Kidney ond Ureter

? Kidneys

Introduction

The kidneys are paired, bean-shaped excretory organs situated on the posterior abdominal wall.

They filter blood, regulate fluid and electrolyte balance, and excrete urine.

Right kidney lies slightly lower than the left, due to the presence of the liver.

Each kidney measures about 11 cm long, 6 cm wide, 3 cm thick, and weighs around 150 g (male), 135 g (female).

Situation and Relations

Vertebral level:

Extends from T12 to L3 vertebrae.

Right kidney slightly lower (½–1 cm) than left.

Orientation:

Upper poles are nearer the midline; lower poles are more lateral.

Long axis is oblique, directed downward and laterally.

Respiratory movement: Kidneys move about 2.5 cm downward during deep inspiration.

Dissection Overview

Posterior abdominal wall is exposed by removing the peritoneum and associated fat.

The renal fascia (Gerota’s fascia) encloses the kidney and suprarenal gland.

The kidney lies retroperitoneally, embedded in perinephric fat.

Hilum of Kidney

Located on medial border of kidney.

Contents (anterior ? posterior):

V – A – P – U

V: Renal vein

A: Renal artery

P: Pelvis of ureter (beginning of ureter)

U: Upper part of ureter (posterior to pelvis)

Relations of the Kidneys

Anterior Relations

Right Kidney:

Suprarenal gland (upper pole)

Liver

Second part of duodenum

Right colic flexure

Left Kidney:

Suprarenal gland (upper pole)

Stomach

Spleen

Pancreas

Left colic flexure and jejunal loops

Posterior Relations (both kidneys):

Diaphragm

Psoas major

Quadratus lumborum

Transversus abdominis

Subcostal vessels and nerves

12th rib (both kidneys) + 11th rib (left kidney only)

Capsules or Coverings of Kidney (from inside outward)

1. Fibrous capsule: Thin, adherent membrane closely applied to kidney surface.

2. Perinephric (perirenal) fat: Surrounds the kidney and vessels; acts as cushioning.

3. Renal fascia (Gerota’s fascia):

Anterior layer — fascia of Toldt.

Posterior layer — fascia of Zuckerkandl.

Encloses kidney and suprarenal gland.

4. Paranephric fat: Outer loose areolar fat between fascia and posterior abdominal wall.

Blood Supply of Kidney

Arterial Supply:

Renal artery from abdominal aorta at level of L1–L2.

Each divides into anterior and posterior divisions, giving 5 segmental arteries:

Apical

Upper (anterior superior)

Middle (anterior inferior)

Lower

Posterior

Segmental ? interlobar ? arcuate ? interlobular ? afferent arterioles ? glomeruli.

Venous Drainage:

Renal veins drain into the inferior vena cava.

Left renal vein is longer and crosses anterior to aorta (beneath superior mesenteric artery).

Left renal vein receives gonadal vein and suprarenal vein.

Lymphatic Drainage

Lymph from both kidneys drains into the lateral aortic (para-aortic) lymph nodes around the origin of the renal arteries.

Nerve Supply

Derived from renal plexus (sympathetic fibers from T10–L1).

Functions:

Vasomotor control of renal vessels.

Pain sensation carried via T10–T12 spinal segments (referred pain ? loin to groin).

Exposure of the Kidney from Behind

Patient placed prone; incision made parallel to 12th rib.

Muscles divided: latissimus dorsi, external oblique, internal oblique, transversus abdominis.

Renal fascia and perinephric fat exposed.

This approach avoids entering the peritoneal cavity (retroperitoneal exposure).

Histology of Kidney

Cortex: Contains renal corpuscles (glomeruli + Bowman’s capsule), proximal and distal convoluted tubules.

Medulla: Contains straight tubules and collecting ducts forming pyramids.

Nephron: Structural and functional unit; about 1–1.3 million per kidney.

Juxtaglomerular apparatus (JGA):

Formed by macula densa, juxtaglomerular cells, and lacis cells.

Regulates blood pressure via renin secretion.

Clinical Anatomy

Renal pain: Felt in loin region, radiating to groin and testis/labium majus.

Renal calculus (stones): Cause colicky pain, hematuria, and hydronephrosis.

Hydronephrosis: Dilation of renal pelvis and calyces due to urinary obstruction.

Polycystic kidney: Multiple cysts causing kidney enlargement and renal failure.

Perinephric abscess: Pus collection around kidney; confined by renal fascia.

Floating kidney (nephroptosis): Downward displacement due to loss of perinephric fat.

Renal biopsy: Usually taken from lower pole of left kidney (less vascular).

Summary Points

Retroperitoneal, bean-shaped organs at T12–L3.

Covered by fibrous capsule, perinephric fat, renal fascia, paranephric fat.

Five vascular segments—basis of partial nephrectomy.

Hilum order (A?P): Vein, Artery, Pelvis.

Left kidney higher and longer than right.

