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REVIEW

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Multidetector computed tomography angiography in non-variceal upper gastrointestinal bleeding: when, why and how?

Alberto Martino[a], Marco Di Serafino[b], Francesco Manguso[a], Francesco Paolo Zito[a], Raffaele Bennato[a], Luigi Orsini[a], Francesco Lisanti[c], Silvana Di Bello[c], Rossana Martino[a], Marianna Guardascione[a], Lucio Amitrano[a], Gianluca Paternoster[d] and Giovanni Lombardi[a]

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ABSTRACT

Introduction: Non-variceal upper gastrointestinal bleeding (NVUGIB) is a common gastroenterological emergency associated with significant morbidity and mortality. According to current gastroenterological guidelines, esophagogastroduodenoscopy (EGD) represents the first-line modality for both diagnosis and treatment of NVUGIB. As opposed to lower gastrointestinal bleeding, multidetector-row computed tomography angiography (MDCTA) has a limited and no well-established role in the diagnostic process of NVUGIB. However, gastroenterological guidelines mainly focus on peptic-related NVUGIB only. Moreover, the adoption of MDCTA in NVUGIB has recently been encountered in radiological guidelines for special situations.

Areas covered: The aim of our study was to comprehensively review and discuss the current and potential indications of MDCTA and its technical aspects in the diagnostic process of NVUGIB. A comprehensive literature search of PubMed, EMBASE, and Google Scholar databases was conducted through May 2025 to identify pertinent studies.

Expert opinion: Although EGD undoubtedly represents the cornerstone in both diagnosis and treatment of most NVUGIB cases, MDCTA has emerged as a promising adjunct diagnostic tool, especially among clinically severe cases and those due to rare, non-peptic sources. However, evidence is still scarce, and further studies are needed to clarify its role in this scenario.

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KEYWORDS
Upper gastrointestinal bleeding; non-variceal upper gastrointestinal bleeding; multidetector-row computed tomography angiography; computed tomography; endoscopy

1. Introduction

Non-variceal upper gastrointestinal bleeding (NVUGIB) is the most common gastroenterological emergency with a reported annual incidence of approximately 60–70 per 100,000 individuals [1,2]. It is defined as a hemorrhage occurring from a non-variceal source located above the ligament of Treitz, including the esophagus, stomach, proximal duodenum, pancreatic and bile duct, and the anastomotic site following gastrojejunostomy. Although its incidence and prevalence have been declining over the last decades, peptic ulcer disease (PUD) is still the most common cause of NVUGIB. Other common NVUGIB sources include esophagitis, angiodysplasia, neoplasms and Mallory-Weiss syndrome [1–3]. Nevertheless, various rare and extremely rare sources of NVUGIB exist, accounting for approximately 5–10% of all NVUGIB cases [2,4].

Despite marked improvements in the medical and endoscopic management of NVUGIB, it is still associated with a high mortality rate ranging from 2.6% to 13% among Western countries [5,6], and approaching up to 30% among high-risk patients [7]. Nevertheless, NVUGIB carries significantly high rebleeding and morbidity rates [8].

Following hemodynamic resuscitation, early esophagogastroduodenoscopy (EGD) performed within 12–24 hours of presentation is currently recommended as the procedure of choice for both diagnosis and treatment of NVUGIB, with transcatheter angiographic embolization (TAE) in case of refractory bleeding and surgery as a last resort [9–13]. As opposed to acute lower gastrointestinal bleeding (LGIB) [14–16], multidetector-row computed tomography angiography (MDCTA) is not recommended in the diagnostic process of NVUGIB [9–13]. However, of note, the currently available NVUGIB guidelines mainly address PUD-related bleed, with other NVUGIB sources, especially those rare and very rare, left orphaned from recommendations due to the scarce literature available [9–13]. As opposed to PUD and other common sources, most of the rare and very rare NVUGIB causes generally require a dedicated, multidisciplinary approach for both diagnosis and treatment [17]. Moreover, with the advent of MDCTA, this noninvasive, fast, and widely available technique has been increasingly adopted in the diagnostic approach of most abdominal vascular emergencies, and a high accuracy of MDCTA for detecting and localizing overt gastrointestinal (GI) bleeding has been reported [18]. Nevertheless, a promising role of MDCTA in the NVUGIB diagnosis has also been recently reported, especially among clinically severe cases and special situations [19–23]. Anyway, evidence regarding the added value of MDCTA and its clinical applicability in NVUGIB is still limited.

