysuria, perineal or groin pain, difficulty passing urine and, in acute disease, considerable systemic disturbance. The prostate is enlarged and tender. Bacterial prostatitis is confirmed by a positive culture from urine or from urethral discharge obtained after prostatic massage. A 4 –6 week course of the appropriate antibiotic is required. Non-bacterial prostatitis can be treated with drugs to relax the prostate and bladder neck.

E. Septicaemia (usually Gram-negative bacteria) May complicate cystitis in compromised host. Pyelonephritis, renal abscess (intrarenal or extrarenal), acute prostatitis or prostatic abscess can cause septicaemia in an immunocompetent host. May present as fever or hypothermia (seen principally in the elderly), tachycardia, tachypnoea and inadequate organ perfusion or function (altered mental state, hypoxaemia, oliguria)

6. Describe the pathogenesis of urinary tract infection due to the different causative micro-organisms.

Organisms causing UTI in the community include:

- *Escherichia coli* derived from the gastrointestinal tract (about 75% of infections)
- *Proteus*
- *Pseudomonas* species
- streptococci
- *Staphylococcus epidermidis*

In hospital, *E. coli* still predominates, but *Klebsiella* or streptococci are more common than in the community.

The first stage in the development of UTI is colonization of the periurethral zone with pathogenic organisms. Urine is an excellent culture medium for bacteria; in addition, the urothelium of susceptible persons may have more receptors to which virulent strains of *E. coli* become adherent. In women, the ascent of organisms into the bladder is easier than in men because of the relatively short urethra and absence of bactericidal prostatic secretions. Sexual intercourse may cause minor urethral trauma and transfer bacteria from the perineum into the bladder. Multiplication of organisms then depends on a number of factors, including the size of the inoculum and virulence of the bacteria. \

Some patients , usually female, have symptoms suggestive of urethritis and cystitis but no bacteria are cultured from the urine (the 'urethral syndrome'). Possible explanations include infection with organisms not readily cultured by ordinary methods (e.g.. *Chlamydia,* certain anaerobes), intermittent or very low-count bacteriuria, symptoms related to sexual intercourse, post-menopausal atrophic vaginitis, trigonitis or interstitial cystitis. Antibiotics are not indicated .

7. **Loretta is diagnosed with an E-coli urinary tract infection; outline your management plan, including any recommendations/ advice that you would provide.**

   Encourage fluid intake of at least 2 litres/day
   Commence the appropriate antibiotic (depending on the sensitivities from the MSU) at the recommended dose and encourage compliance with advice re the potential for developing a resistant strain of organism by not completing the course. Re-visit the information on personal hygiene re appropriate wiping on every occasion, the need for pre- and post- coital voiding and why this is important.
   Review if the symptoms don't settle fully or recur soon after completion of treatment.

8. **Loretta continues to present with further urinary tract infections, outline your assessment and management plan.**

   Document the presence of infection with an MSU - if organism confirmed
   treat as above but arrange a progress MSU at least 24 hours after completing the course of antibiotics to confirm eradication of infection (if organism still present in an asymptomatic patient consider colonization). If no organism evident then consideration should be given to *Chlamydia* infection and a urine PCR arranged.
   Bloods to assess renal function
   Encourage appropriate fluid intake as above and discuss the benefits of a urinary antiseptic and/or cranberry juice or supplements.
   Pelvic examination to exclude structural cause e.g. cystocoele, uterine fibroids etc.
   Consider need to exclude structural cause with initially an ultrasound of the urinary tract looking for large post-voiding residual urine, any abnormality in bladder (e.g. diverticulum) or kidneys - obstruction, calculi etc. A CT scan may be required to further assess any abnormality found at ultrasound.
   Consider need for cystoscopy in the presence of persisting haematuria with no discernible UTI and an otherwise normal CT KUB