

# Acute Mesenteric Ischaemia on Unenhanced Computer-Tomography

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## ABSTRACT

We present a 39-year old man with mesenteric ischaemia. The initial unenhanced images of the, non-oral contrast CT abdomen clearly demonstrated increased density in a significant length of the small bowel and in the veins of the adjacent mesentery. Mesenteric ischaemia is a difficult diagnosis both clinically and radiologically and we demonstrate the potential benefits of an unenhanced abdominal scan (often left out if a contrast enhanced scan is to be performed) and the omission of oral bowel contrast in emergency scans.

## CASE REPORT

### CASE REPORT

A 39-year old gentleman with a 24-hour history of epigastric then global abdominal pain. He had no past medical or significant family history, did not smoke cigarettes and drank over 40 units of alcohol a week, for an unknown number of years. Physical examination revealed a tender epigastrium with no rebound or guarding and soft brown stools on digital rectal examination. Initial investigations showed amylase 373 (56 - 190 IU/L), lactate 5.7 (<2 IU/L) and lactate dehydrogenase 782 (240 - 460 IU/L), with a normal white cell count and differential, C-reactive protein and INR. He was afebrile and cardiovascularly stable. The initial impression was of acute pancreatitis and the patient was treated conservatively. A CT scan, with IV contrast, demonstrated the presence of abdominal free fluid in the pelvis and was initially reported as a possible perforated viscus, with all organs reported normal in appearance with no focal pathology.

#### *Clinical Progression*

After 6 hours the patient became febrile, tachycardia (110 beats per minute) and hypotensive (80/50 mmHg) with diffuse abdominal tenderness, rebound and guarding. He underwent an

emergency laparotomy at which 70cm of ischaemic small bowel was identified and resected. Histopathology demonstrated blood clots in both the veins and arteries.

#### *Radiology*

72-hours post surgery, the patient again became febrile and a repeat CT with IV contrast indicated free fluid in the pelvis, and enlarged para-aortic lymph nodes. On review of the initial CT it was noted that there was increased density in a large segment of small bowel, which could only be reliably identified on the unenhanced part of the scan. There was also increased density of the veins in the adjacent mesentery. See Figure 1.

On investigating his ongoing pyrexia, it was noted that both pre- and post-operatively, the patient's white cell count remained within normal limits. Therefore he proceeded to an HIV test, which was positive. Our patient made a full recovery from his operation and his HIV infection is being followed-up in the outpatient clinic.

## DISCUSSION

Acute mesenteric ischaemia is a calamitous event, with mortality beyond 60% (1). It can result from emboli, arterial or venous thrombi. Acute mesenteric artery thrombi are usually associated with pre-existing atherosclerotic lesions, which are estimated to account for 20-30% of all cases of acute mesenteric ischemia (2,3). Mesenteric venous thrombosis accounts for 10 - 15% of all cases of mesenteric ischaemia (4).

Acute arterial occlusion (usually embolic/thromboembolic) will result in absent arterial inflow to a segment of bowel depending on the site and degree of occlusion (see Addendum - Figure 3/4). If complete the segment of bowel may not have time to become oedematous. Incomplete occlusion and/ or the opening up of a collateral supply will enable the bowel to become oedematous.

Venous occlusion, often in association with systemic hypovolaemia and haemoconcentration, results in bowel wall oedema/ haemorrhage as the outflow is impeded, and subsequently to diminished arterial inflow (and hence ischaemia).

On the unenhanced CT scan it is not possible to demonstrate arterial occlusion, but acute venous thrombosis may be identified as hyperdense mesenteric vein(s). Bowel wall thickening can be diagnosed if there is gas and or fluid present in the lumen. Acute bowel wall haemorrhage and/or fresh blood in the lumen, if present (as in this case), can enable a pre-operative diagnosis of bowel ischaemia to be made.

The administration of intravenous contrast medium (if not contraindicated due to poor renal function) can be helpful in demonstrating arterial occlusion and presence/absence of bowel wall enhancement to support the diagnosis.

