Abdominal Vascular
(Effective February 2007)
Abdominal Vascular (7%-15%)

Anatomy

Blood Circulation
• Pulmonary
• Systemic
• Portal
Capillaries
  – One cell thick
  – Connect arterioles and veins

• Arteries carry oxygenated blood
• Veins carry deoxygenated blood

Exceptions
• Pulmonary artery
  – deoxygenated blood from right ventricle to lungs
• Pulmonary vein
  – oxygenated blood from lungs to left atrium of heart
• Umbilical veins
  – oxygenated blood
• Umbilical artery
  – deoxygenated blood
• Ductus venosus
  – oxygenated blood
Blood vessel walls

Tunica intima
- Inner mucosal lining, endothelial cells, delicate connective tissue

Tunica media
- Middle smooth muscle fibers with collagen and elastic tissue

Tunica adventitia
- Outer loose connective tissue and elastic tissue
- Peritoneal reflection
- Vasa vasorum — minute arteries and veins located here and supply nutrients to vessel

Aorta

Divided into five sections

• Root of the aorta
  – Semilunar cusps
  – Coronary arteries

• Ascending aorta - the arch
  – Right innominate
  – Left common carotid
  – Left subclavian.

• Descending aorta
  – From the arch to where it pierces the diaphragm

• Abdominal aorta

• Bifurcation of the aorta into iliac arteries
Abdominal Aorta

- First major branch
  - celiac axis – 1-2 cm below diaphragm – “Seagull sign”
  - splenic artery – tortuous
  - Left gastric

- Second major branch
  - SMA – ventral – 2 cm below celiac trunk

- Third major branch
  - renals – lateral – paired just inferior to SMA

- Fourth major branch
  - IMA – ventral Lt lateral near bifurcation

Distribution: visceral organs, mesentery

Show renal images
**Celiac Trunk**

Distribution: liver, spleen, stomach, duodenum.  

- Surrounded by liver, spleen, inferior vena cava (IVC), and pancreas  
- branches into  
  - the common hepatic artery  
  - left gastric artery  
  - splenic artery  
  - common hepatic artery passes anterior to the portal vein into liver → Rt and Lt hepatic  
  - right hepatic artery → cystic, gastroduodenal artery,  
  - The left gastric artery  
- Distribution: liver, spleen, stomach, duodenum.  

**Celiac Trunk**

- The left gastric artery  
  - smallest branch  
  - passes anterior and toward the stomach.  
- The splenic artery,  
  - the largest of the branches, is very tortuous.  
  - It usually forms the superior border of the pancreas and divides into several branches to supply splenic tissues.  

**Superior Mesenteric Artery**

Distribution: proximal half of colon (cecum, ascending, transverse) small intestine  

- 1 cm below the celiac trunk  
- runs posterior to the neck of the pancreas  
- anterior to the uncinate process  
- branches into the mesentery and colon.  
- Main branches  
  - Inferior pancreatic artery  
  - Duodenal artery  
  - Colic artery  
  - Ileocolic artery  
  - Intestinal artery  
  - Right hepatic artery
**Inferior Mesenteric Artery**

- level L3 to L4 about 3 to 4 cm proximal to aortic bifurcation.
- Main branches:
  - Left colic artery
  - Sigmoid artery
  - Superior rectal artery
- Distribution: left transverse colon, descending colon, sigmoid, and rectum

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**Lateral Branches of the Abdominal Aorta**

- Phrenic artery first branch of AA
  - small vessel clinging under surface of the diaphragm, which it supplies
- Gonadal artery
  - inferior to renal arteries, courses along psoas muscle to gonadal area

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**Right and left renal arteries**

- arise anterior to L1, inferior to superior mesenteric artery
- Both branch into anterior branch and inferior suprarenal arteries
- The right renal artery longer vessel than the left
  - courses from the aorta posterior to the IVC to the right kidney (RK).
  - The renal artery passes posterior to the renal vein before entering the renal hilus.
- The left renal artery courses from the aorta directly to the left kidney (LK).
Veins

- valves (extension of intimas), semilunar type, which prevent backflow;
  - in the extremities, especially the lower extremities
- Venous return aided by
  - muscle contraction, valves, force of gravity,
    and suction from negative thoracic pressure
- Less muscle and elastic components
  - result in ability to passively expand

Inferior Vena Cava

- ascends retroperitoneally along the vertebral bodies
- caudal to the renal vein entrance.
- three large hepatic veins drain into the IVC (T8), (right, middle, and left)
- common iliac veins converge at the level of L4

Renal Veins

- originate anterior to the renal arteries at the level of L2.
- left renal vein
  - Runs posterior to the SMA
  - anterior to the aorta to enter the IVC
  - Drains: left adrenal vein, left gonadal vein,
    and lumbar vein.
- Right renal vein
  - flows directly into the IVC
Hepatic Veins
- originate in the liver and drain into the IVC at the level of the diaphragm.
- Collect blood from the following three minor tributaries
  - right hepatic vein (RLL)
  - middle hepatic vein (caudate lobe)
  - left hepatic vein (LLL).

Portal Vein
- Formed by confluence of SMV and SV at the level of L2
- courses posterior to first portion of duodenum flows between the layers of the lesser omentum to the porta hepatis,
- Its 7 to 8 cm in length.
- carries blood from the intestinal tract to the liver anastomosis with esophageal vein, rectal venous plexus, and superficial abdominal vein.

- SMV drains blood from
  - Middle colic vein (transverse colon)
  - Right colic vein (from ascending colon)
  - Pancreatic duodenal vein
- IMV drains blood from
  - Left colic vein (from descending colon)
  - Sigmoid vein (from sigmoid colon)
  - Superior rectal vein (from upper rectum)
Splenic Vein

- tortuous vessel arises from five to six tributaries - from the hilus of the spleen.
- runs posterior to the pancreas to join the SMV (at right angles) form the main PV

Distribution: drains blood from stomach, spleen, and pancreas

Venous

IVC
- Posterior margin of head of pancreas
- Increases size with inspiration and Valsalva

Hepatic veins – “Bunny sign”
- Left HV in left intersegmental fissure
- Mid HV in Main lobar fissure
- Right HV in right intersegmental fissure

- Inferior phrenics
- Right adrenal
- Renal veins
  - LRV between AO and SMA – easily compressed

NOTE: left adrenal and lt. gonadal vein drain into left renal vein, thus varicoceles more common on left
Technique
(including Color Doppler, Power Doppler and duplex Doppler)

Laboratory values
Indications
(including clinical symptoms, clinical correlation and associated complications)

Aneurysm

Thrombosis
(including Portal Vein, Splenic Vein and Renal Vein Thrombosis)
Shunts
Arteriovenous

Shunts
Porto-systemic

Shunts
Surgical & Radiological
Doppler Spectral Waveform Analysis
(including Stenosis, Thrombosis, Portal Hypertension, and Direction of flow)

Color Doppler and Power Doppler
(including Stenosis, Thrombosis, Portal Hypertension, and Direction of flow)