

Sectional Anatomy Quiz – VI

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ABSTRACT

This quiz is part of a series which aims to aid nuclear physicians in interpreting the computed tomography (CT) component of the single photon emission computed tomography (SPECT) and positron emission tomography (PET) studies. The current quiz includes normal and pathological axial CT images at the level of the superior mesenteric artery (SMA) and superior mesenteric vein (SMV). The SMV is normally located to the right of the SMA and is of a larger caliber. Various pathologies such as malignancy, infection or vascular disease can alter the position and/or appearance of the SMA, SMV and the surrounding anatomical structures present at this level. Understanding how normal anatomy is altered by pathology at this level will facilitate improved interpretation of abdominal CT images.

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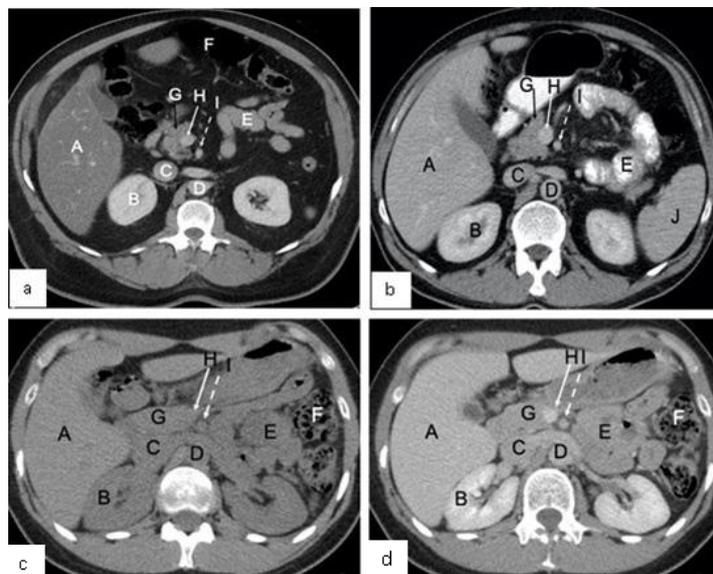


Figure 1. On the axial CT images of the abdomen, identify the normal structures labelled from A to J. Figure 1a and 1b are of two different patients. Figure 1a was acquired after the intravenous administration of radiographic contrast while both intravenous and oral radiographic contrast was given prior to acquisition of Figure 1b. Increased density of small bowel loops in Figure 1b is due to oral contrast.

Figure 1c and 1d are non-contrast and contrast-enhanced images of the same patient.

Note the location and position of the superior mesenteric vein (SMV) and superior mesenteric artery (SMA) as indicated by solid and dashed white arrows respectively

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Answer

These images are through the abdomen at the level of the superior mesenteric artery and vein. The labelled structures are as follows.

- A. Liver
- B. Right kidney
- C. Inferior vena cava
- D. Abdominal aorta
- E. Small bowel
- F. Large bowel
- G. Head of the pancreas
- H. Superior mesenteric vein (SMV)
- I. Superior mesenteric artery (SMA)
- J. Spleen

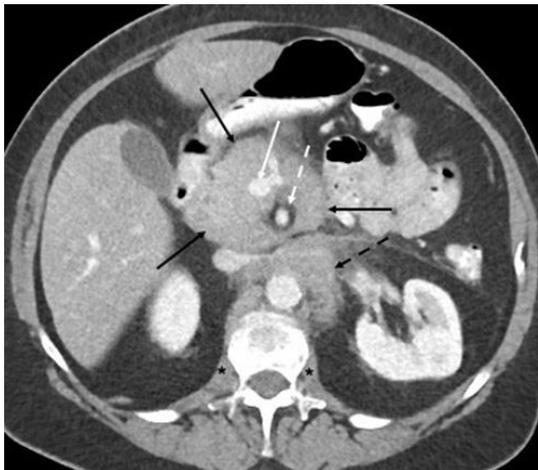


Figure 2. A contrast-enhanced CT abdomen of a 60-year-old female with lymphoma shows a confluent soft tissue density mass suggesting lymphadenopathy (solid and dashed black arrows) surrounding the SMA, SMV and abdominal aorta. Solid and dashed white arrows point to the SMV and SMA, respectively. The psoas major muscles lie adjacent to the vertebral body (asterisks)

