

# The role of computed tomography in acute bowel ischemia

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## 1. General characteristics of acute bowel ischemia

Acute mesenteric ischemia represents 0.1% to 0.01% of all hospitalized patients. Its peak incidence is found between the sixth and seventh decade and it is associated with a high mortality rate (estimated between 60 and 80% according to the literature).

The observed clinical presentations are not often clearly suggestive of mesenteric ischemia therefore its possibility must always be kept in mind when confronted with an acute abdomen in a patient over the age of sixty [5].

We must at once make a distinction between two different clinical presentations [7]:

— acute mesenteric ischemia, whether it be from an occlusive (embolic or thrombotic) or non-occlusive (low flow state) origin, is characterized by a dramatic clinical presentation (which is usually of sudden onset) and a dismal prognosis (60 to 90% mortality rate) which is, in large part, related to a much delayed diagnosis (which explains the extension and severity of intestinal lesions).

— acute venous ischemia from portomesenteric thrombosis, its frequency varying from 5 to 50% of cases according to the series studied in the literature, is actually better recognized by the various imaging techniques, particularly computed tomography. Its clinical presentation is generally less dramatic with a more gradual evolution and a less unfavorable outcome (spontaneously as well as medically treated). Severe and extensive cases, however, may require extensive resections of the small bowel. It is in these "venous" ischemia cases where computed tomography will provide the most useful elements for the definite diagnosis as well as for following the evolution of patients under medical treatment.

## 2. Computed tomography of acute arterial ischemia

Since its evolution is often swift and unfavorable, acute mesenteric arterial ischemia must be confirmed and treated as rapidly as possible which, in theory, represents an indication for either an emergency angiography of the superior mesenteric trunk or an emergency laparotomy. This is particularly true when diagnosis is suspected in the first eight hours or acute abdominal pain; transcatheter thrombolytic therapy can then be used as an alternative to surgery in selected

cases (minor or partial vascular occlusion, mild symptoms without peritoneal signs suggesting bowel necrosis).

Everyday practice, especially in elderly patients and in patients without obvious risk factors (atrial fibrillation, recent myocardial infarct, valvular cardiopathy, aneurysm, etc...) shows that it is often the CT scan that confirms the mesenteric ischemia either by:

— *direct signs*: thrombosis of the main trunk of the SMA with or without associated stenotic atheromatous plaques. We must, however, remember that in segmental thrombosis of the SMA, there is not inevitably an ischemic process. It all depends on many factors such as the speed of installation, the extension of the thrombosis, and, especially, on the quality of substitution by the anastomotic pathways from either the celiac trunk (pancreaticoduodenal arcade) or the inferior mesenteric artery (arc of Riolan). In this context, spiral CT acquisitions of the abdominal aorta and its vascular branches may substitute mesenteric angiography.

— or *indirect signs*: which are found much more frequently. These signs express the repercussions of the ischemia on the bowel wall. Depending on the extent and severity of the ischemia, the state of substituting vascular pathways and on the quality of reperfusion they permit, we can observe different modifications of the ischemic bowel wall segments [3,7].

. In severe cases, the bowel wall of ischemic loops is thinner (disappearing of the mucosa and submucosa by necrotic sloughing) with luminal distention from liquid or gas. There is no enhancement of the bowel wall after injection of contrast media. A few hours later, there is a peritoneal effusion and we may have CT findings of pneumatosis intestinalis and portal venous gas.

. In cases where reperfusion was possible, there is thickening of the bowel wall with "target" enhancement following the injection of contrast media thus revealing submucosal edema (fig. 1 A and B). These CT findings are usually found in transitional segments between bowel spared from the ischemic process and bowel maximally affected, but they can also be found along the entire pathological segment, particularly in non-occlusive ischemia which preferentially affects the ileocecal region or the colon (fulminant ischemic colitis) [1,2,4].

. We may observe the same CT appearance of bowel wall thickening with submucosal edema and "target" contrast enhancement affecting the entire small bowel

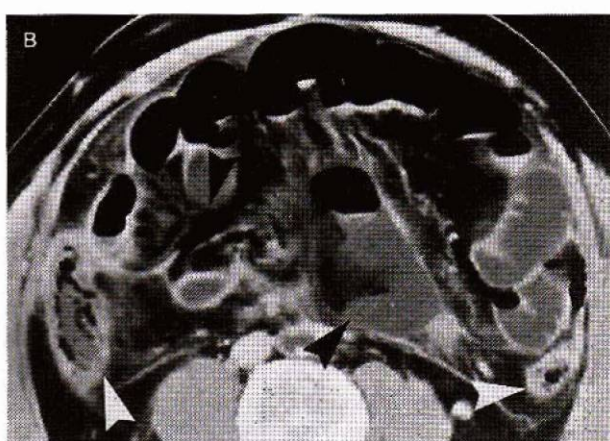


Fig. 1. — Acute thrombosis of the aorta and the mesenteric superior artery. Patient with a history of chronic renal failure (hemodialysed).

A. acute thrombosis of abdominal aorta (star). Extensive thrombus in the trunk of the SMA (curved black arrow). Gaseous distension of jejunal loops.

B. "vanishing" wall of ischemic jejunal loops (black arrowheads) contrasting with normal enhancement of preserved intestine. Thickened colic wall (caecum and left colon) with "target sign" suggestive of submucosal oedema (less pronounced ischemia or revascularization ?) (white arrowheads). Infiltration of mesenteric structures in the ischemic areas.

in the vasculitis syndromes, especially Henoch-Schönlein purpura.

