Obscure gastrointestinal bleeding: gastroenterological and radiological approach

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Occult Blood [E01.450.575]

Keywords: Obscure GI bleeding, Diagnostic techniques

1. Learning objectives

To provide an overview of the diagnostic imaging modalities of OGIB including double balloon enteroscopy, wireless capsule endoscopy, MDCT, angiography, and bleeding scanning with labeled red blood cells.

2. Background

The management of gastrointestinal bleeding often involves a multispecialty approach in which radiologists play a key role, providing several specialized diagnostic examinations with a variety of imaging modalities as well as endovascular therapeutic interventions.

The role of the radiologist is to localize, characterize, and, when indicated, treat the bleeding lesion.

Thus, to optimize patient care, the radiologist must be familiar with the common causes of gastrointestinal bleeding and the strengths and weaknesses of the various available imaging examinations.

Definition

· Bleeding from the GI tract that persists or recurs without an obvious etiology after esophagogastroduodenoscopy (EGD), colonoscopy, and radiologic evaluation of the small bowel such as small bowel follow-through or enteroclysis

· Cat-egorized into obscure overt and obscure occult bleeding based on the presence or absence of clinically evident bleeding

Etiology of Obscure GI Bleeding

Upper GI and lower GI overlooked	Mid GI bleeding
Upper GI lesions ü Cameron's erosions ü Fundic varices ü Peptic ulcer ü Angiectasia ü Dieulafoy's lesion ü Gastric antral vascular ectasia	Younger than 40 years of age ü Tumors ü Meckel's diverticulum ü Dieulafoy's lesion ü Crohn's disease ü Celiac disease
Lower GI lesions ü Angiectasia ü Neoplasms	Older than 40 years of age ü Angiectasia ü NSAID enteropathy ü Celiac disease
	Uncommon · Hemobilia · Hemosuccus pancreaticus · Aortoenteric fistula

- Approximately 5% of patients presenting with GI hem-orrhage have no source found by upper endoscopy and colonoscopy
- In approximately 75% of these patients, responsible lesions can be detected in the small bowel.
- In patients presenting with obscure overt bleeding (defined as the presence of recurrent melena or hematochezia with normal evaluation by upper endos-copy and colonoscopy), small bowel angiectasias are de-tected in 30%-60% of examinations.

Clinical aspects

• Upper GI bleeding

– Hematemesis

– Melena

– Hematochezia (if the bleeding rate is high and the intestinal transit is rapid)

• **Lower GI bleeding**

– Hematochezia

– Melena (if colonic transit time and bleeding rate is low)

• **Bleed anywhere in GI tract**

– Occult blood detected in stools

• **Symptoms and signs of blood loss**

– Dizziness, tachycardia, hypotension, shock

• **Laboratory**

– Ferropenic anemia

– Occult blood in stool

– Abnormal coagulation values

– Elevation of blood urea nitrogen

3. Imaging findings OR Procedure details

Diagnostic techniques

Small bowel series and conventional enteroclysis

- Low diagnostic yield
- Neither of these radiographic studies can diagnose angiectasias
- Unless the clinical findings suggest small bowel obstruction due to malignancy, Crohn's disease, or prior use of NSAIDs and CT-enteroclysis is not available, there is no role for either small bowel series or conventional enteroclysis in the evalu-ation of obscure GI bleeding.

CT enterography / enteroclysis

Introduction

- Computed tomographic (CT) study of the small-bowel is a recently developed diagnostic tool for the evaluation of small-bowel disease.

Technique

This technique uses multidetector CT combined with luminal distention of the small bowel by using neutral enteric oral contrast material.

Image acquisition after intravenous contrast material administration is timed to optimize bowel wall enhancement.

- After a 6-hour fast, patients are given a total of 1600 mL of Polyethylene glycol (PEG) electrolyte solution, 60-120 ml/min through tube (enteroclysis) or divided into four 450-mL oral doses given every 20 minutes, beginning 60 minutes prior to scanning; the last dose is administered with the

patient on the CT table just prior to scanning (enterography).

- Butylscopolamine 10 mg iv just before intravenous contrast material injection to minimize patient discomfort and bowel motion artifact.
- 150ml iodine contrast is injected intravenously at a rate of 4 mL/sec through an antecubital catheter.
- Scanning is best performed by using a 64-section CT system from the diaphragm to the symphysis pubis during each of the following three phases: (a) a bolus-triggered arterial phase, (b) 20–25 seconds after the beginning of the arterial phase acquisition (enteric phase, during maximal bowel wall enhancement), and (c) 70–75 seconds after the beginning of the arterial phase acquisition (delayed phase).
- Bolus triggering is performed by the CT technologist by using software.
- A region-of-interest cursor is placed over the descending aorta 2 cm above the diaphragm. The region-of-interest trigger threshold was set at 150 HU, with scanning initiated 6 seconds later.
- Detector configuration, 64 x 0.625 mm; section thickness, 0.9 mm; section increment, 0.45 mm
- Transverse images are reconstructed at a 2-mm section width and a 1-mm interval. Coronal multiplanar and additional images, including three-dimensional, maximum intensity projection, and volume-rendered image reconstructions of data sets, are obtained at each radiologist's discretion.

Identification of the bleeding cause

- The isotropic spatial resolution provided with 64-section CT system allows us to visualize small vascular lesions responsible for bleeding in multiple orthogonal planes.
- The use of neutral enteric contrast material not only produces excellent luminal distention but also provides a canvas on which enhancing bowel wall lesions and active bleeding can be detected.

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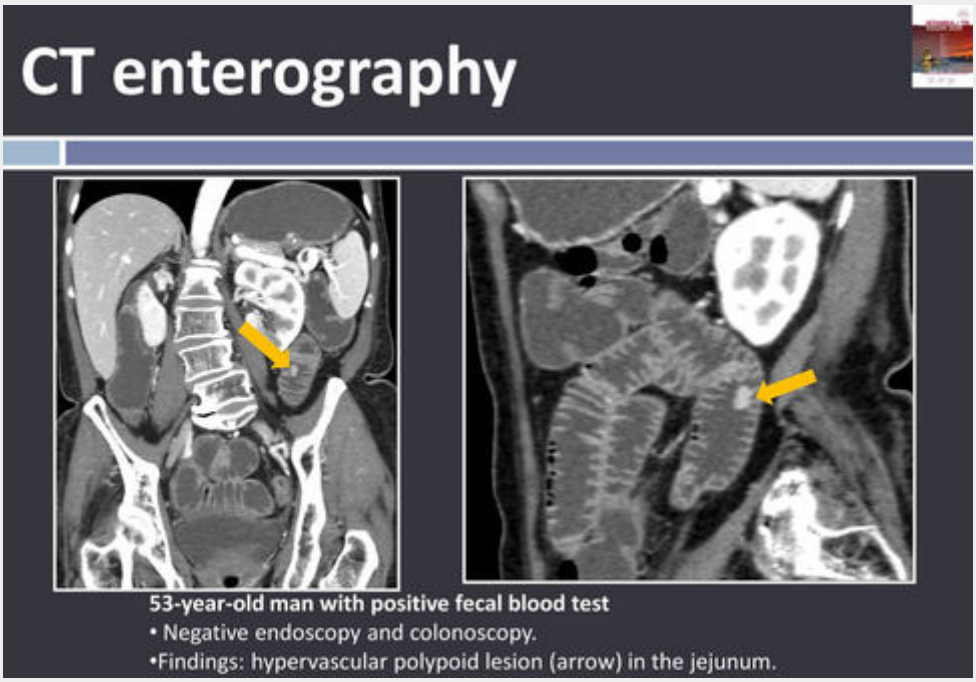

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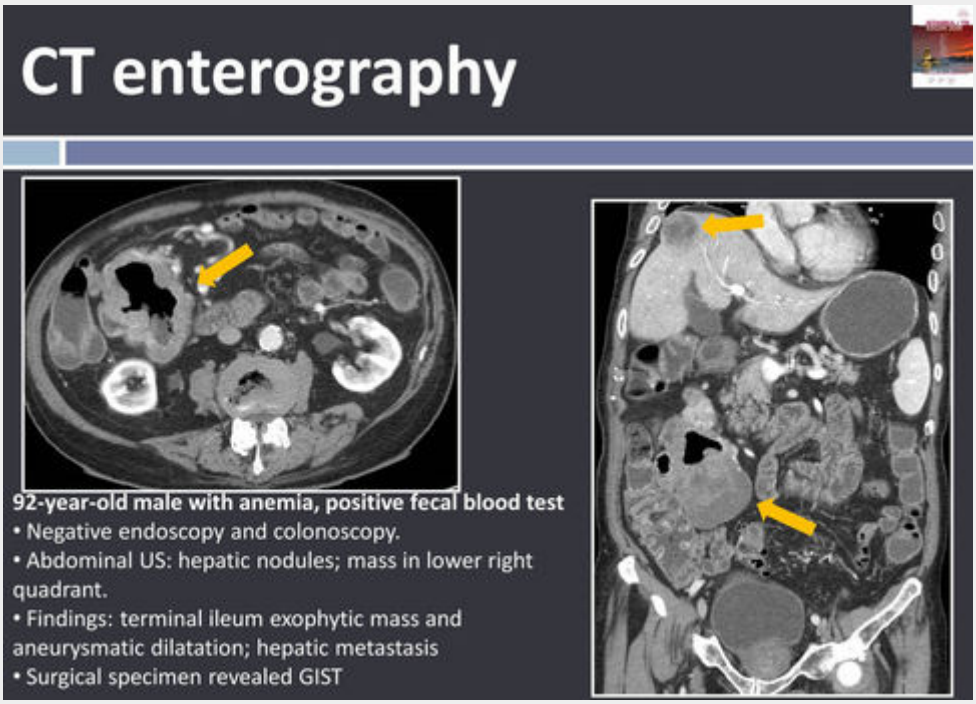

