

## Urogenital pathology

<https://medicine.nus.edu.sg/pathweb/pathology-demystified/urogenital-pathology/>

### Approach to the Urogenital System

#### I. Consider 3 Main Anatomical and Functional Sections:

1. Kidney; 2. Lower Urinary Tract; 3. Male Genital System

#### 1. Kidney

##### Functions:

- Excrete waste products of metabolism (generate approximately 1L of urine from 1700L of blood daily)
- Maintain salt and water balance in body
- Endocrine organ – secretes hormones:
  - Erythropoietin
  - Renin
  - Prostaglandins
- Note – renal diseases not only cause fatality but can also pursue chronic courses and is the cause of significant long term morbidity

##### Structure:

- 4 main histological compartments/units → specific clinicopathological conditions
- **Glomeruli (FILTERS)** – often affected by immune mediated conditions)
- **Tubules and interstitium (REABSORBERS)** – often affected by infections and toxic agents)
- **Vessels** (blood supply, disease include thromboembolism, vasculitis, hypertension)
- **Pelvicalyceal system** (pathology similar to lower urinary tract)

##### Main conditions covered:

- **Medical conditions** (Immune-mediated, infectious, ischaemic, toxic, vascular. **see below under “Kidney”**)
- **Tumours**
- **Congenital**

#### 2. Lower Urinary Tract (Ureters, Bladder, Urethra)

**Function:** Conduit to channel urine from kidneys to bladder for storage and then expulsion through urethra

##### Main disease categories include:

- I. Infectious/Inflammatory conditions (eg. Cystitis – urinary tract infection involving the bladder )
- II. Congenital disorders (eg. Vesicoureteric reflux; posterior urethral valves)

- III. Neoplastic (eg. Urothelial carcinoma)
- IV. Calculi/urolithiasis

Since the organs are tubes or hollow organs, **obstruction** is an important complication of various diseases in the lower urinary tract. (Diagram on next page shows some of the causes of obstruction)

#### 3. Male genital system (prostate, penis, testis)

##### Main disease categories include:

- I. Inflammatory / Infectious (eg. Sexually transmitted infections)
- II. Congenital (eg. Undescended testes)
- III. Neoplastic (eg. Carcinoma of the prostate)

(Notice that the categories are practically the same as in the Lower Urinary Tract.)

#### II. Clinical manifestations of Urogenital Diseases

##### Definitions:

**Uraemia** – Azotaemia together with clinical signs and symptoms. Often, other organs area also affected, eg. Uraemic gastroenteritis, peripheral neuropathy, uraemic fibrinous pericarditis.

**Azotaemia** – Biochemical abnormality characterised by raised blood urea nitrogen (BUN) and creatinine levels

##### Clinical manifestations of Kidney and Lower Urinary Tract disease

###### Renal, ureteric symptoms

- Flank pain (eg. Pyelonephritis)
- Colic (eg. Calculi)
- Flank mass, dragging sensation (eg. Polycystic kidney disease)

###### Abnormal nature of urine

- Abnormal volume: Too high or low (renal failure, obstruction)
- Nature/Colour
- Haematuria (causes include glomerular diseases, tubulointerstitial and lower urinary tract infections, stones, bleeding diatheses)
- Frothy (proteinuria)
- Brown (myoglobinuria)
- Purulent (pyuria)

##### Abnormal micturition (urination) – usually obstruction/infection

- Dysuria (Infection/Inflammation, obstruction)
- Frequency (Infection/Inflammation obstruction)
- Dribbling, hesitancy (obstruction e.g. Benign prostatic hyperplasia)

##### Systemic signs and symptoms

- Fever (pyelonephritis, lower urinary tract infection)

##### Signs and symptoms of chronic renal failure and uraemia

- Sallow appearance of skin, pruritus
- Fatigue, pallor – anaemia
- Nausea, vomiting, gastroenteritis
- Encephalopathy, peripheral neuropathy
- Dehydration
- Cardiovascular complications – cardiomyopathy, heart failure, pulmonary oedema, uraemic pericarditis

#### III. Clinical Investigations

Urine examination is very important in urogenital diseases

- Volume (too little, too much)
- Presence of RBCs (Haematuria)
- Presence of WBCs
- Presence and amount of protein in urine (proteinuria)
- Microbiological investigations (eg. culture)
- Microscopic pathologic examination (eg. for LUT malignancy)

Blood investigations are also important in assessing renal function:

- Blood urea nitrogen (BUN)
- Creatinine
- Glomerular filtration rate
- Electrolytes – hyperkalaemia, metabolic acidosis