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Article highlights

- Although esophagogastroduodenoscopy (EGD) undoubtedly represents the cornerstone in both diagnosis and treatment of most non-variceal upper gastrointestinal bleeding (NVUGIB) cases, multidetector-row computed tomography angiography (MDCTA) has emerged as a promising adjunct diagnostic tool.
- As opposed to lower gastrointestinal bleeding, MDCTA is currently not recommended in the diagnostic process of NVUGIB by gastroenterological guidelines, which mainly focus on peptic-related bleeding only.
- Conversely, the adoption of MDCTA in NVUGIB among special situations has recently been encountered by radiological guidelines and consensus statements.
- MDCTA may be a valuable adjunct diagnostic tool in a restricted subset of patients with ongoing clinically severe NVUGIB.
- MDCTA may be considered after EGD in the following situations: a) diagnostic failure; b) suboptimal or unsuccessful endoscopic hemostasis; c) uncertain etiological diagnosis; d) evidence of a large visible vessel not suitable for endoscopic treatment.
- MDCTA may be considered before EGD in the following situations: a) suboptimal or difficult to maintain hemodynamic stabilization; b) patient unfit for EGD due to severe critical illness; c) recent surgery/interventional procedures; d) no in-house emergency gastrointestinal endoscopy coverage; e) medical history and clinical presentation suggestive of aorto-enteric fistula.

The aim of our narrative review was to comprehensively discuss the current and the potential indications of MDCTA and its technical aspects in the setting of NVUGIB.

1.1. Literature search

A comprehensive literature search of the PubMed/Medline, EMBASE, and Google Scholar databases was performed through May 2025 to identify relevant studies evaluating the role of MDCTA in NVUGIB. The search terms included ('upper gastrointestinal bleeding' OR 'non-variceal upper gastrointestinal bleeding') AND ('computed tomography' OR 'computed tomography angiography' OR 'multidetector computed tomography' OR 'multidetector computed tomography angiography'). The search was restricted to English-language articles. Clinical trials, case reports/series, reviews, position papers, guidelines, and editorials were included. References from the included studies were carefully screened for potential inclusion.

2. Multidetector-row computed tomography angiography in non-variceal upper gastrointestinal bleeding: when and why

Although EGD remains undoubtedly the cornerstone in the diagnosis and simultaneous treatment of the majority of NVUGIB cases, MDCTA may be a valuable complementary diagnostic modality in selected cases of NVUGIB. First of all, its adoption should be restricted to severe cases with ongoing bleeding. As previously reported, severe NVUGIB should be defined as hemodynamic instability with hypotension and systolic blood pressure <100 mmHg, pulse >100 beats/min, hemoglobin less than 100 g/l or transfusion requirements of more than 4 units of packed red blood cells per 24 hours [24]. As for LGIB, MDCTA should not be encountered as a first-line diagnostic modality in hemodynamically stable NVUGIB patients in whom bleeding has subsided [22].

Among ongoing clinically severe NVUGIB patients, MDCTA may be considered after EGD in the following situations: a) diagnostic failure; b) suboptimal or unsuccessful endoscopic hemostasis; c) uncertain etiological diagnosis; and/or d) evidence of a large visible vessel not suitable for endoscopic treatment [20,22,23].

Endoscopy is generally capable of providing effective hemostasis in approximately 90% of NVUGIB cases [25]. However, unsuccessful diagnosis at the initial endoscopy has been reported in up to 24% of cases, due to poor endoscopic visual field for excessive intraluminal blood or clots and/or massive bleed [26,27]. In addition, when EGD detects blood/clots within the upper GI tract but fails to identify a clear bleeding source, MDCTA should be subsequently performed in order to localize and characterize potentially missed NVUGIB sources, such as hemobilia and hemosuccus pancreaticus [23]. Of note, the threshold for active bleeding detection of MDCTA is lower than that of operative angiography [18,28]. Moreover, only arterial and capillary bleeding can be detected by operative angiography, as opposed to MDCTA being capable of identifying venous bleeding also [23]. Finally, if the bleed is intermittent, it can be missed on operative angiography, and the bleeding source may not be ascertained in case of variant vascular anatomy or inadequate contrast resolution [29,30].

In case of suboptimal/failed endoscopic hemostasis emergent MDCTA may help to guide further treatment and to exclude complications (i.e. ruptured visceral artery pseudoaneurysm in case of PUD). Indeed, MDCTA is capable to accurately evaluate the bleeding lesion, providing important information regarding bleeding status, site, and etiology. Anatomic information, such as extraluminal abnormalities, feeding and draining vessels, and relationship to surrounding structures are also clearly outlined by the use of MDCTA. Thus, it may help in determining the appropriateness of subsequent endovascular and/or surgical procedures, allowing a more efficient TAE procedure [29,31,32].

