

# Role of Contrast-Enhanced Computed Tomography in Assessment of Mesenteric Ischemia

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## Abstract

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**Background:** Ischemia of the intestines can be defined as inadequate perfusion through the mesenteric vasculature to meet the demands of downstream organs. **The purpose of this study was to** highlight the role of Contrast-enhanced CT in assessment of mesenteric ischemia. **Methods:** This cross-sectional study included 20 patients present with severe abdominal pain, in addition to a variety of non-specific abdominal complaints including nausea, vomiting, and diarrhea. Patients presented with septic shock secondary to ischemic or necrotic bowel. **Results:** In this study, 80% of Cases were males and 20% of Cases were Females, The Age ranged from 50 years to 85 years with Mean  $69.8 \pm 11.68$ . 90% from the studied group suffering from abdominal pain, 70% from the studied group suffering from Vomiting, 70% from the studied group suffering from diarrhoea, 20% from the studied group suffering from Bleeding per rectum. According to CT findings; 60% from the studied group suffering from Bowel dilatation, 50% from the studied group suffering from Bowel wall thickness, 50% from the studied group suffering from Intramural gas, 50% from the studied group suffering from Mesenteric fat. **Conclusion:** the contrast Enhanced CT is the first line imaging modality when mesenteric ischemia is suspected.

**Keywords:** Contrast-Enhanced; CT; Mesenteric; Ischemia

## Introduction

Mesenteric ischemia is a medical condition that is precipitated by inadequate blood supply to the small intestine. The

inadequacy of blood supply can lead to both reversible and irreversible injury to an affected small intestine segment. The

ischemic injury progresses from cellular damage to intestinal necrosis and can ultimately cause death if left untreated with mortality rates between 30% and 90% (1).

Ischemia of the intestines can be defined as inadequate perfusion through the mesenteric vasculature to meet the demands of downstream organs. The condition, while rare, can result in a very symptomatic and life-threatening clinical presentation. Intestinal, or mesenteric, ischemia is generally divided into acute mesenteric ischemia and chronic mesenteric ischemia (2).

The etiology of acute mesenteric ischemia can be divided into four categories: arterial embolization, arterial thrombosis, and mesenteric venous thrombosis, and non-occlusive, low-flow state (3).

The pathogenesis of NOMI is a splanchnic hypoperfusion commonly caused by a decreased cardiac output. Patients are mostly older than 50 years, with history of ischaemic heart disease, congestive heart failure, renal and peripheral artery disease and patients following cardiac/vascular surgery (4).

The incidence of acute mesenteric ischemia has decreased over the last few years. However, cases of chronic mesenteric

ischemia have grown in number, as this disease is the most frequent disorder of the large intestine in the elderly. The typical clinical presentation of mesenteric ischemia develops gradually and only becomes recognizable in the late stage of the disease (5).

Contrast-enhanced computed tomography (CT) has become the cornerstone of the diagnosis by showing features of vascular disorders (occlusion and/or insufficient blood supply) and features of intestinal ischemic injury. CT should be performed as rapidly as possible (3).

CT plays a double role in patients with AMI. First, diagnosis is reached based on the combination of two sets of features that parallel the pathophysiology of the disease: 1/vascular insufficiency, and 2/ischemic intestinal injury. Second, CT should help identify negative prognostic factors, suggestive of extensive necrosis, or complications. (6).

Biphasic CT has become the gold standard in evaluating patients with suspected mesenteric ischaemia. The modality provides rapid, noninvasive evaluation and minimizes the need for angiography and exploratory laparotomy (7). The purpose of this study was to highlight the role of

Contrast-enhanced CT in assessment of mesenteric ischemia.

## **Patients and methods**

This cross-sectional study included 20 patients present with severe abdominal pain, in addition to a variety of non-specific abdominal complaints including nausea, vomiting, and diarrhea. Patients presented with septic shock secondary to ischemic or necrotic bowel presented to department of El Matarya teaching hospital. during the period from January 2021 to July 2021.

All patients were subjected to the following:

- History taking.
- Full clinical examination.
- Contrast-enhanced CT scan.

### **Inclusion criteria:**

- All patients come to the department with severe abdominal pain, in addition to a variety of non-specific abdominal complaints including nausea, vomiting, and diarrhea. Patients may present with septic shock secondary to ischemic or necrotic bowel.

### **Exclusion criteria:**

- Patients with impaired renal function or hypersensitive who are contraindicated for contrast agent.