While bowel ischaemia is damaging to the patient, it is the subsequent multi-organ failure, which accounts for the increased mortality rate (5). HIV is well known to be associated with both hypercoagulable states and Protein S deficiency (6). The pathophysiology of HIV associated ischaemia is still unclear and an area of active research. This alone though is an associated risk factor and should be considered as such.

The symptoms of acute mesenteric ischaemia are non-specific (as in this patient) and include abdominal pain, frank blood in stools and post-prandial pain. An ischaemic cardiac history is a predisposing factor. The differential diagnoses of this patient's symptoms include pancreatitis (our original clinical diagnosis), severe cholecystitis and a perforated abdominal viscus. To differentiate between these, the examination may demonstrate a rigid abdomen (as in a perforated viscus), or localized pain to the right upper quadrant (as in cholecystitis), or the epigastrium (as in pancreatitis), with the latter associated with an increased amylase. Pancreatitis is also commonly associated with gallstones or a prolonged excessive alcohol intake.

Abdominal ultrasound is the most reliable modality to demonstrate gallstones. It will confirm/ exclude acute cholecystitis and may also reveal dilated bile ducts or an oedematous pancreas. Abdominal CT is more reliable if the gallstones are calcified, and is also an excellent modality to demonstrate cholecystitis, pancreatitis and the presence of free gas or fluid within the peritoneal space. MRI has an important role in the identification of calculi in the bile ducts, but is not a useful examination in the emergency setting due to the time taken to perform the procedure and its relative inaccessibility.

Unfortunately there are no specific blood investigations that can diagnose acute ischaemia and most are done to exclude other conditions. There are however tests that should be done as part of the investigative work-up - a clotting screen including an INR, the activated partial thromboplastin time and prothrombin time. A leucocytosis and acidosis are late, non-specific markers of severe ischaemia. Subsequently other tests to exclude reversible causes, i.e. protein C and S deficiencies; antithrombin III deficiency; and abnormalities in lupus anticoagulant, anticardiolipin antibody, and platelet aggregation.

All too often, patients do not present with the classical symptoms and pre-existing conditions that direct the investigations to look specifically for mesenteric ischaemia. The diagnosis of our patient was retrospective in nature due to the apparent lack of risk factors predisposing towards such catastrophic ischaemia and the lack of associated symptoms. The dense bowel finding was not recognized at first. Delayed diagnosis has in part been held responsible for the significant mortality associated with the condition (6).

The benefits of the unenhanced abdominal scan (often left out if a contrast enhanced scan is to be performed) and the omission of oral bowel contrast in emergency scans are clearly demonstrated with this case. Recognising on plain CT the subtle indicators of ischaemia, i.e. bowel loops denser than normal and/or increased density of mesenteric veins may, alongside the medical history lead to earlier diagnosis and as such earlier life-saving surgery, thus improving patient morbidity and mortality.

#### Addendum

Three new cases (the first two surgically proven) presented themselves to our department during the preparation of this report and have been included to highlight important points.

Case 2: (Fig. 2) dense bowel loops (arrows) on unenhanced CT scan found to be ischaemic/ haemorrhagic at surgery, with evidence of venous thrombosis

Case 3: (Fig. 3) occluded major (Rt) branch of the superior mesenteric artery (arrow head) supplying the Rt sided small bowel loops with no enhancement of the bowel wall (open arrow) compared with enhancing Lt sided loops (closed arrow); note absence of wall oedema

A further case (Fig. 4) was found to have incomplete occlusion of the mesenteric artery (arrow head); enhancement

of small bowel wall was present throughout (open arrow Rt; closed arrow Lt) and patient recovered spontaneously (on anticoagulants) and did not require surgery; also had mural thrombus in Lt ventricle and splenic infarcts visible on CT.

In summary we present a case of mesenteric ischaemia secondary to undiagnosed HIV infection, which was demonstrated on unenhanced CT scanning of the abdomen.