Furthermore, the diagnostic role of EGD is limited in rare and extraordinary rare NVUGIB causes, such as aorto-enteric fistula (AEF), ruptured visceral artery pseudoaneurysm (VAPA), hemobilia, hemosuccus pancreaticus, and gastric submucosal arterial collaterals (GSAC), being mainly directed to exclude common NVUGIB sources [17]. In this scenario, the diagnostic gold standard is generally represented by MDCTA, which is crucial for planning the appropriate, mainly non-endoscopic treatment [16]. Although some of these rare NVUGIB sources may be endoscopically suspected, MDCTA and/or operative angiography are needed for the confirmatory diagnosis, which is essential to provide safe and effective treatment [17]. In our opinion, when uncertainty exists concerning the bleeding etiology at the initial EGD (i.e. gastric varices versus GSAC, gastric/duodenal varices versus gastric/duodenal submucosal tumor, AEF versus upper GI mass), endoscopic hemostasis should not be attempted and postponed following MDCTA, especially in the absence of active bleeding or among less experienced centers. This strategy aims to avoid potentially catastrophic inappropriate endoscopic treatments (i.e. mechanical hemostasis for

gastric varices, any endoscopic hemostasis for AEF, cyanoacrylate injection for GSAC) [17,33,34].

Finally, in case of large size (>2–3 mm) non-bleeding visible vessel thought to be not suitable for endoscopic hemostasis, MDCTA may be considered before planning endovascular treatment, especially in case of unavailability of over-the-scope clip technology, location within difficult sites and/or high-risk vascular area, or less experienced endoscopists [23,35,36].

Two cases of severe NVUGIB in which post-endoscopy MDCTA was performed are presented in Figures 1 and 2.

In the setting of severe NVUGIB, MDCTA may also be adopted prior to any other diagnostic/therapeutic modality in the following scenarios: a) suboptimal or difficult to maintain hemodynamic stabilization; b) patient unfit for EGD due to severe critical illness; c) recent surgery/interventional procedures; d) no in-house emergency GI endoscopy coverage; and/or e) medical history and clinical presentation suggestive for AEF [20,22,23].

As recently suggested by the American College of Gastroenterology and Society of Abdominal Radiology consensus recommendations, MDCTA may be executed in patients with suboptimal or difficult to maintain hemodynamic stabilization or those unfit for EGD due to severe critical illness, and if positive for active bleeding it may allow a less invasive treatment using TEA [20,37]. Given its rapidity and noninvasive nature, upfront MDCTA may be crucial for establishing the timing of hemostasis and its type in cases of suboptimal or difficult to maintain hemodynamic stabilization. For instance, the recommended timing of 12–24 hours for

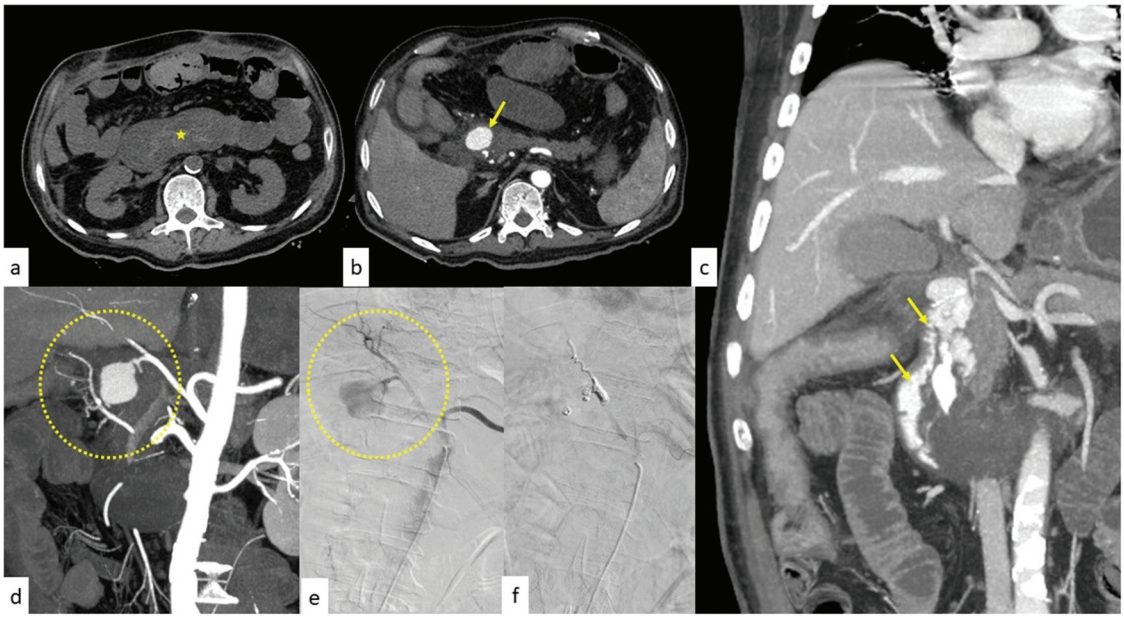

Figure 1. Post-endoscopy multidetector-row computed tomography angiography in a patient with clinically severe non-variceal upper gastrointestinal bleeding due to a giant duodenal ulcer refractory to endoscopic hemostasis. The unenhanced phase (a) demonstrates a spontaneously hyperdense intraluminal area in the stomach and duodenum (star), consistent with a sentinel clot. In the arterial phase (b), an active blush of contrast medium is detected within the gastric lumen (arrow), with progressive increase in the venous phase (c, arrow). Selective angiography confirmed the ct findings, showing prominent gastric arterial extravasation (d, dashed circle), followed by successful embolization (e). Informed patient consent was provided for the publication of these images.

