LEC 7: Renal History & Examination

Anatomy

- Retroperitoneal, **T12–L3 level** and **are 11–14 cm long**.
- The **right** kidney lie**s 1.5 c**m **lower**→ **Liver**.
- The kidneys **move downwards during inspiration** as the lungs expand.
- kidneys receive **~25%** of **cardiac output.**
- Each kidney contains about **one million nephrons**.

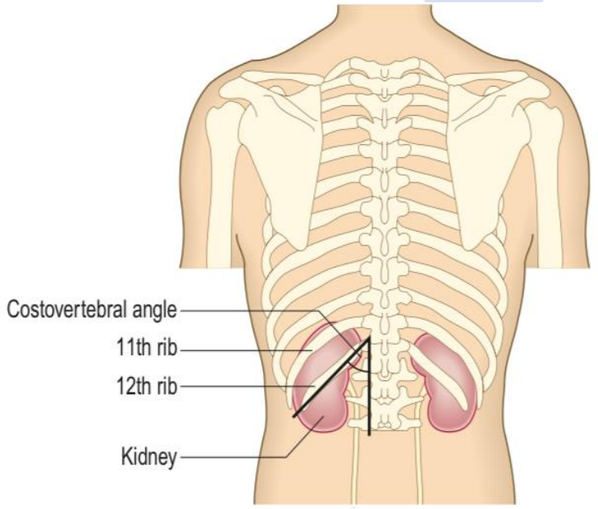


Fig. 12.1 The surface anatomy of the kidneys from the back.

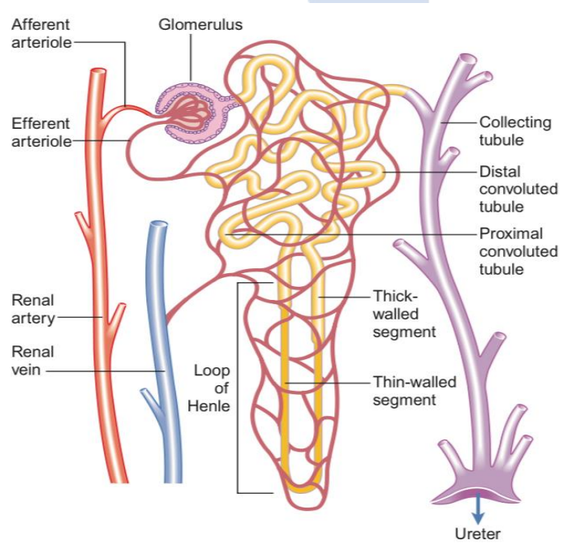


Fig. 12.2 A single nephron.

Function

Kidney

- **Excretion** of **waste** products of metabolism.
- Maintaining **salt, water and electrolyte** homeostasis.
- **Regulating blood pressure** via the renin–angiotensin system.
- **Endocrine functions** related to **erythropoiesis** and **vitamin D metabolism**.

Bladder

- **Reservoir**, as it <u>fills</u>, it **rises out of the pelvis in the midline** towards the umbilicus.
- The **bladder wall contracts under parasympathetic control**, allowing urine to pass through the urethra (**micturition**).
- The **conscious desire** to micturate occurs when the bladder holds ~ **250–350 ml** of urine.
- Renal **capsule** and **ureter** are innervated by **t8- l2 nerve root.**

