Role of triphasic CT imaging in detection of acute non variceal GIT bleeding

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Background

Gastrointestinal bleeding (GIB) is considered a dangerous trouble, an important etiology for hospital admissions, and has a rate of mortality of about 6%–10% for bleeding from the upper GI tract (GIT) and about 4% for bleeding from the lower GIT. It needs combined efforts involving gastroenterology, endoscopy, surgery, and radiology departments.

Aim of the work

To assess the role of multidetector computed tomography (CT) in diagnosing acute nonvariceal bleeding from the GI tract.

Patients and methods

Fifty patients presented by acute nonvariceal GIT bleeding after exclusion of cases that had impaired renal functions or with terminal liver failure, pregnancy, patients who have sensitivity to contrast medium, and patients who were diagnosed as variceal bleeding; they underwent Multi slice computed tomography (MSCT) angiography after resuscitation of patients with shock, monitoring for unstable patients. Images were acquired with slice thickness 5 mm for unenhanced phase and 1.25 mm for arterial phase and portovenous phases, pitch 1.375, 300 MA, 120 kVp, and rotation time 0.7 s. Images acquired were reconstructed for sagittal, coronal, Maximum intensity projection (MIP), and volume-rendering images.

Results

MSCT helped in the diagnosis of the source and/or the cause of bleeding in 66% of examined cases ($n = 33$), whereas CT could not detect the cause of bleeding in 34% of cases ($n = 17$).

Conclusion

CT angiography (CTA) can act as a good first-line screening method in the localization and detection of GIB sites. CTA can be used to triage patients with active GIB and give an idea for required further examination.

Keywords:
computed tomography angiography, endoscopy, gastrointestinal hemorrhage/diagnosis, occult blood

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Introduction

Gastrointestinal bleeding (GIB) is defined classically as regards to the site of its cause. Accordingly, upper GIB originates from a located cause between the oral cavity till the Treitz angle, whereas lower GIB arises from between the angle of Treitz till the anus [1]. Mortality from acute GIB (AOGIB) has been measured up to 10% and rises to 21%–40% when patients with massive AOGIB [2].

An advantage of computed tomography (CT) over endoluminal examinations such as endoscopy or capsule endoscopy is its ability to assess the pathology concerning extraluminal abnormalities, draining and feeding vessels, and anatomical region with its relationship to structure surrounding. Also, CT is available mostly in hospitals around the clock and imaging can be done fast and it is not operator-dependent [3].

This study was designed to assess the multidetector CT role in the diagnosis of acute nonvariceal GI bleeding.

Patients and methods

Our study was performed on 50 patients who presented with acute nonvariceal GIT bleeding and had a failed or nonconclusive endoscopy. They were referred from the internal medicine, emergency, and tropical medicine departments of our institution.

Inclusion criteria

Adult stable patients with acute nonvariceal GIT bleeding that was not explained by or complementary to endoscopy were included.

Exclusion criteria

(1) Known patients as impaired renal function.
(2) Pregnant patients.
(3) Cases known to have contrast sensitivity.
(4) Patients diagnosed as bleeding from varices with endoscopy.

The study was carried out after obtaining the permission of the Institutional Review Board (IRB), Faculty of Medicine Assiut University IRB 17101509. Patients signed informed consent before study initiation as the study had no risk and does not affect the patients' rights.

Endoscopic examination was done using an endoscope that is a long, thin, flexible tube with a light and tiny video camera at its end that transmits an image to a monitor. Endoscopic examination failed in some cases because of massive blood and blood clots in an examined field or due to the need for further preparation of the patient, so the MSCT was a required study to give an idea about the etiology of bleeding, till the time of the next session of endoscopy, and to have an idea about how to manage the bleeding.

Cases with severe GIB were admitted to the critical care department; the shocked patients were rapidly resuscitated. Physicians of critical care provided the needed assessment to shocked cases who need MSCT examination. MSCT angiography was done without oral administration of contrast material or water.

We performed MSCT angiography with 16-MSCT scanner, GE medical system bright speed. In the angiographic CT study, the bleeding was diagnosed by extravasation of the intravenous contrast to the lumen of the bowel. So, oral contrast media was not used (like water or 5% solution of iodine); this would dilute the extravasating used contrast substance to the bowel lumen and can impair the assessment, whereas positive contrast substances within GI lumen interfere with diagnosing the intravenous contrast-medium extravasation, causing false-negative results.

In abdominal CT, the dose of iodine was 1.5–2.0 ml/kg of patient weight. A rapid rate of injection (4–5 ml/s) for taking the arterial images. Tube voltage of 120 kV and automated effective tube current, 100–400 mAs, were used. In all phases, imaging included the whole abdomen and the pelvis (from the diaphragm till below the level of inferior pubic rami) with slice thickness 0.5 mm.

