Chronic Recurrent Urinary Tract Infection

Dr Rodney Itaki
Lecturer
Anatomical Pathology Discipline

University of Papua New Guinea
School of Medicine & Health Sciences
Division of Pathology

Infection of Urinary Tract & Kidney: Overview

- Common diagnosis in out patient visits
- Incidence of UTI higher in women
- Due to shorter length of female urethra
- Higher incidence in pregnancy

Urinary Tract Infection (UTI)

Common causative organisms: KEEPSS

- Klebsiella, Escherichia coli, Enterobacter (enterococci/strep. Fecalis), Proteus, Serratia, Staph. saprophyticus

- a. *Escherichia coli* (gram-negative enteral bacteria) causes most common community acquired infections
- b. *Staphylococcus saprophyticus*, gram-positive organism causes 10 – 15%
- c. Catheter-associated UTI's caused by gram-negative bacteria: Proteus, Klebsiella, Seratia, Pseudomonas, enterococci

Normal: Urine is Sterile

Normal mechanisms that maintain sterility of urine

- a. Adequate urine volume
- b. Free-flow from kidneys through urinary meatus
- c. Complete bladder emptying
- d. Normal acidity of urine
- e. Peristaltic activity of ureters and competent ureterovesical junction
- f. Increased intravesicular pressure preventing reflux
- g. In males, antibacterial effect of zinc in prostatic fluid

Routes of Infection: Pathophysiology

- Haematogenous spread: e.g. sepsis, septic emboli, endocarditis
- Ascending infection: entry of organisms through urethra into bladder and up into ureter and ultimately kidneys

Classification of UTIs

Classifications of infections

- a. Lower urinary tract infections: urethritis, prostatitis, cystitis
- b. Upper urinary tract infection: pyelonephritis (inflammation of kidney and renal pelvis)

Risk Factors

1. Aging
   - a. Increased incidence of diabetes mellitus older population (in PNG younger population too)
   - b. Increased risk of urinary stasis
   - c. Impaired immune response
2. Females: short urethra, having sexual intercourse, use of contraceptives that alter normal bacteria flora of vagina and perineal tissues; with age increased incidence of cystocele, rectocele (incomplete emptying)
3. Males: prostatic hypertrophy, bacterial prostatitis, anal intercourse
4. Urinary tract obstruction: tumor or calculi, strictures
5. Impaired bladder innervations

Risk Factors Contd..

- Urolithiasis (bladder stone)
- Vesicoureteral spincter incompetence resulting in vesicoureteral reflux
- Nephrolithiasis (kidney stone)
- Ureteric strictures from any cause
- Malignancies – primary or secondary: bladder, ureters

Urinary Tract Tumor

Background

- 1. Malignancies in urinary tract: 90% bladder; 8% renal pelvis; 2% ureter, urethral; 5 year survival rate for bladder cancer is 94%
- 2. Bladder cancer: 4 times higher in males than females; 2 times higher in whites than blacks; occurs over age 60

B. Risk factors

- 1. Carcinogens in urine
- a. Cigarette smoking
- b. Occupational exposure to chemicals and dyes
- 2. Chronic inflammation or infection of bladder mucosa

Urinary Tract Tumor

Pathophysiology

1. Tumors arise from epithelial tissue which composes the lining
2. Tumors arise as flat or papillary lesions
3. Poorly differentiated flat tumor invades directly and has poorer prognosis
4. Metastasis commonly involves pelvic lymph nodes, lungs, bones, liver

Manifestations

1. Painless hematuria is presenting sign in 75% cases; may be gross or microscopic and may be intermittent
2. Inflammation may cause manifestations of UTI
3. May have few outward signs until obstructed urine flow or renal failure occurs

Clinical Presentation of UTI

- Urinary frequency
- Dysuria
- Supra pubic tenderness – cystitis, bladder stone, tumour
- Low grade fevers
- Malaise, lethargy
- Lower abdominal pain – cystitis, bladder stone, tumour
- Back pain – cystitis, tumour,
- Loin pain - pyelonephritis, kidney stone, tumour
- Acute urinary retention – prostitis, prostatic hyperplasia
- Haematuria – tumour, kidney stone, bladder stone
- Pyuria with or without offensive odour
- Instrumentation, bed ridden patients, prolonged IDC