Referred pain: Loin to groin (T10–L2).

? Ureters

Introduction

The ureters are two narrow, muscular tubes conveying urine from kidneys to the urinary bladder.

They are retroperitoneal throughout their course.

Each ureter is about 25 cm (10 inches) long.

It begins at the pelviureteric junction and ends at the posterior wall of the urinary bladder.

Dimensions

Length: ~25 cm

Diameter: ~3 mm on average

The lumen is narrow and shows three normal constrictions (important for stone lodgment).

Normal Constrictions

Mnemonic: “Pelvic–Pelvic–Vesical” (P–P–V)

1. Pelviureteric junction – between renal pelvis and ureter (upper end).

2. Pelvic brim – where ureter crosses the external iliac vessels (midpoint).

3. Intravesical part – where ureter obliquely enters the bladder wall (lower end).

Clinical note: Stones (calculi) commonly lodge at these constrictions.

Relations

Anterior Relations

Right ureter:

2nd part of duodenum

Right colic and ileocolic vessels

Terminal ileum

Root of mesentery

Gonadal vessels

Left ureter:

Left colic vessels

Sigmoid colon and mesocolon

Gonadal vessels

Posterior Relations (both ureters):

Psoas major muscle

Genitofemoral nerve (crosses obliquely)

Bifurcation of common iliac artery

Abdominal Part of Ureter

Extends from pelviureteric junction to pelvic brim.

Lies on psoas major; crossed by gonadal vessels (testicular or ovarian).

Right ureter: Lateral to inferior vena cava.

Left ureter: Posterior to sigmoid mesocolon.

Enters pelvis by crossing bifurcation of common iliac artery (near sacroiliac joint).

Pelvic Part of Ureter

Extends from pelvic brim to bladder wall.

Lies in extraperitoneal connective tissue of lateral pelvic wall.

Related to internal iliac artery and its branches.

In males:

Crossed by the vas deferens near bladder.

Lies lateral to seminal vesicle and prostate base.

In females:

Crossed by the uterine artery (about 2 cm lateral to cervix).

Mnemonic: “Water (ureter) under the bridge (uterine artery).”

Related to the vaginal fornix and broad ligament.

Intravesical Part

Shortest segment (~1.5 cm).

Traverses obliquely through the bladder wall, forming a valve-like mechanism that prevents backflow (vesicoureteral reflux).

Opens at the ureteric orifices on the posterolateral angles of the trigone of bladder.

Blood Supply

Arterial supply:

Upper part: Renal artery

Middle part: Gonadal artery, aortic branches, and common iliac artery

Lower part: Superior vesical and uterine (female) or inferior vesical (male) arteries

Venous drainage: Corresponds to arteries; drains into renal, gonadal, and vesical veins.

Nerve Supply

From renal, aortic, hypogastric, and vesical plexuses.

Sympathetic fibers: T11–L2 ? vasomotor control.

Parasympathetic fibers: S2–S4 ? peristaltic movements.

Referred pain: Follows T11–L2 dermatomes ? from loin to groin, scrotum, or labium majus.

Histology

Mucosa: Transitional epithelium (urothelium).

Lamina propria: Fibroelastic tissue with small glands.

Muscular layer:

Upper two-thirds ? inner longitudinal + outer circular.

Lower third ? inner longitudinal + middle circular + outer longitudinal (three layers).

Adventitia: Fibrous connective tissue containing blood vessels and nerves.

Development of Kidney and Ureter

Kidney and ureter develop from intermediate mesoderm (nephrogenic cord).

Ureteric bud (metanephric diverticulum):

Arises from mesonephric duct.

Forms ureter, renal pelvis, calyces, and collecting ducts.

Metanephric blastema (metanephric cap):

Forms nephrons (glomerulus, tubules, loop of Henle, distal convoluted tubule).

Ascent of kidney:

Initially in pelvic region ? ascends to lumbar region.

Blood supply shifts from common iliac to abdominal aorta branches.

Anomalies of Kidney and Ureter

1. Pelvic kidney: Kidney fails to ascend; remains in pelvis.

2. Horseshoe kidney: Fusion of lower poles across midline; ascent blocked by inferior mesenteric artery.

3. Crossed ectopia: One kidney crosses to the opposite side; ureter still enters its normal bladder side.

4. Double ureter: Due to bifid ureteric bud; may open separately or unite before bladder.

5. Retrocaval ureter: Ureter passes behind inferior vena cava ? hydronephrosis.

6. Supernumerary kidney: Rare; additional kidney with separate blood supply.

7. Polycystic kidney: Failure of nephron-collecting duct union ? multiple cysts.

8. Duplex pelvis: Partial duplication of ureteric bud ? double pelvis but single ureter.

Clinical Anatomy

Ureteric colic:

Pain due to stone (calculus) obstruction; radiates loin ? groin ? scrotum/labium majus ? medial thigh.

Hydronephrosis:

Dilation of renal pelvis and calyces from ureteral obstruction.