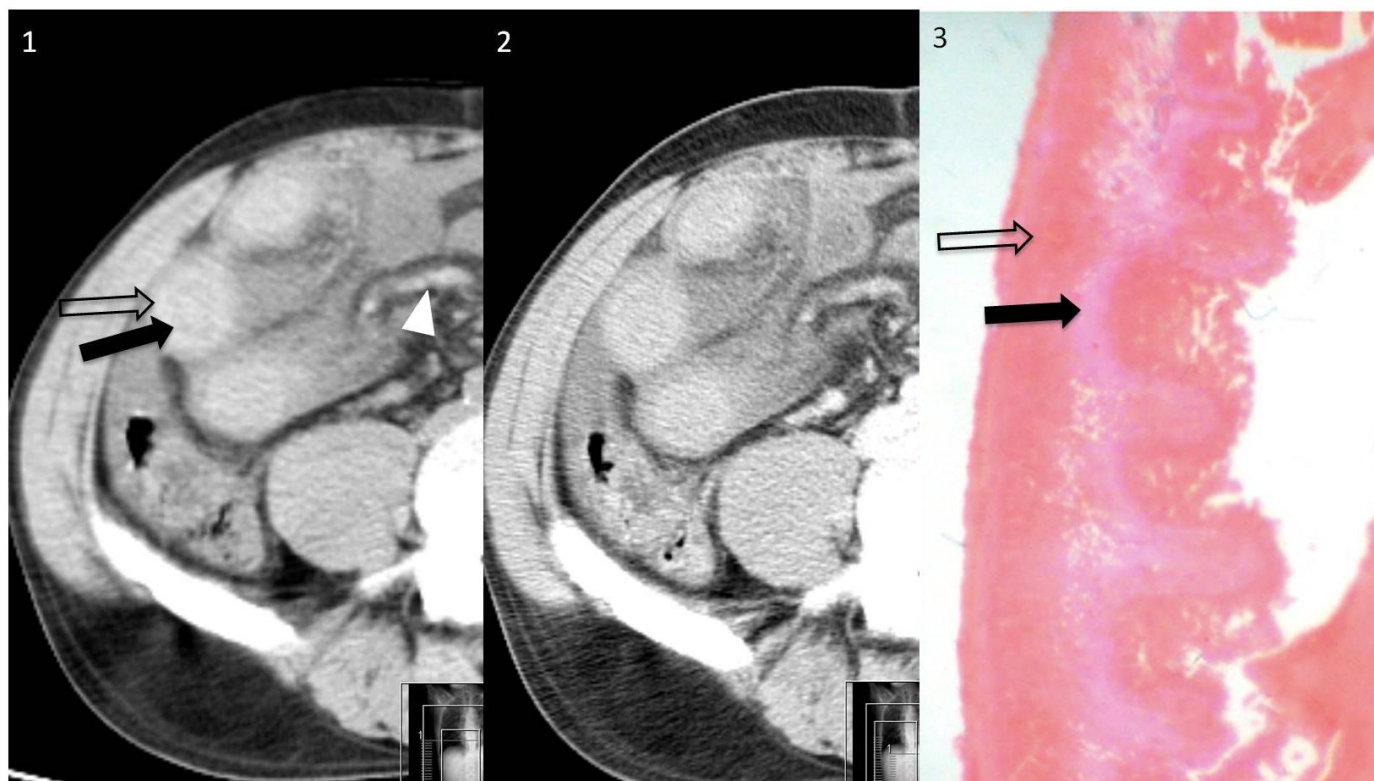
#### TEACHING POINT

Acute mesenteric ischaemia has a poor prognosis, partly due to delayed diagnosis and curative surgery; the close examination of unenhanced CT may aid rapid diagnosis and facilitate cure, as it can demonstrate an increased density in the tissue, which is lost with contrast enhancement.

