Radiology of Small Intestinal Bleeding

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Although chronic iron deficiency anaemia due to the repeated loss of small quantities of blood into the lumen of the small intestine is a common feature of many patients with small intestinal disease, massive haemorrhage from the small intestine or iron deficiency anaemia occurring without other symptoms is uncommon. Since the radiological examination of the small intestine is time-consuming and involves the patient in considerable irradiation, other more common sites of bleeding in the oesophagus and stomach should be examined before the radiological examination of the small bowel is undertaken.

TECHNIQUE OF EXAMINATION

There are a number of different methods of examining the small intestine, each having its advocates. The appearances vary with the type of barium sulphate preparation used, particularly whether or not it contains carboxymethylcellulose, and may be modified by the administration of drugs such as Metoclopramide and the antidepressants. It is important that the radiologist should know the variations in the normal appearances of the particular method used. The aim of all methods is to demonstrate the entire small intestine, both when collapsed and when distended. I prefer to use a simple technique, keeping in reserve the more distressing intubation methods for cases in which the simple methods have failed. Enough barium preparation should be given for it to outline the length of the small intestine in an almost continuous column; this may vary from 300 to 600 ml. The patient lies on his right side between the fluoroscopic examinations so that no air can leave the stomach until all the barium has left. This has the advantage of shortening the time of the examination and ensuring an uninterrupted column of barium in the intestine. Supine films are taken on the fluoroscopic table at intervals determined by the rate of transit of the barium, and if anything abnormal is seen an erect film is taken immediately. These supine and erect films are taped together and are always viewed side by side in the same way as erect and supine films of an acute abdomen are studied. Spot films are taken of the terminal ileum and of any areas suspected of abnormality elsewhere in the
intestine. The time of the examination may be reduced by giving Metoclopramide 10 mg i.v. or orally. As this modifies the appearances of the small intestine, the fact that it has been used should be recorded. If a simple small bowel examination is negative, intubation of the small intestine, possibly with hypotonic duodenography or angiography, may be required.

**CAUSES OF BLOOD LOSS**

*Neoplasms.* Neoplasms of the small intestine form between 1·5 and 6·0 per cent of intestinal neoplasms (Good, 1963). The majority are benign and of these 80 per cent cause no symptoms. Of the benign neoplasms leiomyoma is the commonest, usually occurring in the jejunum. Approximately 75 per cent of these tumours present with bleeding. Less often, they give rise to pain due to intussusception and are occasionally large enough to form a palpable mass. Adenoma and lipoma occur less often and are slightly more common in the ileum. They bleed less frequently than the leiomyoma. The small bowel haemangioma presents with painless bleeding.

Malignant neoplasms form less than 1 per cent of all intestinal neoplasms. They can be divided into epithelial tumours such as the carcinoma or carcinoid tumour, and non-epithelial tumours such as the malignant lymphomas, leiomyosarcoma and vascular tumours. In addition, the small intestine may be involved by tumours from outside, such as the pancreas or ampulla of Vater, or may be the site of metastatic deposits. All of these may cause bleeding into the gut.

*Radiological Appearances.* Most small benign tumours pass unnoticed on barium examination of the small intestine. The larger ones may give rise to smooth intraluminal filling defects that may appear to change position with peristaltic waves (Fig. 1). They may cause intussusception of the small intestine but complete obstruction due to intussusception rarely if ever occurs. Small haemangiomas are virtually never recognised except by angiography. Large ones may be seen occasionally giving rise to multiple submucosal and intraluminal filling defects that are said to change size on compression (Marshak and Lindner, 1970). Occasionally, these haemangiomas may be associated with calcified phleboliths that help to make the diagnosis.

All the malignant tumours may bleed and, in addition, they commonly cause some degree of obstruction. Some of the more cellular tumours, such as the reticulum cell sarcoma, may present with perforation. Radiologically, these malignant tumours are indistinguishable from one another. They destroy the mucosal pattern and usually cause a narrowing of the lumen with some degree of obstruction (Fig. 2). The lymphomas, however, may give rise to a local dilatation rather than stenosis, and frequently involve a number of
loops of small intestine (Fig. 3a, b). Metastatic deposits, particularly from melanoma, may appear as well-defined, often intraluminal, filling defects, sometimes with central ulceration.

The combination of intestinal polyposis with pigmentation of the skin and mucous membranes is called the Peutz-Jeghers syndrome. The melanin pigment usually involves the lips and mouth, less often the face and extremities. The polyps may be present in the stomach, small bowel or colon and are most frequently found in the small bowel where they present with symptoms of intussusception and bleeding. These polyps are hamartomas and may be pedunculated or sessile. They are often too small to be demonstrated radiologically, but should be looked for particularly carefully when patients who have had intestinal bleeding are found to have pigmentation of the skin or mucous membranes.