##### Imaging

- Kidney, lower urinary tract

##### Kidney biopsy

- Glomerular, Tubulointerstitial and Vascular diseases
- Tumours

#### IV. Main Diseases by Anatomical sections:

##### 1. Lower Urinary Tract and Male Genital System

Diseases of the Lower Urinary Tract

- Main aetiologic categories:
- Infectious/Inflammatory
- Congenital
- Neoplastic
- Urolithiasis (calculi formation)

Many conditions can result in **Obstruction**, which is an important clinical complication of LUT diseases

- This in turn can lead to urine stasis and infection, which can not only involve the LUT but ascend into the kidneys, giving rise to pyelonephritis (this is discussed under Tubulointerstitial diseases in the Kidney in the next section)
- Stasis can also contribute to the formation of urinary calculi
- The obstructed ureters may dilate, and cause dilatation of the renal pelvicalyceal system (**hydronephrosis**), which causes thinning and atrophy of the renal parenchyma and eventually renal failure

Some causes of obstruction:

Robbins and Cotran Pathologic  
Basis of Disease , 8<sup>th</sup> Edition

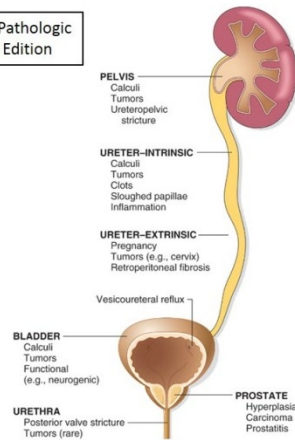


Figure 20-49 Obstructive lesions of the urinary tract.

### Mindmaps:

Diseases of the Lower Urinary Tract and Male Genital System:

<https://medicine.nus.edu.sg/pathweb/pathology-demystified/urogenital-pathology/iii-lower-urinary-tract-and-male-genital-system/>

## **2. Kidney Diseases**

For simplicity, this can be divided into MEDICAL and OTHER conditions.

**MEDICAL CONDITIONS: Glomerular, Tubulointerstitial, Vascular**

### I. Glomerular diseases

Glomeruli are the FILTERS in the kidney – thus TWO things can go wrong:

1. They **leak** – blood, proteins enter the urine → Causing Nephrotic Syndrome or Haematuria
2. They **cease to filter** – toxic waste materials remain in blood, filtrate does not pass through (urine volume goes down) → Causing Acute renal failure

Mechanisms of glomerular diseases: These are often immune mediated. Here are 3 examples:

1. Antibodies bind to antigens in-situ within glomeruli (eg. Anti-Glomerular Basement Membrane in Goodpasture Syndrome)
2. Antibodies and antigens are circulating as Immune Complexes – they get trapped in glomeruli and cause tissue damage and inflammatory reactions (eg. SLE, Post-infectious glomerulonephritis)
3. Antibodies bind to antigens in cells in glomeruli (eg. ANCA – anti-neutrophilic antibodies, in vasculitis)

### II. Tubulointerstitial diseases

Tubules concentrate urine - conditions are often toxic, ischaemic or infectious → They lead to abnormal urine volume, acute or chronic renal failure and signs and symptoms of infections

<https://medicine.nus.edu.sg/pathweb/pathology-demystified/urogenital-pathology/tubulointerstitial-and-vascular-diseases/>

### III. Vascular diseases

These are often seen in systemic conditions.

Note: Although we have divided the Medical conditions by the THREE main functional units of the kidney, it is important to note that some conditions, eg. Diabetes Mellitus, Amyloidosis

and Hypertension can affect more than one compartment. This is elaborated on more in the Glomerular Diseases Mindmap.

### Mindmaps:

1. Kidney Diseases Overview:

<https://medicine.nus.edu.sg/pathweb/pathology-demystified/urogenital-pathology/iv-kidney-diseases/>

2. Glomerular Diseases Clinicopathologic Correlation:

<https://medicine.nus.edu.sg/pathweb/pathology-demystified/urogenital-pathology/glomerular-diseases-clinicopathologic-correlation/>

**Note:** Refer to your lecture notes for the causes of Acute and Chronic Renal Failure (Lecture III) and try to CLASSIFY them according to what you have learned here (eg. glomerular vs tubulointerstitial vs lower urinary tract), so they are easier to remember.

### **OTHER CONDITIONS**

#### 2. Tumours

#### 3. Congenital conditions

#### 4. Conditions affecting the Pelvicalyceal System

Talking POTS:

<https://medicine.nus.edu.sg/pathweb/pathology-demystified/urogenital-pathology/v-ug-system-talking-pots/>

Urogenital System Quiz:

<https://medicine.nus.edu.sg/pathweb/pathology-demystified/urogenital-pathology/urogenital-system-quiz/>