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FIGURES



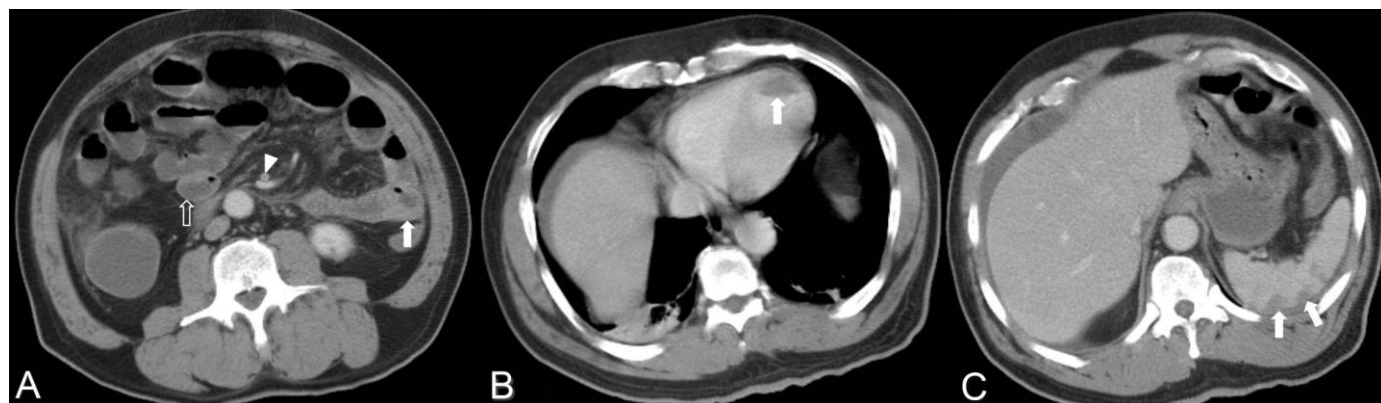
**Figure 1:** 39-Year old male with Acute Mesenteric Ischaemia. Axial Contrast Computer Tomography of Abdomen, Unenhanced (1) and corresponding enhanced (2) abdominal CT scans demonstrating increased density of the small bowel wall (and lumen) correlated with histopathology slide (3) confirming the presence of haemorrhage in the bowel wall (and lumen). Haemorrhage in thickened muscularis propria - open arrow; low density submucosal layer - closed arrow; dense vein consistent with recent thrombosis - arrow head. GE Lightspeed 4 slice CT scanner;5mm slice thickness, omnipaque (iohexol) 300mg/ml 100mls @ 2ml/s



**Figure 2:** Case 2 was found to have haemorrhagic/ ischaemic bowel loops and venous thrombosis at surgery. Unenhanced abdominal CT scan demonstrating dense bowel loops in left mid-abdomen (GE Lightspeed 4 slice CT scanner;5mm slice thickness)



**Figure 3:** (Case 3) Arterial occlusion and ischaemic bowel loops on the Rt side of the abdomen at surgery. Enhanced abdominal CT scan demonstrating an occluded major branch (Rt) of the superior mesenteric artery (arrow head) with no enhancement of the wall of the Rt sided bowel loops (open arrow) compared with enhancing Lt sided loops (closed arrow). (GE Lightspeed 4 slice CT scanner;5mm slice thickness, omnipaque (iohexol) 300mg/ml 100mls @ 2ml/s)



**Figure 4:** Case 4 was found to have incomplete occlusion of the mesenteric artery (enhanced CT) with evidence of ventricular thrombus and splenic infarcts. Bowel wall enhancement could be identified throughout. The patient recovered spontaneously (on anticoagulants) and did not require surgery. 4a: Enhanced abdominal CT scan demonstrating a filling defect in the superior mesenteric artery (arrow head); enhancement of small bowel wall present throughout (open arrow Rt; closed arrow Lt). 4b: thrombus attached to wall of Lt ventricle (arrow). 4c: splenic infarcts (arrows).

