

CLINICAL PRESENTATION AND RADIOLOGY QUIZ QUESTION

A 50 year old woman presents with increasing abdominal pain of three days' duration. Every time she tries to eat, the pain gets much worse. She has nausea but has had no vomiting or diarrhea. She has a history of appendectomy and prior bouts of diverticulitis. She has also had a hysterectomy and a history of kidney stone disease. The patient states that her current pain is quite unlike pain she has had in the past when she has had diverticulitis and kidney stone disease. She rates the pain as a 9 out of 10. The patient has no burning with urination, frequency, or urgency. She has no flank pain. She has no history of trauma, travel, or exposure to illness. She has not had any rashes or joint swelling. The patient's temperature is 100, her blood pressure 116/72, her heart rate 102, her respiratory rate 16, and her pulse oximetry 96% on room air. Her abdomen is mildly distended without tympany, soft, and the patient has no peritoneal signs. There is no localized tenderness or CVA tenderness. There are decreased bowel sounds. The patient's WBC is 9,900 and her urinalysis is normal.

Which of the following studies is usually most helpful in evaluation of the abdominal arterial tree?

- (a) PA and lateral plain films of the abdomen
- (b) computed tomography (CT) angiography of the abdomen and pelvis
- (c) ultrasound (US) of the aorta and branch vessels
- (d) magnetic resonance (MR) angiography of the abdomen and pelvis

RADIOLOGY QUIZ QUESTION, ANSWER, AND EXPLANATION

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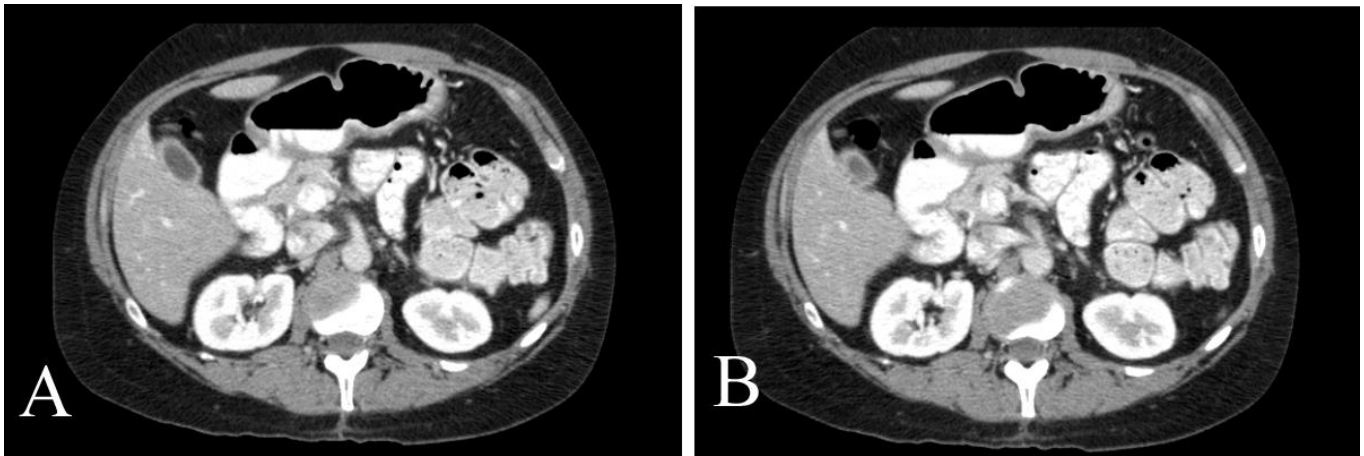
- (a) PA and lateral plain films of the abdomen
- (b) computed tomography (CT) angiography of the abdomen and pelvis
- (c) ultrasound (US) of the aorta and branch vessels
- (d) magnetic resonance (MR) angiography of the abdomen and pelvis

Computed tomography (CT) angiography of the abdomen and pelvis (b) is usually the most helpful study in evaluation of the abdominal arterial tree. It allows accurate evaluation of the abdominal vessels including the abdominal aorta, the celiac trunk and its branches, the superior mesenteric artery, the inferior mesenteric artery, and the iliac vasculature. It is widely available.

PA and lateral plain films of the abdomen (a) do not directly visualize the abdominal vessels unless the vessels are calcified. Even when they are calcified, plain films are not accurate in evaluation of vascular stenosis or aneurysms, and therefore (a) is incorrect. US of the aorta and branch vessels (c) is not nearly as helpful as CT angiography at evaluation of the branch vessels because of the often limited visualization of the celiac trunk, superior mesenteric artery, and inferior mesenteric artery (even in the best of cases only the proximal most aspects of these vessels can be seen), and (c) is incorrect. MR angiography of the abdomen and pelvis (d) is usually somewhat less accurate and more expensive than CT angiography in evaluation of intra-abdominal vessels because of motion artifact along the abdominal vessels caused by bowel motion, and (d) is incorrect.