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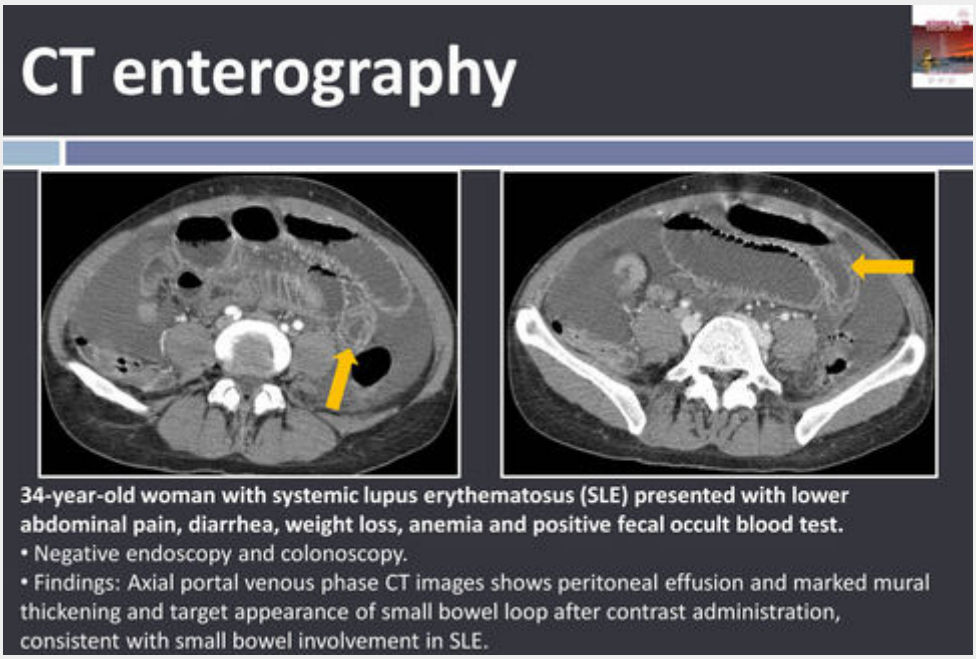

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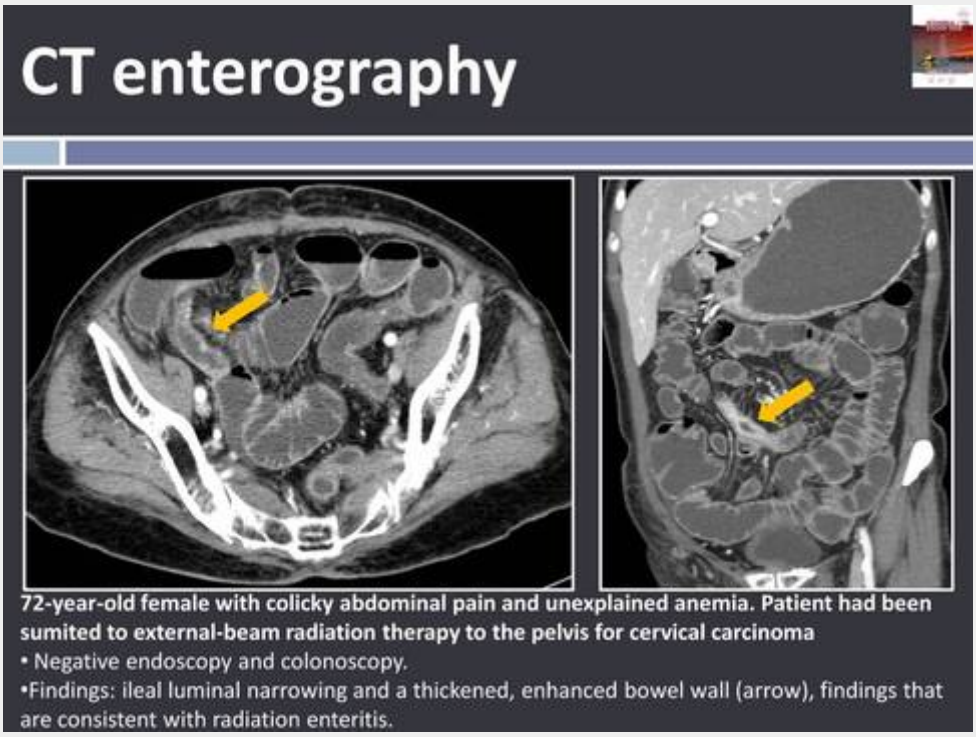

Indications and advantages

- In the clinical setting of silent OGIB, there is no data favoring CT enterography or enteroclysis.
- The ability to exquisitely depict bowel wall abnormalities, as well as extraintestinal disease, has made it an important tool in the evaluation of small-bowel disease, particularly inflammatory bowel disease
- Not indicated in clinically overt OGIB
- May help determine the cause of the bleeding lesion, allows improved interventional planning and lesion-directed planning
- Noninvasise, sensitive

Disadvantages

- Three-phase acquisition results in substantial patient radiation exposure
- Does not allow prolonged imaging times
- Preexisting high attenuation material within the bowel may limit usefulness of study
- Not easy to perform; prolonged preexamination time
- Does not allow therapeutic maneuvers

CT Angiography

Introduction

- Recent advances in CT technology allowing thinner collimation, faster scanning times, greater anatomic coverage, and better multiplanar reformatted (MPR) images have greatly expanded the diagnostic role of CT angiography for various pathologic processes

- In porcine models, helical CT has depicted active colonic hemorrhage with bleeding rates as low

as 0.3 mL/min, which is below the reported threshold for selective catheter angiography.
- Yoon et al (2006) conducted a four–detector row CT angiographic study of 26 consecutive patients with significant gastrointestinal bleeding. Their study demonstrated an overall location-based sensitivity, specificity, accuracy, positive predictive value, and negative predictive value for CT angiography in the detection and localization of gastrointestinal bleeding

Technique

- An unenhanced CT scan is obtained immediately prior to CT angiography to identify any pre-existing hyperattenuating areas within the bowel lumen that could be confused with hemorrhage at CT angiography. The technical parameters used to acquire the unenhanced data are as follows: detector configuration, 64 x 0.625 mm; section thickness, 3 mm; section increment, 3 mm;
- 100 – 150ml iodine contrast is injected intravenously at a rate of 4 mL/sec through an antecubital catheter.
- Scanning is best performed by using a 64-section CT system from the diaphragm to the symphysis pubis during each of the following three phases: (a) a bolus-triggered arterial phase, (b) 20–25 seconds after the beginning of the arterial phase acquisition (enteric phase, during maximal bowel wall enhancement), and (c) 70–75 seconds after the beginning of the arterial phase acquisition (delayed phase).
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Identification of the bleeding cause

- CT angiography may detect lesions responsible for silent OGIB, altough for this purpose CT enterography / enteroclysis may be preferible

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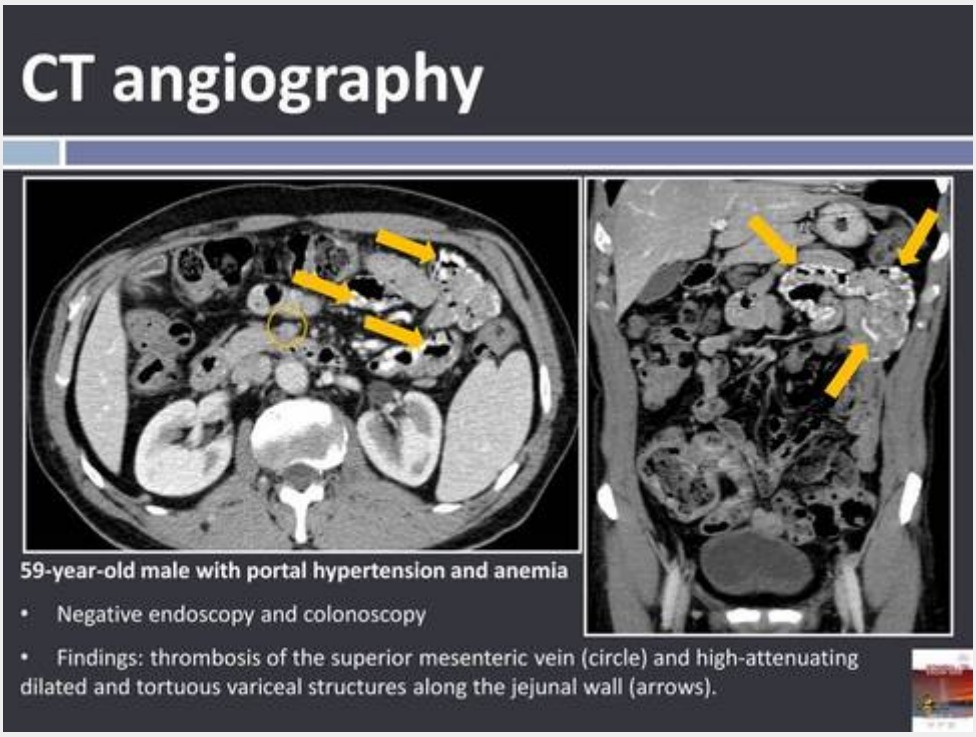

- The CT angiographic diagnosis of active gastrointestinal bleeding is made when hyperattenuating extravasated contrast material is seen within the bowel lumen.
- The extravasated contrast material may demonstrate linear, jetlike, swirled, ellipsoid, or pooled configurations or may fill the entire bowel lumen, resulting in a hyperattenuating loop.
- Therefore, high-attenuation material detected within the bowel lumen at CT angiography that was not present at unenhanced CT performed immediately prior to the CT angiography is diagnostic for acute gastrointestinal hemorrhage.
- Evaluation of gastrointestinal bleeding with CT angiography may also provide etiologic information in many cases, especially with lower gastrointestinal bleeding.
- Distinguishing diverticular from angiodysplastic bleeding (when possible) is important because of the prognostic differences between these two lesions. CT angiography can also help accurately diagnose neoplasms and colitis, the third and fourth most common causes of lower gastrointestinal bleeding, respectively.
- Concurrent localization of active hemorrhage and diagnosis of the underlying cause can also have important treatment and management implications.
- CT angiographic localization of bleeding can assist in determining the endoscopic approach, especially when clinical localization of bleeding to the upper or lower gastrointestinal tract is difficult or unreliable.
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    - Endoscopy of the upper and lower GI tract often fails to depict the exact focus of bleeding when massive bleeding (>1 mL/min) occurs.
    - Conversely, localization of bleeding within the small bowel may prevent unnecessary endoscopic examinations while expediting endovascular or surgical interventions.