Urethritis

- Urethritis: most common UTIs.
- Maybe caused by STIs or uropathogens
- Patients complain of urinary frequency, urethral discharge, burning during urination
- Look for risk factors
- Do urine analysis & ureteral swab

Cystitis

1. Most common UTI in females & can complicate urethritis
2. Remains superficial, involving bladder mucosa, which becomes hyperemic and may hemorrhage
3. General manifestations of cystitis
   - a. Dysuria
   - b. Frequency and urgency
   - c. Nocturia
   - d. Urine has foul odor, cloudy (pyuria), bloody (hematuria)
   - e. Suprapubic pain and tenderness
4. Older clients may present with different manifestations
   - a. Nocturia, incontinence
   - b. Confusion
   - c. Behavioral changes
   - d. Lethargy
   - e. Anorexia
   - f. Fever or hypothermia

Pyelonephritis

1. May follow ureteritis from vesicoureteral reflux
   Inflammation of renal pelvis and parenchyma (functional kidney tissue)
2. Acute pyelonephritis
   - a. Results from an infection that ascends to kidney from lower urinary tract

Risk factors

- 1. Pregnancy
- 2. Urinary tract obstruction and congenital malformation
- 3. Urinary tract trauma, scarring
- 4. Renal calculi
- 5. Polycystic or hypertensive renal disease
- 6. Chronic diseases, i.e. diabetes mellitus
- 7. Vesicourethral reflux

Pyelonephritis

Pathophysiology

1. Infection spreads from renal pelvis to renal cortex
2. Kidney grossly edematous; localized abscesses in cortex surface
3. E. Coli responsible organism for 85% of acute pyelonephritis; also Proteus, Klebisella

Manifestations

1. Rapid onset with chills and fever
2. Malaise
3. Vomiting
4. Flank pain
5. Costovertebral tenderness
6. Urinary frequency, dysuria

Atypical Presentations

Manifestations of pyelonephritis in older adults

- 1. Change in behavior
- 2. Acute confusion
- 3. Incontinence
- 4. General deterioration in condition

Chronic Pyelonephritis

a. Involves chronic inflammation and scarring of tubules and interstitial tissues of kidney
b. Common cause of chronic renal failure
c. May develop from chronic hypertension, vascular conditions, severe vesicourteteral reflux, obstruction of urinary tract
d. Presentation
   - 1. Asymptomatic
   - 2. Mild symptoms: urinary frequency, dysuria, flank pain

Calculi: Presentation

Manifestations: depends upon size and location of stones

1. Calculi affecting kidney calices, pelvis
   - a. Few symptoms unless obstructed flow
   - b. Dull, aching flank pain
2. Calculi affecting bladder
   - a. Few symptoms
   - b. Dull suprapubic pain with exercise or post voiding
   - c. Possibly gross hematuria
3. Calculi affecting ureter, causing ureteral spasm
   - a. Renal colic: acute, severe flank pain of affected side, radiates to suprapubic region, groin, and external genitals
   - b. Nausea, vomiting, pallor, cool, clammy skin
   - 4. Manifestations of UTI may occur with urinary calculi

Complications of Calculi

Complications

1. Obstruction: manifestations depend upon speed of obstruction development; can ultimately lead to renal failure
2. Hydronephrosis: distention of renal pelvis and calyces; unrelieved pressure can damage kidney (collecting tubules, proximal tubules, glomeruli) leading to gradual loss of renal function

- a. Acute: colicky pain on affected side
- b. Chronic: few manifestations: dull ache in back or flank
- c. Other manifestations: hematuria, signs of UTI, GI symptoms

Calculi Management

Principle of Rx

1. Relief of acute symptoms
2. Remove or destroy stone
3. Prevent future stone formation

Diagnostic Tests

1. Urinalysis: hematuria, possible WBCs and crystal fragments, urine pH helpful to diagnose stone type
2. Chemical analysis of stone: All urine must be strained and saved; stones or sediment sent for analysis
3. 24-urine collection for calcium, uric acid, oxalate (common) to identifiy possible cause of lithiasis
4. Serum calcium, phosphorus, uric acid: identify factors in calculi formation

