

Vocabulary	
Nephron	Microscopic functional unit of a kidney that forms urine.
Renal parenchyma	Consists of medulla and cortex
Renal cortex	Outer portion of kidney
Inner medulla	Contains pyramids and columns of Bertin
Columns of Bertin	Separates renal pyramids
Medullary pyramids	Transports urine to minor calyces.
Renal sinus	Contains renal hilum and collecting system
Renal hilum	Opening into sinus. Where blood vessels, nerves, lymphatics enter and exit the kidney.
Collecting system	Consists of minor and major calyces.
Minor calyces	Receive urine from medullary pyramids.
Major calyces	Receive urine from minor calyces and dumps urine into renal pelvis.
Renal pelvis	Holds urine before transporting it to the ureter.
Ureter	Transports urine to urinary bladder
Hydronephrosis	Swelling of ureter
Morrison's pouch	Space that separates the right kidney and liver.
Renal Corpuscle	Consists of Bowmans capsule and glomerulus
Bowman's capsule	covers glomerulus

Vocabulary (cont)	
Glomerulus	Filters, connected to tubules.
Active transport	Requires cellular energy to move material
Passive transport	Material moves from high pressure to low pressure
Nephrectomy	Removal of kidney.
Compensatory Hypertrophy	Kidney enlargement due to one kidney missing; it is compensating for the other one.
Hydronephrosis	Abnormal accumulation of fluid within the kidneys.

Patient Prep	
Transducer	3-5 MHz
Patient Position	Supine, RLD, LLD, prone
No patient prep unless if there will be a renal doppler study. If so then NPO for 6-8 hours.	

Main Function	
Filtration:	get rid of waste products in blood
Produce Urine:	purify blood by secreting urine
Maintain homeostasis:	Regulate temperature and maintain water
Produces hormones	
Note that the functional unit is the nephron!	

Location	
Retroperitoneal:	Behind the peritoneum
Right kidney is lower than the left due to the liver	

Location (cont)	
Posterior to kidneys are	- Diaphragm - Psoas muscle - transversus muscle - and quadratus lumborum
Anterior to right kidney	RLL, 2nd part duodenum, Morrison's pouch, hepatic flexure, jejunum or ileum of small bowel.
Anterior to left kidney	Stomach, tail of pancreas, spleen, Left adrenal gland, splenic flexure of colon.

Sonographic Appearance	
Overall	Heterogeneous
Renal Capsule	Hyperechoic, thin wall on the outside of the kidney
Renal Cortex	Homogeneous. 1/3 less echogenic than the liver and spleen.
Renal Medulla	Anechoic; depending on urine.
Renal Sinus	Hyperechoic due to renal fat.
Renal Vasculature	Anechoic with echogenic walls
Ureters	Not seen on ultrasound unless if hydronephrosis happens.

Measurements			
Normal	Long: 9-13 cm	Wide: 5-7.5 cm	Thick: 2-3 cm
Abnormal	Long: less than 8 cm		



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Measurements (cont)

Compensatory Hypertrophy Kidney gets bigger if one was removed

Kidneys may shrink with age or renal disease.

Normal Variants

Dromedary Hump Bulge on lateral border of kidney; most common on left kidney.

Hypertrophied Column of Bertin Column of Bertin extends into sinus of kidney

Duplicated Collecting System Sinus is divided into 2 which may cause there to be 2 ureters as well.

Horseshoe kidney Kidneys are connected; typically at lower poles.

Junctional Parenchymal Defect Triangular echogenic area located anterior and superior.

Supernumerary Kidney More than 2 kidneys

Renal Agenesis Absence of kidney; No kidney found

Renal Ectopia Kidney is not located in its normal location; most commonly found at the pelvis.

Cross-Fused Ectopia Kidneys are on the same side

Extrarenal pelvis Renal pelvis is outside of the renal hilum

Fetal Lobulation Indentations between pyramids

Anatomy of Kidney (outer to inner)

Gerota fascia Outer layer covering kidney and adrenal glands

Adipose capsule fatty layer located in perinephric space

True capsule inner most layer

Renal parenchyma Consists of cortex and medulla

- Cortex Between true capsule and medulla; nephrons are located here

- Medulla Consists of medullary pyramids and columns of Bertin.

Medullary pyramids Pass urine to minor calyces

Column of Bertin separates medullary pyramids

Renal Sinus Consists of renal hilum and collecting system

- Renal Hilum Space where arteries, veins, ureters, and lymphatic vessels enter

- Collecting system Consists of calyces and renal pelvis

Minor calyces Receive urine from medullary pyramids

Major calyces Receives urine from minor calyces

Renal pelvis Receives urine from major calyces. Reservoir for urine.

Ureter Passes urine from renal pelvic into urinary bladder.

Divisions of the Kidney

The kidney is divided into 3 portions:

Cortex: Outer portion, homogeneous; darkest portion of kidney. Contains: renal corpuscle, proximal and distal convoluted tubules.

Medulla: Middle portion, anechoic Contains: loop of henle, pyramids, and columns of bertin.

Sinus: Central portion Contains: Renal vein and artery, fatty tissue, nerves & lymphatics.

Remember that the cortex and medulla make up the renal parenchyma.

Indications for an Ultrasound

Urinary system obstruction

Enlarged ureters

Renal size

Comparison after therapy

Ultrasound guided biopsies or fluid aspiration

Abscess or hematoma

Protective Coverings

True (renal) Capsule innermost layer, fibrous capsule.

Adipose Capsule Middle layer, perirenal fat; anchors kidney to muscles

Gerota Fascia Outer most layer, surrounds kidneys and adrenal glands.



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Anatomy of Nephron

Nephron	Functional unit of a kidney; helps produce urine.
Afferent arteriole	Sends blood to glomerulus
Glomerulus	Filters blood, passive transport
Efferent arteriole	Carries blood out of glomerulus
Bowmans capsule	Surrounds glomerulus, filtrate (ion, amino acids, sodium, glucose) enters into capsule.
Proximal convoluted tubule	Reabsorption of useful substances; water, glucose, vitamins, amino acids etc. (active transport).
Loop of henle	Consists of ascending and descending limbs.
Ascending limb	Makes medulla salty
Descending limb	Permeable to water (water leaves loop for reabsorption).
Distal convoluted tubule	Reabsorption, dumps waste into collecting ducts.
Collecting ducts	Waste enters then goes into ureters.

Vasculature

Renal artery	Located at hilum
Segmental (lobar) artery	Sinus
Interlobar artery	Between pyramids
Arcuate artery	Base pyramid
Interlobular artery	Cortex
Afferent arterioles	Cortex
Glomerulus	Cortex
Efferent arteriole	Cortex

Vasculature (cont)

Peritubular capillaries	Cortex
Vasa recta	
Interlobular vein	Cortex
Arcuate vein	Base pyramid
interlobar veins	Between pyramids
Segmental (lobar) veins	Sinus
Renal vein	Hilum



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