

INTRODUCTION

Acute gastrointestinal bleeding is a common, potentially life-threatening condition responsible for 1%–2% of all hospital admissions. Mortality ranges between 19% and 40% that increases with older age, the presence of shock and associated underlying comorbidities (**Artigas et al., 2013**)

Gastrointestinal bleeding is not a specific disease but rather is a clinical manifestation of many diseases affecting the digestive tract. GI bleeding is usually classified as upper or lower based on whether the bleeding source is proximal or distal to the ligament of Treitz (**Wu et al., 2010**)

Before the initiation of diagnostic and therapeutic procedures, patient should undergo resuscitation including stabilization of blood pressure and restoration of intravascular volume (**Barkun et al., 2003**). various diagnostic procedures are conducted, the goal of which is to identify and if possible, initiate treatment of bleeding. Diagnostic methods that have been used for the localization of acute GIB include; Conventional endoluminal contrast studies of GIT, upper and lower Glendoscopy and arteriography which is a radiographic contrast study that can identify briskly bleeding sources (**Fallah et al., 2000**). Also technetium-labeled red blood cell is best suited for identifying slow bleeding sources (**Eisen et al., 2001**).

Identification of the source and cause of bleeding helps guide therapeutic decisions, and for years, clinical management has been focused mainly on endoscopic findings. endoscopic procedures in the emergency setting usually poses a variety of challenges, such as variable availability of the service and an insufficient time window to perform adequate bowel preparation in the most serious cases. Mucosal visualization is poor owing to the presence of intraluminal blood clots and other intestinal contents, and the distal portion of the duodenum and the small bowel are not routinely accessed (**Artigas et al., 2013**)

Technical improvements in multidetector CT technology, especially the higher temporal resolution that allows the ability to obtain high-resolution three-dimensional datasets with short acquisition times at different times during the administration and distribution of intravascular contrast material (multiphasic studies), have expanded the applications of CT angiography for evaluating patients with vascular diseases, including acute hemorrhage. Temporally resolved CT angiography allows the identification of active extravasation of contrast material and the accurate identification of the source of hemorrhage. Other advantages of CT angiography include its widespread availability in the emergency setting, its minimal invasiveness, and its reproducible results, which combine high sensitivity and accuracy for detecting or excluding active bleeding, as well as

detecting the potential source and cause. CT angiography can be used to evaluate the wall of the entire gastrointestinal tract and other digestive structures that may occasionally be the source of bleeding (**Artigas et al., 2013**).

AIM OF THE WORK

To evaluate the diagnostic value of MDCT angiography in detecting the etiology and localizing the source of acute gastro intestinal bleeding.

NORMAL VASCULAR AND CTA ANATOMY OF THE GUT

Abdominal aorta begins at midline, at the aortic hiatus of the diaphragm, anterior to the twelfth thoracic vertebra's inferior border and the thoracolumbar intervertebral disc, descending anterior to the vertebrae to end at the fourth lumbar vertebra slightly to the left of the midline, by dividing into two common iliac arteries. It diminishes rapidly in calibre, since its branches are large. The coeliac trunk and its branches is the first branch of the abdominal aorta. Below this the superior mesenteric artery leaves the aorta, crossing anterior to the left renal vein. The body of the pancreas, with splenic vein applied posteriorly, extends obliquely up and left across the abdominal aorta, separated from it by the superior mesenteric artery and left renal vein. Below the pancreas, the proximal parts of its testicular (or ovarian) arteries, and the horizontal part of the duodenum are anterior.

Posterior to the abdominal aorta are the thoracolumbar disc, the upper four lumbar vertebrae, intervening intervertebral discs (**Gabella et al., 1995**).

The aortic branches to the gut are; celiac, superior mesenteric and inferior mesenteric arteries.

A-Coeliac Trunk

It is a wide ventral branch, about 1.25 cm long, just below the aortic hiatus, passes almost horizontally forwards and slightly right above the pancreas and splenic vein, dividing into: left gastric, common hepatic and splenic arteries (*fig. 1*).

1-Left Gastric Artery is the smallest coeliac branch, near the stomach two or three oesophageal branches ascend through the oesophageal opening to anastomose with the aortic oesophageal branches; 'others supply the cardiac part of the stomach and anastomose with the splenic branches (**Gabella et al., 1995**).



Figure 1: Volume-rendered 3D MDCT scan reveals classic branching arterial anatomy. Celiac axis (short solid arrow) trifurcates into splenic artery, common hepatic artery (long solid arrow), and left gastric artery. Common hepatic artery gives rise to gastroduodenal artery (open arrowhead) and proper hepatic artery (solid arrowhead). Right hepatic artery (long open arrow) and left hepatic artery (short open arrow) originate from proper hepatic artery (**Quoted from Winston et al., 2005**).

2-Hepatic Artery is intermediate in size between the left gastric and splenic arteries; it first passes forwards and right, below the epiploic foramen to the upper aspect of the superior part of the duodenum. Crossing the portal vein, it ascends between layers of the lesser omentum, anterior to the epiploic foramen, to the porta hepatis, where it divides into right and left branches to the hepatic lobes, accompanying the ramifications of the portal vein and hepatic ducts.

