Diagnostic Imaging Pathways - Gastrointestinal Bleeding (Obscure)

Population Covered By The Guidance

This pathway provides guidance on the imaging of adult patients with obscure (overt and occult) gastrointestinal bleeding, including the roles of radiological and non-radiological examinations.

Date reviewed: January 2012

Date of next review: 2017/2018

Published: January 2012

Quick User Guide

Move the mouse cursor over the PINK text boxes inside the flow chart to bring up a pop up box with salient points.
Clicking on the PINK text box will bring up the full text.
The relative radiation level (RRL) of each imaging investigation is displayed in the pop up box.

SYMBOL	RRL	EFFECTIVE DOSE RANGE
	None	0
	Minimal	< 1 millisieverts
	Low	1-5 mSv
	Medium	5-10 mSv
	High	>10 mSv

Pathway Diagram

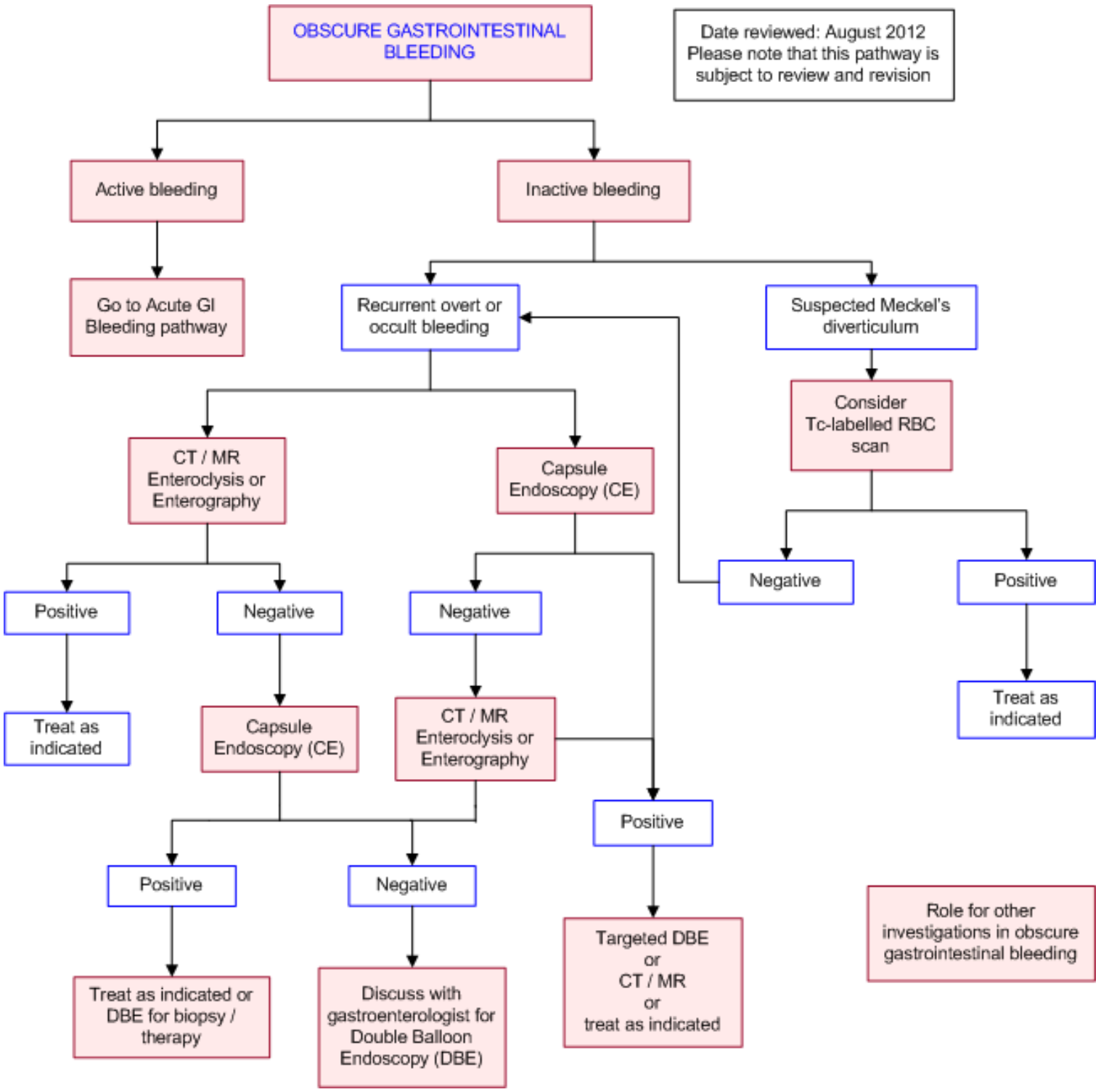


Image Gallery

Note: These images open in a new page

1a **Gastrointestinal Bleeding**

Image 1a (Computed Tomography Angiography): Extravasated contrast in the lumen of the sigmoid colon.

1b

Image 1b (Computed Tomography Angiography): Coronal views of the same patient. Extravasated contrast is seen in the lumen of the sigmoid colon.

1c

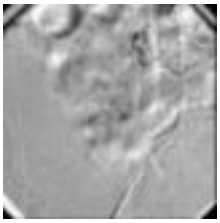
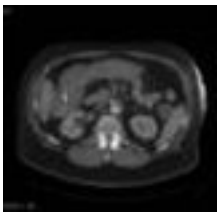


Image 1c (Mesenteric Angiogram): Selective inferior mesenteric catheterisation demonstrates a 'blush' of extravasated contrast indicating the site of bleeding.

1d

Image 1d (Mesenteric Embolisation): Bleeding has ceased with coils deployed in the bleeding artery.

2a



Gastrointestinal Bleeding

Image 2a (Computed Tomography Angiography): Active extravasation of IV contrast into the lumen of the transverse colon in the region of hepatic flexure (arrow).

2b

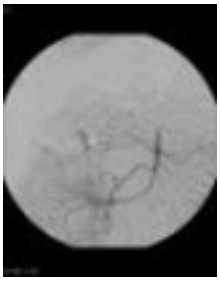


Image 2b (Digital Subtraction Angiography): Selective superior mesenteric artery angiography of the same patient showing contrast extravasation from a right colic artery branch (arrow).