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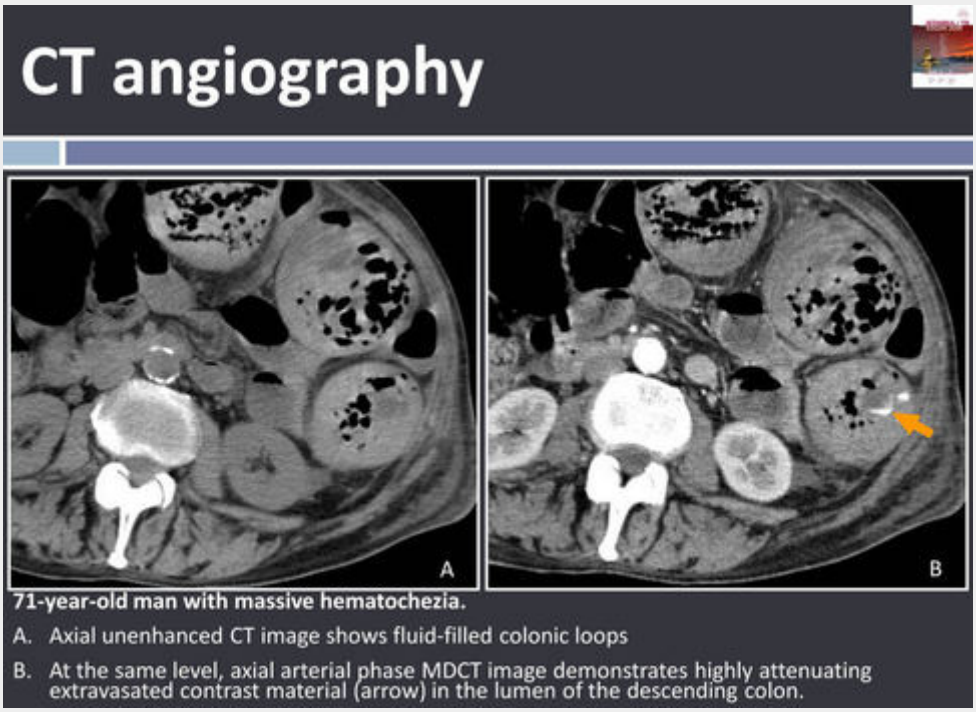

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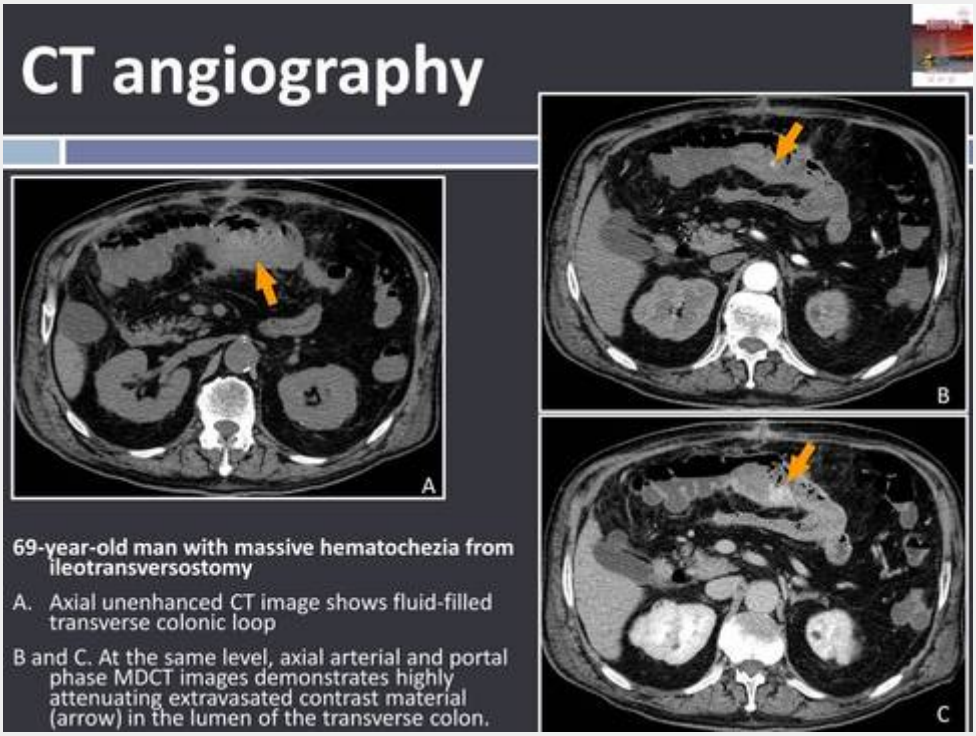

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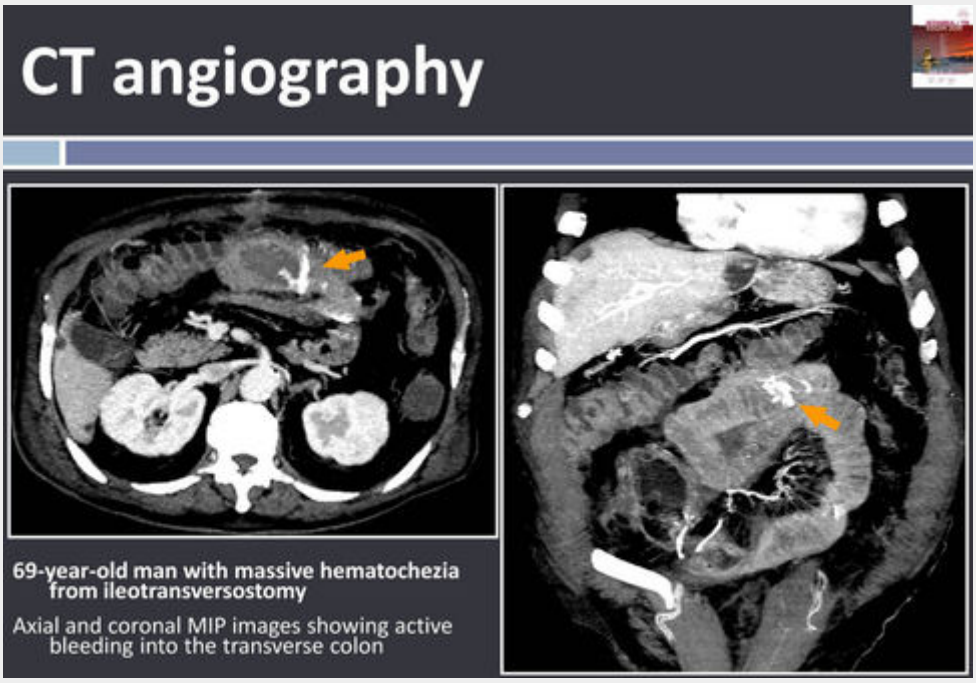

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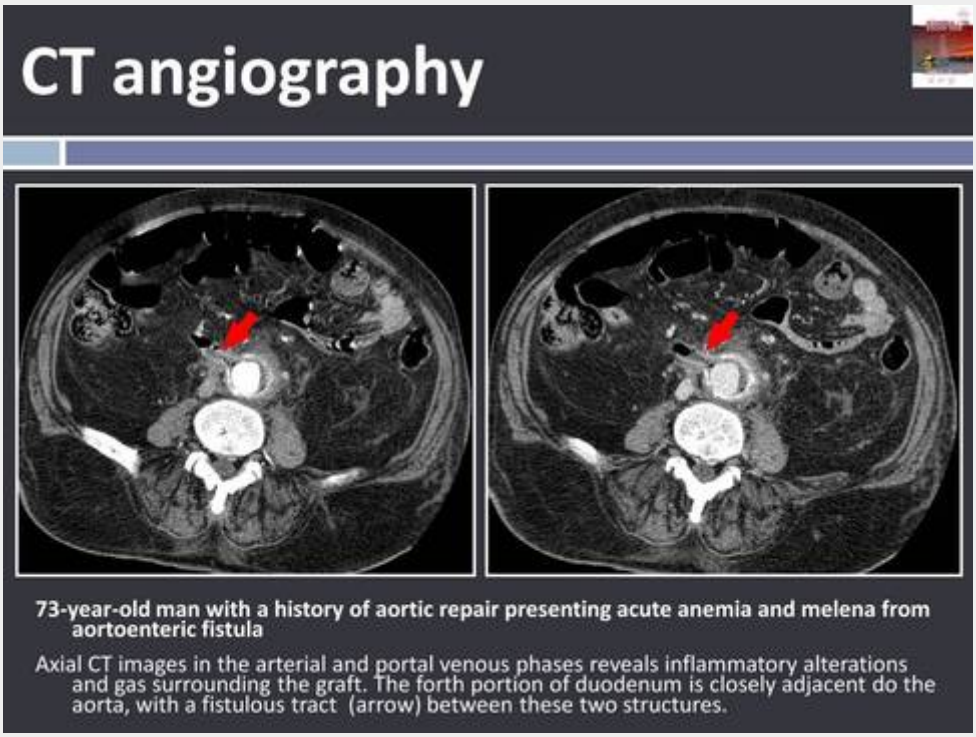

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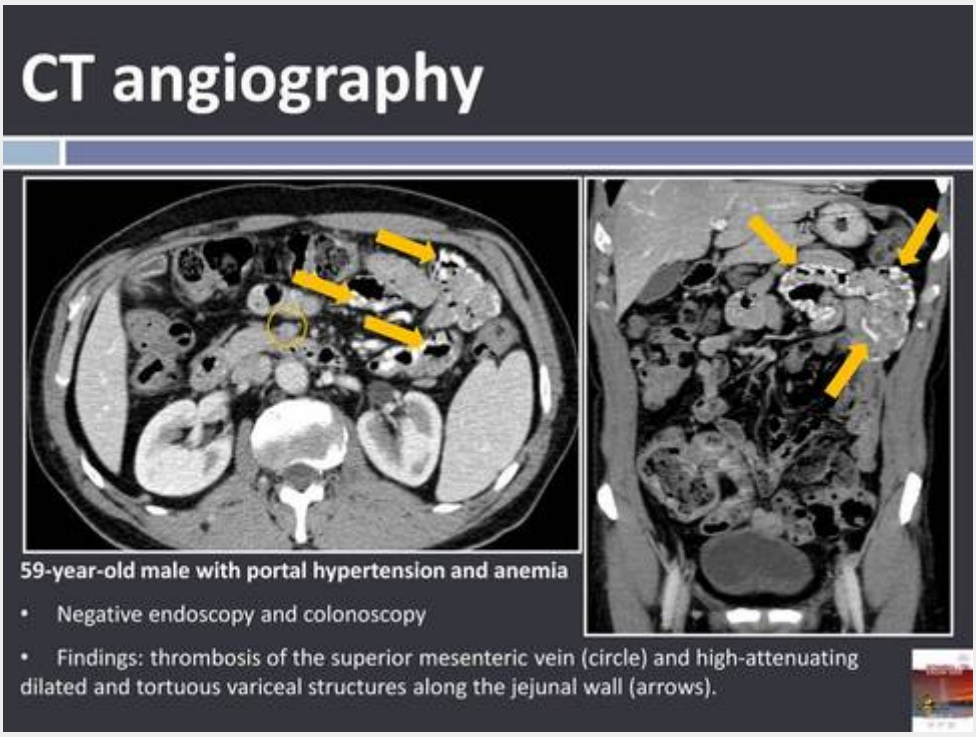

Indications and advantages

- Useful in both silent and overt OGIB (altough prefered for the latter)
- Rapid, noninvasive and sensitive
- Easy to perform
- May help determine the cause of the bleeding lesion, allows improved interventional planning and lesion-directed planning

Disadvantages

- Requires additional radiation exposure and contrast material
- Does not allow prolonged imaging times
- Preexisting high attenuation material within the bowel may limit usefulness of study
- Does not allow therapeutic maneuvers

Radionuclide Imaging

Introduction

- Because of their mode of action, bleeding scans are only useful in the setting of active GI bleeding. Two types of nuclear scans may be used in this setting: the technetium 99m-labeled red blood cell scan and the technetium 99m-labeled sulfur colloid scan. The tagged red blood cell scan is more commonly applied. It can reportedly detect active bleeding at a rate of 0.10 mL/min.