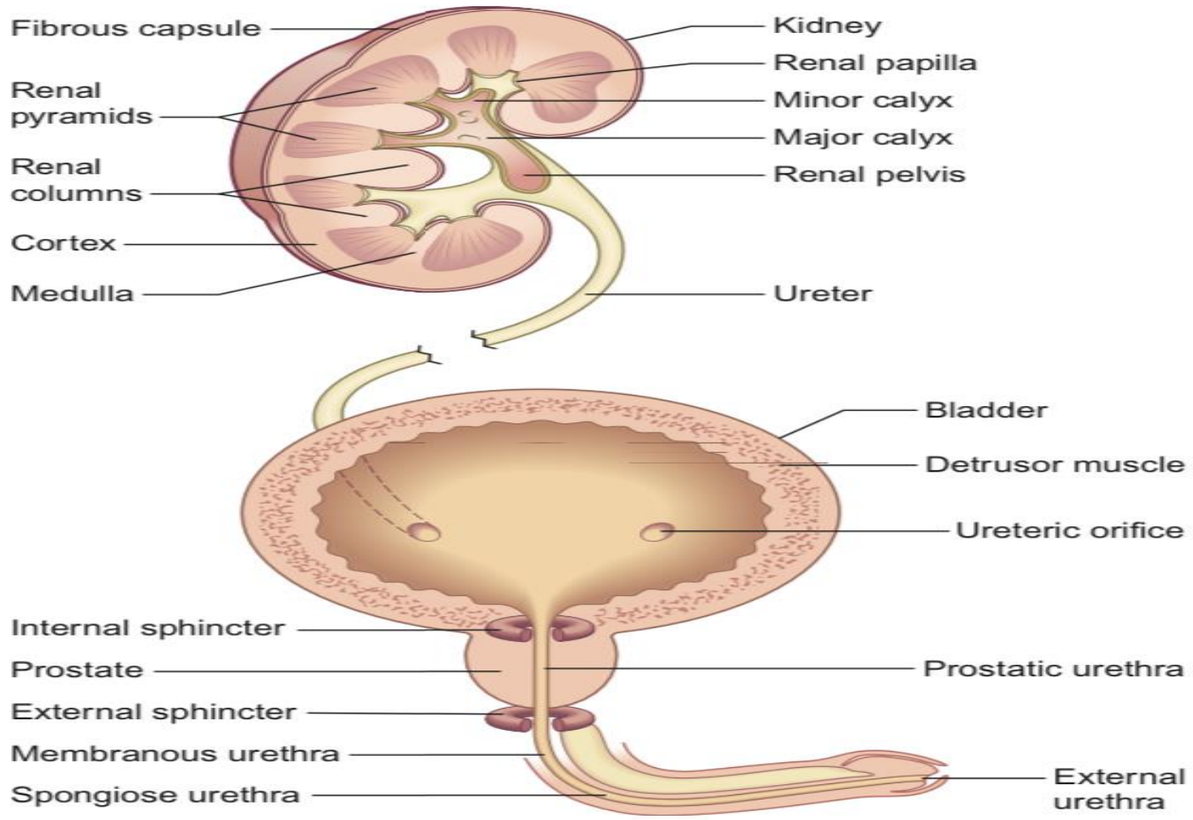


Fig. 12.3 The male urinary tract.

Anatomy

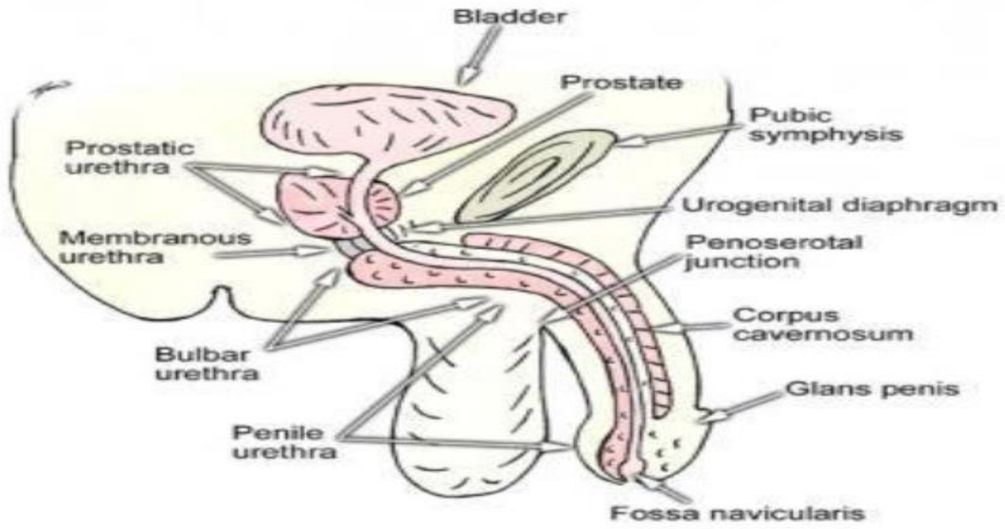
The male urethra runs from the **bladder** to the **tip of the penis**:

1. **Prostatic urethra.**
2. **Membranous.**
3. **Bulbar.**
4. **penile.**

- The female urethra is much **shorter**.

