

with vomiting. All investigations, including cholecystography and barium studies, were negative. The aortogram showed almost complete occlusion of the celiac axis, with some narrowing of the origin of the SMA. The occlusion was relieved by patch angioplasty, resulting in a completely open vessel, as demonstrated on a post-operative arteriogram. He continues to complain bitterly of incapacitating pain in the epigastrium.

**Case 3** A woman of 57 was admitted as an emergency to another hospital with partial infarction of the mid-gut, and survived emergency laparotomy at which no vascular or intestinal operation was attempted. She was subsequently transferred to the Middlesex Hospital for further assessment. She was emaciated and suffering from cramp-like abdominal pain, occurring mainly at night and bearing no particular relation to meals. She was constipated, whereas her bowel habit had previously been regular. Aortography revealed a narrowed celiac axis and a 4 cm stenosis of the SMA which admitted only a fine trickle of contrast material. Intensive investigation of intestinal function was negative, apart from the discovery of a protein-losing enteropathy by the intravenous radioiodinated albumin technique. A side-to-side anastomosis between the superior mesenteric artery and the aorta was followed by complete relief of symptoms, recovery of 7 kg in weight and correction of the faecal protein loss.

It is clear that we are on very uncertain ground in diagnosing intestinal angina, or in ascribing a patient's abdominal symptoms to a blocked artery shown on an X-ray film. This view is well supported in the literature. For instance, of the 11 patients with known stenoses described by Rob (1966), 4 were found to have other causes of abdominal pain. Reuter & Olin's series from Sweden (1965) was reported after the original wave of enthusiasm for arterial reconstruction in general had receded, and their conclusions were even less encouraging; of 12 patients operated on for radiologically proven stenoses and occlusions, 7 were found to have other conditions and in 4 the suspected lesion could not be verified. My own experience is of 17 patients investigated for suspected intestinal angina, of whom 10 were found to have normal aortograms, the diagnosis then being abandoned. Of 7 with radiologically confirmed arterial lesions, one improved spontaneously without treatment and 6 were subjected to arterial reconstruction. Three of these patients are symptomatically improved, 2 are unchanged and one (Case 2 described above is, if anything, rather worse.

The fact that autopsy studies (Carucci 1953, Derrick *et al.* 1959) have shown that symptomless occlusions of the visceral arteries are very common, casts further doubt on the validity of aortography as a basis for recommending a major

arterial operation in this type of patient. Clearly, we need to know more about the effects of chronic intestinal ischaemia, so that we can develop some laboratory test which will enable us to select the particular patient whose arterial lesion is responsible for his symptoms and who is at risk from fatal mesenteric occlusion. Unfortunately, attempts to reproduce this situation in the experimental animal (for example, obliterating the vessels by means of an Ameroid cylinder (Marston 1964, Popovsky 1966)) have not been helpful. Such studies have tended to show that chronic occlusion of the SMA is well tolerated and results in no demonstrable biochemical abnormality.

### Conclusions

It appears that a proportion of people who die from intestinal infarction give a prodromal history of post-cibal abdominal pain, and for this reason it is important to recognize and diagnose this type of pain. However, the diagnosis is far from easy, and aortography can mislead. The concept of intestinal angina is of great interest, and perhaps of some importance, although we do not know the converse of Dunphy's thesis, that is the number of patients with the chronic syndrome who eventually succumb to an acute infarct. The condition is undoubtedly rare. None the less, the clear-cut case does occasionally present, and to reconstruct the visceral circulation, abolish angina and correct malabsorption is a very satisfying surgical exercise.

### REFERENCES

- Carucci J J (1953) *Amer. J. Surg.* 80, 47  
 Dardick H, Seidenberg B, Parker J G & Hurwitz E S (1965) *J. Amer. med. Ass.* 194, 1206  
 Derrick J R, Pollard H S & Moore R M (1959) *Ann. Surg.* 149, 684  
 Dunphy J E (1936) *Amer. J. med. Sci.* 192, 109  
 Fry W J & Kraft R O (1963) *Surg. Gynec. Obstet.* 117, 417  
 Marston A (1964) *Ann. roy. Coll. Surg. Engl.* 35, 151  
 Popovsky J (1966) *Arch. Surg.* 92, 202  
 Reuter S R & Olin T (1965) *Radiology* 85, 4  
 Rob C G (1966) *Arch. Surg.* 93, 21  
 Schnitzler J (1901) *Wien. klin. Wschr.* 51, 505  
 Webb W R & Hardy J D (1962) *Ann. intern. Med.* 57, 289

**Mr R W Marcuson**  
*(The Middlesex Hospital, London W1)*  
**and Dr J A Farman**  
*(North Shore Hospital, Manhasset, NY, USA)*

### Ischaemic Disease of the Colon

In 1966 Marston *et al.* described a series of 16 patients who on clinical, radiological and pathological grounds were considered to have vascular insufficiency of the large bowel. This communication is concerned with a series of 122 such cases.