## **Methodology:**

CT images are obtained from the dome of the liver to the level of the perineum to cover the entire course of the intestine. With MDCT scanners, a collimation of 0.5–2.5 mm and a detector pitch of 1.0–2.0 are used. Images with a 5- to 7-mm section thickness are usually constructed for image interpretation; however, thinner sections of contiguous 1–2 mm should also be constructed for multiplanar image reformations and CT angiography. Sagittal images are helpful in assessing the origin of the mesenteric arteries and their variations.

The study was approved by the Ethical Committee of Benha faculty of Medicine; an informed consent was taken from all participants before taking any data or doing any imaging techniques. The consent contained;

- Simple explanation of the aim of the study to the patient. No harmful maneuvers will be performed or use.
- All data is considered confidential.
- All participants will be informed by the result of the study.

## Data management

The clinical data were recorded on a report form. These data were tabulated and analyzed using the computer program SPSS (Statistical package for social science) version 26 to obtain: Descriptive data; Descriptive statistics were calculated for the data in the form of: Mean and standard deviation (mean  $\pm$  sd) for quantitative data. Frequency and distribution for qualitative data. Analytical statistics; in the statistical comparison between the different groups, the significance of difference was tested using Inter-group comparison of categorical data was performed by using fisher exact test (FET). *P* value  $<0.05$  was considered statistically significant (\*) while  $>0.05$  statistically insignificant *P* value  $<0.01$  was considered highly significant (\*\*) in all analyses.

## Results

In this study, 80% of Cases were males and 20% of Cases were Females, The Age ranged from 50 years to 85 years with Mean  $69.8 \pm 11.68$  (**Table 1**)

Regarding clinical features; 90% from the studied group suffering from abdominal pain, 70% from the studied group suffering from Vomiting, 70% from the studied group

suffering from Diarrhoea, 20% from the studied group suffering from Bleeding per rectum (**Figure 1**)

According to CT findings; 60% from the studied group suffering from Bowel dilatation, 50% from the studied group suffering from Bowel wall thickness, 50% from the studied group suffering from Intramural gas, 50% from the studied group suffering from Mesenteric fat (**Figure 2**) Eighty percent from the studied group have risk factors (**Figure 3**).

There is significant statistical Difference between statistical group with positive RF as All cases of positive RF complaining from abdominal pain and only 50% of negative RF complaining from abdominal pain (**Table 2**).

There is no statistical significance difference between cases with positive and negative CT findings according to bowel dilatation, bowel wall thickening, intramural gas and mesenteric fat stranding (**Table 3**).

**Case 1:** Female patient aged 50 years presented by abdominal Pain and vomiting. CT with oral and IV contrast was done after preparation by fasting 8 hours. CT images show: diffuse segment of regular circumferential mural thickening noted at the jejunal and ileal bowel loops, smudged

peritoneal fat planes and intramural gas with SMA occlusion (arrowed) (**Figure 4**).

**Case 2:** Male patient aged 80 years presented by severe abdominal pain. CT

with IV contrast was done with no preparation. CT images show: lack of enhancement of the IMA from its origin and diffuse colonic dilatation (arrowed) (**Figure 5**).

**Table 1 :** Age and sex distribution of the studied group.

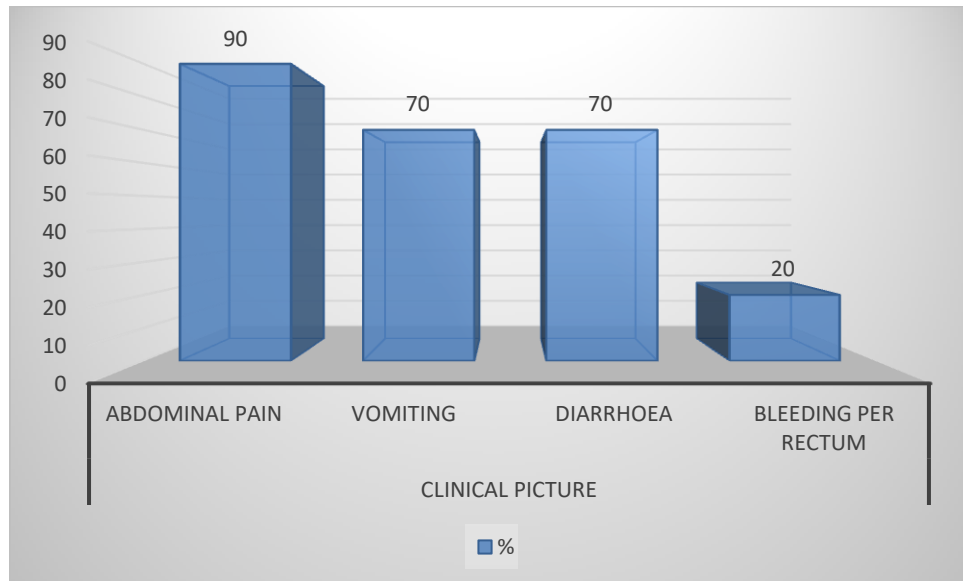
	No (20)	%
<b>Sex</b>		
<b>Male</b>	16	80.0
<b>Female</b>	4	20.0
<b>Age</b>		
<b>Mean ±SD</b>	69.8±11.68	
<b>Range</b>	50.0-85.0	