Two muscular rings acting as valves (sphincters) control micturition:

- The **internal sphincter** is at the **bladder neck** and is **involuntary**.
- The **external sphincter** surrounds the **membranous s2-4.**



Symptoms & Definitions

• Severe renal disease may be **asymptomatic**, or have **nonspecific symptoms**, such as **tiredness or breathlessness from renal failure or associated anemia**, **poor appetite, sleep disturbance,** etc...

• **Growth retardation** is common with CKD in childhood.

• **Detection** often **follows incidental testing** of **blood and urine**.

Dysuria

• **Dysuria:** (voiding pain) is **pain during or immediately after passing urine,** often described as a **'burning' sensation felt at the urethral meatus.**

• **Ask about:** associated symptoms (**cystitis**) /systemic symptoms **(Pyelonephritis)** / **urine outflow obstruction symptoms/ sexual contacts**.

• **Prostatitis** may cause **perineal and rectal pain at the same time**.

Loin Pain

• **Renal angle** or **loin pain** is due to stretching of the renal capsule or renal pelvis → **infection, inflammation** or **mechanical obstruction**.

1. **Constant** loin pain, with systemic **upset, fever, rigors and pain on voiding**, **suggests upper UTI (acute pyelonephritis).**

2. **Chronic dull,** loin discomfort may **occur with chronic renal infection and scarring** from **vesicoureteral reflux, adult polycystic kidney disease (APKD)** or **chronic urinary tract obstruction**.

Ureteric colic ('renal colic')

- **Severe loin pain** is usually due to **ureteric obstruction**, **renal caliculi** are the most common cause. The pain often **comes in waves and is described as colicky**. The patient is **unable to find a comfortable position and will move around the bed**.
- **Site** – **unilateral**, in the **renal angle and flank** area. (Pelvic/ URT).
- **Onset** – **sudden**.
- **Character** – usually **very severe and sustained**, may vary cyclically in intensity.
- **Radiation** – may **radiate to the iliac fossa, the groin and the genitalia/ testes**. (LUT)
- **Associated features** – patient is usually **restless** and **nauseated**, and often **vomits, fever, rigors & chilis.**
- **Timing** – may **last for several hours.**
- **Exacerbating/relieving factors** – **analgesia.**
- **Severity** – often **very severe.**
- **Similar** – **distinguish from intestinal colic or biliary pain, appendicitis, torsion of an ovarian cyst, ruptured ectopic pregnancy**.

Lower urinary symptoms may be:

- **Storage** phase symptoms.
- **Voiding** phase symptoms.
- **Incontinence**.

Storage symptoms: (FUN)

• **Frequency** is a desire to **pass urine more often** than **usual > 6times/day**

• **Urgency** – a **sudden strong need to pass** urine**.**

Urgency is due to either **overactivity in the detrusor muscle or abnormal stretch receptor activity from the bladder** (sensory urgency)**.**

- **Nocturia** – waking **one or more at night** to void.

Storage symptoms are usually **associated with bladder, prostate or urethral problems, e.g., lower urinary tract infection, tumor, urinary stones or obstruction from prostatic enlargement,** or are a consequence of **neurological disease**.

Voiding phase symptoms:

- **Hesitancy** is **difficulty or delay in initiating** urine flow.
- **Dribbling** and **incomplete emptying** are caused by **bladder neck obstruction**, but if they are associated with **storage symptoms, may indicate abnormal detrusor function**.
- **Poor stream.**
- **Voiding symptoms in men over 40** this is commonly due to **bladder outlet obstruction by prostatic enlargement.** In **women** these symptoms **suggest urethral obstruction from stenosis or in association with genital prolapse**.

9.2 Features of bladder outlet obstruction due to prostatic hyperplasia

- Slow flow
- Hesitancy
- Incomplete emptying (the need to pass urine again within a few minutes of micturition)
- Dribbling after micturition
- Frequency and nocturia (due to incomplete bladder emptying)
- A palpable bladder

Incontinence

- **Urge incontinence:** Involuntary release of urine may occur with a need to void, occurs when the **detrusor is overactive**.
- **Stress incontinence:** result from an increase in intra-abdominal pressure, occurs in women due to **weakness of the pelvic floor, usually following childbirth.**
- **Mixed incontinence:** combination of both.

- **Enuresis is incontinence during sleep, and common in childhood**

In adults it **suggests bladder outlet obstruction or abnormalities of the wakening mechanism**.