Fig 1 *Ischæmic colitis – acute lesion. Section shows mucosal necrosis and marked widening of the submucosa by hæmorrhage. The deep muscle layers are intact. H & E.  $\times 6$*

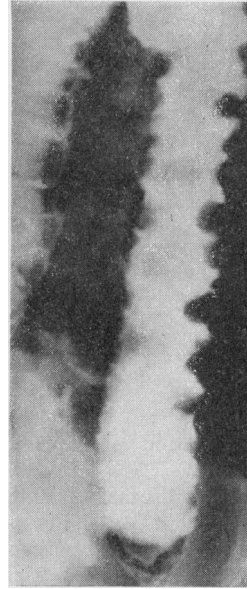


Fig 2 *Barium enema showing the typical changes of 'thumbprinting' in the descending colon*

From the clinical viewpoint, patients with ischæmic disease of the colon fall into two groups. A minority present with an obscure abdominal catastrophe, and gangrene of the colon is found at subsequent laparotomy. In the larger group, the presentation is with varied abdominal and rectal symptoms and essentially these patients have a nongangrenous condition which may be called ischæmic colitis.

The main pathological feature of the acute lesion of ischæmic colitis is widening of the colonic submucosa by hæmorrhage or œdema (Fig 1) and it is this change which accounts for the diagnostic sign of 'thumbprinting' in the barium enema at an early stage of the disease (Fig 2).

The fate of the acute lesion depends on the depth of the necrosis. When it is superficial, complete resolution occurs and only at this stage is it possible to refine the diagnosis to transient ischæmic colitis. This is a retrospective diagnosis (de Dombal *et al.* 1969). With deeper necrosis affecting the submucosa or muscle layers, healing is by fibrosis—usually with the production of an ischæmic stricture. The final classification is: (1) Gangrene of the colon. (2) Ischæmic colitis: (a) transient, (b) stricture.

#### *Clinical Series*

This communication presents an analysis of the 122 cases of ischæmic disease of the colon. For admission to the series, all cases were required to have had either diagnostic barium enema studies or diagnostic histopathological features. Many cases satisfied both criteria. While the majority occurred in the sixth decade or above,

24 cases occurred below 50 years of age, and in this group a possible predisposing factor was found in 18 cases. Of these, 3 patients had diabetes, 1 had rheumatoid arthritis and 6 women were taking œstrogen-containing oral contraceptives. In the over-50 age group, there were 6 diabetics and 3 cases of rheumatoid arthritis. The overall sex ratio was 1.2:1 (F:M), which modifies earlier experience (11 females and 5 males, Marston *et al.* 1966). There were 107 cases of ischæmic colitis (87.7%) and 15 cases of gangrene of the colon (12.3%). These two groups of patients will now be considered separately.

#### *Ischæmic Colitis*

Of the 107 patients with ischæmic colitis, 76 presented as emergencies or in the early stages of the disease and 31 were first seen with an established stricture following an earlier history of acute ischæmia. The clinical picture varied widely from a short history of severe abdominal pain and bloody diarrhœa requiring emergency admission, to many weeks' history of vague abdominal pain and slight alteration of bowel habit. The main symptoms were rectal bleeding (57%), abdominal pain (51%) and diarrhœa (49%). Six cases presented with large bowel obstruction. The diagnosis was apparent from barium enema examination in 74 cases.

All sites in the large bowel were at times involved (including the rectum), but the splenic

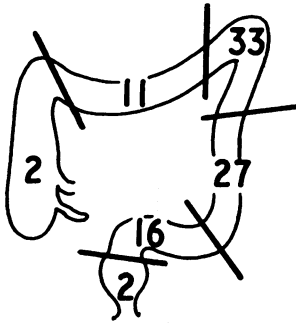


Fig 3 Distributions of 58 ischaemic strictures. See text for explanation

flexure, descending and sigmoid colon were most often affected.