Technique

- During this scan, 20 mL of red blood cells are tagged with technetium and subsequently

reinjected into the patient. In general, images are taken every 3 seconds for the first minute, every 5 minutes for the next 45 minutes, and then every 15 to 60 minutes depending on the clinical setting.

- During the sulfur colloid scan, 20 mL of blood is again tagged and reinjected. The sulfur colloid scan is extremely sensitive, with a reported ability to detect bleeding as slow as 0.05 mL/min. There is intense reuptake, however, in the reticuloendothelial system. The scan can only be performed every 1 minute for the first 10 minutes. After this time period, uptake in the liver and spleen limits further visualization, especially of the upper GI tract and hepatic and splenic flexures.

Identification of the bleeding cause

- A scan is considered to be positive where radiotracer is seen to accumulate outside the vascular system and within the gastrointestinal tract.
- The images are viewed cinegraphically to detect changes in avidity of radiotracer accumulation, and any change in location of radiotracer within the gastrointestinal tract.
- In this way it is possible to determine the presence or absence of bleeding, and where appropriate, the most likely source of bleeding.
- Not uncommonly, gastrointestinal bleeding is an intermittent event. For this reason imaging with 99mTc RBC increases the likelihood of detection due to the ability of this agent to remain within the vascular circulation for the duration of the radionuclide, thus permitting either continuous or intermittent imaging over many hours.
- Because scanning is not therapeutic, in the presence of positive findings, a follow-up study, such as arteriogram or endoscopic examination, must be subsequently performed.

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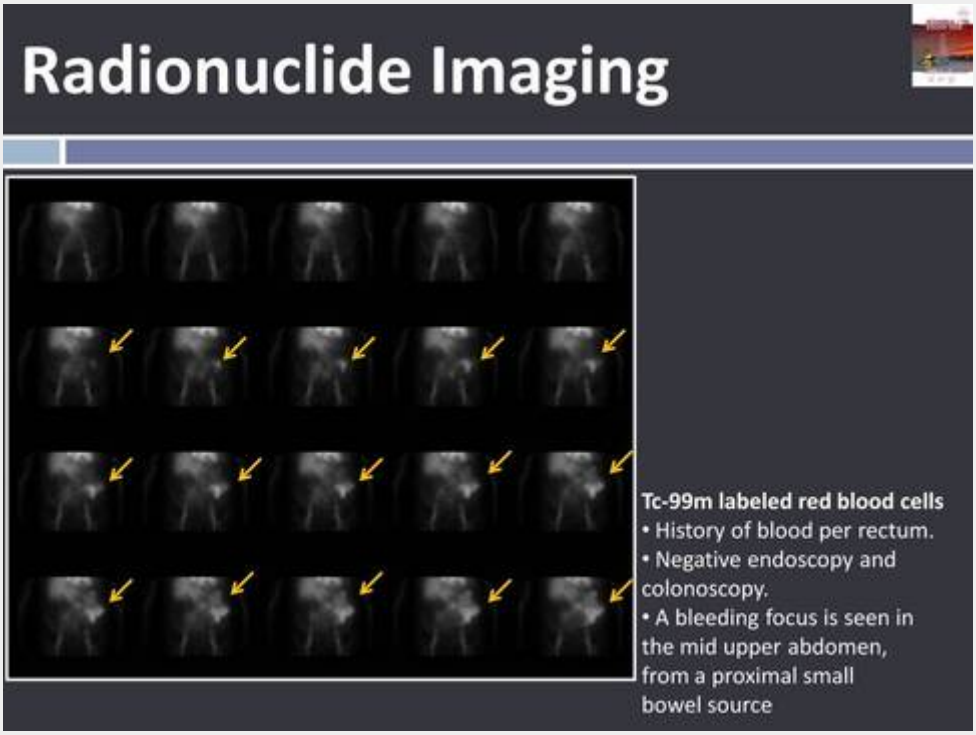

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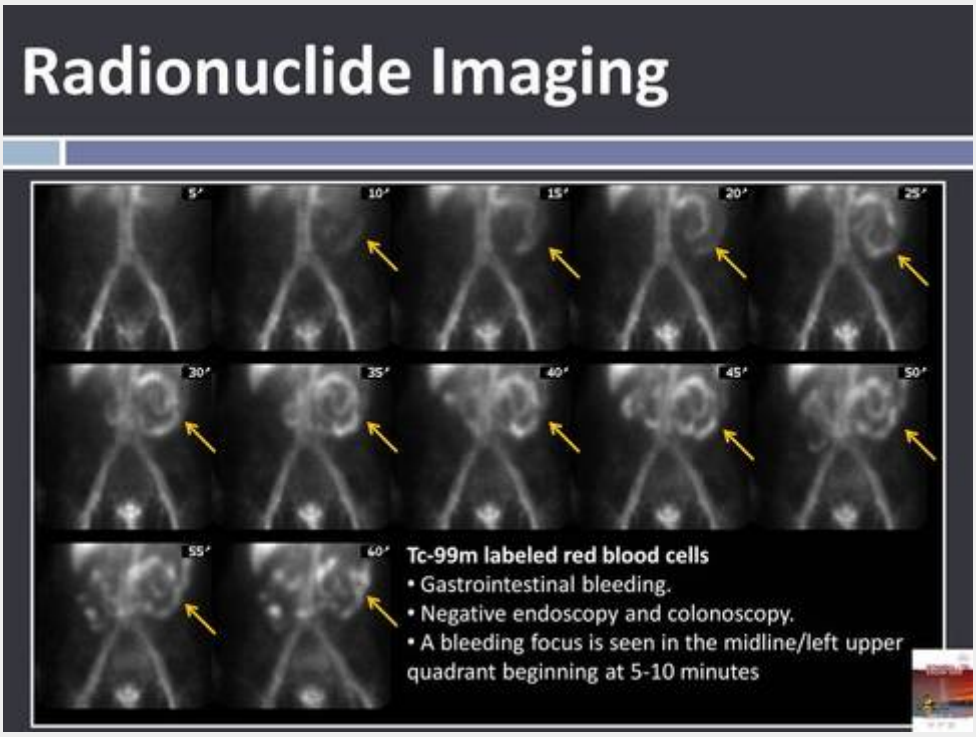

Indications and advantages

- Nuclear scanning should be reserved for patients suffering from bleeding believed to be inaccessible by endoscopy and at centers with angiographic capabilities.
- Noninvasive
- Most sensitive technique (can help detect both venous and arterial bleeding at low rates with little or no patient preparation
- Allows prolonged imaging times, making it useful for detecting intermittent bleeding

Disadvantages

- The ability to local-ize the source of bleeding, especially in the foregut, has been repeatedly demonstrated to be poor.
- Time-consuming procedure
- Limited availability for timely after-hours studies
- Does not allow therapeutic intervention

Catheter-directed Angiography

Introduction

- Angiography may be a useful diagnostic and therapeutic tool in patients who are actively (and more aggressively) bleeding.
- Referrals for angiographic evaluation typically occur in the setting of an acutely unstable patient, after a negative or failed endoscopic evaluation, or as a first-line examination for lower gastrointestinal hemorrhage.
- Angiography can demonstrate extravasation of contrast if bleeding is faster than 0.5 mL/min, although 1 mL/min is optimal. In addition, it can also identify nonbleeding lesions by its vascular

pattern, such as vascular ectasias.

Technique

- Angiography for GI bleeding is usually performed from a common femoral artery access. Upper extremity arterial access can be used when femoral access is not possible, and may even be necessary as it often provides better angles for catheterization of mesenteric vessels relative to the abdominal aorta.
- Angiography for GI bleeding is most often performed with 5 French catheter systems of which there are various useful shapes.
- Aortography is seldom necessary unless there is difficulty with selective catheterization.
- Selective catheterization for upper GI bleeding includes the celiac and superior mesenteric arteries, whereas lower GI bleeding includes the superior and inferior mesenteric arteries.
- The initial artery catheterized is the one most suspected of bleeding based on prior imaging or endoscopy, which is of course the celiac for upper GI bleeding. For lower GI bleeding, if bleeding from the descending and sigmoid colon is suspected, then inferior mesenteric angiography should be performed initially.

Identification of the bleeding cause

- Extravasation of contrast material into the bowel lumen is pathognomonic for active gastrointestinal hemorrhage.
- Indirect signs include detection of pseudoaneurysm, arteriovenous fistula, hyperemia, neovascularity, and extravasation of contrast material into a confined space.
- Embolization of the bleeding vessel is the mainstay of transcatheter treatment for nonvariceal gastrointestinal bleeding, and high technical success rates have been reported.
- Microcoil embolization is typically preferred within the lower gastrointestinal tract, whereas controversy exists regarding the optimal agent within the upper gastrointestinal tract. Common embolic agents include microcoils, polyvinyl alcohol particles, gelfoam, n-butyl cyanoacrylate glue, and enbucrylate tissue adhesive.
- Direct intraarterial infusion of platelets and vasopressin has also been used successfully in the transcatheter treatment of gastrointestinal hemorrhage.