It gives off the following branches:

Right Gastric Artery passes left along the lesser gastric curvature, supplying the upper parts of the anterior and posterior gastric surfaces. It ends by anastomosing with the left gastric artery (**Gabella et al., 1995**).

Gastrooduodenal Artery descends between the duodenum and the neck of the pancreas. At the lower border of the duodenum's superior part it divides into the right gastro-epiploic and superior pancreaticoduodenal arteries, after supplying small branches to the pyloric end of the stomach and to the pancreas, retrooduodenal branches to the superior part of the duodenum, and sometimes providing the supraduodenal artery (**Gabella et al., 1995**).

Right Gastro-Epiploic Artery is the largest terminal branch of the gastroduodenal, it skirts the right margin of the

omental bursa and then turns left along the greater curvature, between the anterior two layers of the greater omentum. It ends in direct anastomosis with the left gastro-epiploic branch of the splenic. It also supplies the inferior aspect of the duodenum's superior part **(Gabellaet al., 1995)**.

Superior Pancreaticoduodenal Arteries are usually double: the anterior descends anteriorly between the duodenum and head of the pancreas. It anastomoses with the anterior division of the inferior pancreaticoduodenal branch of the superior mesenteric. The posterior superior pancreaticoduodenal artery, which is usually a separate branch of the gastroduodenal arising at the upper border of the superior part of the duodenum, descends to the right, anterior to the portal vein and bile duct and then posterior to the head of the pancreas, supplying branches to it and the duodenum; it crosses posterior to the bile duct, piercing the duodenal wall to end by anastomosing with the posterior division of the inferior pancreaticoduodenal artery **(Gabellaet al., 1995)**.

Cystic Artery is usually from the right branch of the hepatic proper, it passes behind the common hepatic and over the cystic duct to the superior aspect of the gallbladder's neck, on which it descends to divide into superficial and deep branches **(Gabellaet al., 1995)**.

3-Splenic Artery is the largest branch of the coeliac axis, and is remarkably tortuous. Surrounded by a splenic nerve plexus and accompanied by the straight splenic vein, it ascends to the left, behind the stomach and omental bursa, along the superior border of the pancreas; it is anterior to the left suprarenal gland and upper part of the left kidney and enters the lienorenal ligament (**Gabella et al., 1995**).

Branches of the splenic artery are as follows:

Pancreatic Branches are numerous and small, they supply the neck, body and tail of the pancreas.

Short Gastric Arteries are five to seven, arising terminally from the splenic and its final divisions or from the left gastro-epiploic artery. They pass between layers of the gastrosplenic ligament to supply the gastric fundus, anastomosing with branches of the left gastric and gastro-epiploic arteries.

Posterior Gastric Artery arises from any part of the splenic but most commonly its middle section. It ascends behind the peritoneum of the omental bursa towards the gastric fundus to reach the posterior gastric wall in the gastrophrenic fold.

Left Gastro-Epiploic Artery is the splenic's largest branch, it arises near the splenic hilum and runs antero-inferiorly and right, sending branches through the gastrosplenic ligament to

supply the proximal third of the greater curvature; these are necessarily longer than the gastric branches of the right gastro-epiploic artery.

Terminal Splenic Branches enter the hilum in the lienorenal ligament (**Gabella et al., 1995**).

B-Superior Mesenteric Artery

The SMA arises from the abdominal aorta, usually at the level of the L1 vertebral body, and supplies blood to the jejunum, ileum, right colon, and, usually, the transverse colon. It also supplies blood to the duodenum via the pancreaticoduodenal arcade. Typically, the SMA arises less than 1.5 cm below the celiac origin and is just superior to the origin of the renal arteries (Fig 2). The left renal vein is located posterior to the proximal portion of the SMA and anterior to the aorta, unless there is a normal variant such as a retroaortic or circumaortic renal vein. The SMA lies to the left of the SMV as it crosses over the third portion of the duodenum. When the SMA enters the mesentery, it usually lies posterior to the mesenteric vein, although this relationship is variable (**Horton and Fishman., 2000**).



Figure 2: Sagittal 3D MDCT scan demonstrates the normal anatomy of the celiac axis (thick solid arrow) and SMA (curved arrow). The SMA courses over the left renal vein (open arrow). The origin of the left renal artery is also visualized (thin solid arrow)(Quoted from Horton and Fishman., 2000).



Figure 3: Coronal 3D MDCT scan demonstrates the normal anatomy and branching pattern of the SMA. The jejunal branches (straight solid arrows) and ileal branches (curved solid arrows) are well visualized. The ileocolic branch of the SMA arises from the right side of the vessel (curved open arrow). The middle colic artery is also identified (straight open arrow) (Horton and Fishman., 2000).



