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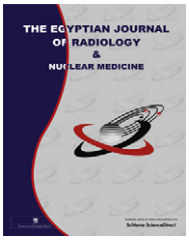

ORIGINAL ARTICLE

Multidetector CT and CT angiography in mesenteric ischemia

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KEYWORDS

Multidetector computed tomography;
CT angiography;
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Abstract *Purpose:* To evaluate the role of 64-multidetector CT in assessment of mesenteric vascular ischemia in clinically suspected patients.
Patients and methods: This study included 38 patients during period from October 2009 to October 2011. The patients age ranged from 38 to 72 year old (mean age was 57 ± 11.2 years). All cases met the criteria of acute non traumatic (28 patients) or chronic abdominal pain (10 patients) and suspected mesenteric vascular ischemia. All 38 cases were evaluated in surgery department, then underwent CT of the abdomen and pelvis & CTA by using 64 multislice GE light speed VCT. MDCT& CT angiographic findings were correlated with surgical findings in acute mesenteric ischemia (AMI) cases & conventional angiography in chronic mesenteric ischemia (CMI) cases.
Results: MDCT findings alone were nonspecific for detection of MI. The sensitivity, specificity& accuracy of CTA in diagnosis of AMI after surgical confirmation were 96%, 66.6% & 92.8% respectively, while in CMI the sensitivity, specificity & accuracy were 88.8%, 100%, 90% respectively, after confirmation by conventional angiography.
Conclusion: CTA scan appears to be an excellent tool to find out and localize cases of AMI rather than in CMI cases.

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1. Introduction

Acute mesenteric ischemia (AMI) is a potentially life threatening condition that has been recognized as a critical cause of catastrophic abdominal events (1). Traditional angiography is the diagnostic gold standard but is invasive, costly can rarely cause morbidity, and does not allow the evaluation of the bowel and other related findings (2,3).

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Computed tomography (CT) is readily available and noninvasive but has shown variable success in diagnosing this disease. The faster scanning time of multidetector row CT (MDCT) greatly facilitates the use of CT angiography (CTA) in the clinical setting (4). MDCT and CTA could accurately demonstrate vascular anatomy and capture the earliest stages of mesenteric ischemia by three-dimensional (3D) volume rendering (VR) reconstruction protocols (5).

AMI is associated with high morbidity and mortality due to its diagnostic difficulty, the diagnosis of AMI is present in nearly 1% of the acute abdomens, with mortality rates ranging from 59% to 93% (6–8). It can be caused by thromboembolism (in 60–70% of cases), bowel obstruction, abdominal inflammatory disease and trauma (9,10).

Chronic mesenteric ischemia (CMI) affects individuals of advanced age, often in the seventh and eighth decades of life, and with systemic atherosclerosis (8).

The ischemic symptoms depend on the number and site of the lesions, their progression, and the patency of collateral vessels (7,9).

MDCT especially with newer 16 or more detector rows scanners has evolved as a self-comprehensive imaging modality of choice for mesenteric ischemia, allowing evaluation of vascular structures, bowel wall and adjacent mesentery, thus determining the primary cause of mesenteric ischemia (5).

2. Patients and methods

From October 2009 to October 2011, 38 patients who met the criteria of acute nontraumatic (28 patients) or chronic abdominal pain (10 patients) and suspected mesenteric vascular ischemia who were evaluated in surgery department. All 38 cases underwent biphasic MDCT of the abdomen and pelvis & CTA for the aorto-iliac vessels in using 64 multislice GE light speed VCT in private and specialist centers, while the conventional angiography were preformed in Zagazig university hospitals. Pre-existing renal insufficiency was excluded by measuring serum creatinine concentration. The study was approved by the Ethical Committee of our Faculty and informed written consent was obtained from patients.

All cases were subjected to:

- Adequate history for coexistent disease or predisposing factors.
- Clinical examination.
- Laboratory investigations.
- Upright and supine plain abdominal radiographs: performed first to evaluate for free air, obstruction, ileus, intussusception, or volvulus.
- Abdominal US.
- MDCT Angiography studies were performed using a Multidetector CT scans (the CT machine is GE light speed, VCT 64 slices), according to the protocol mentioned in (Table 1).

– Multi-planar reconstruction (MPR) in axial, coronal and sagittal planes allow the user to quickly and easily view image data either in the plane of acquisition or any orthogonal plane. Maximum intensity projection (MIP) and volume rendering (VR) images were also used for image interpretation.
– Maximum-intensity projection (MIP) considered as the preferred visualization in vascular imaging because it is independent of threshold selection and only the highest pixel value in a volume data can be displayed in the final projected images.
– MDCT& CTA images interpretation:
o For bowel wall thickening in non-collapsed bowel (if the wall thickness of >3 mm in small or large bowel running perpendicular to the axial images). Bowel dilatation (bowel was defined to be dilated if diameter of small bowel was more than 2.5 cm and diameter of large bowel was more than 5 cm. intestinal pneumatosis, portomesenteric venous gas, intraperitoneal air, free fluid/ascites, solid organ infarction and mesenteric fat stranding. Evidence of arterial stenosis, occlusion, dilatation or/and atherosclerotic changes of the celiac axis, superior mesenteric artery (SMA) or the inferior mesenteric artery (IMA). Evidence of portomesenteric venous thrombosis.
o The radiological data describing the vascular & intestinal findings systematically were collected and the diagnostic findings of AMI were confirmed by surgical data and CMI cases were confirmed by conventional angiography & clinical follow-up.

- Surgical exploration was indicated in patients with suspected AMI diagnosed by preoperative clinical, laboratory, MDCT-A, after rapid resuscitation. During the laparotomy first step was to identify the pathology as the presence of proximal SMA pulsations and jejunal sparing were signs pointing to the presence of embolism while absence of proximal mesenteric pulsations and jejunal involvement indicate thromboses. The distinction between ischemic bowel which is dull, flabby in tone without any pulsations and infracted bowel was done, attempts for revascularization either by thrombectomy or bypass or endovascular procedures are done first before bowel resection. 2nd look surgery was decided at the time of initial laparotomy.
- Non surgical (conservative treatment):
  - o Indicated in non occlusive mesenteric ischemia with absence of clinical and laparotomy evidence of peritonitis and it was in form of treating underlying cause.
  - o Mesenteric venous thrombosis with early initial diagnosis before occurrence of bowel infarction in form of full anti-coagulation therapy & papaverine infusion.
- Data management: The collected data were presented, summarized, tabulated & analyzed by using computerized software statistical packages (EPI-info Version 6.04 & SPSS version 19). $P \leqslant 0.05$ was considered to be statistically significant. Chi square & Fisher exact tests were used to compare proportions.

3. Results

During 2-years period, 38 patients with suspected mesenteric ischemia were examined by MDCT & CTA. The patients age ranging from 38 to 72 years old (mean age was 57 ± 11.2 years). Suspected acute MI cases were 28 patients, while chronic MI cases were 10 patients. Thirty patients were men (79%) and eight cases were females (21%) (Table 2).

The most common finding of MI regarding the intestine is mural bowel wall thickening (89.2%), followed by bowel distension (71.4%).

Bowel wall attenuation in NCCT was high attenuation with hemorrhagic infarction or trans-mural hemorrhage noted in 6/28 in acute MI cases (Table 3), while enhanced bowel loops wall in PCCT were found in both ischemic groups in 8 & 2