Injury during surgery:

Common in hysterectomy (ureter near uterine artery).

Reflux (vesicoureteral):

Due to short intramural ureter; causes infection and kidney damage.

Congenital anomalies:

Horseshoe and pelvic kidneys predispose to stones and infections.

Retrograde pyelography:

Contrast dye injected through bladder to visualize ureter and renal pelvis.

Summary Points

Length: 25 cm; retroperitoneal.

Constrictions: 3 — pelviureteric, pelvic brim, intravesical.

Relations:

Males – crossed by vas deferens.

Females – crossed by uterine artery.

Blood supply: Renal ? gonadal ? vesical.

Nerve supply: T11–L2 (sympathetic) & S2–S4 (parasympathetic).

Histology: Transitional epithelium + muscular coat (2 layers ? 3 layers).

Pain: Loin to groin.

? Mnemonics – Kidneys and Ureters

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1. Relations of Kidney (Anterior Surface)

Right kidney: “DCRL – Duodenum, Colon, Right lobe of liver, Loop of ileum**”

Left kidney: “SPCLK – Spleen, Pancreas, Colon, Left kidney (hilum with vessels), Jejunum (K for jejunum loops)**”

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2. Structures at the Hilum of Kidney (Front to Back)

Mnemonic: “VAP”

V ? Renal Vein (most anterior)

A ? Renal Artery (middle)

P ? Pelvis of ureter (posterior)

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3. Posterior Relations of Kidney

Mnemonic: “11DQTS”

11th and 12th ribs (left kidney both; right only 12th)

D ? Diaphragm

Q ? Quadratus lumborum

T ? Transversus abdominis

S ? Subcostal vessels and nerves

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4. Coverings of the Kidney

Mnemonic: “FPRP” (Fibrous–Peri–Renal–Para)

1. Fibrous capsule

2. Perinephric fat

3. Renal fascia (Gerota’s fascia)

4. Paranephric fat

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5. Segmental Arteries of Kidney

Mnemonic: “AULPS”

A ? Apical

U ? Upper (anterior superior)

L ? Lower (anterior inferior)

P ? Posterior

S ? Segmental (middle)

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6. Constrictions of Ureter

Mnemonic: “P–B–W” ? Pelviureteric, Brim, Wall

Pelviureteric junction

Pelvic brim (crosses iliac vessels)

Wall of bladder (intravesical part)

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7. Relations of Ureter in Females

Mnemonic: “Water under the bridge”

? The ureter passes under the uterine artery near the cervix.

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8. Nerve Supply and Pain Pathway

Mnemonic: “T11–L2 Loin to Groin”

? Referred pain from ureter travels along dermatomes T11–L2 to loin, groin, scrotum/labium majus.

? Facts to Remember – Kidneys and Ureters

Kidneys

Position: Retroperitoneal, on posterior abdominal wall opposite T12–L3 vertebrae.

Right kidney slightly lower due to liver.

Perinephric fat acts as a shock absorber and maintains position.

Renal fascia (Gerota’s) fuses medially with fascia covering great vessels and laterally with transversalis fascia.

Hilum contents (A?P): Vein, Artery, Pelvis.

Left kidney longer and narrower than right; upper pole nearer diaphragm.

Functional segments: Five (AULPS) – basis for partial nephrectomy.

Renal vein lies anterior to artery and pelvis; left vein longer, crossing anterior to aorta.

Kidney movement: Descends ~2.5 cm with respiration.

Renal angle: Between 12th rib and lateral border of erector spinae – site for kidney palpation.

Ureters

Length: 25 cm; retroperitoneal.

Three constrictions: At pelvis, pelvic brim, and bladder wall.

Relations:

Males: Crossed by vas deferens.

Females: Crossed by uterine artery (“water under bridge”).

Arterial supply: Segmental – upper (renal), middle (gonadal), lower (vesical/uterine).

Venous drainage: Corresponds to arterial pattern.

Histology: Transitional epithelium with two muscular layers (upper) and three (lower).

Referred pain: Loin ? groin ? scrotum/labium majus.

Pelvic entry: Crosses bifurcation of common iliac artery near sacroiliac joint.

Intravesical part: Oblique course through bladder wall ? prevents reflux.

Surgical importance: Avoid injury during hysterectomy (close relation to uterine artery).

Development and Anomalies

Kidney: Develops from metanephros (5th week).

Ureter: From ureteric bud (outgrowth of mesonephric duct).

Anomalies:

Pelvic kidney – fails to ascend.

Horseshoe kidney – fused lower poles, halted ascent by inferior mesenteric artery.

Crossed ectopia – one kidney crosses midline.

Double ureter – bifid ureteric bud.

Retrocaval ureter – behind IVC.

Polycystic kidney – cystic dilation of nephrons.

Clinical Essentials

Pain of renal/ureteric colic: Radiates from loin to groin.

Hydronephrosis: Dilatation due to ureteric obstruction.