Indications and advantages

- Angiography seems to be useful in patients with early positive nuclear scans, in postoperative patients, and in patients with severe bleeding not diagnosed or unable to be treated by endoscopy. It may also be helpful in detecting otherwise undiagnosed vascular lesions.
- It is generally reserved for specific situations in which other modalities have failed.
- Allows accurate anatomic localization of the bleeding site and therapeutic interventions upon detection
- Not generally indicated in silent OGIB

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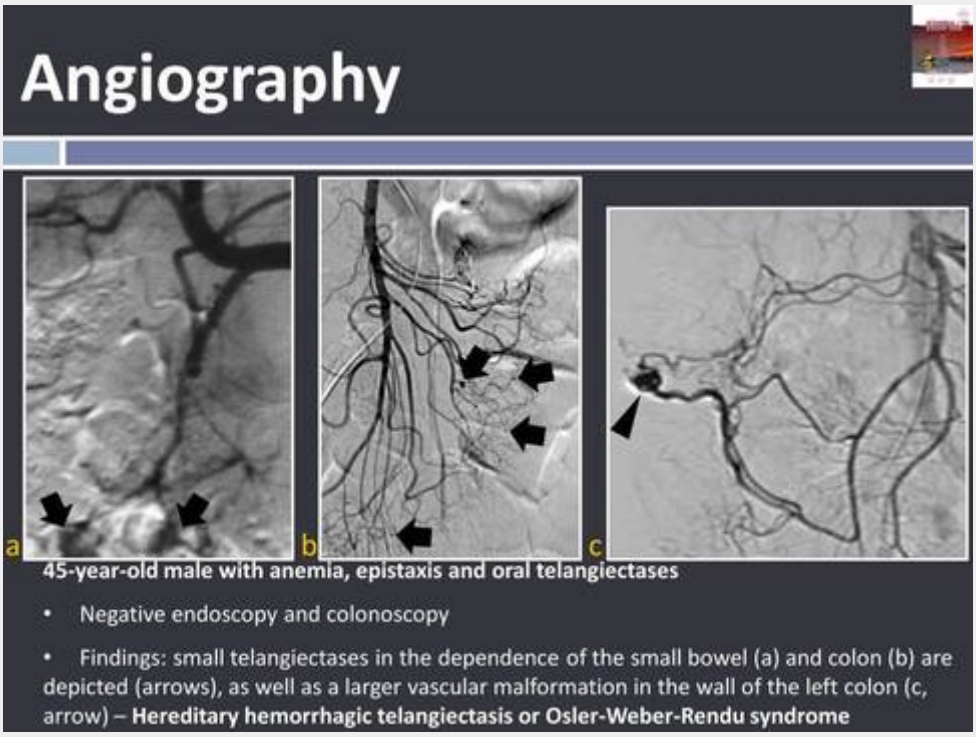

Disadvantages

- Invasive
- Associated risks related to vascular access and other catheter-related complications (the most feared by far has been bowel ischemia)
- Contrast material reactions
- Does not allow prolonged imaging times

Wireless capsule endoscopy

Introduction

- A major advance in the investigation of the small bowel has been wireless video capsule endoscopy.

Technique

- The capsule is 11 by 26 mm in size and contains four light-emitting diodes, a lens, a camera, two batteries, and a radiofrequency transmitter.
- Patients typically undergo a preprocedure preparation (ranging from simple fasting to cathartic cleansing) to clear the gastrointestinal tract.
- After the patient swallows the capsule, the capsule is capable of obtaining two images per second and transmitting the data to a recording device worn by the patient. The data subsequently are downloaded to a computer loaded with software that allows the images to be analyzed. The capsule is disposable and, because of its small size, passes through the gastrointestinal tract naturally.

Identification of the bleeding cause

- Capsule endoscopy has been utilized in patients with iron deficiency anemia and has been demonstrated to identify the full gamut of important small bowel lesions.
- The most common findings include vascular lesions, small bowel malignancies, and small bowel ulcerations. Several studies have further supported the role of capsule endoscopy in the evaluation of obscure GI bleeding, with an overall diagnostic yield of approximately 55% and 70%

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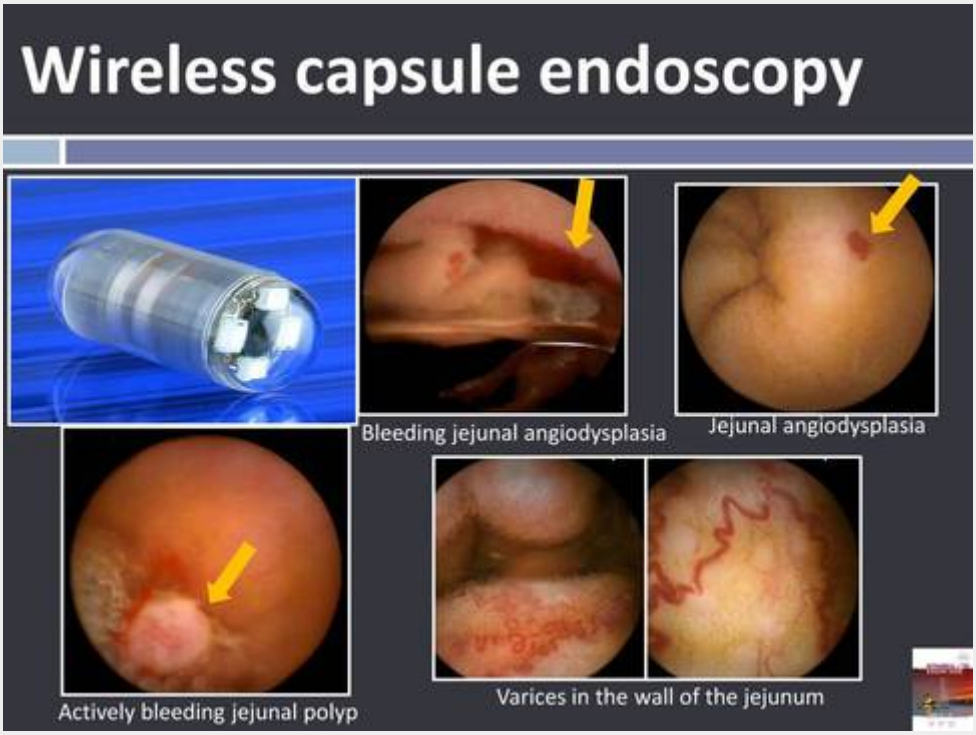

Indications and advantages

- Capsule endoscopy seems to be most useful for patients with a history of recent active bleeding.
- Capsule endoscopy seems to be safe in patients with obscure bleeding.
- Absolute contraindications for its use include GI obstruction and GI pseudo-obstruction–ileus. Relative contraindications include a history of a GI motility disorder, such as gastroparesis; a history of intestinal strictures or fistula; pregnancy; a known history of multiple small bowel diverticula; a history of Zenker's diverticulum; a history of extensive abdominal surgeries or radiation; an active swallowing disorder or dysphagia; and the presence of a cardiac defibrillator.

Disadvantages

- Lack of therapeutic capability
- Massive hemorrhage can obscure the bleeding site
- It is not completely clear that the findings from capsule endoscopy and subsequent capsule-directed management actually improve patient outcome and up to 50% of patients suffering from vascular lesions may continue to bleed, even after endoscopic and surgical intervention.

Double balloon enteroscopy

Introduction

- Yamamoto et al (2001) established a new double-balloon insertion method for enteroscopy, which enables endoscopic inspection of the entire small bowel with interventional capabilities.

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Technique

- The double-balloon enteroscopy system consists of a high-resolution video endoscope with a working length of 200 cm and an external diameter of 8.5 mm, within a flexible overtube with a length of 145 cm and an outer diameter of 12.2 mm. The enteroscope's working channel has a diameter of 2.2 mm.
- Latex balloons are attached at the tip of the enteroscope, and the overtube is inflated and deflated with air from a pressure-controlled pump system that monitored balloon air pressure.
- Endoscope insertion to the distal small intestine is carried out from either an oral or an anal approach.
- As preparation for this procedure, the patient must fast overnight for the oral approach; for the anal approach, preparation was the same as for colonoscopy.
- Because the majority of the lesions responsible for obscure GI bleeding are located in the proximal small bowel and the retrograde approach is more technically challenging due to the floppy nature of the enteroscope, it is preferable to start the procedure with the oral route unless other imaging modalities suggest a lesion in the ileum.
- The overtube is slid over the endoscope from the tip with both balloons deflated, before endoscope insertion. When both balloons reached the duodenum from the oral approach or the cecum from the anal approach, the balloon attached to the overtube is inflated to maintain the tube in place within the intestine.
- The endoscope is inserted further with the overtube immobilized. When the tip of the endoscope is inserted as far as possible, the overtube balloon is deflated, and the overtube is advanced toward the endoscope tip. When the distal end of the overtube reaches the endoscope tip, the overtube balloon is reinflated to maintain the device in place. At this point, gentle withdrawal of the overtube with its balloon inflated causes pleating of the intestine on the overtube, which prevents looping of the endoscope. This sequence is repeated until the entire small bowel was examined.
- For all lesions observed by double-balloon enteroscopy, biopsy specimens are obtained and the lesion is treated as necessary.

Identification of the bleeding cause

- Obscure bleeding is the indica-tion for DBE in approximately 36%-100% of examina-tions, and the overall diagnostic yield from DBE ranges from 43% to 80%. Diagnostic or therapeutic success is reached in 55%-75% of examinations, which is compara-ble to other diagnostic modalities for the small bowel.
- This method is likely to be one of the better at detecting mucosal lesions
- The most common findings include small bowel vascular lesions followed by ulcerations and malignancies.
- Endoscopic interventions can be performed if the bleeding lesion is adequately visualized. Endoscopic therapeutic treatments may be (a) by injection (epinephrine, alcohol), or (b) thermal (heater probe, electrocoagulation, laser).

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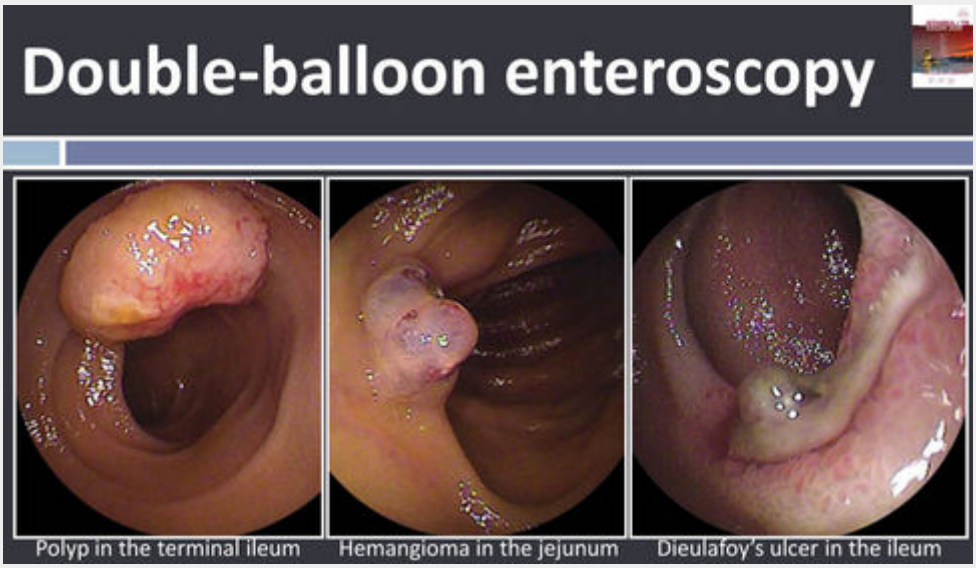

Indications and advantages

- The role of double balloon enteroscopy alone or in conjunction with capsule endoscopy requires further study.
- Probable indications for small bowel enteroscopy include unexplained bleeding from the GI tract, radiographic abnormalities of the small intestine, and chronic diarrhea or malabsorption
- Safe procedure
- Double-balloon enteroscopy possesses the capability of performing biopsy or endoscopic injection therapy.