*Diverticula and Stagnant Loops.* Jejunal diverticulosis usually causes a megaloblastic type of anaemia because of the stagnation of intestinal contents within
the diverticula. Occasionally, when stagnation occurs in loops following abdominal surgery, faecoliths may form and give rise to ulceration and bleeding sufficient to cause an iron deficiency anaemia. Bleeding from a Meckel's diverticulum is not uncommon and is usually associated with the presence of ectopic gastric mucosa.

Jejunal diverticulosis can be demonstrated radiologically without difficulty. The supine films will demonstrate the mucosa running into the mouths of the diverticula and the erect films will show fluid levels within them. Stagnant loops following surgery may be demonstrated and, as in the case of jejunal diverticulosis, the degree of stagnation may be shown by taking films at intervals until all the barium has left the small intestine. Meckel's diverticulum can seldom be shown radiologically because the neck of the diverticulum is wide and peristaltic activity within it tends to keep it empty. They are, however, sometimes demonstrated by retrograde filling of the small intestine following a barium enema.

Fig. 2. Reticulosarcoma of jejunum: a short stricture with mucosal destruction and shouldering.
Fig. 3(a) Coeliac disease causing dilatation of jejunum with thickening of the transverse folds. The effacement of these folds at one site indicates local lymphoma. (b) Five months later. Many loops of small intestine now show narrowing and ulceration due to extensive lymphoma.
Crohn’s Disease and Intestinal Tuberculosis. Iron deficiency anaemia due to loss of blood into the lumen of the small intestine may be a prominent feature of both these conditions. Occasionally, quite massive intestinal bleeding may occur. More commonly, however, other intestinal symptoms such as pain and diarrhoea predominate and the bleeding is merely an incident in the disease. Crohn’s disease and intestinal tuberculosis may be indistinguishable radiologically, showing multiple areas of stenosis and ulceration, usually in the ileum (Fig. 4). It is said that involvement of the caecum, which may become extremely contracted, is more common in tuberculosis than Crohn’s disease.

Helminthic Infections. Although parasitic infestation of the small intestine is an uncommon cause of anaemia in this country, the possibility should be

Fig. 4. Tuberculosis of ileum: an irregular stricture of ileum. There were other strictures in ileum and caecum.
considered, particularly in visitors and immigrants from tropical countries (Salem and Truelove, 1964).

Infection with strongyloides is a common cause of anaemia in tropical countries and sporadic cases are seen in temperate countries. The helminthic parasite enters the body through the skin and passes through the lung on its way to the duodenum and jejunum, where it sets up a duodenitis or jejunitis that cause anaemia and malabsorption. There may be vomiting due to stenosis of the affected gut, and paralytic ileus may occur. The condition usually affects the proximal bowel most severely but the colon may be involved, particularly when there is a paralytic ileus.

Plain films may show a dilated proximal intestine. Barium examination may show dilatation of the duodenum and proximal jejunum, with thickening of the transverse folds. The wall of the bowel may become thickened and rigid. Extreme ulceration of the duodenum and jejunum may occur (Fig. 5). In mild cases the appearances may return to normal with treatment (Middlemiss, 1961, 1967).

Fig. 5. Strongyloides of duodenum and jejunum causing dilatation and mucosal irregularity of the duodenum and pipe-stem narrowing of proximal jejunum.
Hookworm infection (ankylostomiasis) may be responsible for severe anaemia, malnutrition and retarded growth. The radiological features are similar to those seen in strongyloides infestation with oedema and inflammatory reaction in the proximal small bowel. Infestation with *Giardia lamblia*, although common, usually gives rise to few symptoms. Severe infestation may occur in patients with defective immune response. The radiological changes, if any, are usually confined to the duodenum and proximal jejunum unless there is an associated dysgammaglobulinaemia where a nodularity due to lymphoid hyperplasia may be seen throughout the small bowel.

**Intramural Intestinal Bleeding.** Bleeding into the wall of the intestine may occur in normal individuals following trauma. The duodenum is usually affected, probably because it is more fixed than other parts of the small intestine and is crushed against the spine. Intramural haemorrhage may also occur spontaneously in patients who are receiving anticoagulant treatment.