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Duplex Scanning	Abdominal X-Ray	Abdominal CT	MRI
Presence of normal flow in the portal and mesenteric venous system helps exclude portal vein thrombosis	Excludes other causes of abdominal pain.	Increased density in both arteries and veins	High degree of accuracy in Mesenteric Vein Thrombosis (23)
Ascites and absent flow suggest mesenteric venous thrombosis (18)	25% of confirmed Acute Mesenteric Ischaemia will be normal (19)	Maybe normal or non-diagnostic for acute mesenteric ischaemia	
		Contrast administration may show vessel occlusion, but chronic occlusion cannot be discriminated from acute vessel thrombosis  Diagnostic modality for mesenteric vein thrombosis, sensitivity >90% (20-22) with following indications: <ul style="list-style-type: none"> <li>• Superior mesenteric or portal vein appears large, with a central area of low attenuation</li> <li>• Contrast phase: rim may enhance vein wall</li> <li>• Bowel thickening and presence of ascites</li> </ul>	

**Table 1:** Differential table of acute mesenteric ischaemia on imaging

<b>Aetiology</b>	<i>Acute</i>	Occlusive: Arterial emboli from the heart <ul style="list-style-type: none"> <li>• Atrial fibrillation</li> <li>• Mural thrombus</li> <li>• Valvular lesions</li> <li>• Atherosclerotic emboli post surgery</li> </ul> Non-occlusive <ul style="list-style-type: none"> <li>• Intra-abdominal tumours causing vascular compression</li> <li>• Poor perfusion secondary to congestive cardiac failure, myocardial infarction or hypovolaemia</li> </ul>
	<i>Chronic</i>	Narrowing due to atherosclerosis
<b>Incidence</b>		Range from 0.06 to 0.36% (8-10)
<b>Gender Ratio</b>		No specific gender ratio
<b>Age Predilection</b>		In unselected autopsies mesenteric ischaemia in 67% of those aged over 80 years. 29% in all unselected autopsies. (11)
<b>Risk Factors (12)</b>	<i>Thrombosis</i>	Systemic atherosclerosis
	<i>Embolism</i>	Recent myocardial infarction Congestive cardiac failure Arrhythmias Rheumatic fever
	<i>Non-occlusive mesenteric ischaemia</i>	Cardiogenic shock Cardiopulmonary bypass Vasopressor agents Sepsis Burns Pancreatitis
	<i>Mesenteric venous thrombosis</i>	Hypercoagulability Portal hypertension Inflammation Prior surgery Trauma
<b>Treatment [12]</b>	<i>Medical</i>	Aggressive fluid resuscitation Systemic blood pressure monitoring Nasogastric tubing to decompress the stomach
	<i>Interventional radiology</i>	Indicated for non-occlusive mesenteric ischaemia
	<i>Surgery</i>	Primary curative treatment <ul style="list-style-type: none"> <li>• Perform revascularisation</li> <li>• Resect nonviable bowel</li> </ul>
<b>Prognosis</b>	<i>1-year (13-15)</i>	>60%
	<i>2-year (16)</i>	70%
	<i>5-year (17)</i>	50%
<b>Findings on Imaging</b>	<i>Duplex Scanning</i>	Presence of normal flow in the portal and mesenteric venous system helps exclude portal vein thrombosis Ascites and absent flow suggest mesenteric venous thrombosis (18)
	<i>Abdominal X-ray</i>	Excludes other causes of abdominal pain. 25% of confirmed Acute Mesenteric Ischaemia will be normal (19)
	<i>Abdominal CT</i>	Increased density in both arteries and veins Maybe normal or non-diagnostic for acute mesenteric ischaemia Contrast administration may show vessel occlusion, but chronic occlusion cannot be discriminated from acute vessel thrombosis Diagnostic modality for mesenteric vein thrombosis, sensitivity >90% (20-22) <ul style="list-style-type: none"> <li>• Superior mesenteric or portal vein appears large, with a central area of low attenuation</li> <li>• Contrast phase: rim may enhance vein wall</li> <li>• Bowel thickening and presence of ascites</li> </ul>
	<i>MRI</i>	High degree of accuracy in Mesenteric Vein Thrombosis (23)

**Table 2:** Summary table of acute mesenteric ischaemia

ABBREVIATIONS

CT = Computer Tomography  
IV = intravenous  
IU/L = international units/litre  
HIV = human immunodeficiency virus  
INR = International Normalisation Ratio  
IU = International Units  
L = Litre  
Lt = Left  
mmHg = millimeters of mercury  
Rt = Right

KEYWORDS

Mesenteric Ischaemia, HIV

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