9.6 Causes of urinary incontinence

- Pelvic floor weakness following childbirth
- Pelvic surgery or radiotherapy
- Detrusor overactivity
- Bladder outlet obstruction
- Urinary tract infection
- Degenerative brain diseases and stroke
- Neurological diseases, e.g. multiple sclerosis
- Spinal cord damage

9.11 Urinary incontinence: points to cover in the history

- Age at onset and frequency of wetting
- Occurrence during sleep (enuresis)
- Any other urinary symptoms
- Provocative factors, e.g. coughing, sneezing, exercising
- Past medical, obstetric and surgical histories
- Number of pads used. Are they damp, wet or soaked?
- Impact on daily living

Abnormalities in urine volume and composition

- Healthy adults produce **2–3 liters of urine per day,** equivalent to their **fluid intake minus insensible fluid losses** through the skin and respiratory tract **(500– 800 ml/day)**.

Polyuria

- Polyuria is an abnormally **large volume of urine**, and **is most commonly due to excessive fluid intake >3 L /day.**
- **Psychogenic polydipsia.**
- **Polyuria also occurs when the kidneys cannot concentrate urine:**

1. Extrarenal: e.g., diuretic drugs; DM, DI, Addison's disease.

2. Renal causes: nephrogenic diabetes insipidus.

Oliguria

- **< 500 ml/day**.
- It may be appropriate with a **very low fluid intake** or **mechanical obstruction**, but may also **indicate loss of kidney function**.
- The **minimum urine volume needed to excrete the daily solute load varies** with diet, physical activity and metabolic rate, **but is at least 500 ml/day.**
- **Acute renal failure is usually associated with oliguria.**

Anuria

- Anuria is the **total absence of urine production OR < 50ml/ per day.**
- **Exclude urinary tract obstruction**, which may be **lower** (bladder neck or urethral obstruction causing acute urinary retention) or **upper**, e.g., a ureteric stone in a patient with a single functioning kidney.

Pneumaturia

- **Passing gas bubbles** in the urine, is rare.
- It may be associated with **faecuria**, when **feces are voided**. It suggests a **fistula between the bladder and the colon**, from a diverticular abscess, cancer or Crohn's disease.

Hematuria

- **Non-visible hematuria** occurs in **renal or urinary tract disease**, especially if associated with **proteinuria, hypertension, raised serum creatinine or reduced estimated glomerular filtration rate**.
- **+1 on dipstick**, in female reproductive age = **contamination**.
- **Visible hematuria**
  - Urine describes as **pink, red, brown in color**. Ask about **previous episodes** their time course and whether they **were persistent or intermittent.**
  - **It can arise anywhere** along renal tract from the **glomerular to the urethra.**
  - The **most common glomerular disorder associated with hematuria is IgA-Nephropathy**.
  - **It may be due to urinary tract infection** with its associated symptoms but should be investigated, if **painless→cancer of the kidney, bladder or prostate.**
- **Investigate all patients >40 years with hematuria** (visible or non-visible).
- **Contamination of the urine by blood** from the female genital tract during menstruation.
- **Free hemoglobin** in the urine due to **hemolysis**, **myoglobin** in **rhabdomyolysis** and other abnormalities of urine color may **mimic** hematuria.
- **Ask about: loin pain, fever, lower urinary symptoms, family hx (APKD).**

