Urinary tract infection

UTI is an inflammatory response of the urothelium to bacterial invasion that is usually associated with bacteriuria and pyuria..
It is a term that is applied to a variety of clinical conditions ranging from cystitis to severe infection of the kidney with resultant sepsis.
Bacteriuria is the presence of bacteria in the urine, which is normally free of bacteria.
Bacteriuria can be symptomatic or asymptomatic.
Pyuria is the presence of white blood cells (WBCs) in the urine is generally indicative of infection and/or an inflammatory response of the urothelium to the bacterium, stones, or other foreign body.

Defense mechanism against infection

1.flushing effect of urine.
2.mucopolysuccharide coating of bladder.
3.low urinary PH &high osmolality reduce bacterial growth.
4.urinary IgA inhibits bacterial adherence.

Predisposing factors of urinary tract infection

- Incomplete emptying of the bladder such as bladder outflow obstruction, bladder diverticulum & neurogenic bladder.
- Incomplete emptying of the upper tract as in dilatation of the ureters associated with pregnancy, or vesicoureteric reflux
- A calculus, foreign body or neoplasm.
- Oestrogen deficiency, which may give rise to lowered local resistance.
- Colonisation of the perineal skin by strains of *Escherichia coli* expressing molecules that facilitate adherence to mucosa
- Diabetes &Immunosuppression

Classification of UTI

Many clinically important classification

1. isolated or recurrent UTI

Isolated UTI a single episode of lower tract infection occurs frequently in females and is rarely complicated.

Recurrent UTI is >2 infections in 6 months, or 3 within 12 months.

- Recurrent UTI may be due to reinfection (i.e., infection by a different bacteria) or bacterial persistence (infection by the same organism).
- Bacterial persistence is caused by the presence of bacteria within calculi (e.g., struvite calculi), antimicrobial resistance & Patient noncompliance with therapy.

2. Uncomplicated &complicated UTI

Uncomplicated describes an infection in a healthy patient with a structurally and functionally normal urinary tract.

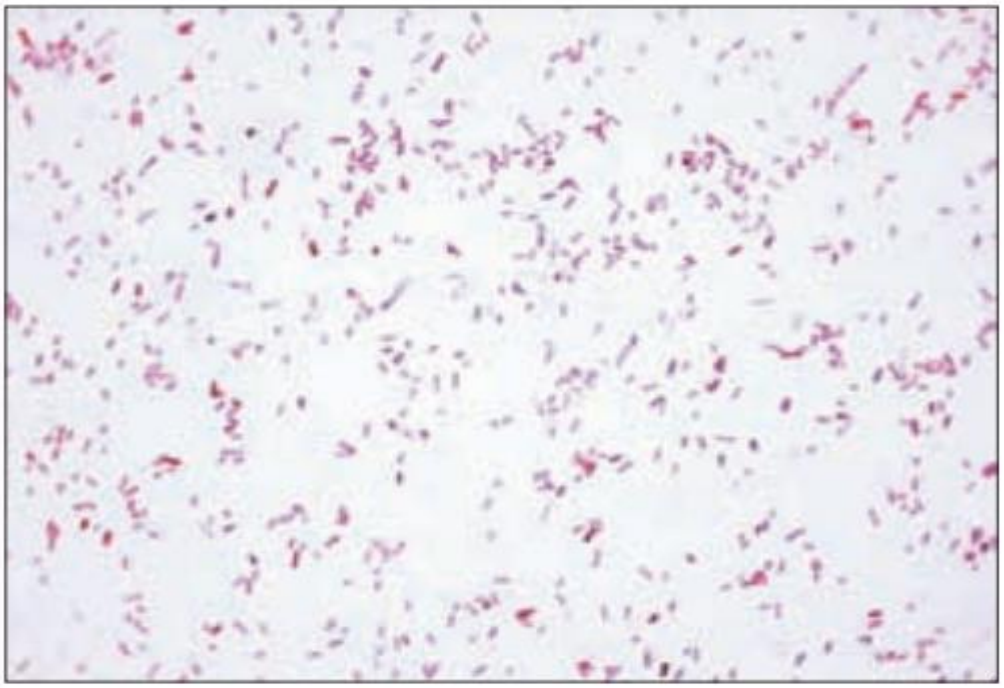
***A complicated* infection** is associated with factors that increase the chance of acquiring bacteria and decrease the efficacy of therapy. The urinary tract is structurally or functionally abnormal, the host is compromised, and/or the bacteria have increased virulence or antimicrobial resistance. The majority of these patients are men.

3.Upper urinary tract infection (pyelonephritis) &Lower urinary tract (cystitis &urethritis).

Causative agent

Most UTIs are caused by a single bacterial species. At least 80 %of the uncomplicated cystitis and pyelonephritis are due to E. coli Other less common uropathogens include Klebsiella, Proteus ,and Enterobacter spp .and enterococci.