2c

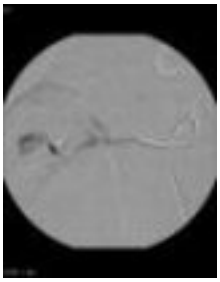


Image 2c (Digital Subtraction Angiography): Super-selective angiogram of same vessel.

2d

Image 2d (Mesenteric Embolisation): Post-embolisation image demonstrates shows no further extravasation after coiling (arrow).

3a

Gastrointestinal Bleeding

Image 3a (Radionuclide RBC Scan): Extravasation of tracer in ascending colon (arrow, AC) with extension over time in the transverse colon (arrow, TC).

3b

Image 3b (Angiography): Angiography of same patient demonstrating extravasation of contrast medium from a branch of the superior mesenteric artery in the ascending colon.

Teaching Points

- Obscure Gastrointestinal Bleeding (OGIB) is defined as bleeding of unknown origin, that persists or recurs after initial negative upper and lower endoscopy and conventional barium small bowel studies. 1 It can have two clinical forms
    - Obscure occult – this is manifested as iron deficiency anaemia or recurrent positive Faecal Occult Blood Test (FOBT) results
    - Obscure overt – this is manifested as recurrent episodes of clinically evident bleeding (e.g. melaena or haematochezia)
- The cause of GI bleeding in a large proportion of patients with an initially normal endoscopy (upper and lower) usually resolves spontaneously 2
- Patients with persistent iron deficiency anemia / FOBT positivity or overt blood loss require further investigation 1
- The majority of OGIB arises from the small bowel. The most common small bowel lesions that cause OGIB are angiodysplasia and tumors 3
- To determine the most appropriate sequence of investigations, it is important to determine whether bleeding is active or inactive at the time of presentation. The following discussion mainly corresponds to inactive bleeding at the time of presentation

Role of Other Investigations

Computed Tomography Angiography (CTA)