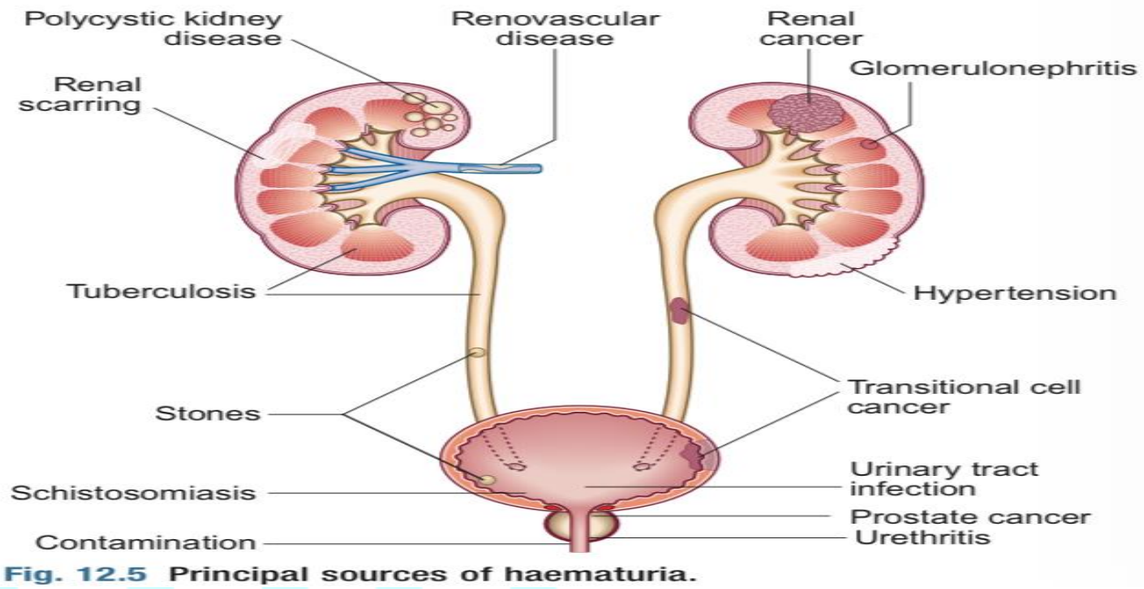


Fig. 12.5 Principal sources of haematuria.

9.7 Abnormalities of urine colour

Orange-brown
- Conjugated bilirubin
- Rhubarb, senna
- Concentrated normal urine, e.g. very low fluid intake
- Drugs: sulfasalazine

Red-brown
- Blood, myoglobin, free haemoglobin, porphyrins
- Beetroot, blackberries
- Drugs: rifampicin, rifabutin, clofazimine, entacapone

Brown-black
- Conjugated bilirubin
- Drugs: L-dopa, metronidazole, nitrofurantoin, chloroquine, primaquine
- Homogentisic acid (in alkaptonuria or ochronosis)

Blue-green
- Drugs/dyes, e.g. propofol, fluorescein, triamterene

Proteinuria & Nephrotic syndrome

- Proteinuria is the **excretion of more than 150 mg per day of protein in the urine**.
- It is **usually asymptomatic** but <u>if persistent</u>, **may indicate underlying renal disease.**
- **Nephrotic syndrome** is characterized by the combination of **heavy proteinuria (> 3.5 g/day), hypoalbuminemia and edema.**
- Nephrotic syndrome may come on **<u>over a few weeks</u> (As in minimal change disease) and cause acute kidney injury (AKI)**, or **<u>it can evolve over many months</u> (As in membranous nephropathy), giving a picture of chronic kidney disease (CKD).**
- **The most cause of nephrotic syndrome is DM**, although it can also be the result of **other systemic disease, including malignancy.**
- <u>Patients may notice that</u> the **urine is frothy due to the proteinuria. Hyperlipidemia, hypercoagulability and increased risk of infection may also develop**.

- **<u>Ask about:</u>**
- **Weight loss, altered bowel habit, cough, back pain or chronic inflammation conditions such as rheumatoid arthritis, inflammatory bowel disease, or bronchiectasis.**
- **Ankle swelling (Pitting edema). Younger** patients may also notice **fascial puffiness, especially early in the morning**.
- **Breathlessness (Pleural effusion).**
- **Abdominal swelling (ascites).**

ACUTE KIDNEY INJURY

- Abrupt elevation in (serum cr) conc or a decrease in urine output.
- **It may have prerenal, renal and postrenal causes:**

1. PRE-RENAL.
2. RENAL.
3. POST-RENAL.

Prerenal AKI (Almost always due to volume depletion):

Ask about:

1. **Fluid losses such as vomiting, diarrhea, bleeding and inadequate oral intake.**
2. Recent **operation or investigations** that may be associated with increase fluid loss or decrease intake.
3. **Any feature of infection: Fever, sweats, productive cough, or dysuria.**
4. **History of heart failure or liver cirrhosis**.
5. **Recent drug prescriptions such as ACEI, ARBS, diuretics…etc**.

Intrinsic AKI

The most common cause in the hospital sitting will be **acute tubular injury (ATI)**, which may lead to **acute tubular necrosis (ATN).**

Ask about:

1. **Recent illnesses or operations.**
2. **Drug history** & any change in medications (**Antibiotics, NSAID, PPI**).

3. Symptoms of systemic disease: weight loss, fever, night sweat, tiredness.

4. Ask about **prior episodes, loin pain, hematuria, previous sore throat**.

Post renal AKI

This is usually due to **any cause of obstruction from the pelvis to urethra**.