![Fig. 6. Intramural haemorrhage in jejunum causing partial obstruction in a patient on anticoagulant therapy.](382)
or have an underlying condition associated with a coagulation defect. Spontaneously occurring haematomas may involve any portion of the bowel and tend to give rise to diffuse infiltration of the bowel wall rather than a localised intramural mass.

In cases of trauma the radiological findings are usually confined to the stomach and duodenum. A mass, usually on the medial aspect of the duodenum, may displace the stomach and duodenum and cause varying degrees of obstruction. The soft tissue mass may be recognisable on the plain film of the abdomen and may cause obliteration of the psoas shadow. Barium studies may demonstrate displacement of the duodenum by the haematoma and the wall may be stretched over it so that the folds appear like a coiled spring. These folds are commonly thickened by oedema.

In spontaneous intramural haemorrhage any part of the small intestine may be involved. A plain film may show evidence of a local ileus or of obstruction of the bowel proximal to the site of injury. Occasionally, if the haemorrhage is massive, displacement of gut may be recognised. Barium studies usually show segmental involvement with varying degrees of rigidity,
dilatation and thickening of the folds. These thick folds are often well-defined and lie parallel to one another, producing a symmetrical appearance sometimes described as like a stack of coins or a picket-fence (Figs. 6, 7). These changes are more striking in the jejunum than in the ileum because of the thicker folds in the normal jejunum. The erect film sometimes shows retention of fluid within these damaged folds due to rigidity of the intestinal wall and a local ileus (Fig. 8). The small indentations known as thumb printing when seen in the colon are seldom seen in the small intestine. Serial examinations usually demonstrate a resolution of the changes over the course of three to five days.

Massive intestinal haemorrhage, often associated with intramural haemorrhage, may occur whenever there is segmental infarction of the small intestine. This may be due to sudden occlusion of a small artery by embolus or atheroma or may occur in the course of a connective tissue disorder such as rheumatoid

Fig. 8. Intramural haemorrhage of jejunum in haemophilia.
arthritis, polyarteritis nodosa, systemic lupus erythematosus and dermatomyositis. Similarly, the blood supply to the wall of the intestine may be impaired in Henoch-Schonlein purpura and paroxysmal nocturnal haemoglobinuria (Fig. 9) (Blum, 1966; Lee, 1973).

The radiological appearances of these conditions are similar. The appearances vary with the severity of the infarction. A plain film of the abdomen may show distended gas-filled loops of small intestine with thickened oedematous folds outlined by the gas. Where ulceration and necrosis of the wall has occurred gas may be seen in the portal system both in the portal vein and in the intrahepatic branches of the portal vein towards the outer margin of the liver. This latter sign indicates severe infarction of the bowel and usually heralds death.

Barium studies in less severe cases may show a number of rather distended rigid loops of small intestine partly separated from each other because of the thickness of their wall and showing thickening also of their folds, resembling a picket-fence. Sometimes the lumen may be narrowed and individual loops

![Fig. 9. Paroxysmal nocturnal haemoglobinuria: intramural haemorrhage in jejunum.](image)
displaced by haematoma in the mesentery. There may be a little dilatation of loops proximal to the abnormal segments but complete obstruction is uncommon in spite of the rigidity of the abnormal segments of intestine. In some instances these segmental areas of ischaemia may closely resemble the appearances seen in Crohn’s disease (Marshak and Lindner, 1970). During the healing phase the small intestine sometimes becomes featureless and devoid of mucosal pattern so that it resembles a hose pipe.

**SUMMARY**
There are a limited number of ways in which the radiological appearances of the small bowel are modified by disease. Many of these changes are common to a number of different disorders, which makes a tissue diagnosis on radiological grounds alone often unreliable. Even so, much valuable information may be obtained by simple radiological methods provided the normal range of the technique used is understood and the results are correlated with the whole clinical picture. In no field is close collaboration between physician and radiologist of more importance than in the study of patients with small bowel disease.

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**References**
Blum, S. F. (1966) *New England Journal of Medicine, 274,* 1137.
Good, C. A. (1963) *American Journal of Roentgenology, 89,* 685.
Lee, B. C. P. (1973) *British Journal of Radiology, 46,* 467.
Marshak, R. H. and Lindner, A. E. (1970) In *Radiology of the Small Intestine.* London: W. B. Saunders.
Middlemiss, H. (1961) *Tropical Radiology.* London: Heinemann.
Middlemiss, H. (1967) In *Alimentary Tract Radiology,* Chapter 45. Saint Louis: C. V. Mosby.
Salem, S. N. and Truelove, S. C. (1964) *British Medical Journal, 1,* 1074.