In hospital-acquired UTIs, a wider variety of causative organisms is found, including Pseudomonas and Staphylococcus spp.



Gram-negative bacilli on light microscopy.

Route of infection

- Ascending route (commonest) bacteria derived from the large bowel, colonize the perineum, vagina, and distal urethra. They ascend along the urethra to the bladder (risk is increased in female as the urethra is shorter), causing cystitis, & from the bladder they may ascend, via the ureters, to involve the kidneys (pyelonephritis).
- Hematogenous route

  Infection of the kidney is uncommon. Occurs in patients with *Staphylococcus aureus* bacteremia & TB **.**

Lower urinary tract (acute cystitis)

- urinary infection of the lower urinary tract, principally the bladder.
- Acute cystitis ♀ > ♂.
- The primary mode of infection is ascending from the periurethral / vaginal and fecal flora.
- The diagnosis is made clinically confirm by urinalysis

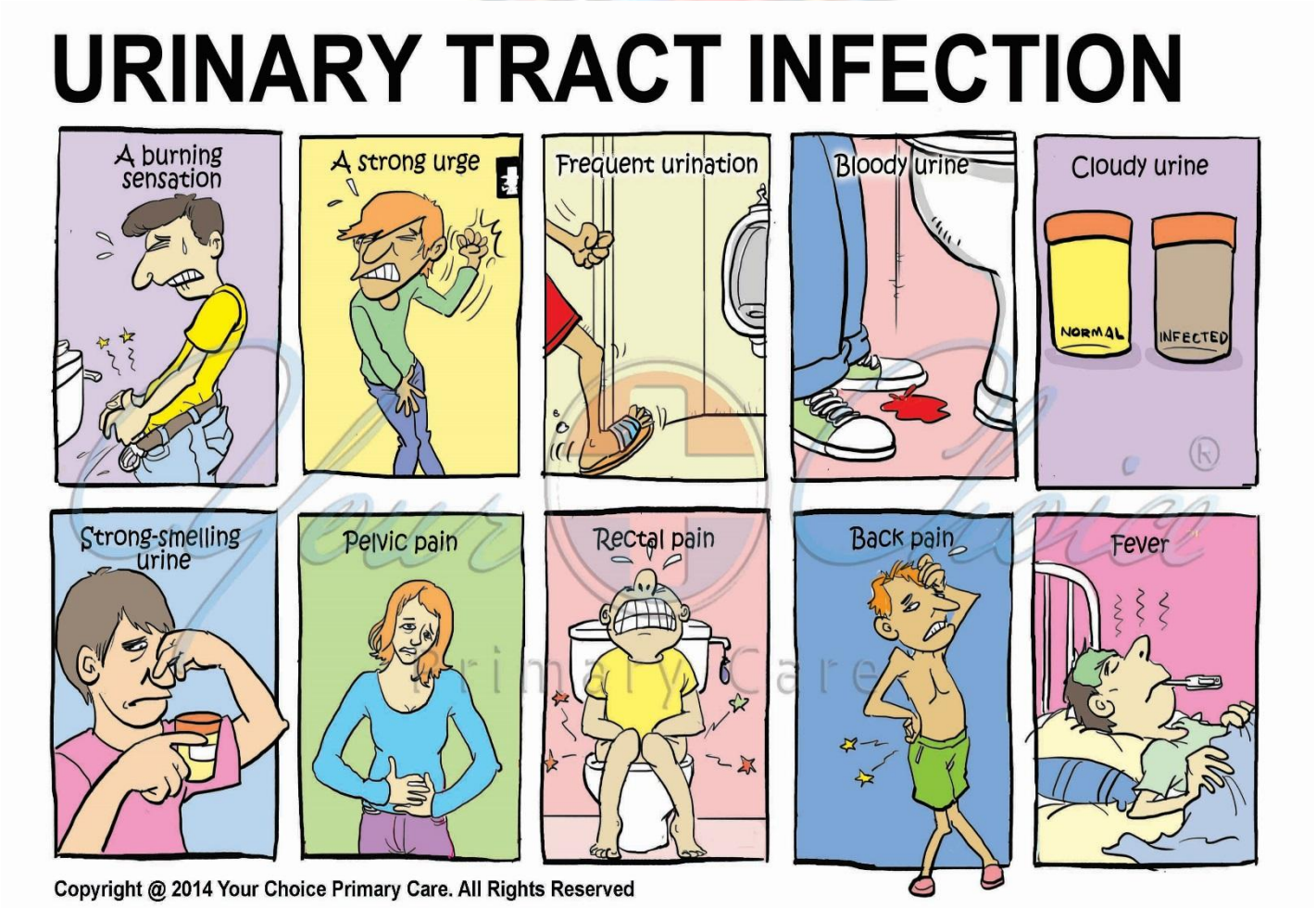
Sign &symptoms

- Patients present with irritative (storage) symptoms such as

1.Dysuria: painful urination.

