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Value of multislice computed tomography in the diagnosis of acute mesenteric ischemia☆

Ali Yikilmaz[a,*], Okkes Ibrahim Karahan[a], Serkan Senol[a], Ibrahim Sacit Tuna[a], Hizir Yakup Akyildiz[b]

[a] Erciyes University, School of Medicine, Gevher Nesibe Hospital, Department of Radiology, Talas Yolu, 38038 Melikgazi, Kayseri, Turkey
[b] Erciyes University, School of Medicine, Gevher Nesibe Hospital, Department of General Surgery, Talas Yolu, 38038 Melikgazi, Kayseri, Turkey

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ABSTRACT

Objective: To define the value of multislice computed tomography (CT) in the diagnosis of acute mesenteric ischemia (AMI).
Materials and methods: Two hundred patients (age range: 20–92 years) who were referred to the emergency CT department with a clinical suspicion of AMI were prospectively included in the study. CT examinations were performed with a multislice (16) CT scanner and the protocol included pre-contrast, arterial and venous phase acquisitions. Images were evaluated by using multiplanar reconstruction, maximum intensity projection and volume-rendering techniques at the CT workstation.
Results: Ninety-four patients (47%) underwent surgery for AMI or for other causes of acute abdominal pain. One hundred-six patients (53%) were followed conservatively according to clinical, radiologic and laboratory findings. Of the 94 patients who underwent surgery, 49 (25%) were found to have AMI. All of these 49 patients with a proven AMI diagnosis were diagnosed with CT. In the other 45 patients who underwent surgery, CT findings were negative for AMI. None of the patients, who were followed conservatively, were eventually diagnosed as having AMI except 1 patient. This patient was unfit for surgery although his clinical and radiologic findings were consistent with AMI and died in 3 days. The sensitivity and specificity values of CT for the detection of AMI were calculated to be 100% for each.
Conclusions: Multislice CT is an effective imaging technique for the diagnosis of AMI with excellent sensitivity and specificity values.

Acute mesenteric ischemia (AMI) comprises approximately 1% of all causes of acute abdomen and is associated with a mortality rate between 59 and 93% [1,2]. Clinical and laboratory findings are usually nonspecific and consequently, the diagnosis is delayed. In spite of the high mortality rate, early diagnosis may be life saving. The etiology is embolic or thrombotic arterial occlusion in 60–70% of the cases, nonocclusive ischemia and infarction in 20–30% and mesenteric venous thrombosis in 5–10% [3].

Multislice CT is a rapid and noninvasive technique that is being increasingly used for the diagnosis of AMI in emergency units. The gold standard diagnostic method of AMI is conventional catheter angiography that has a sensitivity of 88% [4]. However, it is an invasive, expensive and technically complex procedure. Multislice CT is advantageous over conventional angiography in that it delineates not only vascular structures but also demonstrates bowel wall changes and may exclude other causes of acute abdomen [5].

This study was performed to evaluate the sensitivity, specificity and clinical applicability of multislice CT in a series of patients referred to the radiology department with the clinical diagnosis of AMI.

1. Material and methods

Two hundred patients with a presumptive diagnosis of AMI based on clinical and laboratory findings at the Erciyes University, Medical Faculty, Gevher Nesibe Hospital were included in the study in a prospective manner between January 2006 and June 2007. Of the 200 patients, 94 underwent surgery and 106 were followed conservatively.

The mean age of the study group was 66 years (range 20–92 years) that included 95 male (mean age: 63 years) and 105 female (mean age: 68 years) patients. Age was not an exclusion criterion. However, patients with contrast allergy or impaired renal function or patients whose CT examination was not performed with appropriate protocol were excluded from the study. The CT examinations of 8 patients had suboptimal image

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* Corresponding author at: Erciyes University, Medical School, Gevher Nesibe Hospital, Department of Radiology, 38039 Talas, Kayseri, Turkey.
Tel.: +90 4374937/23781; fax: +90 352 4375273.
E-mail addresses: dryikilmaz@yahoo.com, ayikilmaz@erciyes.edu.tr (A. Yikilmaz).

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Table 1
Overview of the comparative CT findings of our study and the literature.