- With the development of MDCT, a non-invasive method of establishing a cause for OGIB has been developed. However, trials comparing capsule endoscopy and MDCT have clearly demonstrated the higher diagnostic yield with CE. 23 In a recent prospective cohort study CTA identified a source of OGIB in 24% of patients compared to 68% when CE was utilised in the same cohort but it was unclear whether the bleeding was inactive or active in these patients 24
- CTA is only likely to be useful in patients with active bleeding
- Hence at this stage, MDCT should be considered after CE and DBE in the assessment of OGIB

Mesenteric Angiography

- The role of mesenteric angiography in the assessment of OGIB is hampered by a paucity of studies in this sub-group of gastrointestinal bleeders 1
- Diagnostic yields of 40-44% 25,26 have been quoted in the literature, although yields as high as 74% have been reported. 27 The diagnosis can be made based on extravasation of contrast into the bowel lumen or typical angiographic appearances of vascular lesions. The rate of active bleeding has to be at least >0.5mL/min, for contrast to be seen in the bowel lumen 1
- Provocative angiography (the use of anti-coagulants) has also been trialed in OGIB with mixed success. Although a higher yield of diagnosis was found, this came at the expense of more adverse effects (groin hematoma) 1
- Significant morbidity is associated with angiography, including renal failure, arterial dissection, ischemic colitis and death
- Given the high sensitivity and safety of other techniques (capsule endoscopy and double balloon enteroscopy), angiography should be reserved for truly occult OGIB.

Small Bowel Follow-Through / Enteroclysis

- Oral ingestion of a barium suspension is required for a Small Bowel Follow-Through (SBFT) series. In a large retrospective series of greater than 1000 patients for a range of indications, SBFT had a diagnostic yield of 5.6% (12/215 patients) for the detection of OGIB. 28 A more recent retrospective series found comparable results (3% of barium studies for OGIB) 23
- Enteroclysis requires the placement of a tube in the proximal small bowel. A contrast solution is then instilled through the tube and sequential fluoroscopy is undertaken to identify an abnormality. This technique has been shown to have a diagnostic yield in OGIB of 21%. 29 However this is at this expense of patient discomfort
- Small bowel barium studies have low diagnostic yield in suspected OGIB and have been replaced by cross-sectional imaging (CT / MRI) where needed

Intra-Operative Enteroscopy / Exploratory Laparotomy

- Intra-operative Enteroscopy (IOE) at laparotomy involves the passage of an endoscope per oral, transnasally, per rectum or via enterotomies at the time of exploratory laparotomy
- It requires considerable resources including an endoscopist and surgeon and rarely done these days
- IOE has been shown to have excellent diagnostic yields in the assessment of OGIB 1
- It is however associated with significant morbidity and mortality 1

Active Versus Inactive Bleeding

- Choice of investigation following initial endoscopies for OGIB mainly depends on bleeding being

active or inactive at the time of presentation and on the patient demographics

- For inactive bleeding, assuming all investigative modalities are available, a reasonable strategy in older patients (>50 years) is to perform CE initially to detect lesions followed by targeted DBE for biopsy or intervention. 31,32 A negative CE however, should be followed by CT enterography or enteroclysis
- For inactive bleeding in younger patients, it is reasonable to perform CT enteroclysis in view of higher likelihood of finding tumors rather than angiodysplasia in this group
- In patients presenting with active bleeding, radiological investigations are the mainstay given their high sensitivity and non-invasiveness. CT Angiography can detect bleeding rates of 0.5 ml/min and above. If CTA is negative, this usually signifies that catheter angiography is not indicated since the latter is less sensitive than the former and has been shown to detect bleeding rates greater than 0.5 ml/min only
- If bleeding persists following a negative CTA, technetium 99m – labeled RBC nuclear scan is used as the second line of investigation at some institutions while others may use this as the first line of investigation for active bleeding. Among the available modalities, RBC nuclear scan is the most sensitive for active GI bleeding and can detect bleeding rates as low as 0.1 mL/min 11
- Life-threatening hemorrhage should indicate catheter angiography as the first line of management