In men the most common cause is **BPH**.

Ask about:

1. Urinary urgency, frequency, nocturia and incontinence.

2. Poor urine stream & terminal dribbling.

3. Previous **prostatic assessments**.

4. Suprapubic pain.

5. Leg weakness, perineal numbness, or fecal incontinence.

Acute urinary retention: complete inability to pass urine and associated with suprapubic pain.

Chronic urinary retention: usually painless.

CHRONIC KIDNEY DISEASE

- Alteration in **kidney function or structure for more than 3 months**
- Look for **underlying conditions** that may explain the etiology of CKD:
- **HTN**, **DM**, **vascular Disease**: (**MI /PAD /STROKE**), **hyperlipidemia**, episodes of **acute GN, nephrotic syndrome**.
- **Proteinuria or hematuria** may **suggest glomerular disease**
- **Detailed FHX** is required as a number of genetic diseases may present with CKD.

END STAGE RENAL DISEASE AND URAEMIA

- Most commonly **when the estimated GFR less than 10ml/min/1.73m2**.
- **Poor concentration, lethargy, anorexia, n, v, pruritus, sob, peripheral edema**.
- Less commonly **pericarditis and peripheral neuropathy**.

The patient with a renal transplant

- Identifying the fact that a patient has had a kidney transplant is important early in the history.
- **The main presenting problems are a decline in kidney function** (usually identified by routine blood tests), infection or malignancy.
- The risks of the latter two are increased by immunosuppression.

Infections in renal transplant Patients may be masked by immunosuppression.

- It **is important to consider lymphoma in the early years after a transplant.**
- **Ask about:**
- **Date of transplant operation;** organ rejection is more common in the **first few weeks.**
- **Current and previous immunosuppression** and **any recent changes in treatment** that may increase the risk of rejection; any **intercurrent illness** that may have contributed to AKI.
- **Fever, weight loss, cough, breathlessness, dysuria, and tenderness over the graft.**

DIALYSIS PATIENTS

There are two main forms of dialysis:

Hemodialysis and peritoneal dialysis

1. HEMODIALYSIS: is delivered via arteriovenous fistula or tunneled vascular access catheter.

A. The fistula has an obvious thrill (p.243) and the patient may complain that this has been lost.

This is usually **due to thrombosis and needs urgent attention front a vascular surgeon.**

- **The most common problem with vascular access catheter is infection.**

2. PERITONEAL DIALYSIS: involves a tunneled catheter and Infection is also a common presentation.

Ask about **fever and rigors** (and their relation to hemodialysis), **abdominal pain, and peritoneal dialysate fluid appearance** (has it become 'cloudy'?)

Past history

Ask about any previous history of renal system disease.

- **Hypertension** (which may cause or result from renal disease)
- **Diabetes mellitus** (associated with diabetic nephropathy and renovascular disease)
- **Vascular disease** at other sites (which makes renovascular disease more likely)
- Past history of urinary tract stones or surgery
- Renal disease.
- **Recurrent infections** (particularly urinary infection which may be associated with renal scarring, and upper respiratory infections which may be associated with glomerulonephritis and/or vasculitis).
- **Anemia** (which may be due to CKD).

Drug history

- **Drugs which accumulate in renal failure,** such as digoxin, lithium, aminoglycosides, opioids and water-soluble beta-blockers, e.g., atenolol.
- **Drugs which may affect renal function** include angiotensin- converting enzyme inhibitors, angiotensin receptor antagonists and NSAIDs.
- Aminoglycosides, amphotericin, lithium, ciclosporin, tacrolimus and, in overdose, paracetamol are **toxic to normal kidneys.**

Family history

- The most common inherited conditions are **APKD (autosomal dominant) and Alport's syndrome (X-linked dominant).**
- APKD is associated with **subarachnoid hemorrhage from intracranial berry aneurysms.**
- Alport's syndrome is associated with **high-tone sensorineural deafness.**