Disadvantages

- Does not allow visualization of the entire small bowel in one examination
- Not widely available
- Massive hemorrhage can obscure the bleeding site
- Although treatment of lesions found on enteroscopy, especially vascular lesions, may decrease hospitalizations and transfusion requirements, up to 31% of all patients who undergo push enteroscopy for evaluation and treatment of obscure GI bleeding continue to rebleed over time

4. Conclusion

Obscure GI bleeding is a relatively common problem facing internists, gastroenterologists, and surgeons in a typical clinical practice.

The etiology is occasionally suggested by the patient's age, history, and medications.

Management is complicated and typically requires a team-oriented approach, with input from the internist, gastroenterologist, radiologist, and surgeon alike.

There are multiple imaging modalities and therapeutic interventions that are currently being used in the evaluation and treatment of obscure gastrointestinal hemorrhage, each with its own strengths and weaknesses.

Small bowell series and conventional enteroclysis seem to have a limited role, unless there is a high suspicion of a small bowel mass lesion or Crohn's disease.

Scintigraphy may be performed in patients with active bleeding in whom endoscopy has failed or is contraindicated.

Angiography may be used in patients with an early positive nuclear imaging or failed endoscopic therapy.

Initial experience indicates that multidetector computed tomographic angiography is a promising first-line modality for the time-efficient, sensitive, and accurate diagnosis or exclusion of active gastrointestinal hemorrhage and may have a profound impact on the evaluation and subsequent treatment of patients who present with acute gastrointestinal bleeding.

In patients with silent OGIB the role of MDCT as an primary tool may be less proeminent.

All patients with obscure GI bleeding should undergo repeat upper endoscopy and perhaps colonoscopy to rule out missed lesions.

Capsule endoscopy has emerged as an important tool to investigate obscure GI bleeding, but it may soon have competition from double-baloon enteroscopy, a diagnostic technique that can also be therapeutic.

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6. Author Information

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7. Mediafiles

autores.jpg

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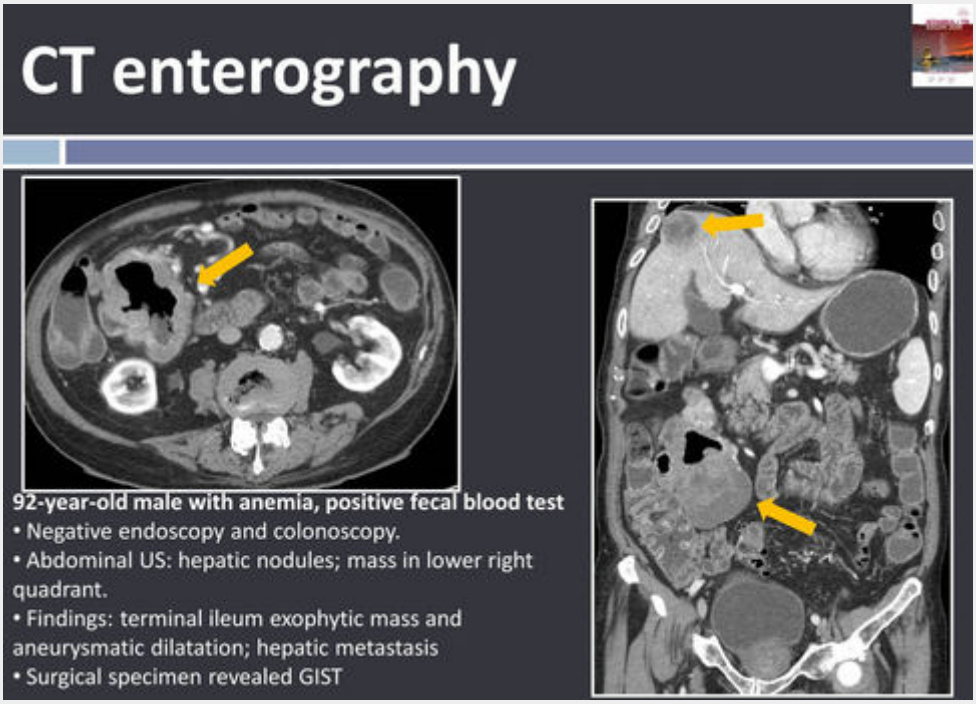

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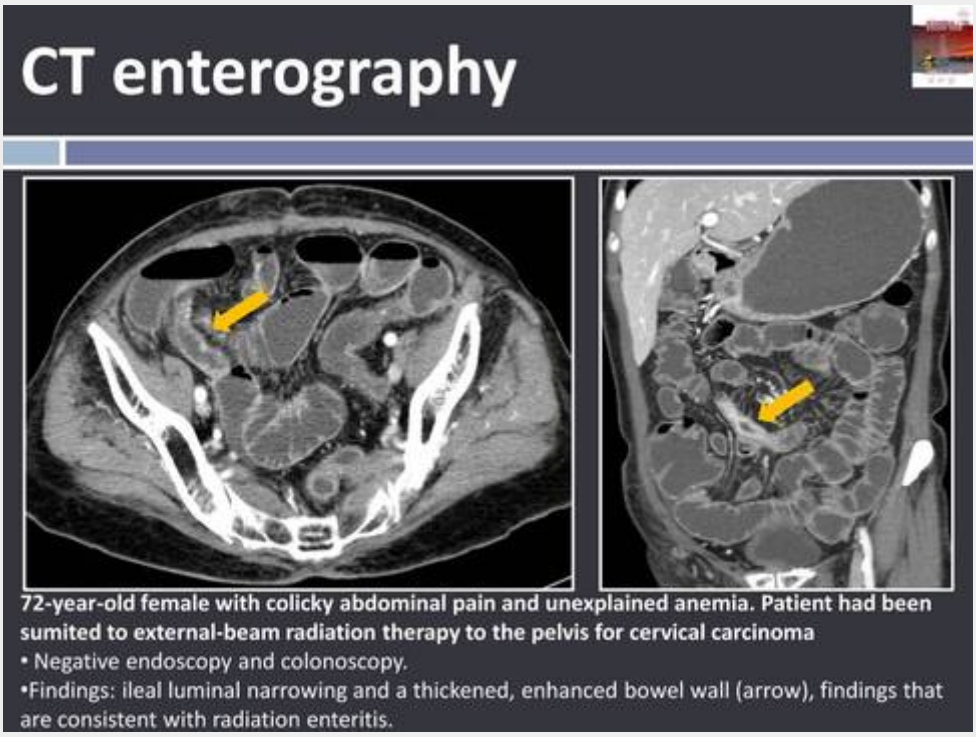

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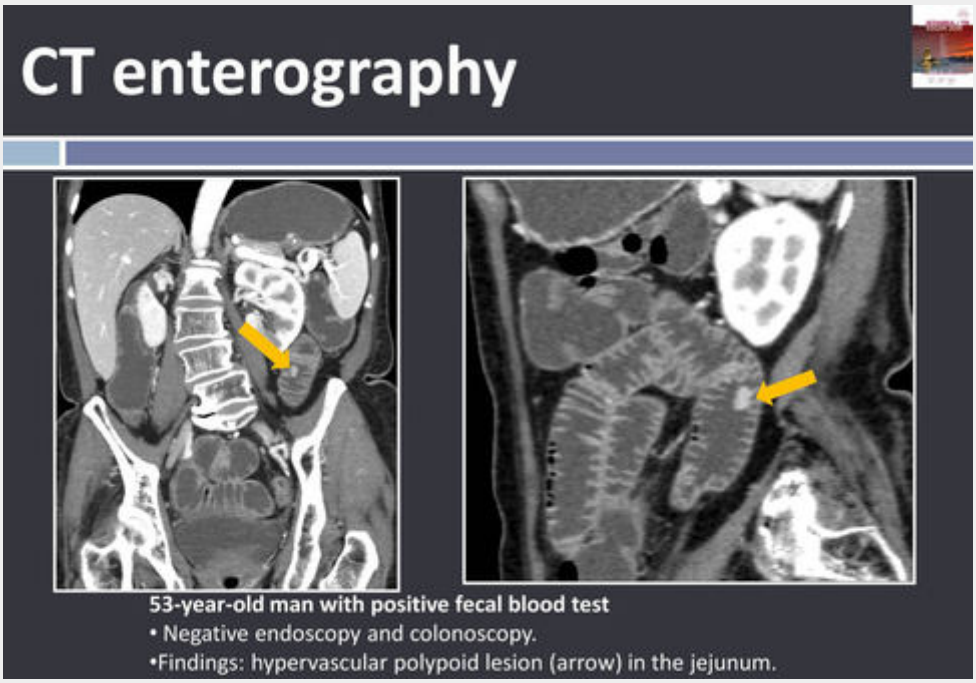

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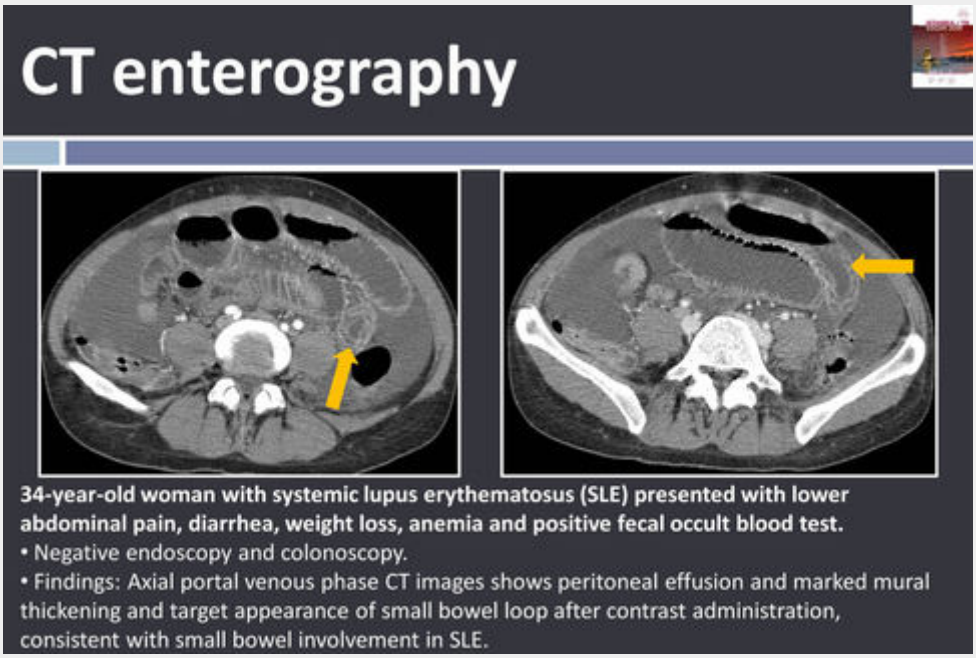