Capsule Endoscopy (CE)

- Has been shown to have higher diagnostic yield for obscure GI bleeding when prospectively compared with other imaging modalities. Compared to intra-operative enteroscopy at laparotomy (reference gold standard), CE has a sensitivity, specificity, positive predictive value & negative predictive value of 95%, 75%, 95% and 86% respectively 4
- Two meta-analyses examining CE compared to other conventional diagnostic modalities in patients with OGIB have supported the findings of initial small cohort studies 5,6
- Studies that have examined the long-term results following CE for the investigation of OGIB, have proved the clinical utility of this diagnostic modality in altering patient outcome 7
- Despite lack of studies on accuracy and strong RCTs, a weight of evidence and consensus points to CE being most useful in inactive OGIB 8,9 and has similar diagnostic yield as DBE for the evaluation of OGIB 10
- American Society for Gastrointestinal Endoscopy (ASGE) guidelines for management of OGIB named CE as the primary procedure of choice after excluding upper GI and colorectal lesions with endoscopy 11
- Contraindications for its use include a history of GI motility disorder, a history of known strictures or fistulae, a history of extensive abdominal surgery, an active swallowing disorder and the presence of a cardiac pacemaker/implantable cardiac defibrillator (relative contraindication as some groups have safely performed CE in this group)
- Advantages of CE include
    - Non-invasive
    - Accepted and well tolerated by patients
    - Ability to visualise the entire small bowel
- Disadvantages of CE include
    - Technical malfunction of the capsule and Slow GI transit time may result in part of the small bowel being not visualised
    - Difficulty in localising lesions due to lack of anatomical details
    - Inability to perform diagnostic or therapeutic maneuvers, requiring further invasive investigations
    - Strictures may result in capsule retention needing further intervention for their retrieval
    - May not detect mass lesions and extra-mucosal abnormalities

Double Balloon Enteroscopy (DBE)

- Enteroscopy was first introduced in 1973; small bowel 'push enteroscopy' is an important tool for the investigation of small bowel
- Initial endoscopes permitted examination of a variable length of the small bowel (proximal jejunum). The diagnostic yield for the evaluation of a cause of OGIB has been reported to be between 38-75% with push enteroscopy 1
- In 2001, a Japanese group developed a method of examining the entire small bowel. DBE either per oral, per anal or a combination of both (total enteroscopy) has increased the diagnostic yield of OGIB 3
- Most researchers and specialists propose a CE-guided DBE where targeted DBE is performed for biopsy and intervention in patients with a positive CE examination 12
- Can visualize the entire small bowel using retrograde and antegrade intubation but a recent systematic review concluded that complete enteroscopy was possible in only 44% of cases even with combined antegrade and retrograde approaches 13
- In two large case series that examined the utility of DBE in a range of small bowel diseases, the yield of DBE in establishing a cause of occult gastrointestinal bleeding was 73-75% 14,15
- Initial studies comparing capsule endoscopy (CE) to DBE have demonstrated a clear diagnostic benefit for CE. Access to the entire small intestine was 90.2% for CE, significantly higher than DBE (62.5%) 16 but, a recent meta-analysis comparing CE and DBE suggested similar diagnostic yields for evaluation of OGIB 10
- Retrograde DBE can be of use if Meckel's diverticula are considered as the cause for OGIB 17
- Advantages of enteroscopy include
    - Ability for diagnostic and therapeutic intervention
    - Improved visualization of the small bowel as a result of insufflation of air
    - Focused examination of any abnormality visualized
- Disadvantages/adverse effects of enteroscopy include
    - Technically demanding and time-consuming
    - Limited availability
    - Visceral perforation
    - Mucosal bleeding as a result of contact by the enteroscope
    - Pancreatitis
    - Abdominal pain a result of the insufflation of air into the bowel
- Given the non-invasive nature of CE, there is a strong move towards using this modality as a first line investigation prior to enteroscopy 4,16