Perinephric abscess: Confined by renal fascia.

Floating ki

dney (nephroptosis): Downward displacement due to loss of fat.

Renal biopsy: Lower pole of left kidney – safer and less vascular.

Common stone sites: Pelviureteric junction, pelvic brim, intravesical part.

?? Clinicoanatomical Problems – Kidneys and Ureters

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1. Pain from a Renal Stone

A 40-year-old male presents with severe pain radiating from the loin to groin, associated with nausea and vomiting.

? Diagnosis: Renal or ureteric calculus (stone).

? Anatomical reason: Pain travels along T11–L2 segments (renal and ureteric nerves), hence radiates to loin, groin, scrotum or labium majus, and upper medial thigh.

? Common sites of stone impaction:

1. Pelviureteric junction

2. Pelvic brim (crossing iliac vessels)

3. Intravesical part of ureter

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2. Hydronephrosis

A patient with long-standing renal obstruction develops a swollen kidney with a thin cortex.

? Cause: Obstruction at the ureter causes urine backflow into the pelvis and calyces.

? Result: Progressive dilatation of renal pelvis ? compression and atrophy of renal parenchyma ? loss of function.

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3. Perinephric Abscess

A patient with fever and flank swelling shows a localized pus collection near the kidney.

? Explanation: Infection around kidney confined by renal fascia (Gerota’s fascia).

? Spread: May track downwards into pelvis or upward into subphrenic space.

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4. Floating (Ptotic) Kidney

A thin woman complains of flank pain that increases on standing but disappears when lying down.

? Diagnosis: Nephroptosis (floating kidney).

? Reason: Loss of perinephric fat and laxity of renal fascia, causing the kidney to descend abnormally.

? Differentiation: Unlike ectopic kidney, the ureter is of normal length.

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5. Renal Angle Tenderness

A patient with urinary tract infection shows tenderness at the renal angle.

? Definition: Angle between 12th rib and lateral border of erector spinae.

? Significance: Pain or tenderness here indicates renal inflammation or infection (pyelonephritis).

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6. Renal Vein Entrapment Syndrome (Nutcracker Syndrome)

A young male complains of left flank pain and visible hematuria.

? Cause: Compression of left renal vein between superior mesenteric artery and aorta.

? Effect: Increased venous pressure ? hematuria, left testicular pain, and varicocele.

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7. Perirenal Hemorrhage

A patient sustains blunt trauma over the flank and develops shock.

? Mechanism: Renal vessels or parenchyma rupture ? blood collects within perinephric space bounded by renal fascia.

? Imaging: CT shows perirenal hematoma outlining the kidney.

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8. Polycystic Kidney

A 30-year-old patient has bilateral enlarged kidneys with multiple cysts and features of renal failure.

? Cause: Congenital failure of union between collecting ducts and nephrons.

? Result: Progressive cystic dilation, hypertension, and renal insufficiency.

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9. Congenital Pelvic Kidney

A neonate’s ultrasound shows a kidney located in the pelvis.

? Cause: Failure of ascent of the metanephric kidney during development.

? Clinical significance: May compress pelvic structures or be mistaken for pelvic mass.

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10. Horseshoe Kidney

An adult presents with midline abdominal mass below umbilicus.

? Cause: Fusion of lower poles of both kidneys during ascent; arrested by inferior mesenteric artery.

? Clinical relevance: Usually asymptomatic but prone to infection, stone formation, and hydronephrosis.

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11. Crossed Renal Ectopia

CT scan shows both kidneys on the right side, with one ureter crossing midline.

? Mechanism: One kidney crosses over during ascent; ureter enters bladder on its own side.

? Result: Often asymptomatic but may cause obstruction or infection.

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12. Retrocaval Ureter

A young male presents with recurrent right loin pain and hydronephrosis.

? Cause: Ureter passes behind the inferior vena cava due to abnormal venous development.

? Radiological sign: “Fish-hook” or “S-shaped” deformity on imaging.

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13. Duplex Ureter

During IVU, two ureters are seen on one side joining before entering the bladder.

? Cause: Partial duplication of ureteric bud.

? Clinical effect: Urinary infection or reflux if both open separately.

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14. Double Kidney

Two separate kidneys are seen on one side, each with its own ureter.

? Cause: Complete duplication of ureteric bud.

? Clinical effect: May lead to hydronephrosis or infection.

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15. Renal Transplantation

In renal transplantation, the donor kidney is placed in the iliac fossa.

? Reason:

Easy access to iliac vessels for anastomosis.

Shorter course of ureter to bladder.

? Anatomical importance: The transplanted kidney lies extraperitoneally in pelvis.

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16. Referred Pain of Ureteric Colic

A patient with ureteric calculus experiences pain radiating to the scrotum and inner thigh.

? Explanation: Due to common nerve supply of ureter, testis, and thigh skin (T11–L2 segments).