Precontrast imaging was done to confirm preexisting hyperdense swallowed substances inside the bowel cavity to be diagnosed from current hemorrhage within the study. Arterial examination was done by bolus tracking on abdominal aorta (150-HU point), the venous examination was done in 69–90 s after injection of contrast.

Reconstruction was carried out in the axial plane with 1.0-mm slice thickness and 1.0-mm slice interval. Image analysis was done using RadiAnt DICOM Viewer (Version: 2021.1) with multiplanar reconstruction and volume-rendering features.

Three observers reviewed the cases (HS, OK, and GA with 26, 20, and 4 years of experience, respectively).

Statistical analysis

Data were evaluated using IBM SPSS software package version 23 (IBM Corp., Armonk, NY). Qualitative data were described using numbers and percentages. The Kolmogorov–Smirnov test was used to verify the normality of distribution. Quantitative data were described using range (minimum and maximum), mean, and SD. The χ^2 test was used to compare according to categorical variables. The significance of the obtained results (*P* value) was judged at the 5% level.

Results

Studied cases' ages range from 16 to 80 years with their mean age 50 years (±15.71 SD). About 46% of the patients had other risk factors (n = 23). Hypertension (HTN) was the most common risk factor that presented in 18% of the patients (n = 9).

There were 14 cases (28%) presented by hematemesis, 8 (16%) by melena, and 22 (44%) by fresh bleeding per rectum. There were 6 (12%) cases presented by combined hematemesis and melena (Table 1).

Abdominal colic and vomiting are the most common associated complaints in the presented cases, being 28% (n = 14) and 16% (n = 8), respectively.

Table 1 Examined patient distribution as regards to the presentation (*n*=50)

Presentation	No. (%)
Hematemesis	14 (28.0)
Melena	8 (16.0)
Fresh bleeding per rectum	22 (44.0)
Combined hematemesis and melena	6 (12.0)

As regards patients with upper endoscopy, 65.4% (*n* = 17) showed positive endoscopic results (inflammation, masses, or ulcers), 19.2% (*n* = 5) were normal upper endoscopy (as the lesion was mostly distal to the field of the scope), and 15.4% (*n* = 4) were negative in upper endoscopy (in the form of failed examination) as they had marked bloody field or distal gastric stenosis that prevented further passage of the scope (Fig. 1 and Table 2).

Regarding lower endoscopy, 47.8% (*n* = 11) showed positive endoscopic findings (inflammation, masses, and diverticulations), 34.8% (*n* = 8) were normal examination in lower endoscopy, and 17.4% (*n* = 4) were failed examination and needed further patient preparation (Fig. 2 and Table 3).

CT could not detect the cause of bleeding in 34% of cases (*n* = 17), but diagnosed the bleeding cause in 66% of cases (*n* = 33). Soft-tissue masses were the most common MSCT finding being 24% (*n* = 12), followed by GIT wall thickenings being 16% (*n* = 8), 8% of cases showed vascular abnormalities (*n* = 4) (Table 4 and Fig. 3).

Table 2 Examined patient distribution as regarding upper endoscopy (*n*=26)

Upper endoscopy	No. (%)
Positive	17 (65.4)
Failed	4 (15.4)
Normal	5 (19.2)

Table 3 Examined patients as regarding lower endoscopy (*n*=23)

Lower endoscopy	No. (%)
Positive	11 (47.8)
Failed	4 (17.4)
Normal	8 (34.8)

Table 4 Examined patients as regarding MSCT findings (*n*=50)

CT findings	No. (%)
Negative (normal)	17 (34)
Positive	33 (66)
Soft-tissue masses	12 (24)
Wall thickening	8 (16)
Polyps	2 (4)
Angiodysplasia	3 (6)
Thrombosis	4 (8)
Celiac artery thrombosis	1 (2)
SMV thrombosis	3 (6)
Pseudoaneurysm[a]	1 (2)
Abnormal mucosal enhancement	1 (2)
Diverticulation	1 (2)
Extravasation	1 (2)

CT, computed tomography; MSCT, Multi slice computed tomography; SMV, Superior mesenteric vein. [a]Pseudoaneurysm is defined as an injury of the blood-vessel wall, leading to blood leakage collected in the surrounding tissue.