Computed Tomography (CT) Enteroclysis / Enterography

- CT enterography and enteroclysis are CT techniques used to provide better images of the small bowel lumen and wall
- CT enterography involves rapid oral ingestion of 2L of contrast media before CT scanning
- The contrast used is usually neutral (water density) or diluted positive contrast. Neutral intra-luminal contrast is essential for obscure GI bleeding. CT may be performed in several phases (e.g. non-contrast, post-contrast arterial, portal venous phase or delayed phase), or combined with CT angiography when investigating active bleeding. Limitations include inability of some patients to consume a large amount of fluid in a short period of time, achieving appropriate timing of the scan to obtain good bowel distension and radiation dose
- CT enteroclysis involves passing a naso-jejunal catheter under fluoroscopic guidance. Neutral or

dilute positive contrast is instilled through the tube allowing rapid filling and distension of the intestine. Images are obtained as for CT enterography. Limitations of this technique include more invasive nature (compared to enterography), achieving correct timing of scan (less problematic than enterography) and radiation dose. Enteroclysis has been shown to provide superior bowel distension than enterography 18, however it is uncertain whether this translates into better diagnostic outcomes. There are few comparisons in the literature. Two studies found similar accuracy between the two techniques 18,19

- CT techniques are unable to detect angiodysplastic lesions in the bowel, which are usually small and flat and are better visualized with endoscopic techniques like CE or DBE. However, cross-sectional imaging can detect non-mucosal lesions such as tumours. One study found multiphase CT enterography to have a higher diagnostic yield than capsule endoscopy, but there was a high prevalence of tumours in the study population 20
- CT is more likely to be of importance for patients below 50 years as the most common cause for OGIB in this group is tumours 21
- A recent study comparing CE and uniphasic multidetector CT suggest that the techniques are complimentary, since CE may miss extra-mucosal lesions best seen on a CT 22

Nuclear Scintigraphy

- Nuclear scintigraphy techniques have been validated in acute GI bleeding, where there is active blood loss into the bowel lumen. However there is a lack of studies utilising this investigation for OGIB 1
- The diagnostic yield of technetium 99m labeled red cells in a series was reported as 33% 30
- Meckel's diverticula may also present with bleeding and/or pain. No studies have been performed comparing various modalities in their detection, but since the occurrence of bleeding suggests the presence of ectopic gastric mucosa, scintigraphy with technetium labeled sodium pertechnetate is a useful procedure 17
- There are several limitations of nuclear scintigraphy in OGIB
    - Nuclear scanning localises active bleeding to a region of the abdomen, not a particular site
    - The rate of active bleeding has to be at least 0.1-0.4mL/min for a positive result
    - Scanning is not therapeutic, thus requiring further invasive procedures

References

References are graded from Level I to V according to the Oxford Centre for Evidence-Based Medicine, Levels of Evidence. Download the document

1. Zuckerman G, Prakash C, Askin M et al. **AGA technical review on the evaluation and management of occult and obscure gastrointestinal bleeding.** Gastroenterolgy. 2000;118:201-21. (Clinical practice guideline). View the reference
2. Rockey D, Cello J. **Evaluation of the gastrointestinal tract in patients with iron-deficiency anaemia.** N Engl J Med. 1993;329:1691-5. (Level III evidence)
3. Lin S, Rockey D. **Obscure gastrointestinal bleeding.** Gastroenterol Clin North Am. 2005;34:679-98. (Review article)
4. Hartmann D, Schmidt H, Bolz G **A prospective two-centre study comparing wireless capsule endoscopy with intraoperative enteroscopy in patients with obscure GI bleeding.** Gastrointest Endosc. 2005;61:826-32. (Level II evidence)

