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 the 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		

By **Alyssabruestle1**

cheatography.com/alyssabruestle1/

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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.
Hypert-rophied 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 Parenc-hymal Defect	Triangular echogenic area located anterior and superior.
Supern-umerary 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 perine-phric 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, homoge-neous; 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.

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