**Table 2:** Difference between presence and absence of RF according to clinical picture.

Clinical picture	Positive RF (16)		Negative RF (4)		Statistical test	P value
	No	%	No	%		
<b>Abdominal pain</b>						
<b>Yes</b>	16	100	2	50.0	FET= 4.2	0.032*
<b>No</b>	0	0.0	2	50.0		
<b>Vomiting</b>						
<b>Yes</b>	12	75.0	2	50.0	FET= 0.134	0.55
<b>No</b>	4	25.0	2	50.0		
<b>Diarrhoea</b>						
<b>Yes</b>	12	75.0	2	50.0	FET= 0.134	0.55
<b>No</b>	4	25.0	2	50.0		
<b>Bleeding per rectum</b>						
<b>Yes</b>	4	25.0	0	0.0	FET= 0.176	0.54
<b>No</b>	12	75.0	4	100		

**Table 3:** Difference between presence and absence of RF according to CT findings.

CT findings	Positive (16)		Negative (4)		Statistical test	P value
	No	%	No	%		
<b>Bowel dilatation</b>						
Yes	8	50.0	4	100	FET= 1.58	0.12
No	8	50.0	0	0.0		
<b>Bowel wall thickness</b>						
Yes	10	62.5	0	0.0	FET= 2.81	0.09
No	6	37.5	4	100		
<b>Intramural gas</b>						
Yes	8	50.0	2	50.0	FET= 0.0	1.0
No	8	50.0	2	50.0		
<b>Mesenteric fat</b>						
Yes	10	62.5	0	0.0	FET= 2.81	0.09
No	6	37.5	4	100		



**Figure 1:** Bar chart showing distribution of the studied group according to clinical picture.

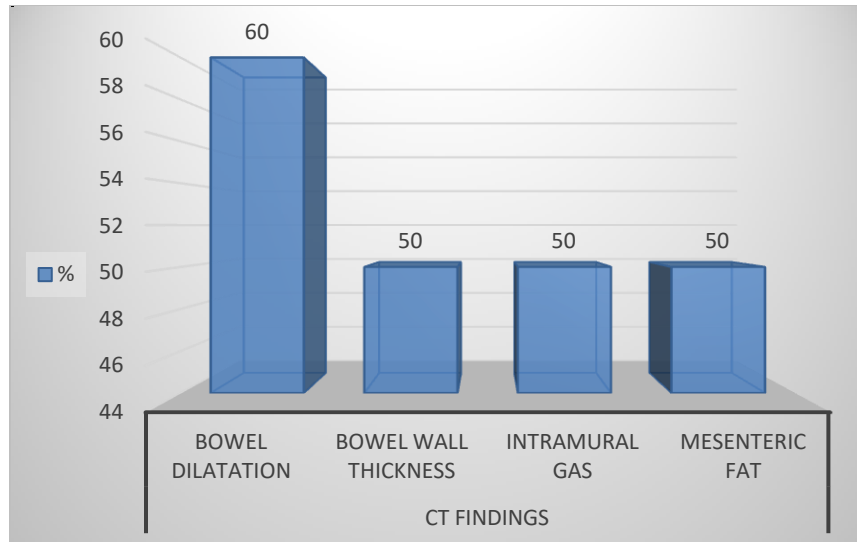


Figure 2: Bar chart showing distribution of the studied group according to CT findings.