2.urgency: A strong, sudden desire to urinate difficult to defer.

With frequency ,suprapubic pain, hematuria, & cloudy/foul smelling urine. Fever and systemic symptoms are rare.



Investigation

- **Urinalysis** WBCs in the urine (> 5cell/hpf) & hematuria(R.B.C> 3cell/hpf) may be present.
- **Urine culture** is required to confirm the diagnosis & identify the causative organism & antibiotic sensitivity .

2.17 Disk diffusion sensitivity testing for routine coliforms. The antibiotics used here are Nitrofurantoin, Trimethoprim, Gentamicin, Ciprofloxacin, Cephalexin and Cefpodoxime. The zones are measured against a template: in this case, the coliforms are resistant to Trimethoprim (TMP).

However, when the clinical picture & urinalysis are suggestive of the Dx of acute cystitis, urine culture may not be needed.

Radiographic study

- In uncomplicated infection of the bladder, radiologic evaluation is often not necessary
- Ultrasound study &other study may need when there is suspicion of complicated UTI or recurrent UTI, Fever& UTI in children.

Management

- Management for acute cystitis consists of a short course of oral antibiotics.
- Trimethoprim –sulfamethoxazole.
- Nitrofurantoin
- Quinolones(ciprofloxacin ,levofloxacin….etc)

Short oral course 3-5 days for female , 7 Days for male &children.

- In **recurrent infection** due to persistent infection**The UTIs will not resolve until this underlying problem has been**

addressed and corrected. e.g. surgical removal of the infected source (such as urinary calculi).

- In recurrent UTI in ♀ with reinfection **do not** usually have an underlying functional or anatomical abnormality. But have higher adherence of bacteria to their mucosal cells compared to women who never had UTI.
- Male with reinfection may have underlying bladder outlet obstruction (due to prostate enlargement or urethral stricture), which makes them more likely to develop a repeat infection.

- The patient with Recurrent UTI due to reinfection treated by low-dose **continuous prophylactic antibiotic** which has been shown to reduce the recurrences of UTI by 95% compared to placebo.(1/4 dose)
- Nitrofurantoin, 50 or 100 mg daily
- TMP-SMX, 40/200 mg daily
- Trimethoprim, 100 mg daily
- Cephalexin, 250 mg daily
- Ciprofloxacin, 250 mg daily

Acute Pyelonephritis

Acute pyelonephritis is defined as inflammation of the kidney and renal pelvis, and its diagnosis is usually made clinically.

Clinical Presentation

Patients with acute pyelonephritis present with chills ،fever, and costovertebral angle tenderness.

They often have accompanying lower-tract symptoms such as dysuria, frequency, and urgency. Sepsis may occur, with 20–30% of all systemic sepsis resulting from a urine infection.

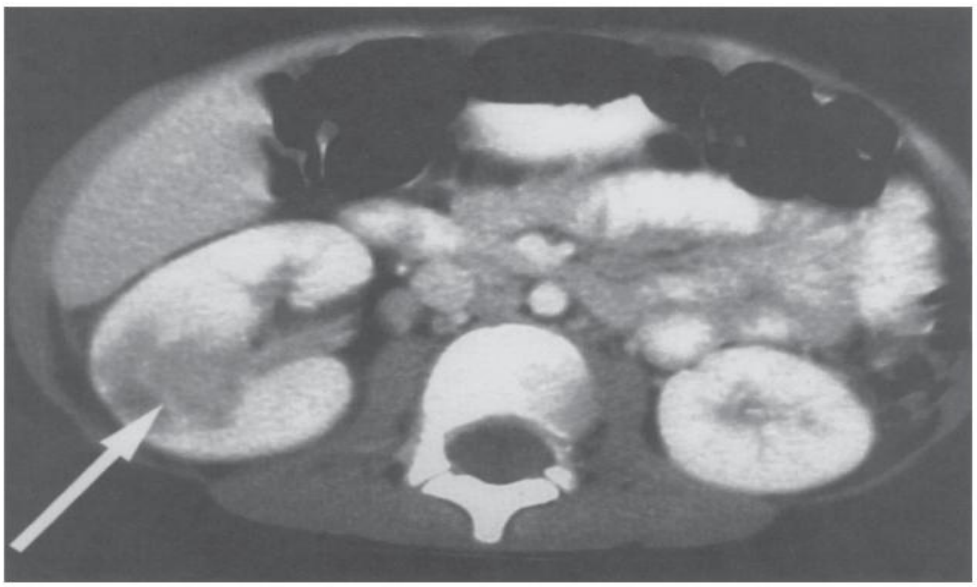
Investigation

- Urinalysis commonly demonstrates the presence of WBCs and red blood cells in the urine.