5. Triester S, Leighton J, Leontiadis G, et al. **A meta-analysis of the yield of capsule endoscopy compared to other diagnostic modalities in patients with obscure gastrointestinal bleeding.** Am J Gastroenterol. 2005;100:2407-18. (Level I evidence). View the reference
6. Marmo R, Rotondano G, Piscopo R et al. **Meta-analysis: capsule endoscopy vs conventional modalities in diagnosis of small bowel diseases.** Aliment Pharmacol Ther. 2005;22:595-604. (Level I evidence)
7. Saurin J, Delvaux M, Vahedj K, et al. **Clinical impact of capsule endoscopy compared to push enteroscopy: 1-year follow-up study.** Endoscopy. 2005;37:318-23. (Level II evidence). View the reference
8. Filippone A, Cianci R, Milano A, Valeriano S, Di Mizio V, Storto ML. **Obscure gastrointestinal bleeding and small bowel pathology: comparison between wireless capsule endoscopy and multidetector-row CT enteroclysis.** Abdom Imaging. 2008;33:398–406. (Level III evidence)
9. Pennazio M, Eisen G, Goldfarb N. **ICCE consensus for obscure gastrointestinal bleeding.** Endoscopy. 2005;37:1046–50. (Consensus statement)
10. Teshima CW, Kuipers EJ, van Zanten SV, Mensink PB. **Double balloon enteroscopy and capsule endoscopy for obscure gastrointestinal bleeding: an updated meta-analysis.** J Gastroenterol Hepatol. 2011;26:796–801. (Level I evidence)
11. Fisher L, Lee Krinsky M, Anderson MA, et al. **The role of endoscopy in the management of obscure GI bleeding (ASGE standards of practice).** Gastrointest Endosc. 2010;72:471–9. (Practice standard)
12. Keum B, Chun HJ. **Capsule endoscopy and double balloon enteroscopy for obscure gastrointestinal bleeding: which is better?** J Gastroenterol Hepatol. 2011;26:794–5. (Editorial comment)
13. Xin L, Liao Z, Jiang YP, Li ZS. **Indications, detectability, positive findings, total enteroscopy, and complications of diagnostic double-balloon endoscopy: a systematic review of data over the first decade of use.** Gastrointest Endosc. 2011;74:563–70. (Level II evidence)
14. Sun B, Rajan E, Cheng S et al. **Diagnostic yield and therapeutic impact of double-balloon enteroscopy in a large cohort of patients with obscure gastrointestinal bleeding.** Am J Gastroenterol. 2006;101:2011-5. (Level IV evidence)
15. Heine G, Hadithi M, Groenen M, et al. **Double-balloon enteroscopy: indications, diagnostic yield and complications in a series of 275 patients with suspected small-bowel disease.** Endoscopy. 2006;38:42-8. (Level IV evidence)
16. Nakamura M, Niwa Y, Ohmiya N et al. **Preliminary comparison of capsule endoscopy and double-balloon enteroscopy in patients with suspected small-bowel bleeding.** Endoscopy. 2006;38(1):59-66. (Level II evidence). View the reference
17. Van Weyenberg SJ, Van Waesberghe JH, Ell C, Pohl J. **Enteroscopy and its relationship toradiological small bowel imaging.** Gastrointest Endosc Clin North Am. 2009;19:389–407. (Review article)
18. Minordi LM, Vecchioli A, Mirk P, Bonomo L. **CT enterography with polyethylene glycolsolution vs CT enteroclysis in small bowel disease.** Br J Radiol. 2011;84:112–9. (Level III evidence)
19. Wold PB, Fletcher JG, Johnson CD, Sandborn WJ. **Assessment of small bowel Crohn's disease: noninvasive peroral CT enterography compared with other imaging methods and endoscopy–feasibility study.** Radiology. 2003;229:75–81.
20. Huprich JE, Fletcher JG, Fidler JL et al. **Prospective blinded comparison of wireless capsule endoscopy and multiphase CT enterography in obscure gastrointestinal bleeding.** Radiology. 2011;260:744-51. (Review article)
21. Filippone A, Cianci R, Milano A, Pace E, Neri M, Cotroneo AR. **Obscure and occult gastrointestinal bleeding: comparison of different imaging modalities.** Abdom Imaging. 2011;37:41-52. (Review article)
22. Khalife S, Soyer P, Alatawi A, et al. **Obscure gastrointestinal bleeding: preliminary comparison of 64-section CT enteroclysis with video capsule endoscopy.** Eur Radiol.

