ANSWERS: CHAPTER 10

MATCHING

1. d  5. f  9. m  13. e
2. h  6. l  10. g  14. c
3. b  7. a  11. i
4. j  8. k  12. n

IMAGE LABELING

1A. Liver
1B. Right kidney
1C. Pancreas
1D. Left kidney
1E. SMA, SMV
1F. Aorta
1G. IVC
1H. Quadratus lumborum muscle
1I. Psoas major muscle
1J. Renal artery and vein
2A. Left adrenal gland
2B. Left kidney
2C. IVC
2D. Aorta
2E. Ureter
2F. Urinary bladder
2G. Urethra
3A. Cortex
3B. Renal capsule
3C. Renal artery
3D. Renal vein
3E. Renal pelvis
3F. Ureter
3G. Major calyx
3H. Minor calyx
3I. Renal pyramid (medulla)
3J. Renal column
3K. Interlobar vessels
3L. Arcuate vessels
3M. Interlobular vessels
4A. Renal pyramids (medulla)
4B. Renal cortex
4C. Renal sinus
5. Duplicated collecting system

FILL-IN-THE-BLANK

1. Kidneys; ureters; urinary bladder; urethra
2. Retroperitoneal
3. Pronephros; mesonephros; metanephros; paramesonephric
4. Wolffian or mesonephric; epididymis; ductus deferens; müllerian or paramesonephric; uterus; vagina
5. Artery; vein; lymphatics; ureter
6. Renal capsule; trauma; infection; adipose; Gerota’s
7. 2 to 8 cm; liver; 2
8. Cortex; pyramids; medullary
9. Isoechoic; hypoechoic; isoechoic; hyperechoic; 1 cm
10. Waste; blood; fluid; electrolyte
11. RBCs; WBCs; bacteria; infection; tumor
12. Life; urinary bladder; oligohydramnios
13. Ectopic ureterocele
14. Hemorrhagic; infected; septated; multilocular
15. Hemorrhage; infection; malignancy
16. Cyst; diverticulum; inflammation; obstruction or stasis
17. Angiomyolipomas; cysts
18. Cysts; renal cell carcinoma
19. Adenoma; renal cell carcinoma
20. Women; Multiple
21. Hypernephroma; adenocarcinoma
22. Fat; vein; contralateral
23. Transitional cell carcinoma; squamous cell carcinoma; hematuria
24. Dilatation; pelvis; calyceal; infundibula; infection; stone formation; damage
25. Hematuria; oliguria; renal colic; appendicitis
26. Fracture; hypoechoic; subcapsular hematoma
27. WBCs; blood; pus; bacteria
28. Increase; smaller; echogenic
29. Diabetic nephropathy
30. Acute tubular necrosis; metabolites; nitrogenous waste; blood urea nitrogen; uric acid; serum creatinine

SHORT ANSWER

1. A hypertrophied column of Bertin is a double layer of cortex folded in between the renal pyramids. This can mimic a renal tumor and so care must be taken to ensure that a mass is not present. Coronal imaging can help distinguish the two. The following characteristics should be present: the cortex should indent the sinus laterally; it should be clearly defined from the sinus; and the area should measure less than 3 cm, should be continuous with the renal cortex, and have the same echogenicity as the renal cortex. An extrarenal pelvis is a pelvis that lies outside the renal sinus instead of within the renal sinus. This could mimic a cyst. Imaging the area in the transverse plane should demonstrate its continuity with the renal sinus. Color Doppler can distinguish the extrarenal pelvis from an aneurysm of the renal artery.
2. The kidneys remove waste products from the blood and regulate its fluid and electrolyte content. The nephrons control blood concentration and volume by removing water and solutes. They help regulate blood pH and remove toxic wastes and form urine. BUN, serum creatinine, uric acid, and a urinalysis can be used to evaluate renal function.

3. There are many possible causes. The first is agenesis or hypoplasia of the left kidney. In these cases, the kidney is either congenitally absent or so small that it cannot be easily visualized. The kidney may also be ectopic in location. An ectopic kidney may lie anywhere along the left flank and may lie just above the pelvic brim or even in the pelvis next to the urinary bladder. This entire area should be interrogated. Finally, both kidneys may be located on the same side of the body and therefore the entire right flank and pelvis should also be evaluated.

4. RCC is more common in men after the age of 50. Patients with von Hippel-Lindau syndrome, ADPKD, and tuberous sclerosis are at an increased risk of developing RCC and should therefore be evaluated closely. RCC spreads into the perinephric fat, so the area surrounding the kidney should be evaluated as well as the renal vein and IVC. RCC also metastasizes to the contralateral kidney and possibly the liver, so both areas should be carefully interrogated. The hilum and paraaortic areas should be evaluated for lymphadenopathy.

5. Intrinsic causes of hydronephrosis include renal calculi, hematoma, neoplasms in the kidney, bladder, or collecting system, ureterocele, stricture of the ureter, or congenital malformations. Extrinsic causes include BPH, fibroid uterus, pregnancy, retroperitoneal fibrosis or other retroperitoneal tumor, and endometriosis. A false-positive diagnosis may be caused by an extravascular mass, vesioureteral reflux, an overly distended urinary bladder, or peripelvic or parapelvic cysts.

**IMAGE EVALUATION/PATHOLOGY**

1. Adult polycystic kidney disease appears in the third or fourth decades of life. Common complications include infection and stone formation. Cyst rupture, hemorrhage into the cysts, and obstruction of the ureter may occur. Patients experience renal failure and hypertension as the disease progresses.

2. A small, solitary, well-defined hyperechoic mass is seen in the mid pole of the kidney. This is consistent with an angiomyolipoma. Multiple bilateral angiomyolipomas may be seen in patients with tuberous sclerosis.

3. Medullary sponge kidney. The medullary pyramids are echogenic without associated shadowing. This is typically bilateral. Renal function is typically normal; however, infection and stone formation are possible complications.

4. An irregular cystic mass with multiple septations is seen within the cortex of the kidney. Possible diagnoses include a septated cyst, a cyst with hemorrhage or infection, abscess, or even a cystic renal cell carcinoma. If the diagnosis is unclear, further investigation with CT or aspiration of the cyst could be performed.

5. Kidney stones or nephrolithiasis are seen. Symptoms include flank pain, hematuria, renal colic, fever, chills, nausea, and vomiting. Color Doppler can be used to evaluate suspected kidney stones. Stones will typically demonstrate a twinkling artifact with color Doppler.

**CASE STUDY**

1. Dilatation of the renal collecting system or hydronephrosis is seen in this image. If the obstruction is at the UPJ, the right renal pelvis and calyces will be dilated. If the obstruction is at the UVJ, the right ureter as well as the right renal pelvis and calyces could be dilated.

2. A large, solid, well-defined homogeneous mass is seen projecting off of the lower pole of the left kidney. This is most likely a renal cell carcinoma or hypernephroma. Renal cell carcinoma can have a variety of sonographic appearances from hypoechoic to isoechoic to hyperechoic. Typically, they are well-defined, but irregular masses are also seen. Areas of hemorrhage or necrosis may give the mass a complex appearance. Multilocular cystic masses are sometimes seen in patients with von Hippel-Lindau syndrome.