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A study of bowel wall ischemia using contrast enhanced MDCT

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Abstract

Introduction

Acute mesenteric ischemia is a life-threatening condition, with a reported mortality rate of 50–90%, that requires early diagnosis and treatment[1]. Angiography has been the reference standard imaging examination, however, the role of CT in this setting has expanded with the advent of helical CT scanners[2].

Acute mesenteric ischemia can be caused by various conditions such as arterial occlusion, venous occlusion, strangulating obstruction, and hypoperfusion associated with non-occlusive vascular disease, and the CT findings vary widely depending on the cause and underlying pathophysiology[3].

CT findings of acute mesenteric ischemia should be characterized based on the cause. In addition, the severity of bowel ischemia (i.e., superficial mucosal or transmural bowel wall necrosis), the location (i.e., small, or large bowel), and the presence and degree of haemorrhage or subsequent superinfections may affect the CT appearance[4].

Mesenteric ischemia is classified into two forms, acute and chronic, which are differentiated on the timing of symptom onset and extent of decreased blood flow. Mesenteric ischemia is further subdivided by etiology: arterial, venous, and non-occlusive[5].

Acute mesenteric ischemia (AMI) occurs from arterial embolic or thrombotic obstruction, mesenteric venous thrombosis, or a non-occlusive etiology (embolic and thrombosis, emboli in the setting of atrial fibrillation, arterial emboli from a cardiac or septic source are the most common causes)[6].

Chronic arterial bowel ischemia presents with subacute and even fewer specific symptoms in the setting of long-

standing mesenteric arterial atherosclerotic disease resulting in constant decreased blood flow, especially in the post-prandial state[7].

Non-occlusive mesenteric ischemia (NOMI), occurring in 10-20% of AMI cases, is most common in elderly patients with severe systemic illnesses that reduce cardiac output[8].

Ischemic bowel may result of as complication of other underlying intraabdominal comorbidities. The identification of bowel obstruction on CT should always prompt the search for the complication of bowel ischemia since rapid triage to surgery may be necessary to prevent abdominal catastrophe from bowel perforation[9].

Early MDCT findings include bowel wall thickening, bowel wall edema, the target sign

and adjacent mesenteric fat stranding[10]. Target sign is seen on contrast enhanced scans.

The inner and outer layers of the target represent the mucosa and the muscularis propria and / or serosa, respectively[11]. High attenuation due to hyperemia and contrast enhancement is seen in the outer and inner layer respectively, whereas low attenuation of the middle layer is due to edema in the sub-mucosa[12].

As the ischemia progresses there is decreased attenuation and enhancement of the bowel wall. In the later stages, there is bacterial proliferation and gas production leading to pneumatosis intestinal is or presence of intramural air[13]. Air may reach the portal circulation via mesenteric veins. Some amount of free fluid in peritoneal cavity is usually present and is often haemorrhagic[14].

Contrast enhanced MDCT can also detect thrombosis / occlusion of vessels (SMA / SMV) which are often responsible for bowel ischemia[15].

Materials and methods

Source of data: Cases for the above study are collected from Rajarajeswari Medical College and Hospital, Bengaluru.

Study Period: January 2022 till July 2022.

Study design: Prospective observational and descriptive study

Place of study: Rajarajeswari Medical College and Hospital, Bengaluru

Sample size: 43

Inclusion criteria

All patients with clinical suspicion of mesenteric ischemia.

Exclusion criteria

In cases where computed tomography is contraindicated.

Method of Collection of Data

Patients admitted to Rajarajeswari Medical College and Hospital with clinical suspicion of mesenteric ischemia who underwent contrast enhanced MDCT abdomen and pelvis during study period will be included in the study.

Methodology

All scans will be done using Siemens Somatom Perspective 128- slice MDCT, with 120 KVp and 300 mAs with 1 mm slice thickness. Initial non -enhanced MDCT scan will be followed by arterial and venous phase contrast enhanced MDCT scan of abdomen and pelvis. Bolus tracking method will be used for post contrast scan, with the tracker placed in the descending aorta at the level of dome of diaphragm. 70-80 ml of 300mg/ml nonionic iodinated contrast (IOHEXOL) injected using pressure injector at the rate of 3-4ml/sec. Threshold set at 100 Hounsfield units and delay of 5 seconds (approx. 30 seconds from the time of contrast injection) will be given after the attainment of threshold for arterial phase. Venous phase will be

acquired after a delay 60 seconds from the time of contrast injection. Scanning will be done in cranio-caudal direction in the non-contrast scan from the level of diaphragm to the level of pubic symphysis. Scanning will be done in cranio-caudal direction in arterial and venous phases, from the level of diaphragm to aortic bifurcation in the arterial phase and from the level of diaphragm to the level of pubic symphysis in the venous phase. Images will be reconstructed with 1.25 mm slice thickness and reformatted in sagittal and coronal planes for analysis. Oral and rectal contrast will be given when necessary.