2011;21:79–86. (Level III evidence)
23. Hara A, Leighton J, Sharma V, et al. **Small bowel: preliminary comparison of capsule endoscopy with barium study and CT.** Radiology. 2004;230:260-5. (Level IV evidence)
24. Saperas E, Dot J, Videla S et al. **Capsule endoscopy versus computed tomographic or standard angiography for the diagnosis of obscure gastrointestinal bleeding.** Am J Gastroenterol. 2007;102:731-7. (Level III evidence)
25. Rollins S, Picus D, Hicks M et al. **Angiography is useful in detecting the source of chronic gastrointestinal bleeding of obscure origin.** AJR Am J Roentgenol. 1991;156:385-388. (Level II evidence). View the reference
26. Fiorito J, Brandt L, Kozicky O et al. **The diagnostic yield of superior mesenteric angiography: correlation with the pattern of gastrointestinal bleeding.** Am J Gastroenterol. 1989;84:878-81. (Level IV evidence)
27. Allison D, Hemingway A, Cunningham D. **Angiography in gastrointestinal bleeding.** Lancet. 1982;3:30-3. (Level II evidence). View the reference
28. Rabe F, Becker G, Besozzi M et al . **Efficacy study of the small-bowel examination.** Radiology. 1981;140:47-50. (Level IV evidence)
29. Malik A, Lukaszewski K, Caroline D et al. **A retrospective review of enteroclysis in patients with obscure gastrointestinal bleeding and chronic abdominal pain of undetermined etiology.** Dig Dis Sci. 2005;50(4):649-55. (Level IV evidence)
30. Ohri S, Desa L, Lee H et al. **Value of scintigraphic localization of obscure gastrointestinal bleeding.** J R Coll Surg Edinb. 1992;37:328-31. (Level II evidence). View the reference
31. Dionisio PM, Gurudu SR, Leighton JA, et al. **Capsule endoscopy has a significantly higher diagnostic yield in patients with suspected and established small-bowel Crohn's disease: a meta-analysis.** Am J Gastroenterol. 2010;105:1240–8. (Level I evidence)
32. Leighton JA, Triester SL, Sharma VK. **Capsule endoscopy: a meta-analysis for use with obscure gastrointestinal bleeding and Crohn's disease.** Gastrointest Endosc Clin N Am. 2006;16:229–50. (Level I evidence)
33. Chak A, Koehler M, Sundaram S. **Diagnostic and therapeutic impact of push enteroscopy: analysis of factors associated with positive findings.** Gastrointest Endosc. 1998;47(1):18-22. (Level IV evidence)
34. Zaman A, Katon R **Push enteroscopy for obscure gastrointestinal bleeding yields a high incidence of proximal lesions within reach of a standard endoscope.** Gastrointest Endosc. 1998;47(5):372-6. (Level II evidence)
35. Mylonaki M, Fritscher-Ravens A, Swain P. **Wireless capsule endoscopy: a comparison with push enteroscopy in patients with gastroscopy and colonoscopy negative gastrointestinal bleeding.** Gut. 2003;52:1122-6. (Level II evidence)
36. May A, Nachbar L, Schneider M. **Prospective comparison of push enteroscopy and push-and-pull enteroscopy in patients with suspected small bowel bleeding.** Am J Gastroenterol. 2006;101:2016-24. (Level II evidence). View the reference

Information for Consumers

Information from this website	Information from the Royal Australian and New Zealand College of Radiologists' website
Consent to Procedure ot Treatment	Angiography

Radiation Risks of X-rays and Scans Angiography (Angiogram) Computed Tomography (CT) Computed Tomography (CT) Angiography	Computed Tomography (CT) Iodine-Containing Contrast Medium Magnetic Resonance Imaging (MRI) Plain Radiography/X- rays Radiation Risk of Medical Imaging During Pregnancy Radiation Risk of Medical Imaging for Adults and Children MRI Enterography or Enteroclysis Nuclear Medicine

Copyright

Legal Notice

Please remember that this leaflet is intended as general information only. It is not definitive and The Department of Health, Western Australia can not accept any legal liability arising from its use. The information is kept as up to date and accurate as possible, but please be warned that it is always subject to change

.

File Formats

Some documents for download on this website are in a Portable Document Format (PDF). To read these files you might need to download Adobe Acrobat Reader.

Get ADOBE READER

Legal Matters