CT sign	Taourel et al. [10]	Kirkpatrick et al. [6]	Aschoff et al. [9]	Our study
SMA occlusion (emboli in SMA)	AMI: 7/39 (18%) Control: 0/24 Sens: 18% Spec: 100%	AMI: 5/26 (19%) Control: 0/36 Sens: 19% Spec: 100%	AMI: 16/28 (57%) Control: 0/47 Sens: 57% Spec:100%	AMI: 44/50 (88%) Control: 0/150 Sens: 88% Spec: 100%
Mesenteric vein thrombosis	AMI: 6/39 (15%) Control: 0/24 Sens: 15% Spec: 100%	AMI: 4/26 (15%) Control: 2/36 (6%) Sens: 15% Spec: 94%	AMI: 6/28 (21%) Control: 0/47 Sens: 21% Spec: 100%	AMI: 14/50 (28%) Control: 0/150 Sens: 28% Spec: 100%
Bowel wall thickening	AMI: 15/39 (38%) Control: 8/24 (33%) Sens: 38% Spec: 67%	AMI: 22/26 (85%) Control: 10/36 (28%) Sens: 85% Spec: 72%	AMI: 22/28 (79%) Control: 14/47 (30%) Sens: 79% Spec: 70%	AMI: 33/50 (66%) Control: 58/150 (39%) Sens: 66% Spec: 61%
Bowel dilatation	AMI: 26/39 (67%) Control: 17/24 (71%) Sens: 67% Spec: 29%	AMI: 17/26 (65%) Control: 6/36 (17%) Sens: 65% Spec: 83%	AMI: 18/28 (64%) Control: 12/47 (26%) Sens: 64% Spec: 74%	AMI: 33/50 (66%) Control: 30/150 (20%) Sens: 66% Spec: 80%
Ascites	AMI: 19/39 (49%) Control: 7/24 (29%) Sens: 49% Spec: 71%	AMI: 19/26 (73%) Control: 24/36 (67%) Sens: 73% Spec: 33%	AMI: 20/28 (71%) Control: 28/47 (60%) Sens: 71% Spec: 40%	AMI: 22/50 (44%) Control: 63/150 (42%) Sens: 44% Spec: 58%
Mesenteric fat stranding	AMI: 27/39 (69%) Control: 15/24 (63%) Sens: 18% Spec: 28%	AMI: 23/26 (88%) Control: 10/36 (28%) Sens: 88% Spec: 61%	AMI: 24/28 (86%) Control: 34/47 (72%) Sens: 86% Spec: 28%	AMI: 48/50 (96%) Control: 87/150 (58%) Sens: 96% Spec: 42%
Extensive musocal enhancement	AMI: 13/39 (33%) Control: 7/24 (29%) Sens: 33% Spec: 71%	AMI: 12/26 (46%) Control: 7/36 (19%) Sens: 46% Spec: 81%	–	AMI: 41/50 (82%) Control: 96/150 (64%) Sens: 82% Spec: 36%
Focal loss of contrast enhancement	AMI: 7/39 (18%) Control: 1/24 (4%) Sens: 18% Spec: 96%	AMI: 11/26 (42%) Control: 1/36 (3%) Sens: 42% Spec: 97%	–	AMI: 30/50 (60%) Control: 1/150 (1%) Sens: 60% Spec: 99%
Portomesenteric gas	AMI: 2/39 (5%) Control: 0/24 Sens: 5% Spec: 100%	AMI: 3/26 (12%) Control: 0/36 Sens: 12% Spec: 100%	AMI: 10/28 (36%) Control: 0/47 Sens: 36% Spec: 100%	AMI: 5/50 (10%) Control: 0/150 Sens: 10% Spec: 100%
Pneumatosis intestinalis	AMI: 11/39 (28%) Control: 1/24 (4%) Sens: 28% Spec: 96%	AMI: 11/26 (42%) Control: 0/36 Sens: 42% Spec: 100%	AMI: 12/28 (43%) Control: 0/47 Sens: 43% Spec:100%	AMI: 6/50 (12%) Control: 1/150 (1%) Sens: 12% Spec: 99%
Solid organ infarction	AMI: 7/39 (18%) Control: 0/24 Sens: 18% Spec: 100%	AMI: 4/26 (15%) Control: 2/36 (6%) Sens: 15% Spec: 94%	AMI: 10/28 (36%) Control: 2/47 (43%) Sens: 36% Spec: 96%	AMI: 9/50 (18%) Control: 147/150 (98%) Sens: 18% Spec: 98%
Free intraperitonel free air	–	AMI: 5/26 (19%) Control: 2/36 (6%) Sens: 19% Spec: 94%	AMI: 6/28 (21%) Control: 3/47 (6%) Sens: 21% Spec: 94%	AMI: 1/50 (2%) Control: 5/150 (3%) Sens: 2% Spec: 97%
Bowel obstruction	AMI: 4/39 (10%) Control: 16/24 (67%) Sens: 10% Spec: 33%	AMI: 3/26 (12%) Control: 2/36 (6%) Sens: 12% Spec: 94%	–	AMI: 2/50 (4%) Control: 8/150 (5%) Sens: 4% Spec: 95%

AMI: acute mesenteric ischemia; SMA: superior mesenteric artery; sens: sensitivity; spec: specificity. The numbers before slash represent the number of the patients demonstrating the corresponding CT finding where as the number after slash represent the total number of patients.

quality; however all of them were sufficient to make the diagnosis.

The study was conducted as follows: CT was performed on patients referred consecutively to the radiology department with the presumptive diagnosis of AMI from clinical departments in the first 6 h of admission (emergency, general surgery, gastroenterology, cardiology). The duration between the onset of the symptoms and the CT examination was 1–8 days (mean 3.2 days). For the clinical diagnosis of AMI, at least one of the following together with abdominal pain out of proportion with clinical findings was required:

- Biochemical findings of ischemia: e.g. metabolic acidosis, increased lactate level
- Risk factors for ischemia
  - History of symptoms compatible with acute or chronic mesenteric ischemia
  - Severe vascular disease
  - Atrial fibrillation patients not on anticoagulant treatment
  - Hypotension in patients on antihypertensive or vasopressor agents
  - Hypercoagulable state [antithrombin III, factor V Leiden, protein S, protein C deficiency; phospholipid antibodies in blood (anticardiolipin antibodies, lupus anticoagulant)]

CT was performed with a multislice CT apparatus (Light Speed 16, GE Medical systems Milwaukee, Wisconsin, USA). First, 5-mm sections from the level of the diaphragm to the pelvis, were acquired without intravenous contrast agent. Then 100 mL of non-ionic contrast agent was administered at a rate of 3.5 mL/s; 25 s later, 1.25-mm arterial phase images and 60 s later, 5-mm venous phase images were acquired. The images of all patients were evaluated immediately after acquisition by one of the two relevant experienced radiologists one of whom was an abdominal radiol-