Figure 4: Coronal 3D MDCT scan demonstrates the normal terminal branching pattern of the ileocolic artery (black arrow), which supplies the terminal ileum, cecum, and lower ascending colon. With optimization of technique, even the smallest branches feeding the bowel can be visualized (white arrows). The branches on this image represent the vasa recta(**Quoted from Horton and Fishman., 2000**).

The jejunal arteries (usually 4–6 arteries) arise from the left side of the SMA (Fig 3). The ileocolic artery, which arises from the right side of the SMA, marks the transition from jejunal to ileal arteries. There are usually between eight and 12 ileal arteries (**Rosenblum et al., 1997**). The branching pattern of the last jejunal artery, ileocolic artery, and ileal arteries varies, sometimes forming a loop or tripod. The ileocolic artery has branches to the terminal ileum, cecum, and lower ascending colon (Figs 3, 4). The right colic artery can arise from the SMA to aid the ileocolic and middle colic arteries in supplying blood to the ascending colon. However, it is absent in up to 80% of individuals (**Rosenblum et al., 1997**). The middle colic artery usually arises from the right side of the SMA just before it enters

the mesentery (Fig 3). It descends into the right lower quadrant, where it anastomoses with the ileocolic artery (Fig 5). Other branches that may arise from the SMA include an artery for the right angle of the colon and one for the transverse colon. There are also anastomotic connections between the artery to the transverse colon and the left colic artery, which arises from the IMA. Many variations exist (**Kornblith et al., 1992**). The inferior pancreaticoduodenal artery is the pivotal point of embryologic gut rotation. It can arise from either the right or left side of the SMA (**Rosenblum et al., 1997**) and may arise as one vessel or two (anterior and posterior). This vessel courses behind the SMV and superiorly to anastomose with the superior pancreaticoduodenal artery, which arises from the gastroduodenal artery (Fig 6).

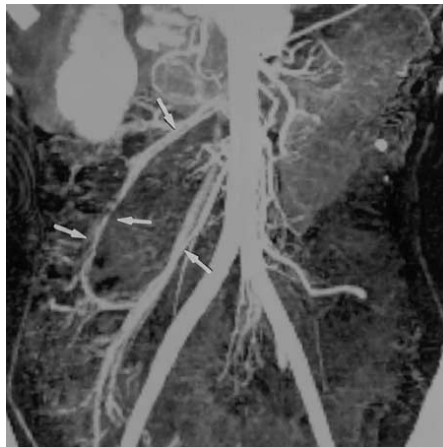


Figure 5. Three-dimensional multi– detector row CT scan (maximum intensity projection) demonstrates a normal variant anastomotic pathway between the ileocolic and middle colic arteries (arrows)(**Quoted from Horton and Fishman., 2000**).



Figure 6. Coronal 3D multi– detector row CT scan demonstrates the inferior pancreaticoduodenal artery (straight arrow), which arises from the SMA (curved arrow) and connects to the gastroduodenal artery (Quoted from Horton and Fishman., 2000).

The marginal arteries of Dwight and Drummond supply the vasa recta to the small intestine and colon and provide a continuous channel of potential collateral blood supply to the entire gut (Linnet al., 2000). The marginal artery is defined as the artery closest to and parallel with the wall of the intestine, supplying the vasa recta. The vasa recta are fine branches that arise from the marginal artery and supply the bowel wall (Fig 4). The middle colic artery is often the marginal artery for the major portion of its distribution. The arc of Riolan is an inconstant artery that courses parallel to a portion of the middle colic artery.

Aberrant branches from the SMA are relatively common (Fig 7). They include the common hepatic artery, right hepatic artery, splenic artery, celiac trunk, cystic artery, gastroduodenal artery, right gastroepiploic artery, and left gastric artery (**Linnet al., 2000**).

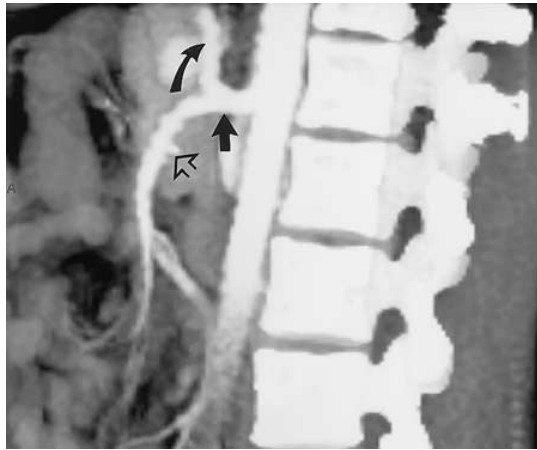


Figure 7. Sagittal 3D multi– detector row CT scan demonstrates a normal variant common trunk (straight solid arrow), which gives rise to the celiacaxis (curved arrow) and SMA (open arrow)(**Quoted from Horton and Fishman., 2000**).

Superior Mesenteric Vein

The SMV is usually a single trunk of variable length (5–50 mm) that is formed by two large intestinal branches (right and left), which receive blood from several veins including the ileocolic, gastrocolic, right colic, and middle colic veins (Fig 8).