9.12 Some hereditary and congenital conditions affecting the kidneys and urinary tract

Name	Principal findings	Commonly associated abnormalities	Most common form of inheritance
Adult polycystic kidney disease	Bilateral enlarged kidneys, sometimes massive, with nodular surface	Liver cysts Intracranial berry aneurysms Mitral or aortic valve abnormalities	Autosomal dominant
Alport's syndrome	Haematuria, proteinuria, renal failure	Nerve deafness Lens and retinal abnormalities	X-linked dominant
Medullary sponge kidney	Tubular dilatation; renal stones	Other congenital abnormalities, e.g. hemihypertrophy, cardiac valve abnormalities, Marfan's syndrome	Congenital, rarely familial
Nail–patella syndrome	Proteinuria Renal failure (30%)	Nail dysplasia, patellar dysplasia or aplasia	Autosomal dominant
Cystinosis	Tubular dysfunction; renal failure	Rickets, growth retardation, retinal depigmentation and visual impairment	Autosomal recessive
Tuberous sclerosis complex	Renal cysts Renal angiolipomata	Seizures, mental retardation, facial angiofibromata, retinal lesions	Autosomal dominant
Prune-belly syndrome	Dilated bladder and urinary tract; urinary infection and renal failure	Absent abdominal wall musculature	Sporadic mutation

Social history

- **End-stage renal disease** requiring dialysis and/or transplantation has major **implications for lifestyle, employment and relationships**.
- **Incontinence** has major implications for daily living.
- **Smoking**.
- Take a **dietary history** in patients with **renal stones and patients with CKD.**

Occupational history

- Exposure to **organic solvents** may cause glomerulonephritis.
- **Aniline dye** and **rubber** workers have an increased incidence of urothelial cancer.
- Long term exposure to **lead and cadmium** may cause renal damage.

The physical examination

- Physical examination **may be normal**, even with significant kidney disease.

Examination sequence

Assess the patient's **general appearance** and conscious level.

■ Look for **fatigue, pallor, breathlessness, uremic complexion**, **cushingoid** appearance and hirsutism.

LEC 7: Renal History & Examination

■ Measure the **temperature** + vs (Bp (+ postural).

■ Look at the eyes for **anemia**, fundoscopy.

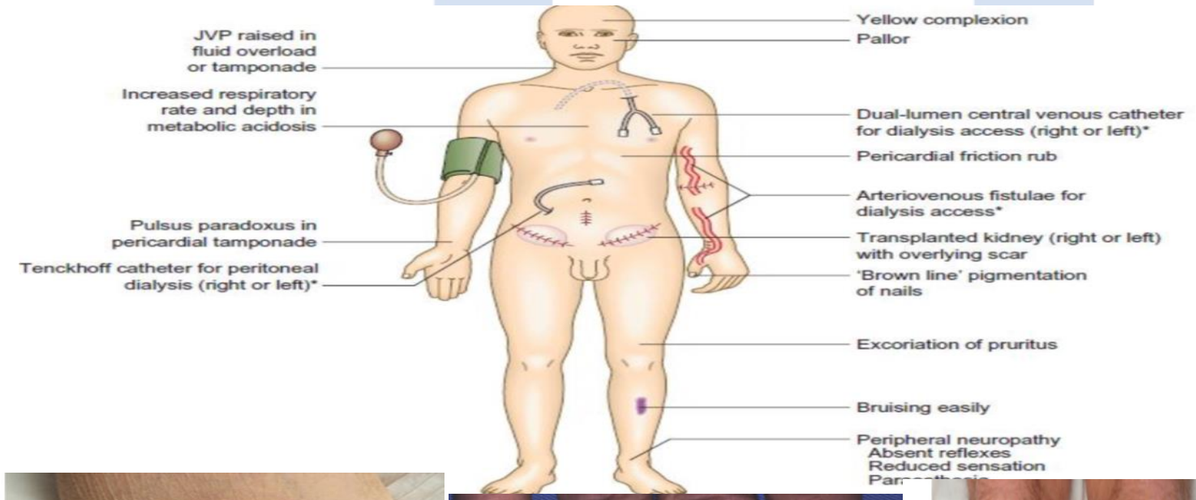
■ Note **any bruising or excoriation**.

■ Examine the hands for **nail changes**, vasculitis rash.

■ Look for a coarse **flapping tremor.**

■ Smell the patient's breath for **uremic fetor.**

■ Assess **hydration** by checking skin turgor, eyeball tone, JVP and presence of **oedema**, **dry mucus membrane**, weight assessment, fluid balance chart.



Haemodialysis fistula.