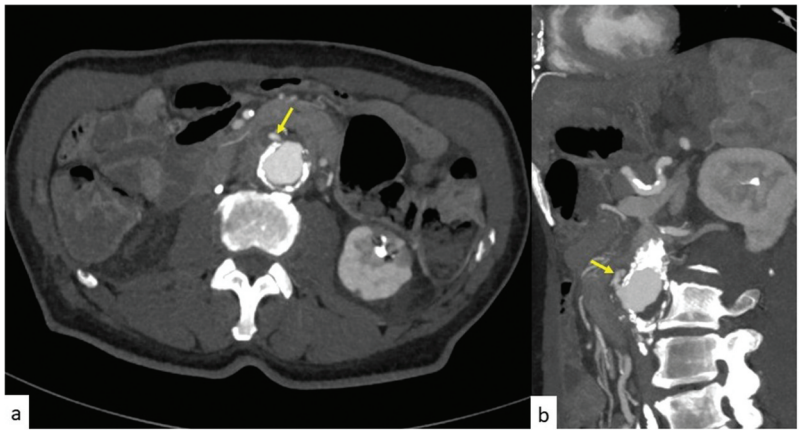

Figure 2. Post-endoscopy multidetector-row computed tomography angiography in a patient with clinically severe non-variceal upper gastrointestinal bleeding and diagnostic failure of esophagogastroduodenoscopy. Axial (a) and oblique coronal (b) arterial phase images with maximum intensity projection reconstruction demonstrate active bleeding (arrow) from an aorto-duodenal fistula in previous aortic bypass surgery. Informed patient consent was provided for the publication of these images.

EGD may not be appropriate in cases of MDCTA evidence of active arterial bleeding and/or detection of certain rare NVUGIB sources (i.e. AEF, VAPA), dictating an emergent hemostasis. Furthermore, in the event of the need for TAE due to endoscopic failure or unsuitability, the interventional radiologist could be precisely assisted by the pre-operative MDCTA findings. Conversely, MDCTA has no role in the case of hemodynamic instability refractory to resuscitation. In this clinical scenario, the patient should emergently undergo proper treatment.

In severe NVUGIB patients with a recent history of upper GI surgery or hepato-bilio-pancreatic interventional procedures, pre-operative MDCTA should be taken into consideration to exclude extraluminal bleeding and/or other concomitant complications (i.e. free perforation, intraperitoneal hemorrhage, VAPA formation) not amenable by endoscopy, thus driving proper endovascular or surgical treatment [23,38].

Moreover, in the absence of in-house emergency GI endoscopy coverage and/or limited resources, pre-operative MDCTA may be performed to assist the clinician in the timing and type of treatment, and the patient transfer to a GI bleeding hub center [22].

Finally, in case of positive medical history for surgical or endovascular aortic reconstruction and clinical presentation suggestive for AEF (i.e. the classic triad of GI bleed, abdominal pain, and pulsatile abdominal mass or the so-called 'herald bleeding') upfront MDCTA may be considered in order to avoid unuseful and potentially catastrophic endoscopic approach and drive emergent surgical or endovascular treatment [17,22].

A case of severe NVUGIB in which upfront MDCTA was performed is presented in Figure 3.

A proposed algorithm incorporating MDCTA for the multidisciplinary approach to severe NVUGIB is given in Figure 4.

3. Multidetector-row computed tomography angiography in non-variceal upper gastrointestinal bleeding: how

Strict compliance with the MDCTA protocol is crucial. MDCTA should be conducted on all patients using the multi-slice spiral technique, capturing images from the head to the feet while the patient lies supine with upper limbs abducted. This approach helps minimize radiation exposure and enhances the image quality of the thoraco-abdominal organs. Acquiring images while the patient holds their breath helps prevent movement artifacts [39,40]. The recommended acquisition volume covers the entire abdomen and also includes the chest if esophageal hemorrhages are suspected [39]. It is recommended to utilize 100–120 ml of contrast medium (CM) with high iodine content at a fast injection rate (at least 4 ml/s) [39,40].

To achieve optimal vascular enhancement in MDCTA, several parameters must be considered. Patient-related factors – such as sex, age, body weight, and cardiac output – play a crucial role, together with CM injection protocols, including the total iodine dose and the administration rate [41].