Results

	Number of cases	Percentage %
Males	28	65
Females	15	35
Total	43	100

Table 1: Gender distribution of the cases

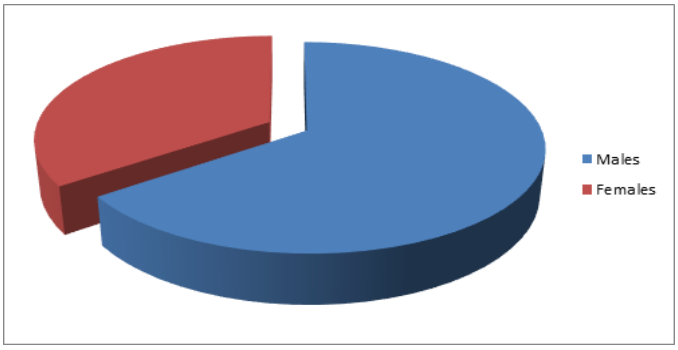

Figure 1: Gender distribution of the cases

Age distribution	Number of cases	Percentage %
11-20	1	2.3
21-30	4	9.3
31-40	12	27.9
41-50	13	30.2
51-60	4	9.3
61-70	5	11.6
71-80	4	9.3
Total	43	100

Table 2: Age distribution of the cases

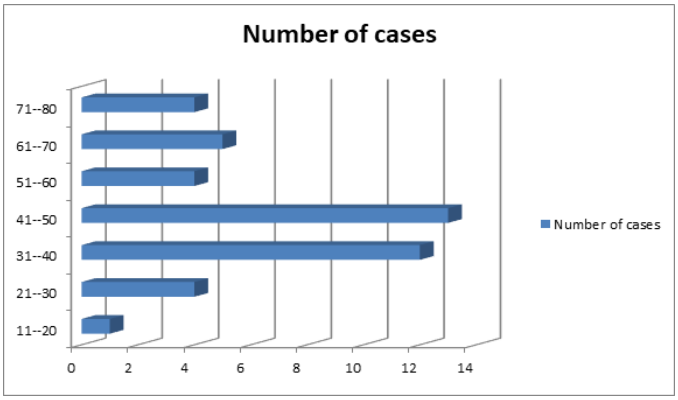

Figure 2: Age distribution of the cases

Pain abdomen only	Vomiting only	Both	Others
16	8	17	2

Table 3: Presenting complaints in the cases

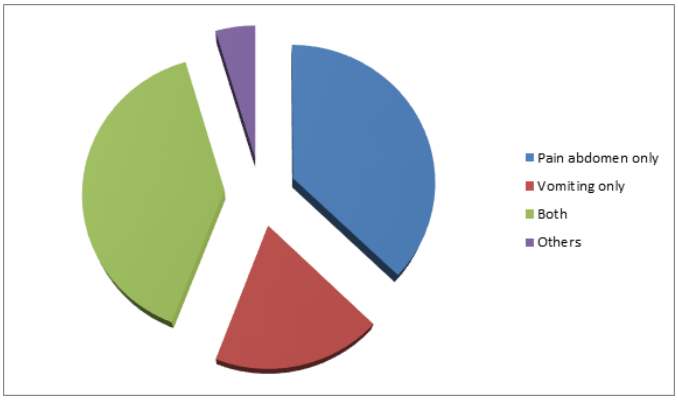

Figure 3: Presenting complaints in the cases

CT feature	Number of cases	(%)
Wall thickening	43	100
Decrease contrast enhancement	22	50
Pneumatosis	7	12.5
Ascites	22	50

Table 4: CT features of gangrenous bowel

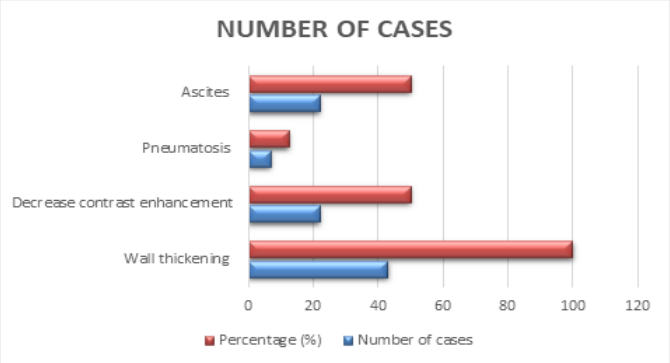

Figure 4: CT features of gangrenous bowel

		Intra operative Gangrenous Bowel	
		Present	Absent
Wall Thickening on CT	Present	43	8
	Absent	0	27

Table 5 (A, B, C & D): Specificity and Sensitivity of each CT feature of gangrenous bowel.

Sensitivity - 84%, Specificity – 97.5%

		Intra operative Gangrenous Bowel	
		Present	Absent
Pneumatosis	Present	7	0
	Absent	7	35

Sensitivity – 50%, Specificity – 100%

		Intra operative Gangrenous Bowel	
		Present	Absent
Ascites	Present	22	14
	Absent	4	21

Sensitivity – 84%, Specificity – 66%

Discussion

This is a prospective study of 43 patients who presented with mesenteric ischemia, on whom CT scan of abdomen and pelvis was done. Out of 43 cases, 28 are males (65%) and 15 are females (35%). Out of 43 cases, 17 cases (39.5%) presented with complaints of both pain abdomen and vomiting. 16 cases (37.2%) presented with only pain abdomen; 8 cases (18.6%) presented with only vomiting. The other complaints which are seen in 2 cases (4.6%) are constipation, loss of weight.

Out of 43 cases which were diagnosed to have gangrenous bowel on CT, showed following features; bowel wall thickening in all 43 cases (100%), decrease contrast enhancement in 22 cases (50%), ascites in 22 cases (50%) and pneumatosis in 7 cases (12.5%).

Out of 43 cases, bowel wall thickening had specificity of 77%, decrease contrast enhancement with specificity of 97%, ascites with 66% and pneumatosis with specificity of 100%.

So, these features can be considered as the alarming signs for the gangrenous bowel in intestinal obstruction.

Conclusion and summary

This is a prospective study of 43 consecutive patients who presented with acute mesenteric ischemia in whom CT abdomen and pelvis was done.

This study showed a male predominance of 2:1 with majority of patients aged between 30 to 50 years. The common complains presented by patients were pain abdomen and vomiting.

The CT imaging features of gangrenous bowel in this study was bowel wall thickening with specificity of 77%, decrease contrast enhancement with specificity of 97%, ascites with 66% and pneumatosis with specificity of 100%. Therefore, these features should be considered as the alarming signs for complications if detected on CT.

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