RATIONAL IMAGING

Investigating occult gastrointestinal haemorrhage

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This article explores the radiological investigations available to diagnose recurrent blood loss from the gastrointestinal tract

The patient

A 78 year old woman with moderate renal impairment as a result of renovascular disease presented with tiredness and malaise. Twelve years earlier she had had an inferior myocardial infarction complicated by severe mitral incompetence, which was treated by mitral valve replacement and coronary artery bypass grafting. She had been taking warfarin since this time, but she had not taken aspirin or non-steroidal anti-inflammatory drugs. On examination she was clinically anaemic and had a prosthetic first heart sound. Her haemoglobin was 111 g/l (normal range 125-160) and ferritin was 63 pmol/l (67-618). The patient was treated by her general practitioner with oral iron for six weeks. Her tiredness improved and her haemoglobin concentration returned to normal.

Four months later the patient developed recurrent iron deficiency anaemia with a haemoglobin of 62 g/l and ferritin of 11 pmol/l. Upper gastrointestinal endoscopy, duodenal biopsy, and colonoscopy were all normal. She was given a blood transfusion then oral iron for three months. Her tiredness improved, and her haemoglobin returned to normal. Six months later her haemoglobin dropped once again to 71 g/l (ferritin 11 pmol/l).

What is the next investigation?

The patient had recurrent blood loss from the gastrointestinal tract. The common causes of this condition, such as peptic ulceration and gastric or colorectal malignancy, had been excluded by the use of conventional endoscopy. A diagnosis of obscure gastrointestinal bleeding was made. It seemed likely that she was losing blood from the small bowel, and further investigations were directed to that region.

Small bowel barium studies

Barium studies in the small bowel are helpful in the investigation of obscure gastrointestinal bleeding only when a strong clinical suspicion of Crohn's disease exists.[1] Barium studies can detect strictures and transmural inflammation, as in Crohn's disease, but cannot detect the small mucosal lesions that are usually cause bleeding in the small bowel. Enteroclysis, in which dilute barium is infused through a nasojejunal tube, and which is superior to standard barium studies of the small bowel for most applications, detects the cause of obscure gastrointestinal haemorrhage in up to 11% of patients.[2]

Radionuclide studies

Radionuclide studies have a role in the investigation of patients with overt gastrointestinal bleeding of obscure origin. Studies in which red blood cells are labelled can reveal the source of blood if the rate of bleeding is more than 0.3 ml/min. However, this technique is much less useful outside the setting of active bleeding. When bleeding is caused by ectopic gastric mucosa in a Meckel's diverticulum, pertechnetate scanning has a sensitivity of 85% and specificity of 95% in children, but it has an overall accuracy of only 46% in adults.[3]

Computed tomography scanning

The advent of multidetector row computed tomography scanners with improved spatial resolution has allowed the development of new techniques for examining the small bowel. Both computed tomography enteroclysis (in which a nasojejunal tube is inserted and the small bowel is distended with fluid to improve visualisation) and computed tomography angiography have been used to search for causes of obscure gastrointestinal bleeding. As with catheter angiography, relatively good results have been reported in patients who are overtly bleeding

Exposure of patients to radiation with the tests used to investigate obscure gastrointestinal bleeding

Examination	Approximate radiation dose (mSV)
Barium studies	2-5
Radionuclide scintigraphy	2-5
Computed tomography scanning	5-8
Catheter angiography	5-8
Enteroscopy	None
Videocapsule endoscopy	None

The average annual background exposure in most parts of Europe is 2-5 mSV.

This series provides an update on the best use of different imaging methods for common or important clinical presentations. The series advisers are Fergus Gleeson, consultant radiologist, Churchill Hospital, Oxford, and Kamini Patel, consultant radiologist, Homerton University Hospital, London.

at the time of the examination, with the cause being detected in up to 60% of patients. However, success has been limited in people with occult haemorrhage, with detection rates of about 15% in small series.[4]

Catheter angiography

"Three vessel angiography"—involving catheterisation of the coeliac axis, superior mesenteric artery, and inferior mesenteric artery—has traditionally been performed in the context of acute haemorrhage of obscure origin; it allows therapeutic intervention in selected cases. However, as with computed tomography angiography, sensitivity is poor in patients who are not overtly bleeding. Provocative angiography, in which thrombolytic or anticoagulant agents are given at the time of catheter angiography, has been reported to increase the sensitivity of this technique in experienced hands, but it is not widely practised. Both catheter angiography and computed tomography angiography involve a slightly higher radiation dose than the other techniques listed and carry a small risk of allergy to intravascular contrast agents (table).

Enteroscopy

Push enteroscopy examines the upper gastrointestinal tract as far as the mid-jejunum. It has a detection rate of around 30% in patients with obscure gastrointestinal bleeding, with the highest yield in patients with overt bleeding.[5] The instrument used is similar to a standard upper gastrointestinal endoscope, but it is longer (260 cm). It enables suspicious lesions to be biopsied and vascular lesions to be treated with argon beam diathermy.