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17. Ureteral Injury During Hysterectomy

Post-operative patient develops anuria from one kidney.

? Cause: Ureter accidentally ligated with uterine artery during hysterectomy.

? Anatomical reason: The ureter passes under the uterine artery near cervix (“water under the bridge”).

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18. Vesicoureteral Reflux

A child has recurrent urinary infections due to backflow of urine from bladder to ureter.

? Cause: Short intramural ureter ? failure of oblique valve-like entry into bladder.

? Effect: Leads to hydronephrosis and renal scarring.

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19. Nephrectomy (Kidney Removal)

Surgeon mobilizes the kidney for removal.

? Precautions:

Preserve suprarenal gland and its vessels.

Identify and control renal artery before vein (to prevent congestion).

Avoid injury to colon and duodenum (anterior relations).

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20. Renal Biopsy Site

A biopsy needle is inserted at the lower pole of left kidney.

? Reason:

Lower pole is less vascular.

Left kidney avoids interference from liver on the right side.

? Clinical value: For diagnosis of glomerular and interstitial diseases.

Summary

These 20 cases cover:

Renal pathologies: Stones, infections, cysts,

abscess, trauma.

Developmental anomalies: Ectopia, horseshoe, duplication, retrocaval ureter.

Surgical importance: Biopsy, hysterectomy, nephrectomy, transplant.

Functional issues: Pain, reflux, hydronephrosis.

? Frequently Asked Questions – Kidneys and Ureters

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1. What is the position of the kidneys in the body?

The kidneys lie on the posterior abdominal wall in the epigastric, hypochondriac, lumbar, and umbilical regions, opposite T12–L3 vertebrae. The right kidney is slightly lower than the left due to the liver.

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2. What are the coverings of the kidney?

From inside outward:

1. Fibrous capsule

2. Perinephric fat

3. Renal fascia (Gerota’s fascia)

4. Paranephric fat

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3. What are the structures at the hilum of the kidney?

From anterior to posterior ? Vein, Artery, Pelvis (VAP).

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4. What is the renal sinus?

It is a fat-filled space within the kidney that contains renal pelvis, calyces, vessels, nerves, and fat.

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5. What is the difference between right and left renal veins?

Right renal vein ? shorter, opens directly into IVC.

Left renal vein ? longer, crosses anterior to aorta and posterior to SMA.

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6. What is the renal angle?

It is the angle between the 12th rib and lateral border of erector spinae.

? Tender in renal inflammation (pyelonephritis).

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7. What are the constrictions of the ureter?

1. Pelviureteric junction

2. Pelvic brim (crossing external iliac vessels)

3. Intravesical part (bladder wall)

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8. Why do ureteric stones cause loin-to-groin pain?

Because pain fibers from the ureter reach T11–L2 spinal segments, producing referred pain along the corresponding dermatomes.

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9. What are the main arteries supplying the ureter?

Upper part ? Renal artery

Middle part ? Gonadal and aortic branches

Lower part ? Vesical and uterine arteries

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10. What is the relation of ureter to uterine artery?

In females, the ureter passes under the uterine artery near the cervix — “Water under the bridge”.

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11. What are the developmental origins of the kidney and ureter?

Kidney: From metanephric blastema.

Ureter: From ureteric bud (outgrowth from mesonephric duct).

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12. Why is the left kidney preferred for transplantation?

Because the left renal vein is longer, making vascular anastomosis easier.

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13. What are the major relations of the kidneys anteriorly?

Right kidney: Liver, duodenum, colon.

Left kidney: Spleen, stomach, pancreas, colon, and jejunum.

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14. What is the function of the renal fascia (Gerota’s fascia)?

It anchors the kidney, separates it from suprarenal gland, and limits spread of infection or abscess.

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15. What is nephroptosis?

Also called floating kidney — abnormal downward displacement due to loss of perinephric fat and fascial support.

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16. What is hydronephrosis?

Dilatation of renal pelvis and calyces due to obstruction in ureter or urethra, leading to compression and atrophy of renal tissue.

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17. What is the difference between hydronephrosis and pyonephrosis?

Hydronephrosis: Urine accumulation (non-infective).

Pyonephrosis: Pus accumulation (infected hydronephrosis).

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18. What is a horseshoe kidney?

Fusion of lower poles of both kidneys; ascent is arrested by the inferior mesenteric artery.

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19. What is a retrocaval ureter?

The ureter passes behind the inferior vena cava due to abnormal venous development ? causes hydronephrosis.

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20. What are the functions of the kidney?

Excretion of metabolic waste.

Regulation of blood volume and pressure.

Acid-base and electrolyte balance.

Erythropoietin production.

Activation of Vitamin D.

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21. What are common congenital anomalies of the kidney?

Pelvic kidney

Horseshoe kidney

Crossed ectopia

Polycystic kidney

Double ureter

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22. What is the segmental arterial distribution of the kidney?

Five segments — Apical, Upper, Middle, Lower, Posterior (Mnemonic: AULPS).