Post-contrast vascular enhancement is essentially determined by the following two main parameters: the iodine

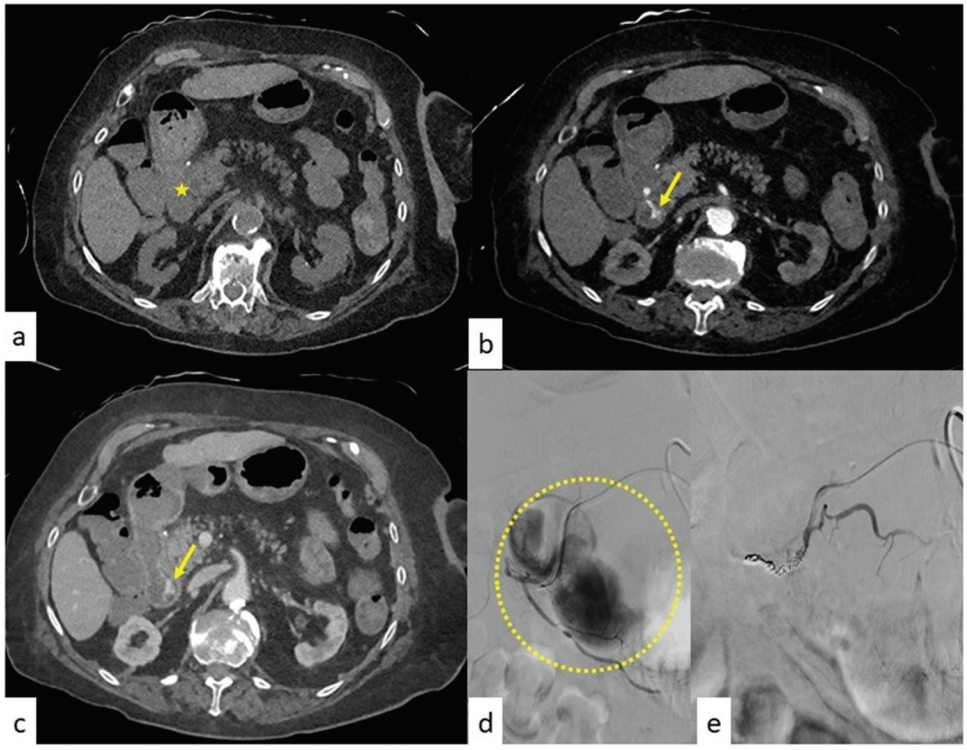

Figure 3. Upfront multidetector-row computed tomography angiography in a patient with clinically severe non-variceal upper gastrointestinal bleeding and a recent history of subtotal gastrectomy. The pre-contrast phase (a) demonstrates a spontaneously hyperdense intraluminal area in the stomach and duodenum (star), consistent with a sentinel clot. In the arterial phase (b), a giant pseudoaneurysm is revealed at the surgical site (arrow), with a massive increase of contrast blush in the venous phase (c, arrow). Coronal maximum intensity projection highlights the vascular anatomy of the pseudoaneurysm arising from the gastroduodenal artery (d, dashed circle). These findings are consistent with those obtained from the subsequent operative angiography (e, dashed circle), before embolization (f). Informed patient consent was provided for the publication of these images.