Double balloon enteroscopy is a new technique, still under evaluation, that allows visualisation of a greater area of the small bowel mucosa than is possible with standard push endoscopy techniques. It has the potential for therapeutic intervention such as thermocoagulation of angiodysplastic lesions and has a detection rate of about 60%.[6] Major complications of enteroscopy are uncommon but include perforation, bleeding, and pancreatitis. Around 20% of people have severe abdominal pain after the procedure.[7]

Videocapsule endoscopy

Videocapsule endoscopy has become the mainstay of small bowel investigation when obstructive lesions are not suspected or have been excluded. The small bowel is prepared with osmotic laxative taken the evening before the examination, and the patient is asked to fast from midnight. The next morning the capsule is swallowed with a small amount of water and 10 mg metoclopramide (to increase upper gastrointestinal transit time) and simeticone, which reduces bubble formation in the small bowel.

The capsule takes 50 000 images over seven hours at a rate of two images per second. These images are transmitted to a recording device worn on a belt by the patient. The patient does not need to stay in hospital over the course of the day but comes back at the end of the afternoon, when the recording device is removed and the images are downloaded. The recording is reviewed by the endoscopist, and this takes 60-90 minutes. The capsule is excreted in the stool.

Three images from the videocapsule endoscopy examination showing multiple telangiectasia (arrowheads) throughout the small bowel

Additional educational resources for healthcare professionals

Sidhu R, Sanders DS, Morris AJ, McAlindon ME. *Guidelines on small bowel enteroscopy and capsule endoscopy in adults*. British Society of Gastroenterology. 2008. www.bsg.org.uk/bsgdisp1.php?id=b93ef9f4314a121a9d85&h=1&sh=1&i=1&b=1&m=00023

LEARNING POINTS

Recurrent iron deficiency anaemia as a result of occult gastrointestinal blood loss is common in elderly people

Most causes are within reach of conventional endoscopy (oesophagogastroduodenoscopy and colonoscopy)

Small bowel barium radiology is rarely helpful in patients with no gastrointestinal symptoms

Capsule endoscopy is the first line investigation in patients with normal results on oesophagogastroduodenoscopy and colonoscopy

Capsule endoscopy establishes an accurate diagnosis in most cases, allowing treatment to be tailored to the individual and avoiding unnecessary endoscopic or radiological investigations

The only complication of capsule endoscopy is impaction, usually caused by a previously undocumented small bowel stricture. This occurs in fewer than 1% of examinations.[6] The test is well tolerated by patients and has a detection rate of around 60%, which is generally superior to other imaging modalities.[8] Each disposable capsule costs about £450 (€570; $890), exclusive of purchase of hardware and the time needed to read each recording.

Outcome

The patient underwent videocapsule endoscopy. This showed multiple telangiectasia throughout the small bowel (figure), which were thought to be the source of haemorrhage. The advent of capsule endoscopy has led to these lesions being increasingly recognised as a cause of recurrent iron deficiency anaemia, particularly in elderly people and patients with cardiac valvular disease.[9] In this patient, chronic blood loss resulted in recurrent anaemia. Warfarin treatment may have exacerbated the problem, but it would have been inadvisable to discontinue this drug because of the presence of a prosthetic mitral valve. The main treatment options available to this patient were:

- Treatment of symptoms with oral iron and blood transfusions as needed
- Therapeutic enteroscopy with argon beam plasma coagulation of the telangiectasia in the proximal small bowel
- Hormone replacement therapy.

The patient did not tolerate oral iron well because of gastrointestinal side effects. Argon beam plasma coagulation of the telangectasia ablates the source of blood loss and has been used successfully to treat this condition. However, this treatment is usually applied during push enteroscopy, which can only reach as far as the mid-jejunum. The vascular lesions in this patient were distributed throughout the small bowel, and many lesions were out of reach of the enteroscope. We decided to perform a trial of oestrogen-containing hormone replacement therapy, which can reduce blood loss and transfusion requirements in patients with this condition.[10] The treatment was successful and the patient's anaemia did not recur.

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The carbon footprint of specialty training in general surgery

You can't walk down the street these days without being reminded of the carbon footprint you are leaving behind. I don't consider myself an ecowarrior, but I try to do my bit. After all we have the ice caps as well as our patients to look after.

You can only imagine my ecological outcry when I began applying for specialty training posts (ST 3) in general surgery: 80% of the applications had to be on paper, with some deaneries demanding up to 12 copies at 20 sheets apiece. My own hard copies of my writing for proofreading increase the paper consumption even further. So I thought I'd consider the contribution of ST 3 applications to global warming:

1) Draft copies of completed application forms and guidance letters (ultimately destroyed)—320 sheets
2) Real copies of application forms—1050 sheets
3) Four ink cartridges
4) Electricity to power computer, lighting, and heating
5) Transport of application forms—train and van.

Total carbon footprint estimated at 480 kg CO_2 (www.carbonfootprint.com).

This equates to four return flights to Australia, heating a modest three bedroom house in the UK for a year, or perhaps driving a gas guzzling SUV around central London five days a week for a year.

Of course, there was also the astronomical secondary contribution to my carbon footprint from the nicely packaged, environmentally damaging comfort foods I munched on, and burning the midnight oil.

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