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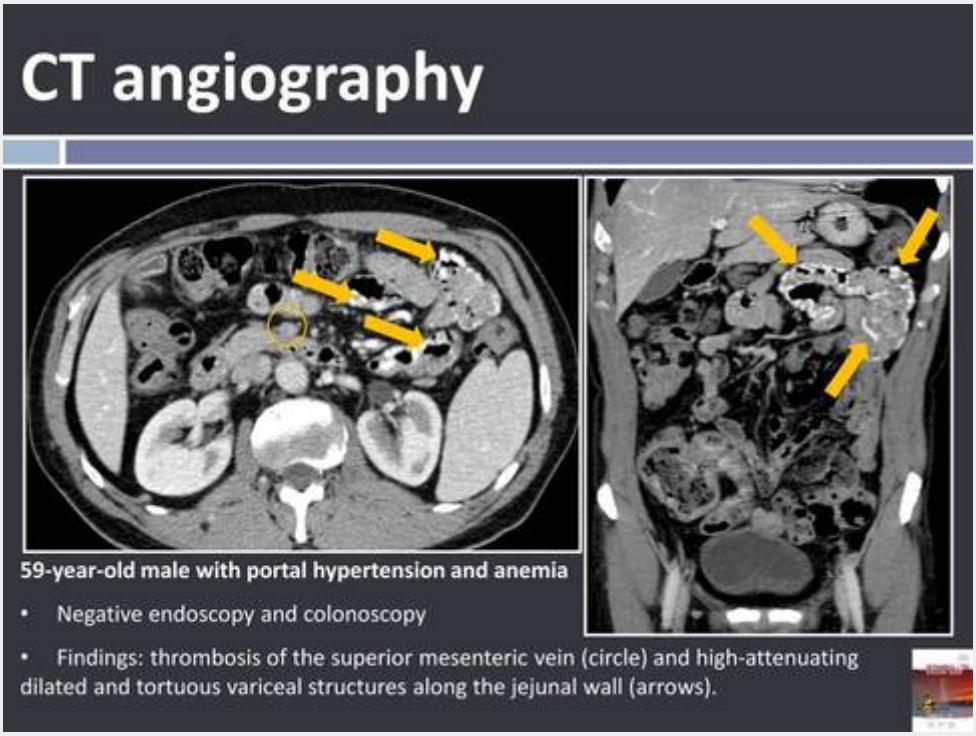

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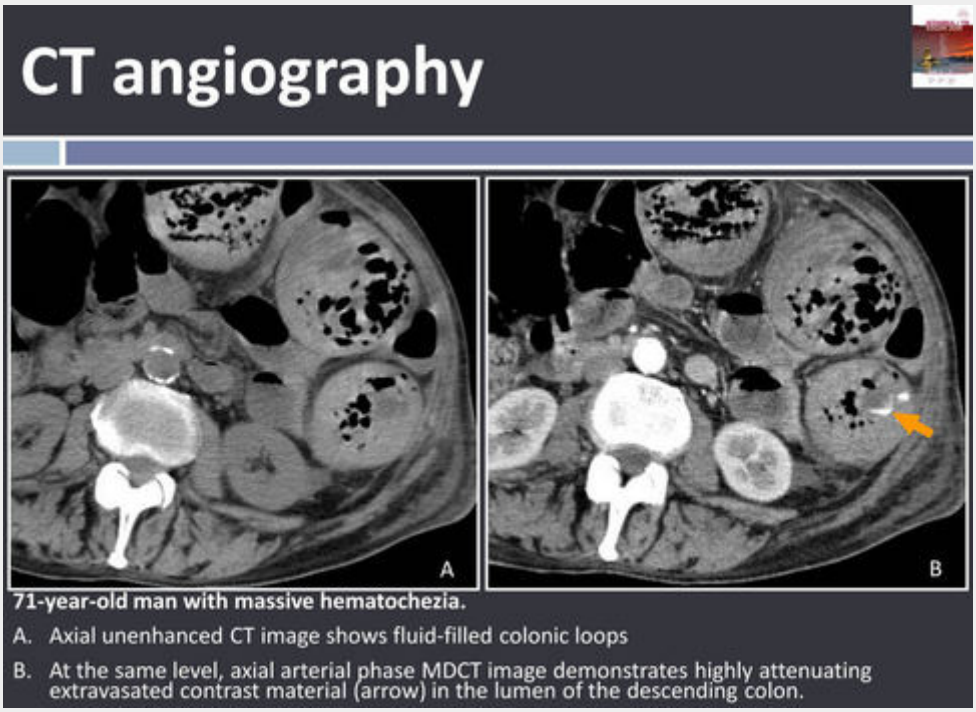

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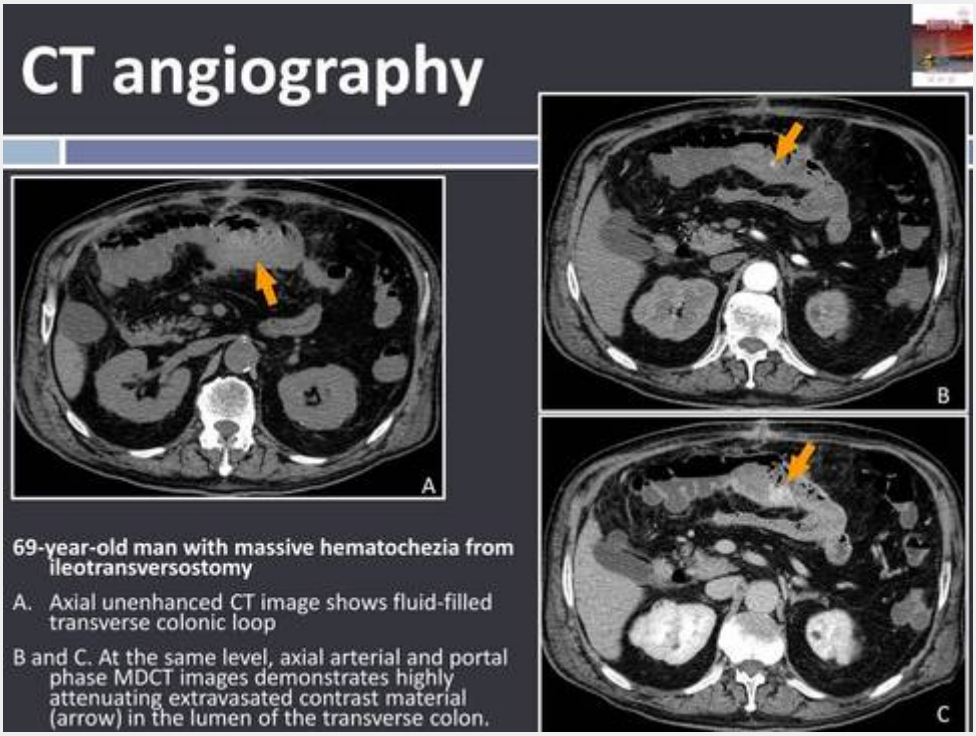

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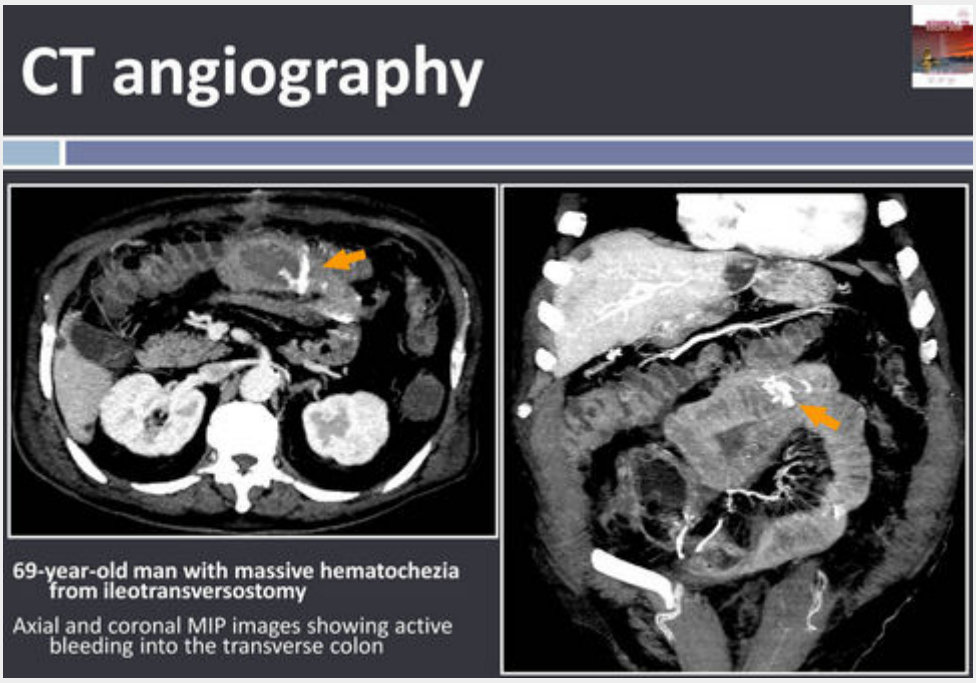