IMAGING STUDY AND QUESTIONS

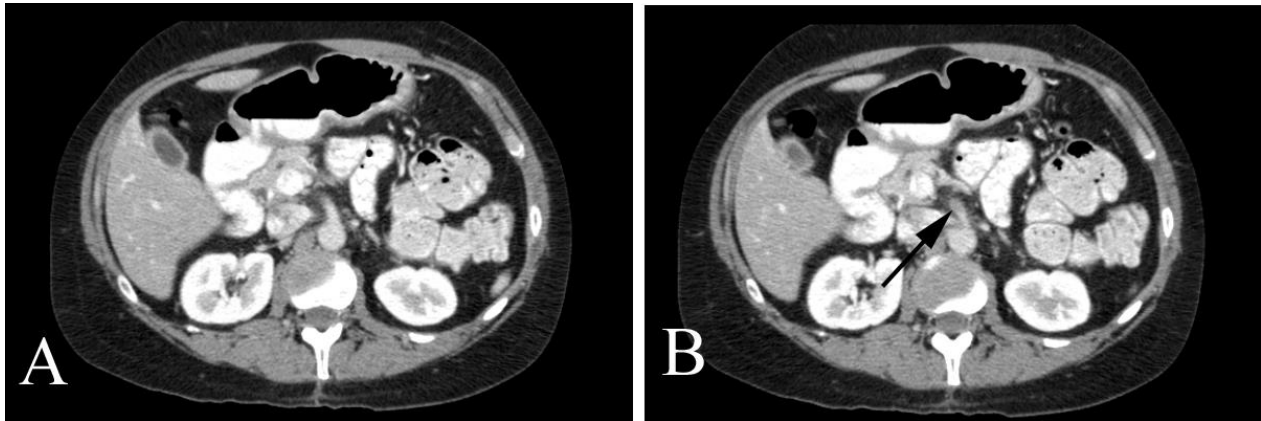
The patient underwent imaging:



Imaging questions:

- 1) What type of study is shown?
- 2) Are there any abnormalities?
- 3) What is the most likely diagnosis?
- 4) What is the next step in management?

IMAGING STUDY QUESTIONS AND ANSWER

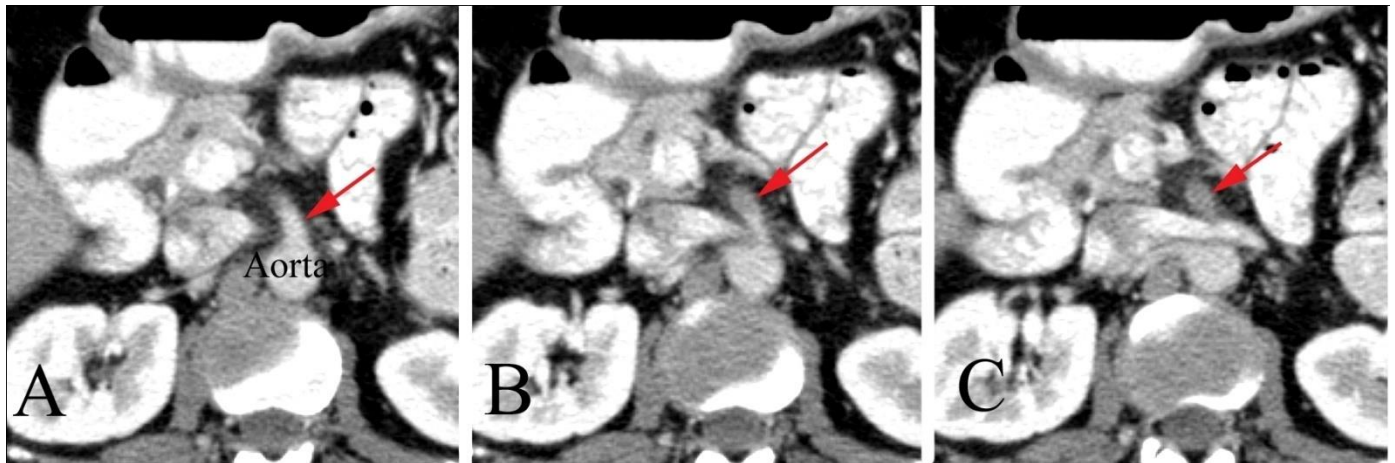


Imaging questions:

- 1) What type of study is shown? A CT study of the abdomen performed with oral and IV contrast.
- 2) Are there any abnormalities? Possibly. There is a suggestion of a filling defect within the superior mesenteric artery (arrow in panel B).
- 3) What is the most likely diagnosis? Possible superior mesenteric artery thrombus.
- 4) What is the next step in management? CT or catheter angiography of the abdominal aorta.