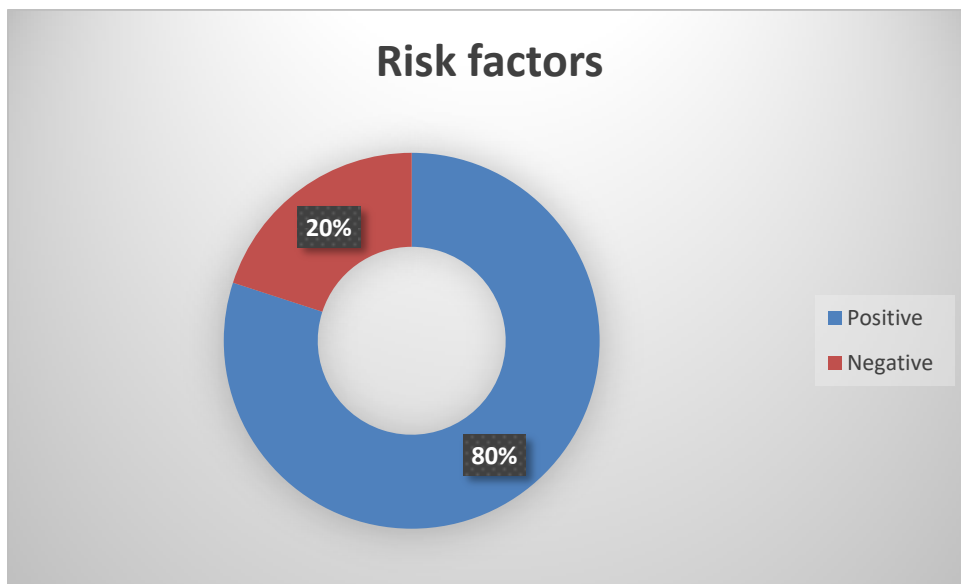
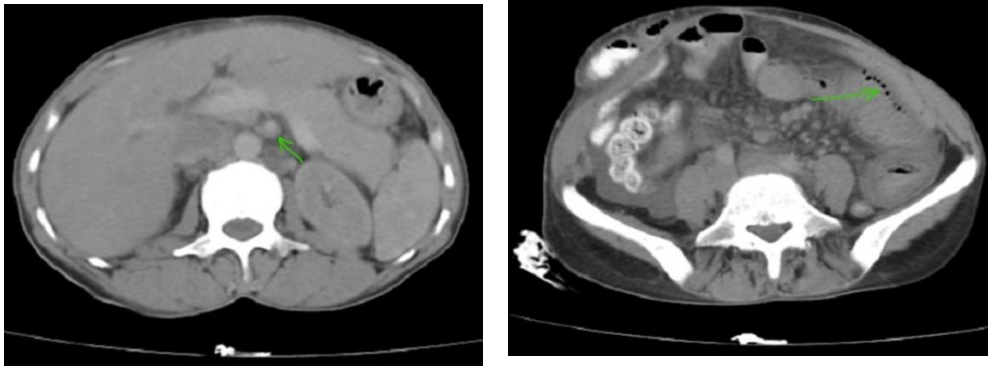
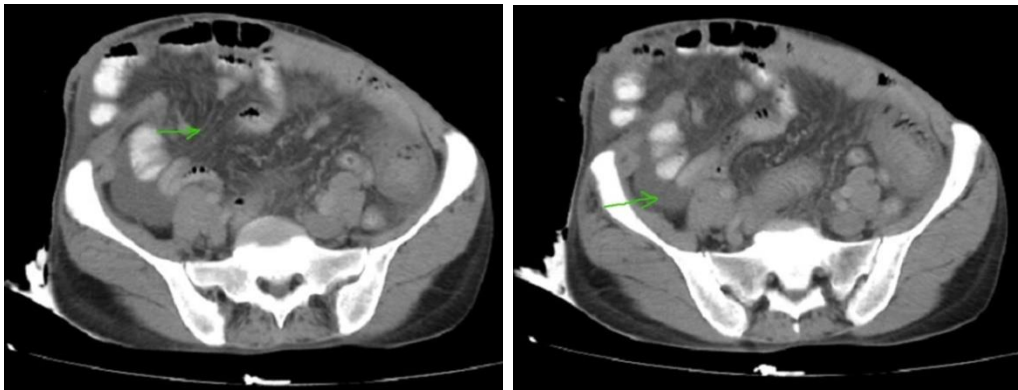


Figure 3: Pie chart showing distribution of the studied group according to risk factors presence.