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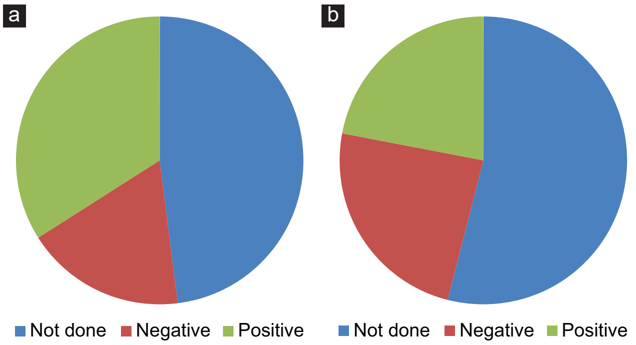
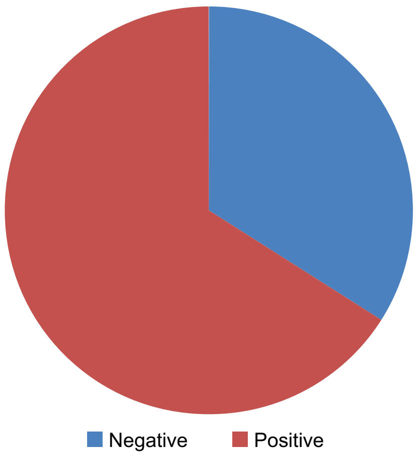
Figure 1



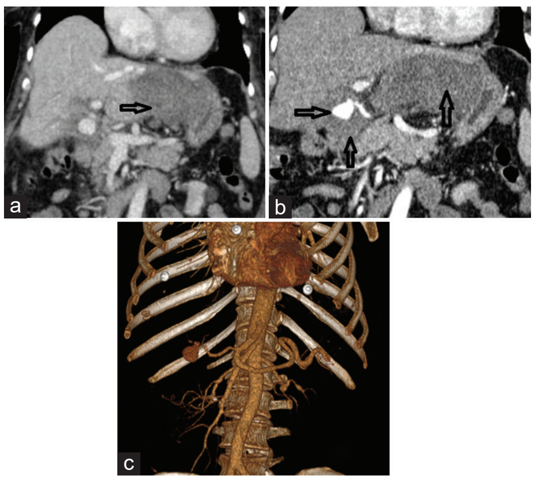
Examined patient distribution as regarding upper endoscopy (a) and lower endoscopy (b).

Figure 2



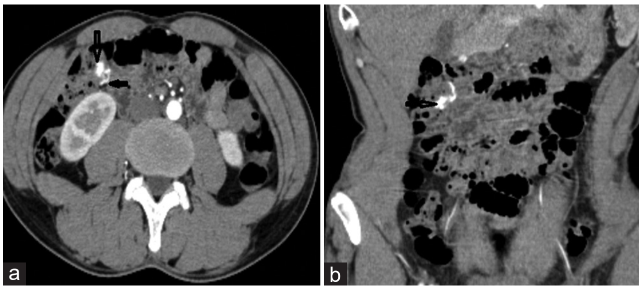
Examined patients as regarding MSCT findings.

Figure 3



(a) Coronal portal-phase computed tomography image shows nonenhancing hematoma at the lesser curve (arrowed). (b) Coronal arterial image shows cystic artery pseudoaneurysm and two nonenhancing hematomas at the lesser curve and GB bed (arrowed). (C) Volume-rendering image shows the pseudoaneurysm*.

Figure 4



(a) Axial image, (b) coronal image, and arterial-phase computed tomography reveal vascular angiodysplasia at the right colic branch from the superior mesenteric artery (arrowed).

Discussion

GIB is defined as regards to the site of etiology. So, upper GIB arises as an origin from the oral cavity and the angle of Treitz, whereas lower GIB originates from the angle of Treitz till the anus [4]. Recent studies recommended MSCT as an excellent tool in the diagnosis of the origins of GIB, whereas studies for the effectiveness of CT for assessing lower GIB were restricted [5].

A benefit of CT than examinations like capsule/endoscopy is its capability to assess the lesions good with consideration to extraluminal extensions, feeding, and draining vessels, and also, the definite site and relation with adjacent structures. Also, MSCT is mostly contactable in all institutions all the time and examination is performed rapidly and it does not depend on the operator [6].

In our study, the clinical presentation was hematemesis (40%), melena (28%), and fresh bleeding per rectum (44%), and 12% showed both hematemesis and melena. This was in concurrence with Sun *et al.*[7] who found that about 30% of the patients presented with upper GIB, and 70% of patients presented with lower GIB, whereas only 1% presented with both upper and lower GIB. On the other hand, Shotar *et al.* [8] found that 10% of cases presented by melena, 33% by hematochezia, 20% by hematemesis, and 37% had combined presentation.

The main role of upper GI-tract endoscopy is to detect the bleeding origin and to detect if its etiology was variceal or not [9]. Also, endoscopy helps to take histologic biopsies, sometimes therapeutic intervention examinations, like thermal coagulation, laser therapy, and injection therapy, for cases with active hemorrhage. The importance of urgent endoscope study in these cases is well explained [10].