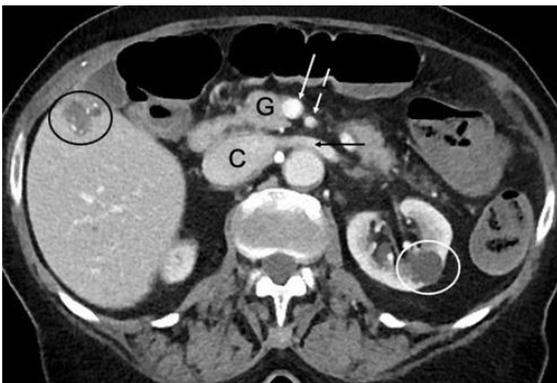


Figure 3. A contrast-enhanced CT abdomen of an 85-year-old female with sigmoid colon carcinoma shows a heterogeneously enhancing hypodense lesion with some peripheral enhancement in the right lobe of the liver anteriorly (black circle). In the given clinical context this lesion is suspicious of a metastasis. However, a hemangioma can have a similar appearance on CT and is a differential consideration. A round non-enhancing

hypodense lesion (white circle) seen in the left kidney is consistent with a simple cyst. The left renal vein (solid black arrow) is anterior to the abdominal aorta and joins the inferior vena cava (C). The head of the pancreas (G) is visible to the right of the SMV (solid white arrow). Dashed white arrow points to the SMA

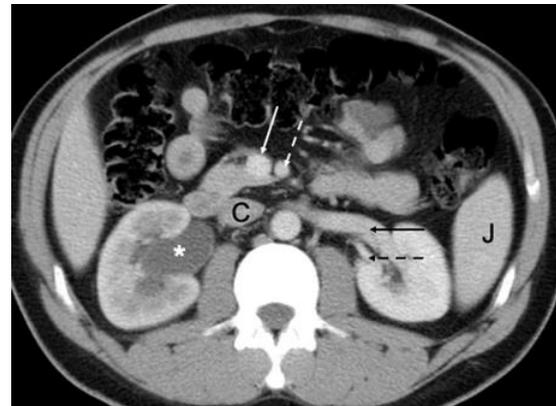


Figure 4. A contrast-enhanced CT scan of a 34-year-old male shows hydronephrosis (white asterisk) of the right kidney which was due to a ureteric calculus in the distal right ureter (not seen in the image). Hydronephrosis can occur due to obstruction of the ureter by intraluminal, intramural or extramural causes. Some of these include renal and ureteric calculi, ureteric strictures, malignancy or prostatic pathologies. The left renal vein (solid black arrow) is anterior to the abdominal aorta and joins the inferior vena cava (C). The left renal artery (dashed black arrow) is posterior to the renal vein and arises from the lateral aspect of the abdominal aorta. The spleen (J) is also visible in this image. Solid and dashed white arrows point to the SMV and SMA, respectively



Figure 5. A non-contrast CT of an 85-year-old male with acute cholecystitis shows a distended thick-walled gallbladder (black asterisk) with surrounding fat stranding and pericholecystic fluid (solid black arrow). Gallstones (black circle) appear as hyperdense material in the dependent portion of the gallbladder. The large bowel (white asterisk) is mildly dilated suggesting decreased peristalsis secondary to localised ileus. Note calcification of the abdominal aorta (dashed black arrow). Inferior vena cava is labelled C. Solid and dashed white arrows point to the SMV and SMA, respectively

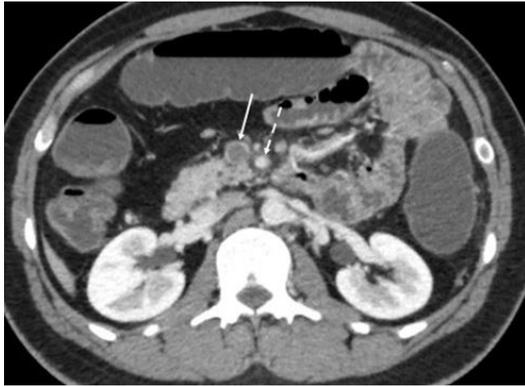


Figure 6. A contrast-enhanced CT abdomen of a 35-year-old man with acute abdominal pain and distension shows absence of contrast (filling defect) in the SMV (solid white arrow) suggesting a thrombus. Note normal enhancement of the SMA (dashed white arrow) compared to the hypodense SMV