- Leukocytosis, increased erythrocyte sedimentation, and elevated levels of C-reactive protein are commonly seen on blood analysis.
- Bacteria are cultured from the urine when the culture is obtained before antibiotic treatment is instituted. E. coli is the most common causative organism, accounting for 80% of the cases .Klebsiella, Proteus, Enterobacter, Pseudomonas, Serratia, and Citrobacterspp. account for the remaining cases.

Radiographic Imaging

- Ultrasound : Renal ultrasonography is important to rule out concurrent urinary tract obstruction but cannot reliably detect inflammation or infection of the kidney.
- Contrast-enhanced computed tomography (CT) scans: can accurately demonstrate findings, confirming the diagnosis of pyelonephritis ,Renal enlargement, attenuated parenchyma, and a compressed collecting system are other characteristic findings on CT scan. However, CT scan is not necessary unless the diagnosis is unclear or the patient is not responding to therapy.



Acute pyelonephritis. Computed tomography scan with intravenous contrast demonstrates a perfusion defect (*white arrow*) and enlargement of the affected kidney.

Management

The management of acute pyelonephritis depends on the severity of the infection.

In patients who have toxicity because of associated septicemia, hospitalization is warranted.

Empiric therapy with intravenous ampicillin and aminoglycosides is effective against a broad range of uropathogens, including enterococci and Pseudomonas species. Alternatively, amoxicillin with clavulanic acid or a third-generation cephalosporin can be used.

Fever from acute pyelonephritis may persist for several days despite appropriate therapy.

Parenteral therapy should be maintained until the patient defervesces then the patient should be switched to oral treatment for 10–14 days.

In patients who are not severely ill, outpatient treatment with oral antibiotics is appropriate. For adults, treatment with fluoroquinolones or TMP–SMX is well tolerated and effective. Therapy should continue for 10–14 days.

Emphysematous Pyelonephritis

Emphysematous pyelonephritis is a necrotizing infection characterized by the presence of gas within the renal parenchyma or perinephric tissue. About 80–90% of patients with emphysematous pyelonephritis have diabetes; the rest of the cases are associated with urinary tract obstruction from calculi or papillary necrosis.

Clinical Presentation

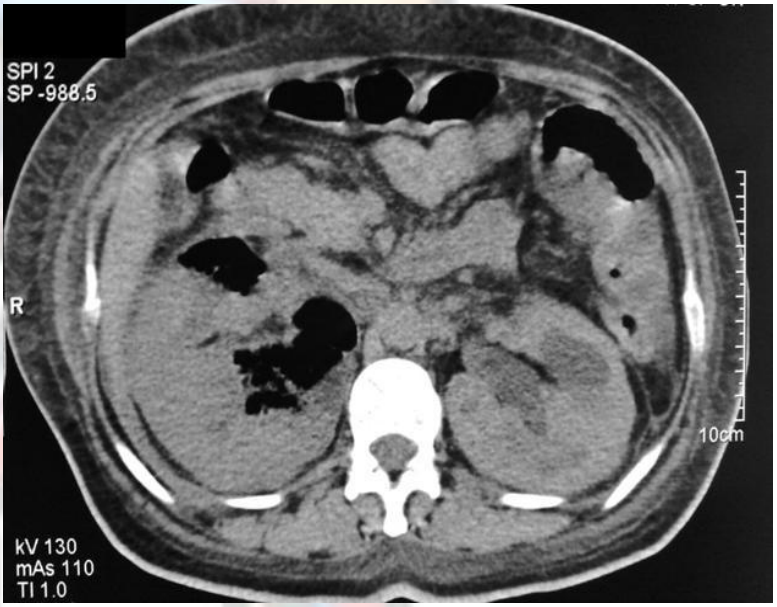
Patients with emphysematous pyelonephritis present with fever ، flank pain, and vomiting that fails initial management with parenteral antibiotics . Pneumaturia may be present.

Investigation

- Bacteria most frequently cultured from the urine include E. coli, Klebsiella pneumoniae, and Enterobacter cloacae.

Radiographic Imaging

- The diagnosis of emphysematous pyelonephritis is made after radiographic examination. Gas overlying the affected kidney may be seen on a plain abdominal radiograph [kidneys, ureters, bladder (KUB)].
- CT scan is much more sensitive in detecting the presence of gas in the renal parenchyma than renal ultrasonography.



Management

In the management of emphysematous pyelonephritis prompt control of blood glucose and relief of urinary obstruction are essential, in addition to fluid resuscitation and parenteral antibiotics. The mortality rate is 11–54%.

In combination with medical treatment, percutaneous drainage appears to be helpful in accelerating resolution of the infection and minimizing the morbidity and mortality of the infection . Nephrectomy may be required if there is no function in the affected kidney. About 3-4 weeks of parenteral antibiotic therapy is usually required.