In the current study, upper GI endoscope was performed in 26 patients (52%), but it was nonconclusive in 9 patients (18%) because the field was filled with blood or the endoscope could not pass the gastric outlet or the first part of the duodenum, so these cases needed further MSCT examination that revealed vascular lesions, mass lesions, or inflammatory thickening at or distal to the area seen by the endoscope. Lower endoscopy was done for 23 cases (46%) and was negative in 12 (26%) cases that needed good preparation of the patient or done up to the level of the splenic flexure, transverse colon, or even hepatic flexure. MSCT was done in such cases to show whole colonic parts as well as the small intestine. This was in accordance with Shotar *et al.*[8] who performed upper endoscopy before MSCT for 36 of 49 cases (74%). Lower endoscopies were done before MSCT for 14 of 49 cases (29%), this was nearly similar to our results.

Regarding our MSCT examination, we failed to diagnose the etiology of GIT bleeding in 17 cases (34%); these were confirmed by endoscopy as gastric, duodenal, or colonic ulcers, duodenal and colonic diverticulae, Mallory Weis tear with gastroduodenitis, and endoscopy/biopsy-confirmed inflammations (gastritis, colitis, and proctocolitis).

We had positive MSCT in 33 (66%) patients, which were soft-tissue mass lesions in (24%) 12 patients, 4 cases (8%) of them showed avid arterial enhancement of the mass lesion that we considered as a sign for the source of bleeding. Wall thickening of variable GIT locations was seen in 8 (16%) of cases. Vascular abnormalities were seen in 4 (8%) cases, gastric angiodysplasia in 1 case (2%), right colic angiodysplasia in 1 (2%), inferior rectal angiodysplasia in 1 (2%), and pseudoaneurysm of the cystic artery in 1 (2%). Mesenteric vascular ischemias were seen in 4 (8%) cases, celiac artery thrombosis in 1 (2%), and mesenteric venous thrombosis in 3 (6%) cases. Mucosal enhancement was seen in 4 (8%), duodenal and rectal polyps found in 2 (4%) cases, subhepatic hematoma in 1 (2%) case, diverticulation in the duodenum in 1 (2%), and extravasation from rectal varices in 1 (2%) of cases. These findings were slightly different from Scheffel *et al.*[3] who reported that etiologies of bleeding were duodeno-aortic fistula (4 cases), hepatic artery pseudoaneurysm after a biliodigestive anastomosis (2 cases), gastroduodenal artery pseudoaneurysm (1 case), splenic artery pseudoaneurysm (1 case), mucositis of jejunum (1 case), bilioarterial fistula following a biopsy from the liver (1 case), ischemic anastomotic duodenal ulcer (1 case), GI stromal tumor from the ileum (1 case), ileal neuroendocrine carcinoma (1 case), nonocclusive ischemic cecal ulcer (2 cases), transverse colon nonocclusive ischemic ulcer (1 case), cecal varices because of portal hypertension (1 case), and sigmoid diverticulation (1 case). The higher incidence of these vascular lesions could be due to the higher number of postoperative or biopsy cases of the examined patients in comparison with only two postoperative cases that showed vascular abnormality in our study.

The final diagnosis in our study was as the following: inflammatory findings in 23 patients (46%), mass lesions (malignancies) in 15 patients (30%), ulcers in 12 patients (24%), vascular abnormalities in 4 patients (8%), mesenteric vascular ischemias in 4 patients (8%), and diverticulae in 3 patients (6%) as causes of GIT bleeding. This is nearly in agreement with Sun *et al.* (2012) study [9], where CTA diagnosed the etiology of bleeding in 58 (72.5%) cases, which were the segmental or focal abnormal mucosal enhancement of the bowel in 15 (18.75%) from the 80 cases, all of them seen in portal phase. Findings such as vascular abnormalities were diagnosed for 15 (18.75%) from 80 cases. Polyposis is seen in 2 (2.5%) of the 80 cases. A single case (1/80, 1.25%) showed diverticulations with abnormal enhancement in the colon of the right-side inferior part. Masses were seen for 25 (31.25%) from 80 cases.

Our study had some limitations. First, given the small sample size might affect the power of the study to reveal an accurate conclusion. Second, not all patients had a successful endoscopic examination, thus, a gold-standard test to compare the CT with it was not available for all cases.

Conclusion

CT angiography can be considered as a useful examination for rapid and proper diagnosis and localization of acute GIB or intraperitoneal hemorrhage. A benefit of MSCT in the diagnostic workup for cases suspected of active abdominal bleeding involves its wide applicability, rapidness, and low intervention. CT would be done promptly at bleeding attacks, hemorrhage would be seen inside the small bowel, which is a site not well available for endoscopic examinations. Noncontrast CT examination should be done before contrast study to reveal any hyperdense substances that may be mistaken as active extravacation post contrast.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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