### 3. Computed tomography in acute venous ischemia

Venous ischemia can be suspected clinically when the history of the patient, presenting with a revealing acute manifestation, confirms the existence of painful phenomena in the days preceding the acute manifestation. There is often fever and neutrophilic leukocytosis. Pathologically, there is infarction with red blood cell infiltration of the entire parietal tunica.

CT diagnosis of acute mesenteric venous ischemia is, by rule, quite simple and is based on :

— *direct signs* : thrombosis of the main trunk of the superior mesenteric vein or its main proximal branches can be easily demonstrated on CT slices after the injection of contrast media. The CT findings demonstrate the absence of luminal enhancement (with an increase in the diameter of the lumen) which contrasts with the enhancing thickened vascular walls. We can also demonstrate, on non-enhanced CT, by using thin high resolution slices, the presence of a spontaneous hyperdense intraluminal blood clot and occasionally the presence of intraparietal hemorrhagic infiltration.

— *indirect signs* : they are stereotypical and associate an extensive regular and circumferential thickening of the affected bowel loops with adjacent peritoneal infiltration (loss of normal fat lucency) and minimal peritoneal effusion. Injection of contrast media demonstrates the characteristic "target" enhancement of submucosal edema [6] (fig. 2).

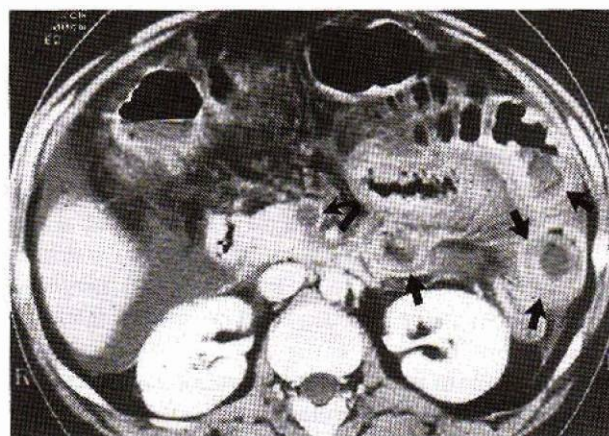


Fig. 2. — Thrombosis of mesenteric portal axis with extensive venous intestinal ischemia.

Thrombus in the proximal part of SMV is clearly depicted (curved black arrow).

Diffuse congestion of the mesenteric structures with abundant ascite. Enlarged jejunal wall with "target enhancement" representing "congestive" submucosal oedema.

The CT findings are identical to the ones observed in parietal hematomas of the bowel found in patients treated with vitamin K-inhibiting anticoagulants. Only the demonstration of the direct signs of mesenteric venous thrombosis will permit us to distinguish between the two (fig. 3).

The evolution of venous ischemia, which depends on its extent, is often favorable because of the significance of the anastomotic network. The risk of parietal necrosis is only observed when the right intra-mural vessels are involved, making the collateral vascular network non-functional. An initially favorable evolution can lead to an extensive and organized fibrous stenosis in just a few weeks which, consequently, may require a resection of the narrowed segment.

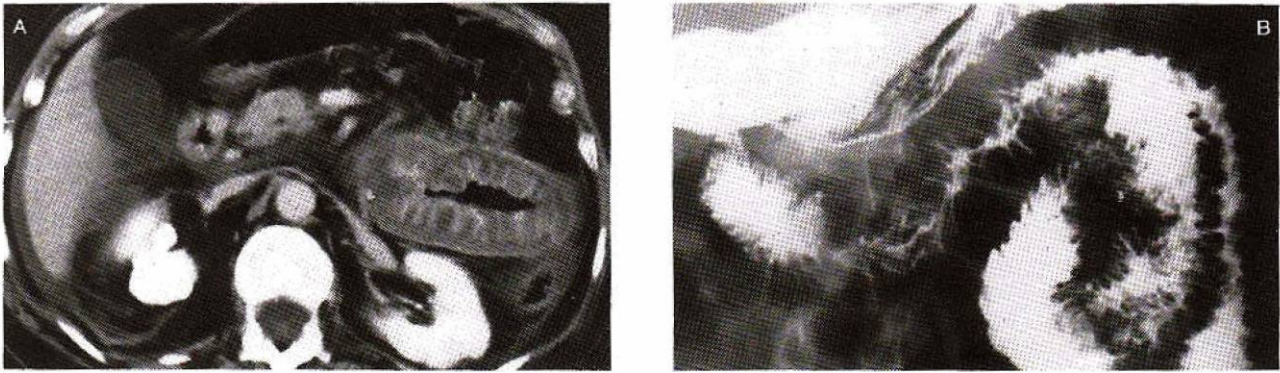


Fig. 3. — Intramural hemorrhage of the small intestine in patient receiving Vit. K inhibitors.

3A: intramural hematoma of the jejunum is the most common presentation. Huge enlargement of the wall of the first jejunal loops with thickened oedematous valvules. Peritoneal effusion with perihepatic and left parietocolic ascite (arrows).

3B: small bowel opacification, seven days later, shows the corresponding endoluminal coating of the enlarged valvules. This "stacked-coin" appearance closely resembles an ischemic bowel segment.

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