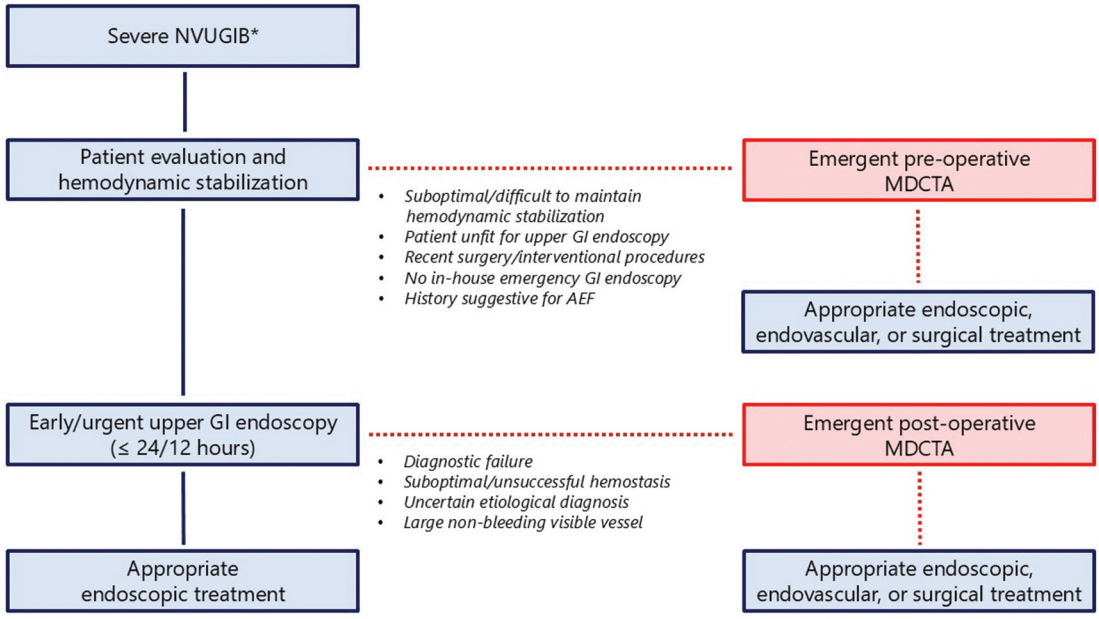

Figure 4. Proposed algorithm incorporating multidetector-row computed tomography angiography for the multidisciplinary management of severe non-variceal upper gastrointestinal bleeding.

*Defined as hemodynamic instability with hypotension and systolic blood pressure <100 mmHg, pulse >100 beats/min, hemoglobin less than 100 g/l or transfusion requirements of more than 4 units of packed red blood cells per 24 hours.

Abbreviations: NVUGIB: non-variceal upper gastrointestinal bleeding; GI: gastrointestinal; AEF: aorto-enteric fistula; MDCTA: multidetector-row computed tomography angiography.

delivery rate (IDR, expressed in gI/sec), which depends on both the CM concentration and the injection flow rate, and the injection duration (ID). ID becomes particularly relevant in acquisitions of longer duration (> 10 seconds), typically required for larger study volumes. In this setting, higher ID leads to greater arterial enhancement. This phenomenon is related to the recirculation of the CM bolus, which contributes an additional 10–20% increase in peak arterial enhancement [41,42].

Cardiac output is another major determinant. In patients with reduced cardiac output, the maximum peak intensity of aortic enhancement is paradoxically higher. Specifically, a 60% reduction in cardiac output results in an approximately 30% increase in aortic peak enhancement. This underscores the need for tailored CM protocols according to patient hemodynamic status, in order to optimize image quality while minimizing the risk of artifacts or suboptimal vascular opacification [41]. From a clinical perspective, individualizing CM injection strategies – by adjusting IDR, ID, and timing of acquisition – can substantially improve diagnostic accuracy in acute bleeding scenarios, where precise vascular mapping is critical for guiding therapeutic decision-making.

Typically, an initial non-contrast computed tomography (CT) scan is essential to detect any preexisting hyperattenuating substances in the bowel lumen, such as suture materials, clips, foreign bodies, and orally ingested medications, which might be mistaken for active bleeding [39,40]. After intravenous administration of CM, CT acquisition is typically performed in two or three phases at predefined time points. The first post-contrast phase corresponds to the arterial phase, which is particularly important for detecting active arterial extravasation and for providing a detailed depiction of the regional vascular anatomy. To optimize the arterial phase and correctly determine the start of volumetric acquisition after CM injection, the use of the *bolus tracking* technique is essential. This method relies on the automatic measurement of CT attenuation values within a region of interest placed in the aortic lumen [41]. Image acquisition is then triggered once the attenuation increase reaches a predefined threshold, typically 100–120 Hounsfield Units (HU) [41]. Systematic application of bolus tracking ensures accurate synchronization between peak vascular enhancement and data acquisition, thereby minimizing the risk of early or delayed scanning. This is particularly relevant in the emergency setting of acute GI bleeding, where suboptimal timing may compromise the detection of active CM extravasation or vascular abnormalities [41]. Subsequently, after a delay of 70 to 90 seconds, additional scans are conducted to detect potential sources of venous-origin bleeding that could be confused with active focal hemorrhages, such as clips, foreign bodies, orally ingested drugs, or coproliths. In certain situations, particularly in patients with diminished cardiac function or when further investigation of identified pathologies is necessary, a late venous phase scan conducted 5 minutes after the start of the injection may also be considered [39,40].

The hallmark finding of MDCTA in the setting of GI bleeding is the visualization of hyperdense CM extravasating into the bowel lumen. Active hemorrhage typically appears as a focal area of high attenuation (around 90 HU) within the GI tract. The extravasated CM may assume different morphologies, including linear, jet-like, swirled, ellipsoidal, punctate, or pooling patterns, and in severe cases it can completely fill a bowel loop,

rendering it diffusely hyperattenuating [39,43–45]. However, attenuation values alone are not always reliable markers, since small or diluted bleeds may fail to reach the 90 HU threshold. Therefore, the most accurate diagnostic approach combines multiphasic evaluation, comparing arterial-phase findings with those obtained in the unenhanced and venous phases. The dynamic change in the appearance of extravasated CM across these phases provides the most definitive evidence of active bleeding [39,43].