**Figure 4: Case 1**



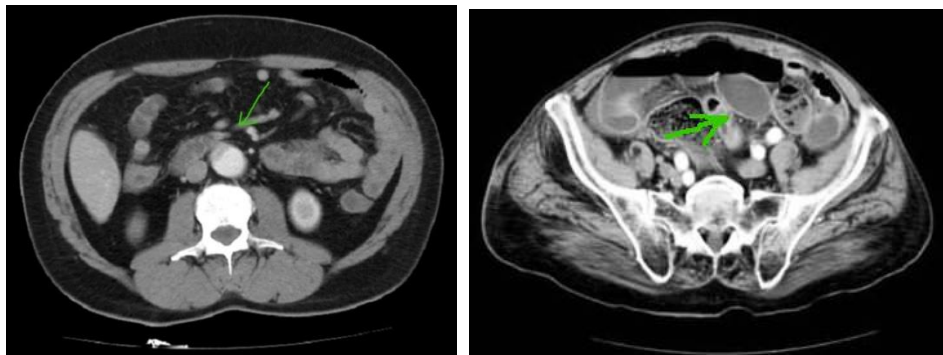
**Axial CT**



**Axial CT**

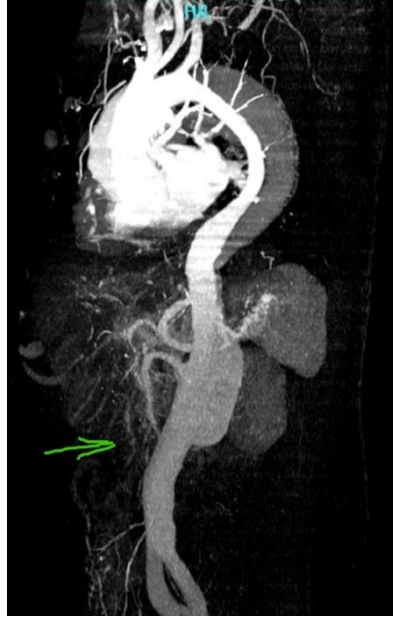
- CT interpretation suggested ischemic change.
- An operation was done and the pathology confirmed the diagnosis of bowel ischemia.

**Figure 5: Case 2**



**Axial CT**





### 3D-CT

## Discussion

Contrast-enhanced computed tomography (CT) has become the cornerstone of the diagnosis by showing features of vascular disorders (occlusion and/or insufficient blood supply) and features of intestinal ischemic injury. CT should be performed as rapidly as possible (3).

The purpose of this study is to highlight the role of Contrast-enhanced CT in assessment of mesenteric ischemia.

Among the 20 Patients included in this study 16 of them were males and 4 females with no significant relation between the sex and the Pathology.

In our study we found that the contrast Enhanced CT is the first line imaging modality when mesenteric ischemia is suspected.

As in a previous study (6), Acute mesenteric ischemia is a life-threatening abdominal emergency defined by the association of mesenteric vascular insufficiency and intestinal ischemic injury. The cornerstone of the diagnosis of acute mesenteric ischemia is multiphase contrast-enhanced CT including unenhanced, early arterial and portal venous phase images. There are no strong clinical and biological findings, any sudden ("vascular"), unusual, intense

abdominal pain should be suspicious of AMI. Intra-luminal defects or occlusions of the mesenteric vessels are highly specific for the diagnosis (94-100%). absent/decreased bowel wall enhancement, bowel loop dilatation, pneumatosis intestinalis with or without associated portal venous gas, and extra digestive gas bubbles are the most important imaging features.

### Conclusion

Ischemia of the intestines can be defined as inadequate perfusion through the mesenteric vasculature to meet the demands of downstream organs. The condition, while rare, can result in a very symptomatic and life-threatening clinical presentation. Intestinal, or mesenteric, ischemia is generally divided into acute mesenteric ischemia and chronic mesenteric ischemia. The cornerstone of the diagnosis of acute mesenteric ischemia is multiphasic contrast-enhanced CT including unenhanced, early arterial and portal venous phase images. Intra-luminal defects or occlusions of the mesenteric vessels are highly specific for the diagnosis. Absent/Decreased bowel wall enhancement, bowel loop dilatation,

pneumatosis intestinalis with or without associated portal venous gas, and extra digestive gas bubbles are the most important imaging features.

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