PATIENT DISPOSITION, DIAGNOSIS, AND FOLLOW-UP

Note that while the question refers to which study is best for evaluation of the abdominal arterial tree, most patients with disease of the abdominal arterial tree present with symptoms which are caused by a wide variety of other diseases. Most of these alternative diagnoses do *not* involve the arterial tree. Abdominal pain may be caused, for example, by diverticulitis, pancreatitis, gastritis, duodenitis, ulcer disease, and intra-abdominal malignancy. The patient underwent a routine CT scan of the abdomen and pelvis. The images demonstrated the patient's vascular tree well enough to suggest a filling defect of the superior mesenteric artery. On the basis of the abnormality seen on the initial CT study, a CT angiogram was subsequently performed (see below) to obtain a better picture of the vascular tree. The images in a CT angiogram are obtained during optimal opacification of the arterial tree (earlier than the routine CT studies, obtained portal venous phase images).



50 year old woman with acute abdominal pain and a superior mesentery artery thrombus. A-C Sequential axial computed tomography (CT) angiogram images from superior-to-inferior demonstrate the superior mesenteric artery (SMA, arrow) branching off of the aorta. In panels B and C, there is a lower-density filling defect in the SMA (arrow). More superior images (not shown) showed a thrombus extending off of the lower thoracic aortic wall, the likely source of the embolism.

The patient was referred to an interventional radiologist, and interventional tissue plasminogen activatory (tPA) therapy was performed. Her abdominal pain resolved. The patient was placed on chronic anti-coagulant therapy, and a follow-up CT angiogram performed three weeks later showed resolution of both the superior mesenteric artery and the thoracic aortic thrombus.

SUMMARY

Presenting symptoms: The patient presented somewhat of a diagnostic dilemma, since she had significant (9 out of 10) abdominal pain but specifically stated that her pain was unlike her prior bouts of diverticulitis and renal stone disease, and she had already undergone appendectomy. The one clue to the diagnosis was that the patient spontaneously related that the pain worsened every time she ate; this was due to ischemia of the bowel prompted by the increased demand for blood flow following meals.

Imaging work-up: The first imaging study for patients with abdominal pain is typically either an ultrasound study (if the pain is in the right upper quadrant; see Radiology Quiz of the Week 023) or a CT of the abdomen and pelvis (if the pain is elsewhere in the abdomen; see Radiology Quiz of the Week 024, 025, and 026). When patients have *acute, severe* abdominal pain and there is a strong clinical suspicion of vascular compromise (for example, if the patient has a history of left heart valvular disease/atrial fibrillation or known coronary, carotid, or peripheral arterial disease), then emergent catheter angiography is usually done because it allows both diagnosis and treatment of diseased arteries. In this case, the appearance on the initial CT study was suspicious and prompted performance of a CT angiogram.

Establishing the diagnosis: Vascular compromise of the bowel secondary to an arterial thrombus may be established by CT angiography or catheter angiography.

Take-home message: In patients with abdominal pain, CT of the abdomen and pelvis is typically the first imaging study performed. While this study may reveal evidence of vascular compromise, CT angiography offers greater detail of the vascular tree and may be performed either at the same time, or after, routine CT of the abdomen and pelvis. Catheter angiography is generally reserved for cases of acute, severe abdominal pain in the setting of known vascular disease, or as an additional step allowing further diagnostic evaluation and therapeutic maneuvers after arterial disease has been established by CT angiography.

FURTHER READING

Renfrew, DL. Vascular imaging. Chapter 12 of *Symptom Based Radiology*, Symptom Based Radiology Publishing, Sturgeon Bay, WI, 2010, available for no charge at www.symptombasedradiology.com.

Roy-Choudhury SH, Gallacher DJ, Pilmer J. Relative threshold of detection of active arterial bleeding: in vitro comparison of MDCT and digital subtraction angiography. *Am J Radiol* 2007;189:W238-W246

Tendler DA, LaMont JT. Acute mesenteric ischemia. UpToDate, accessed 11/25/09.

Tendler DA, LaMont JT. Chronic mesenteric ischemia. UpToDate, accessed 11/25/09.