Images from the baseline phase, obtained without contrast, should be reconstructed with a thickness of 5 mm, whereas images from the arterial, venous, and late phases should be reconstructed at a thickness of 1.25 mm. Post-processing techniques prove to be extremely useful. Methods like multiplanar reformatting and maximum intensity projection are particularly helpful for outlining the arterial anatomy and more accurately determining the source of bleeding. It is generally recommended to avoid the use of oral contrast agents, as they can obscure the origin of the bleeding [39,40].

Achieving high-quality CT examinations requires the use of appropriate scanning settings, typically including a tube voltage between 80 and 120 kVp, automatic tube current modulation, rotation times of around 0.5 seconds, and thin collimation (slice thickness 1–2.5 mm) combined with a low noise index [41]. A careful balance must always be maintained between minimizing radiation exposure and ensuring sufficient image quality for a reliable clinical diagnosis. Inadequate or suboptimal acquisitions may necessitate repeat scans or additional study volumes, inevitably increasing the cumulative radiation dose to the patient [41]. Although multiphasic and volumetric protocols inevitably involve higher radiation exposure, they also provide higher diagnostic accuracy, which can be crucial for guiding timely and effective clinical management [41]. For this reason, dose optimization strategies are of paramount importance. Efforts should focus on reducing radiation burden without impairing diagnostic confidence [41]. Modern CT platforms incorporate advanced technologies, particularly iterative reconstruction algorithms (i.e. Admire, Safire, iDose, ASiR, IRIS, Veo), which have been shown to substantially lower radiation dose – by up to 80%—while preserving, or in some cases even enhancing, image quality [41].

Advancements in CT imaging have led to the development of dual-energy CTA (DECTA), which uses dual-energy technology for post-processing. This technology is highly effective for diagnosing GI tract diseases and includes a virtual non-contrast (VNC) feature. The VNC simulates a pre-contrast scan, potentially reducing radiation exposure by about 30%. It helps in examining the presence of iodine in dense areas without an actual scan [39,46]. Additionally, DECTA employs low-keV virtual monochromatic X-ray images (VMIs), which enhance iodine contrast and aid in detecting extravasation, crucial for confident diagnoses. VMIs are particularly useful in improving the identification of bleeding sites and assessing vascular anomalies before embolization procedures. These images keep the spatial positioning of organs consistent, facilitating comparisons without the influence of intestinal movement or patient motion [39,46]. Iodine maps within DECTA further distinguish between intestinal contents and extravasations, enhancing diagnostic reliability and efficiency in GI bleeding scenarios. Furthermore, techniques within DECTA reduce metal density artifacts from surgical clips and implants, improving the visibility of contrast material in the vessel lumen. Overall, DECTA offers significant improvements over traditional single-energy CT imaging, particularly for conditions involving significant bleeding or the presence of dense material into the bowel, thus enhancing lesion detection and disease characterization in the GI tract [39,46].

Despite its recognized diagnostic value, MDCTA is not without limitations. Accessibility may be restricted in smaller or non-tertiary hospitals, where latest-generation scanners availability, radiology expertise, or after-hours coverage are limited. Radiation exposure remains a relevant concern, particularly in younger patients or in those requiring multiple imaging studies during recurrent or severe bleeding episodes. Similarly, the need for intravenous CM exposes patients to potential adverse events, including allergic reactions and contrast-induced nephropathy, which can be especially problematic in patients with preexisting renal impairment. From a clinical standpoint, these limitations underscore the importance of patient selection.

3.1. Structured reporting of multidetector-row computed tomography angiography findings

In the context of acute NVUGIB, structured reporting can significantly enhance the practical value of MDCTA. Essential elements that should be systematically included in radiology reports are the following: a) bleeding location: precise anatomical site of active or recent hemorrhage; b) etiology: suspected cause, such as PUD, malignancy, or post-procedural bleeding; c) vascular abnormalities: VAPA, arterial irregularities, or other anomalies contributing to bleeding; and d) suitability for endovascular and/or other hemostatic techniques: evaluation of arterial anatomy, access routes, and feasibility of embolization or other interventions.

4. Conclusion

NVUGIB is an ‘umbrella’ term encompassing bleeding occurring proximally to the ligament of Treitz due to various sources, including not only peptic ulcers, but also rare and iatrogenic causes, and clinically ranging from mild with a tendency to spontaneous resolution to severe and potentially life-threatening. Although EGD undoubtedly represents the first-line modality for both diagnosis and simultaneous treatment of NVUGIB, MDCTA may play a crucial role in the diagnostic process of a subset of clinically severe NVUGIB patients. Nevertheless, MDCTA should never be intended as an alternative diagnostic modality to EGD. Instead, it should serve as a valuable adjunct tool for superselected cases of severe NVUGIB, aimed at guiding proper and timely treatment. MDCTA adoption outside of the above-discussed clinical situations should be discouraged. Its indiscriminate use could expose patients to unnecessary risks and healthcare systems to avoidable costs.