Figure 7. A contrast-enhanced CT abdomen of a 25-year-old male following a road traffic accident shows laceration (dashed black arrow) of the right kidney extending through the cortex and medulla. Density surrounding the right kidney (solid black arrows) is suggestive of a perinephric haematoma. The left renal vein (black asterisk) is anterior to the abdominal aorta and joins the inferior vena cava (black circle). The heterogeneity of the inferior vena cava is secondary to incomplete mixing of the intravenous contrast. Solid and dashed white arrows point to the SMV and SMA, respectively

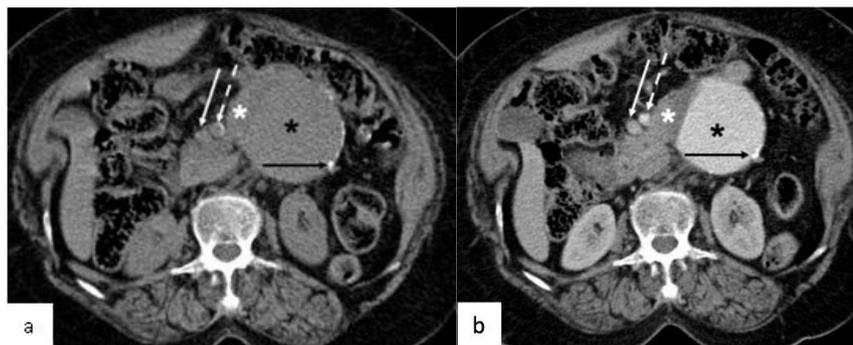


Figure 8. Non-contrast (a) and contrast-enhanced (b) CT images of the abdomen of an 87-year-old female show a large abdominal aortic aneurysm (black asterisk). Calcification (solid black arrow) is seen along the wall of the abdominal aorta. The contrast-filled true lumen of the aneurysm (black asterisk) appears hyperdense in Figure 8b. The non-enhancing hypodense area on the right side of true lumen (white asterisk) is thrombus. Solid and dashed white arrows point to the SMV and SMA, respectively. Note calcification along the wall of the SMA

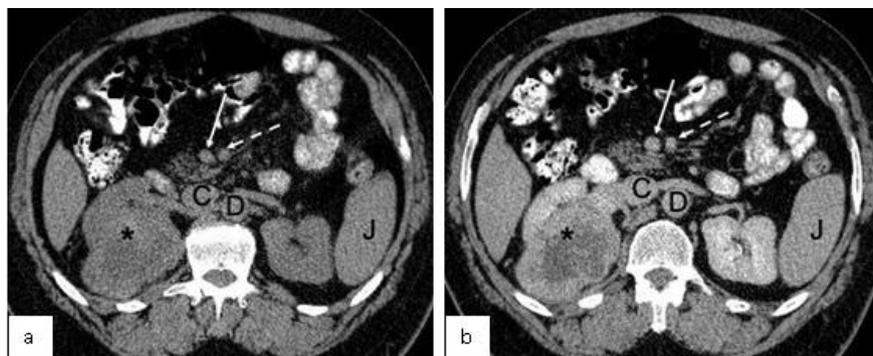


Figure 9. Non-contrast (a) and contrast-enhanced (b) CT images of the abdomen of a 52-year-old male show a right-sided renal cell carcinoma (black asterisk). The mass arises from the medial aspect of the right kidney and shows heterogeneous and relatively reduced enhancement compared to the native kidney. The inferior vena cava (C), abdominal aorta (D) and spleen (J) are also visible in this image. Solid and dashed white arrows point to the SMV and SMA, respectively