Calculi Diagnosis

5. KUB xray (kidney, ureters, bladder): flat plate to identify presence and location of opacities
6. Renal ultrasonography: sound waves to detect s stones and detect hydronephrosis
7. CT scan of kidney: identify calculi, obstruction, disorders
8. IVP
9. Cystoscopy: visualize and possibly remove calculi from urinary bladder and distal ureters

Medications

1. Treatment of acute renal colic: analgesia and hydration
2. Narcotic such as intravenous morphine sulfate, NSAID, large amounts of fluid by oral or intravenous routes

Calculi Management

3. Medications to inhibit further lithiasis according to analysis of stone:
   - a. Thiazide diuretics: promotes reduction of urinary calcium excretion
   - b. Potassium citrate: used to alkalinize urine for stones formed in acidic urine (uric acid, cystine, and some calcium stones)

Dietary Management: Prescribed to change character of urine and prevent further lithiasis

- 1. Increased fluid intake to 2 – 2.5 liters daily, spaced throughout day
- 2. Limited intake of calcium and Vitamin D sources if calcium stones
- 3. Phosphorus and/or oxalate may be limited with calcium stones
- 4. Low purine (rich meats) diet for clients with uric acid stones

Calculi Management

Surgery

1. May be indicated as treatment depending on stone location, severe obstruction, infection, serious bleeding
2. Types:

- a. Ureterolithotomy: incision into affected ureter to remove calculus
- b. Pyelolithotomy: incision into and removal of stone from kidney pelvis
- c. Nephrolithotomy: surgery to remove staghorn calculus in calices and renal parenchyma
- d. Cystoscopy: crushing and removal of bladder stones through cystocope; stone fragments irrigated out of bladder with acid solution

Diagnosis of UTI

d. Urine culture and sensitivity: identify infecting organism and most effective antibiotic; culture requires 24 – 72 hours for results; obtain by clean catch urine or catheterization
e. Females: clean perineum prior to collection if midstream

e. WBC with differential: leukocytosis and increased number of neutraphils

6. Diagnostic Tests for adults who have recurrent infections or persistent bacteriuria

a. Intravenous pyelography (IVP) or excretory urography

- 1. Evaluates structure and excretory function of kidneys, ureters, bladder
- 2. Kidneys clear an intravenously injected contrast medium that outlines kidneys, ureters, bladder, and vesicoureteral reflux
- 3. Check for allergy to iodine, seafood, radiologic contrast medium, hold testing and notify physician or radiologist

Prognosis

- Possible outcomes of treatment for UTI, determined by follow-up urinalysis and culture
- 1. **Cure**: no pathogens in urine
- 2. **Unresolved bacteriuria**: pathogens remain
- 3. **Persistent bacteriuria or relapse**: persistent source of infection causes repeated infection after initial cure
- 4. **Re-infection:** development of new infection with different pathogen
- Prophylactic antibiotic therapy with TMP-SMZ, TMP alone or nitrofurantoin (Furadantin, Nitrofan) may be used with clients who experience frequent symptomatic UTIs
- Catheter-associated UTI: removal of indwelling catheter followed by 10 – 14 day course of antibiotic therapy
- Chronic renal failure from insterstial fibrosis

Summary:

- UTI is a very common clinical diagnosis
- Uncomplicated UTI more common in women and in pregnancy
- Recurrent UTI = underlying major pathology = thorough investigation required
- Uncomplicated UTI diagnosis: Urine analysis (MCS)

Summary:

- Investigation of recurrent UTI: Xray, USS, CT
- Consider IVP or micturating cysturography to investigate recurrent UTI
- Screen risk factors in predisposed individuals
- Prevent UTI in high risk patients e.g. Bed ridden patients

END

Reference: Robins Pathological Basis of Diseases

Download seminar notes: www.pathologyatsmhs.com