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23. What is the difference between nephroptosis and ectopic kidney?

Nephroptosis: Descended normal kidney with normal ureter length.

Ectopic kidney: Congenitally misplaced kidney with short ureter.

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24. Why is renal biopsy done from the lower pole?

The lower pole is less vascular, reducing risk of bleeding and injury to renal vessels.

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25. What is the ureter’s course in males and females?

Males: Crossed by vas deferens near bladder.

Females: Crossed by uterine artery near cervix.

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26. What is vesicoureteral reflux?

Backward flow of urine from bladder to ureter due to defective oblique entry of ureter ? leads to infection and hydronephrosis.

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27. What is the surgical significance of renal fascia?

It must be incised during nephrectomy and confines perinephric abscess or hemorrhage within a limited area.

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28. What are the histological features of the ureter?

Epithelium: Transitional (urothelium)

Muscular coat: Inner longitudinal, outer circular (upper part); additional outer longitudinal (lower part)

Adventitia: Connective tissue with vessels and nerves

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29. What is the difference between right and left kidneys in relation to ribs?

Right kidney: Related only to 12th rib.

Left kidney: Related to 11th and 12th ribs.

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30. What are the structures anterior to the ureter in the abdomen?

Gonadal vessels

Colic vessels

Root of mesentery

Peritoneum

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31. How is renal pain differentiated from muscle pain?

Renal pain is deep, dull, and radiating, while muscle pain is localized and affected by movement.

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32. Why are kidneys retroperitoneal?

They develop in the posterior wall and remain behind the peritoneum throughout life.

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33. What is the functional unit of the kidney?

The nephron, comprising glomerulus, tubules, loop of Henle, and distal convoluted tubule.

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34. What is the ureteric colic pain pathway?

Pain follows sympathetic fibers to T11–L2 spinal segments, producing referred pain to loin, groin, genitalia, and medial thigh.

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35. What are the causes of hydronephrosis?

Stones

Ureteric stricture

Tumor

Enlarged prostate

Vesicoureteral reflux

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36. What is the difference between cortical and medullary regions of kidney histologically?

Cortex: Glomeruli + convoluted tubules

Medulla: Straight tubules + collecting ducts

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37. What is the arterial supply of suprarenal gland versus kidney?

Suprarenal gland: Three arteries (superior, middle, inferior).

Kidney: Single renal artery dividing into segmental branches.

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38. Why is ureteral peristalsis not dependent on gravity?

Because smooth muscle contractions in the wall propel urine toward the bl

adder.

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39. What is the clinical importance of the oblique course of ureter through bladder wall?

It acts as a valve during bladder contraction, preventing vesicoureteral reflux.

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40. What is the surgical plane for approaching kidney posteriorly?

Between latissimus dorsi and external oblique (lumbar incision), avoiding peritoneal cavity entry.

? Multiple Choice Questions – Kidneys and Ureters

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1. The kidneys are located at the level of:

A. T10–L2

B. T11–L2

C. T12–L3 ?

D. L1–L4

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2. The right kidney lies lower than the left because of:

A. Stomach

B. Spleen

C. Liver ?

D. Pancreas

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3. Which of the following passes anterior to the right kidney?

A. Spleen

B. Duodenum ?

C. Stomach

D. Pancreas

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4. The structures at the hilum of kidney from anterior to posterior are:

A. Artery, Vein, Pelvis

B. Pelvis, Artery, Vein

C. Vein, Artery, Pelvis ?

D. Artery, Pelvis, Vein

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5. The fibrous capsule of the kidney is:

A. Vascular and adherent

B. Non-vascular and easily stripped off ?

C. Firmly adherent

D. Absent

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6. The renal fascia is also called:

A. Colles’ fascia

B. Gerota’s fascia ?

C. Camper’s fascia

D. Scarpa’s fascia

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7. The perinephric abscess is limited by:

A. Fibrous capsule

B. Perinephric fat

C. Renal fascia (Gerota’s) ?

D. Paranephric fat

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8. The anterior surface of the left kidney is related to all EXCEPT:

A. Stomach

B. Spleen

C. Liver ?

D. Pancreas

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9. The posterior surface of right kidney is related to:

A. 11th and 12th ribs

B. 12th rib only ?

C. 10th and 11th ribs

D. None

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10. The segmental branches of the renal artery are:

A. 3

B. 4

C. 5 ?

D. 6

---

11. Which is the most posterior structure at the renal hilum?

A. Renal vein

B. Pelvis of ureter ?

C. Renal artery

D. Lymphatics

---

12. The right renal vein drains directly into:

A. Left renal vein

B. Portal vein

C. Inferior vena cava ?

D. Azygos vein

---

13. Which is the narrowest part of ureter?

A. Pelvic brim

B. Pelviureteric junction

C. Intravesical part

D. Intravesical part (as it pierces bladder wall) ?

---

14. Which of the following arteries supplies the middle part of the ureter?

A. Renal artery

B. Gonadal artery ?

C. Vesical artery

D. Inferior mesenteric artery

---

15. The normal length of ureter is about:

A. 15 cm

B. 20 cm

C. 25 cm ?

D. 30 cm

---

16. Pain from ureteric colic is referred to:

A. Scapular region

B. Loin to groin ?

C. Left hypochondrium

D. Right shoulder

---

17. The ureter passes under which artery in females?

A. Ovarian

B. Uterine ?

C. Vesical

D. Umbilical

---

18. Which part of ureter is most likely injured during hysterectomy?

A. Abdominal part

B. Pelvic part near uterine artery ?

C. Pelviureteric junction

D. Bladder entry

---

19. Horseshoe kidney results due to fusion of:

A. Upper poles

B. Lower poles ?

C. Middle parts

D. Entire kidneys

---

20. In horseshoe kidney, ascent is arrested by:

A. Aorta

B. Gonadal vessels

C. Inferior mesenteric artery ?

D. Common iliac artery

---

21. The kidney develops from:

A. Mesonephros

B. Pronephros

C. Metanephros ?

D. Cloaca

---

22. Ureter develops from:

A. Mesonephric duct

B. Ureteric bud ?

C. Metanephric blastema

D. Cloacal membrane

---

23. Which condition is due to failure of ascent of kidney?

A. Pelvic kidney ?

B. Floating kidney

C. Horseshoe kidney

D. Crossed ectopia

---

24. Which artery crosses anterior to the left renal vein?

A. Celiac trunk

B. Superior mesenteric artery ?

C. Inferior mesenteric artery

D. Gonadal artery

---

25. Which vein is longer?

A. Left renal vein ?

B. Right renal vein

C. Both equal

D. Depends on position

---

26. Renal pain is felt in:

A. Right shoulder

B. Epigastrium

C. Loin ?

D. Umbilicus

---

27. The renal sinus contains all EXCEPT:

A. Renal pelvis

B. Renal capsule ?

C. Calyces

D. Vessels

---

28. The ureteric peristalsis is controlled by:

A. Voluntary control

B. Autonomic nervous system ?

C. Somatic nerves

D. None

---

29. The peritoneal relation of kidney is:

A. Intraperitoneal

B. Retroperitoneal ?

C. Subperitoneal

D. Extraperitoneal

---

30. Pain from the kidney is referred to which dermatome level?

A. T8–T10

B. T11–L2 ?

C. L3–L4

D. T10–T12

---

31. The right ureter passes posterior to:

A. Duodenum

B. Gonadal vessels

C. Both A and B ?

D. Colon

---

32. The most common site for a renal stone to lodge is:

A. Pelvic brim

B. Pelviureteric junction ?

C. Intravesical part

D. Bladder neck

---

33. Which of the following is a retrocaval ureter associated with?

A. Aorta

B. Inferior vena cava ?

C. Portal vein

D. Gonadal vein

---

34. During nephrectomy, which structure is clamped first?

A. Renal vein

B. Renal artery ?

C. Ureter

D. Adrenal vein

---

35. Floating kidney occurs due to:

A. Excess perinephric fat

B. Loss of perinephric fat and lax fascia ?

C. Fusion of kidneys

D. Extra artery

---

36. Polycystic kidney disease is due to:

A. Infection

B. Failure of union between collecting and secretory parts ?

C. Congenital obstruction

D. Stone formation

---

37. Which structure lies between the kidney and suprarenal gland?

A. Diaphragm

B. Renal fascia (septum) ?

C

. Peritoneum

D. Colon

---

38. The lower pole of the kidney is related to:

A. Diaphragm

B. Suprarenal gland

C. Colon ?

D. Stomach

---

39. The medullary pyramids drain into:

A. Minor calyces ?

B. Major calyces

C. Renal pelvis

D. Ureter

---

40. Which part of the ureter is intramural?

A. Within bladder wall ?

B. At pelvic brim

C. Pelvic part

D. Abdominal part

?? Viva Voce – Kidneys and Ureters

---

1. Where are the kidneys situated?

Behind the peritoneum on the posterior abdominal wall, one on each side of the vertebral column — opposite T12 to L3 vertebrae.

---

2. Which kidney is lower and why?

The right kidney lies lower because of the presence of the liver above it.

---

3. What is the shape of the kidney?

Bean-shaped — convex laterally and concave medially.

---

4. What are the poles of the kidney?

Upper pole (related to suprarenal gland) and lower pole (near iliac crest).

---

5. What is the hilum of kidney?

A vertical slit on the medial border allowing entry and exit of vessels, nerves, and ureter.

---

6. What is the arrangement of structures at the hilum from anterior to posterior?

Vein ? Artery ? Pelvis (Mnemonic: VAP).

---

7. What is the renal sinus?

A fat-filled space inside the kidney containing pelvis, calyces, vessels, and nerves.