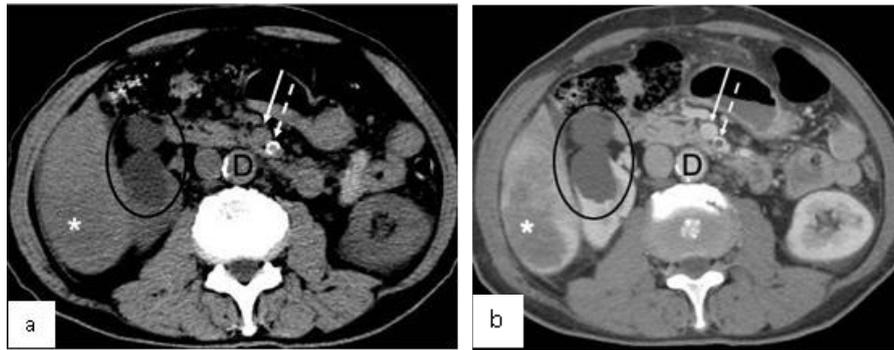


Figure 10. Non-contrast (a) and contrast-enhanced (b) CT images of the abdomen of a 71-year-old male with a history of colon cancer shows ill-defined heterogeneously enhancing low density areas in the liver (white asterisk) consistent with hepatic metastasis. The well-defined non-enhancing hypodense area in the upper pole of the right kidney (black circle) is consistent with a simple renal cyst. Solid and dashed white arrows point to the SMV and SMA, respectively. Note calcification of the wall of the abdominal aorta (D) and SMA (dashed white arrow). The absence of contrast in the SMA in the contrast-enhanced image (b) is described radiologically as a filling defect and suggests the presence of a thrombus. Comparison with Figure 8 will help in appreciating the filling defect in the SMA

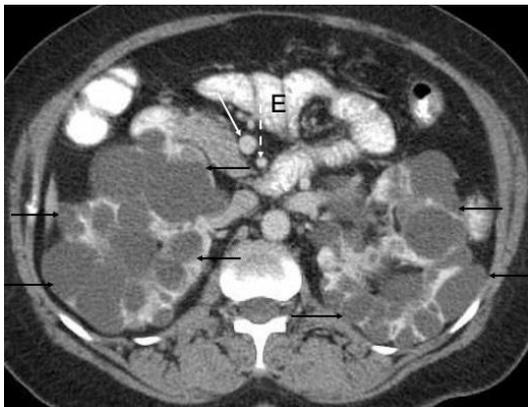


Figure 11. A contrast-enhanced CT abdomen of a 45-year-old female with autosomal dominant polycystic kidney disease shows multiple non-enhancing low-density lesions (solid black arrows) in both kidneys. The patient was given oral contrast as evident by the hyperdense small bowel loops (E). Solid and dashed white arrows point to the SMV and SMA, respectively



Figure 12. A 45-year-old male presenting with left flank pain was investigated for renal calculi using a non-contrast CT scan. This incidentally showed the SMV (solid white arrow) located to the left of the SMA (dashed white arrow). This indicates malrotation of the bowel. Compare this to previous images where the SMV was located to the right of the SMA

Points to Remember

- The superior mesenteric artery (SMA) is one of the unpaired branches of the abdominal aorta that arises anteriorly approximately at the level of the 1st lumbar vertebra. Parts of bowel derived from the midgut (entire small bowel, caecum, ascending colon and mid transverse colon) is supplied by the SMA .
- Other unpaired branches of the abdominal aorta are the coeliac and inferior mesenteric arteries. These arise approximately at the level of the 12th thoracic and 3rd lumbar vertebrae, respectively .
- The superior mesenteric vein (SMV) lies to the right of the SMA and its caliber is typically larger than the artery. It drains areas supplied by the SMA.

- The head of the pancreas lies to the right side of the SMV within the curve of the second part of the duodenum .
- The left renal vein, compared to its opposite counterpart, is longer and normally courses anterior to the abdominal aorta to drain into the inferior vena cava .
- Normal loops of the small and large bowel can be distinguished by their location and content. Small bowel loops are centrally located in the abdomen and pelvis while the large bowel loops are located peripherally. As small bowel is mostly filled with fluid and a small amount of air, its density is different from the large bowel which normally contains air and faeces.
- Fat in the peritoneal and retroperitoneal portion of the abdomen and pelvis results in a

characteristic dark density on CT images. Alteration in the normal density of fat can be an indicator of disease processes .

Recommendations for Further Reading

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Acknowledgement

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