5. Expert opinion

In our opinion, MDCTA may be a valuable diagnostic tool in superselected cases of severe NVUGIB, effectively guiding not only the proper diagnosis but also the timing and the type of treatment, whether it is endoscopic or non-endoscopic. It could assist the involved clinicians in the effective prompt and tailored management of these patients, thus improving their outcomes and allowing proper resource utilization. As expected, the potential role of MDCTA seems to be more evident in the setting of clinically severe NVUGIB, especially when secondary to rare and extraordinary rare sources. For instance, in this setting, such as NVUGIB secondary to AEF or ruptured VAPA, the currently recommended timing of EGD ≤12–24 hours from presentation may result in a fatal delay [9–13].

A recent single-center retrospective study from our group showed that emergent MDCTA was highly sensitive for the detection of bleeding status (72.5% for active bleeding, 87.0% for recent bleeding and 100% for non-active and non-recent bleeding), location (92.4%), and etiology (79.0%) in clinically severe NVUGIB patients. With regard to the bleeding status, all the included patients with active bleeding confirmed by the reference standard (endoscopy, digital subtraction angiography and/or surgery) were correctly identified by MDCTA, and no false positives were observed, resulting in a positive predictive value (PPV) of 100%. Moreover, all the 2 included patients with non-active and non-recent NVUGIB were correctly identified by MDCTA, resulting in a negative predictive value and PPV of 100%. Concerning the bleeding etiology, MDCTA showed an excellent sensitivity (100%) in diagnosing ruptured VAPA and anastomotic bleeding, allowing proper and prompt endovascular and/or surgical treatment in all of the included cases of ruptured VAPA and AEF. Worth mentioning, emergent MDCTA as the first diagnostic modality or following EGD was performed in only 80 out of 935 acute NVUGIB patients admitted to our bleeding unit in the study period (December 2019 – October 2022). This highlights the value of MDCTA as an adjunct diagnostic tool in a very restricted subset of NVUGIB patients [20].

As previously described, emergent MDCTA may be indicated following EGD or prior to EGD in a very restricted subset of clinically severe NVUGIB patients. However, in this subset, MDCTA may assist the involved clinicians in choosing the most appropriate therapeutic pathway and its timing. MDCTA allows a comprehensive management of NVUGIB primarily among rare non-peptic sources or in special clinical scenarios, supporting a tailored treatment plan aimed at optimizing outcomes. MDCTA is a safe, noninvasive, fast and widely available diagnostic tool that may have a deep impact on the real-life emergent diagnosis of a subset of NVUGIB patients and their subsequent effective treatment. Indeed, MDCTA is a very fast imaging modality, with images typically obtained in less than one minute and requiring a limited amount of intravenous CM to provide high-quality anatomic images. Moreover, MDCTA is capable of comprehensively evaluating the bleeding lesion, providing additional information to extraluminal abnormalities, feeding and draining vessels, and its anatomical relationship to surrounding structures. Furthermore, it may rule out potential complications (i.e. bleeding PUD complicated by perforation) and spare useless or inappropriate treatments (i.e. EGD for AEF). Nevertheless, MDCTA may typically be promptly performed. Indeed, unlike endoscopists who are primarily on-call, radiologists are generally present on-site in the emergency department. However, the radiologist's experience and familiarity with GI bleeding are crucial for the proper interpretation of MDCTA images in this complex setting. Dedicated training, especially in the recognition of the rarest NVUGIB sources, and the adoption of standardized terminology are pivotal for accurate diagnosis and for guiding clinicians on the timing and type of subsequent treatment.

In the near future, MDCTA may represent a valuable and reproducible adjunct diagnostic tool for a subset of clinically severe NVUGIB patients, allowing for planning the most optimal therapeutic strategy and its timing, also taking into consideration local expertise and availability. Thus, it could assist the involved clinicians in providing tailored treatment with the final aim of optimizing outcomes and reducing morbidity and mortality. Anyway, despite the growing interest, evidence regarding the role of MDCTA in NVUGIB is still lacking. Large prospective studies in high-volume referral centers are needed to clarify the role of MDCTA in clinically severe NVUGIB. Although difficult to arrange in an emergency scenario, multicenter randomized controlled trials should ideally be conducted to best prove the added value of MDCTA and strengthen its clinical application. In this context, future research should focus on identifying those patients most likely to benefit from upfront or post-endoscopy MDCTA among the above-discussed indications. The diagnostic accuracy for the identification of active bleeding and the detection of bleeding etiology and site of MDCTA, and its safety should be evaluated. The added value of MDCTA to plan further management strategy should be carefully addressed. The adoption of standardized MDCTA protocols along with standardized and reproducible terminology for active bleeding definition should be deeply encouraged. High morbidity and mortality still associated with acute NVUGIB justify active research in this field.

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Declaration of interest

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AI-based tools and technologies declaration

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