---

8. What are the coverings of the kidney?

1. Fibrous capsule

2. Perinephric fat

3. Renal fascia (Gerota’s)

4. Paranephric fat

---

9. What is the function of the renal fascia?

Anchors kidney and limits the spread of infection or hemorrhage.

---

10. What is the renal angle and what is its clinical importance?

Angle between 12th rib and lateral border of erector spinae; tenderness here indicates renal inflammation.

---

11. What are the posterior relations of the kidney?

Diaphragm, psoas major, quadratus lumborum, transversus abdominis, 12th rib, and subcostal vessels and nerves.

---

12. Name the arteries supplying the kidney.

Each kidney is supplied by a renal artery from the abdominal aorta.

---

13. What are the segmental branches of renal artery?

Apical, Upper (anterior superior), Middle (anterior inferior), Lower, and Posterior.

---

14. Which renal vein is longer and why?

The left renal vein is longer as it crosses the aorta to reach the inferior vena cava.

---

15. What is the embryological origin of the kidney?

From the metanephros.

---

16. What is the embryological origin of the ureter?

From the ureteric bud, an outgrowth from the mesonephric duct.

---

17. What is the peritoneal relation of the kidney?

It is retroperitoneal.

---

18. What are the three normal constrictions of the ureter?

1. Pelviureteric junction

2. Pelvic brim

3. Intravesical part (entry into bladder)

---

19. What is the total length of ureter?

Approximately 25 cm.

---

20. What is the arterial supply of the ureter?

Upper part: Renal artery

Middle part: Gonadal and aortic branches

Lower part: Vesical or uterine arteries

---

21. What is the nerve supply of the ureter?

From renal, aortic, and hypogastric plexuses — T11–L2 spinal segments.

---

22. What is the course of the ureter in females?

It passes under the uterine artery near the cervix — “water under the bridge”.

---

23. What is the course of the ureter in males?

It is crossed anteriorly by the vas deferens near the bladder.

---

24. What is the significance of the oblique course of the ureter in the bladder wall?

Prevents reflux of urine from bladder to ureter during micturition.

---

25. What are the constrictions of the ureter clinically important for?

Common sites for stone impaction (calculi).

---

26. What are the symptoms of renal colic?

Severe pain radiating from loin to groin, nausea, vomiting, and hematuria.

---

27. What is hydronephrosis?

Dilatation of renal pelvis and calyces due to obstruction to urine outflow.

---

28. What is nephroptosis?

Downward displacement of kidney due to loss of perinephric fat and fascial support.

---

29. What is horseshoe kidney?

Fusion of lower poles of kidneys; ascent stopped by inferior mesenteric artery.

---

30. What is polycystic kidney?

Congenital cystic dilatation of nephrons leading to large, cyst-filled kidneys.

---

31. What is retrocaval ureter?

Ureter passing behind the inferior vena cava, causing obstruction.

---

32. What is the difference between ectopic kidney and floating kidney?

Ectopic: Congenital failure of ascent, short ureter.

Floating: Acquired descent, normal ureter length.

---

33. Why is the left kidney preferred for donation?

Because the left renal vein is longer, facilitating vascular anastomosis.

---

34. What is the site of renal biopsy and why?

Lower pole of left kidney — safer, less vascular, and avoids liver injury.

---

35. What are the relations of ureter at the pelvic brim?

Crossed anteriorly by gonadal vessels and posteriorly by iliac vessels.

---

36. What is vesicoureteral reflux?

Backward flow of urine from bladder to ureter due to failure of the oblique intramural valve.

---

37. What is the function of the kidney?

Excretion, osmoregulation, acid-base balance, BP control, erythropoietin and renin secretion, and vitamin D activation.

---

38. What is the difference between cortical and juxtamedullary nephrons?

Cortical: Short loops, mainly filtration.

Juxtamedullary: Long loops, maintain concentration gradient.

---

39. What is the commonest cause of renal angle tenderness?

Acute pyelonephritis.

---

40. What are the three layers of the ureter wall?

1. Mucosa: Transitional epithelium

2. Muscle: Inner longitudinal, outer circular (plus third outer longitudinal in lower part)

3. Adventitia: Connective tissue

---

41. What is Nutcracker syndrome?

Compression of the left renal vein between aorta and superior mesenteric artery, causing hematuria and varicocele.

---

42. What happens if the ureter is ligated accidentally during hysterectomy?

Urine backs up ? hydronephrosis of the corresponding kidney.

---

43. What is the function of perinephric fat?

Acts as a shock absorber and supports kidney position.

---

44. What is the most common cause of hydronephrosis in infants?

Congenital pelviureteric junction obstruction.

---

45. What is the site of referred pain in ureteric calculus?

Loin, groin, scrotum/labium majus, and inner thigh (T11–L2 dermatomes).

These viva questions cover anatomy, relations, embryology, clinical correlations, and surgical anatomy — the same focus areas used in professional practical exams.