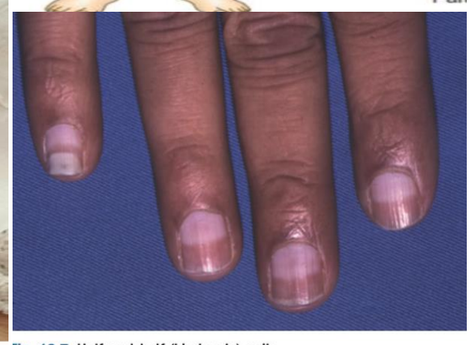
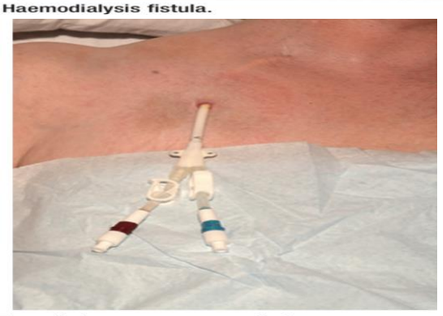


Fig. 12.7 Half-and-half (Lindsay's) nails.

Vasculitic rash.



Tunnelled venous access catheter.

Sacral oedema showing pitting.

Abdominal examination

Inspection

■ Look for **distension** (from the enlarged kidneys of APKD, ascites, and suprapubically from bladder distension.

■ Look in the **loins for scars of renal tract surgery and in the iliac fossa for those of transplant surgery**.

■ You may see a **catheter for peritoneal dialysis or small scars left by one in the midline and hypochondrium**.

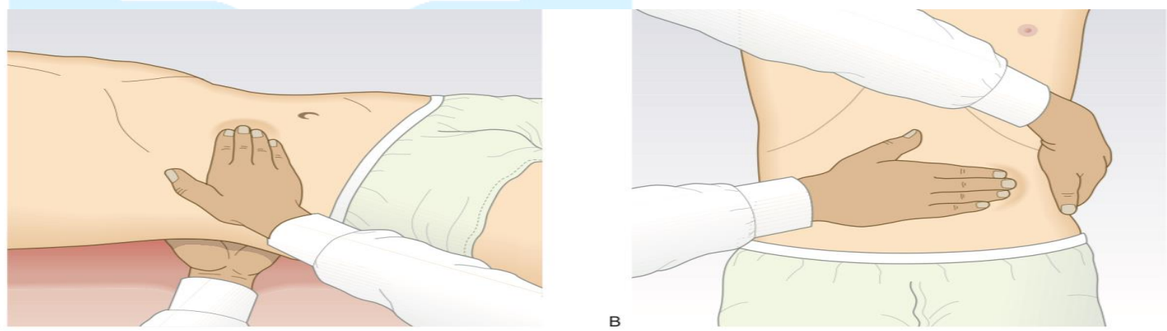
Fig. 12.11 Renal transplant scar in the right iliac fossa.

Palpation

■ Palpate the kidneys.

■ If the kidney is **palpable, assess its size, surface and consistency**.

■ Ask the patient to sit up. Palpate the **renal angle.**



12.12 Palpation of the kidney. A Right kidney. B Left kidney.

• Use the fingers of your **right hand**. Start in the right lower quadrant and palpate each area systematically a distended bladder is felt as a smooth firm mass arising from the pelvis which disappears after urethral catheterization.

Polycystic kidneys have a distinctive nodular surface.

• To detect lesser degrees of kidney enlargement, place your left hand **behind the patient's back below the lower ribs and your right index finger against the 12th rib**. Firmly, but **gently, push your hands together as the patient breathes out**. Ask the patient to **breathe in deeply; feel for the lower pole of the kidney moving down between your hands**. If this happens, gently push the kidney back and forwards between your two hands to demonstrate its mobility. This is balloting, and confirms that this structure is the kidney.

• Ask the patient to **sit up. Palpate the renal angle firmly but gently**. If this does not cause the patient discomfort, firmly (but with moderate force only!) **strike the renal angle once with the ulnar aspect of your closed fist after warning the patient what to expect.**

Percussion

Percussion of the kidneys is unhelpful.

■ **Percuss** for the bladder over a resonant area in the upper abdomen in the midline and then down towards the symphysis pubis.

■ **Test for ascites**, which may be found in nephrotic syndrome or in patients having peritoneal dialysis.

Auscultation

■ Auscultate for bruits arising from the **renal arteries.**

Specific test:

■ In men examine the external genitalia and perform a **rectal examination** to assess the prostate for benign or malignant change.