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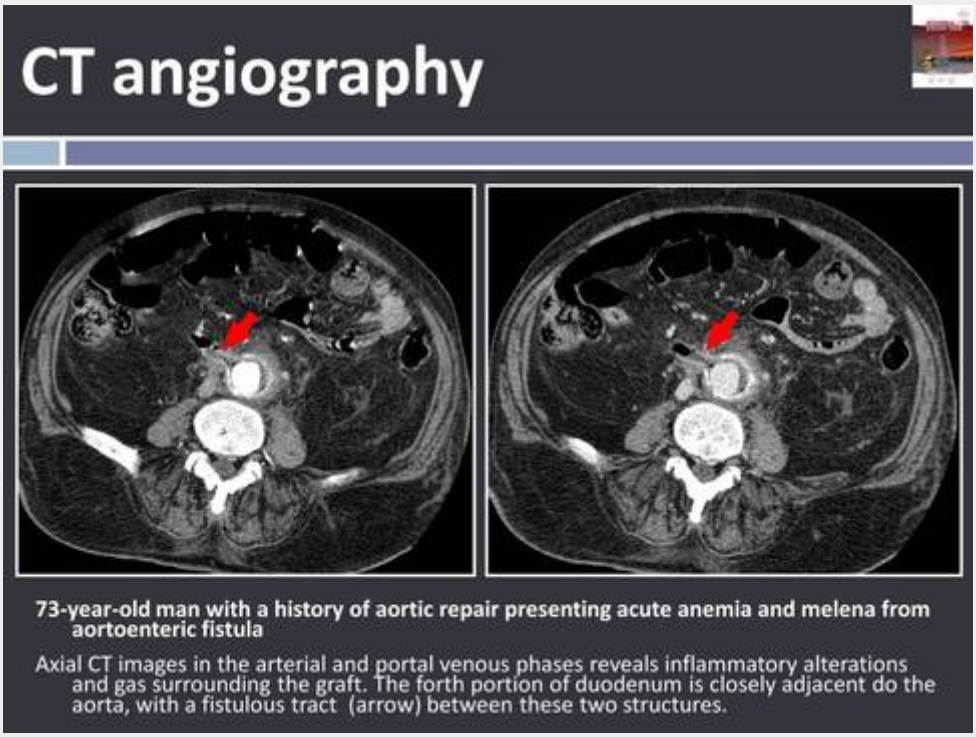

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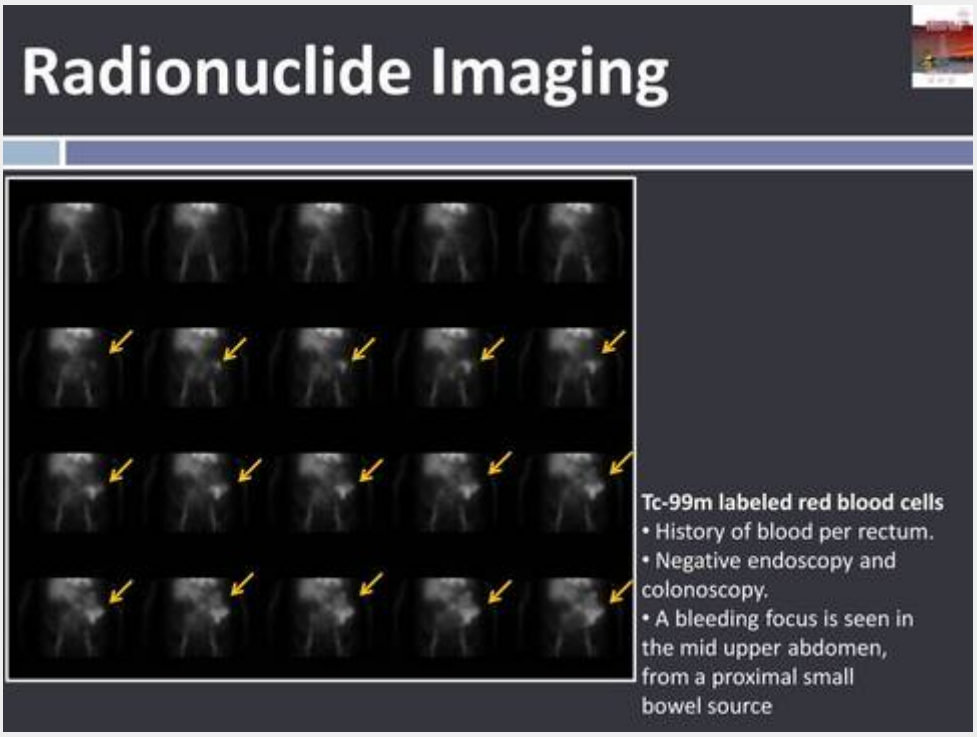

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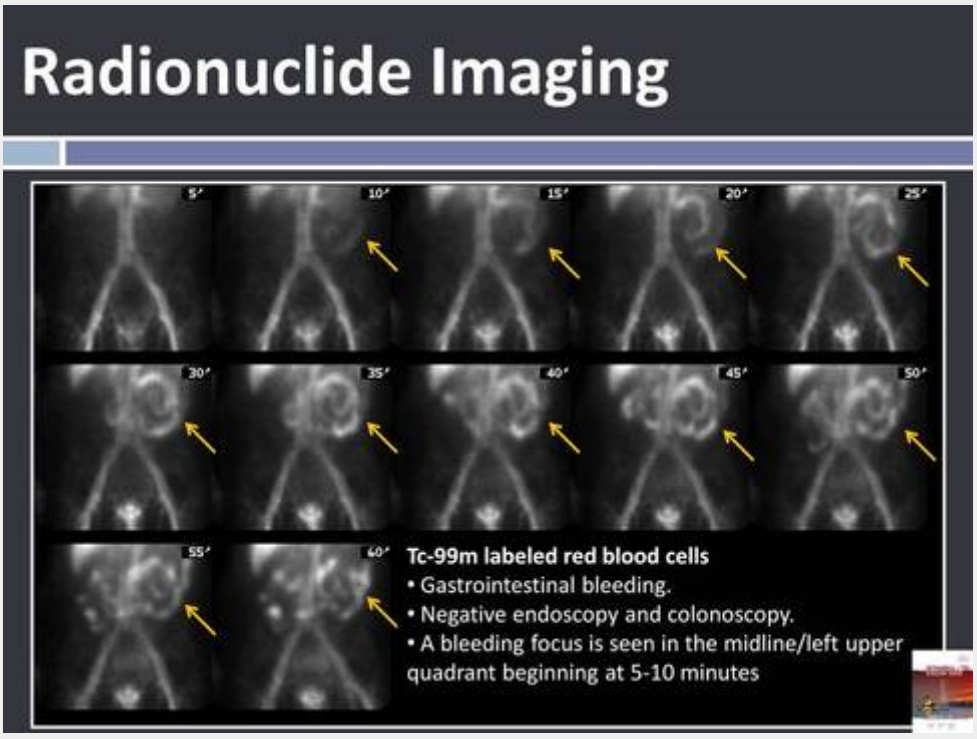

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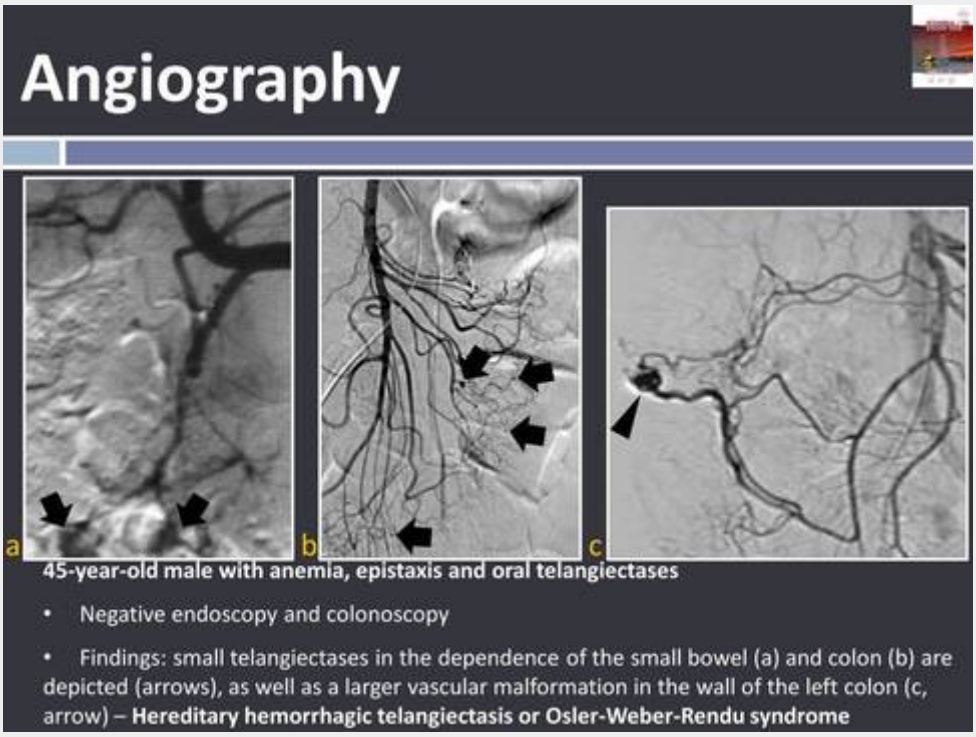

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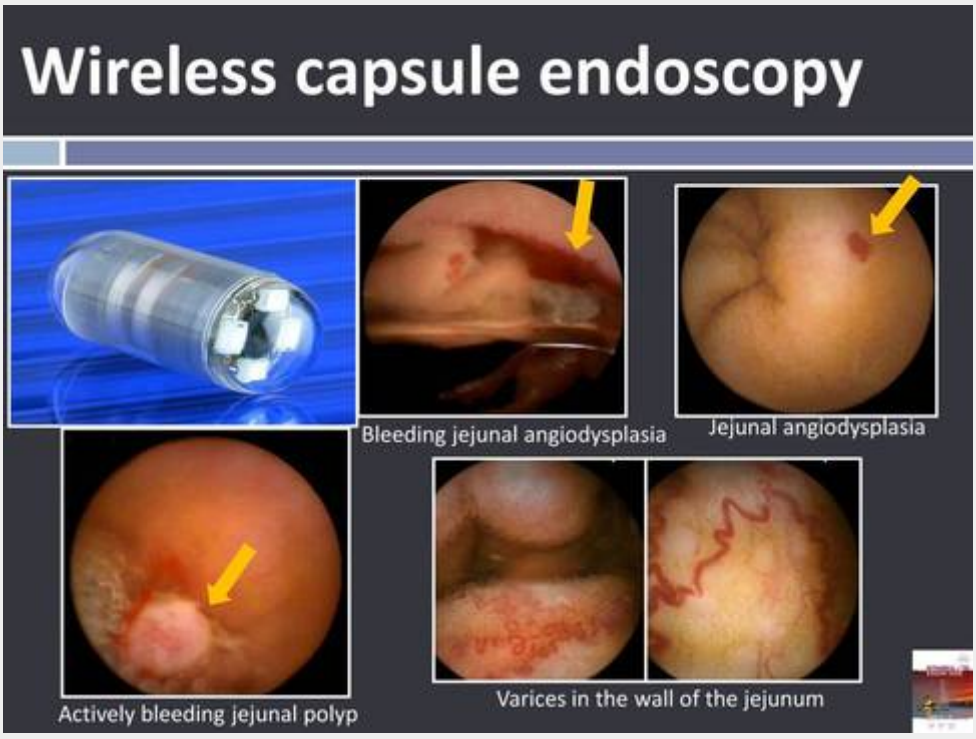

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