The course of the disease was interrupted by early colon resection in 3 cases, none of which showed pathological evidence of gangrene, and early death from other causes in 2 cases. Resolution occurred in 44 cases (transient ischaemic colitis) and strictures developed in 58 cases. The distribution of the strictures is shown in Fig 3. The site totals represent the frequency with which each site was involved: long strictures will therefore count at 2 or more adjacent sites. It is seen that most of the lesions affected the splenic flexure or descending colon. Of the 58 strictures, 47 were treated by resection with 4 deaths, and 11 were treated conservatively with one death from a cerebrovascular accident. Serial barium enema studies in those cases treated conservatively show that some strictures open up as they mature (Fig 4).

#### *Gangrene of the Colon*

There appeared to be no predilection for the left colon in this type of disease, and the lesions were distributed evenly throughout the large bowel. Relatively long lengths of colon were affected. Successful surgery was carried out in 4 cases.

#### *Conclusions*

The following conclusions have been drawn from the data presented:

(1) *Etiology*: The incidence of diabetes (8%) and collagen disease (3%) in the series suggests that small vessel disease may be an important etiological factor. Six women were taking oestrogen-containing oral contraceptives which are known to be associated with venous thrombosis. Recent experimental work has shown that canine inferior mesenteric vein thrombosis produces 'thumbprinting' similar to that seen in ischaemic colitis; but there are histological differences (Marcuson *et al.* 1971).

(2) *Diagnosis, treatment and fate of ischaemic colitis*: Because of the variable presentation, barium enema studies are required for accurate early diagnosis. All cases may be treated conservatively, provided a close watch is maintained for gangrene and spreading peritonitis, in which case surgery must be undertaken. Nearly half of the cases will resolve and require no further treatment. The remainder will develop strictures, but some of these will dilate as they mature. Surgery is indicated for obstruction or to exclude malignancy.

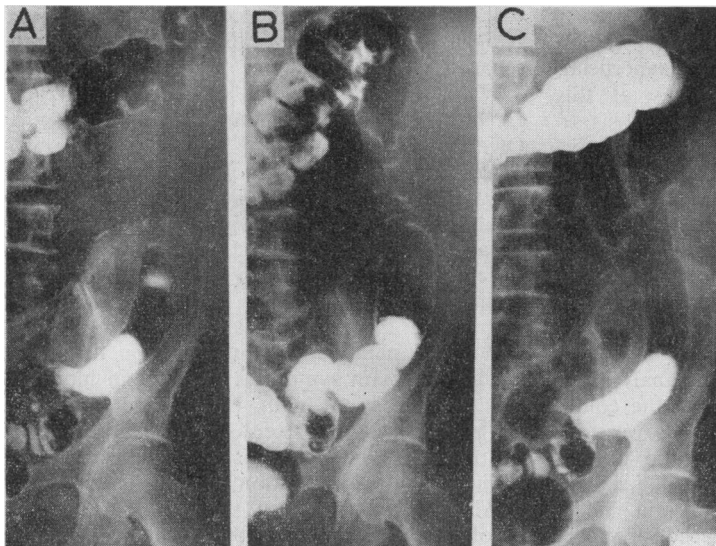


Fig 4 Barium enema studies on a single patient with an ischaemic stricture to show spontaneous improvement. A, two weeks after onset of disease. B, one month later. C, six months later

**Acknowledgment;** We are grateful to Mr Adrian Marston and Dr Basil Morson for details of some of the cases in the series.

#### REFERENCES

- de Dombal F T, Fletcher D M & Harris R S (1969) *Gut* 10, 131  
 Marcuson R W, Stewart J O & Marston A (1971) (in preparation)  
 Marston A, Thomas M L & Morson B C (1966) *Proc. roy. Soc. Med.* 59, 881

**Dr Basil Morson** (*Department of Pathology, St Mark's Hospital, London*) said that there were numerous examples in the literature of membranous or pseudo-membranous enterocolitis which had been regarded by the authors as being due to the injudicious use of powerful antibiotics leading to invasion of the gut mucosa by virulent staphylococci. Membranous enterocolitis had a distinctive histopathology which should not be confused with staphylococcal enterocolitis. In his opinion the former was the result of acute ischaemia, probably the nonocclusive type in most cases. It could be recognized in some patients by characteristic sigmoidoscopic and biopsy appearances.

**Mr Reginald Murley** (*Royal Northern Hospital, London N7*) said that surgeons were in danger of becoming too preoccupied with the intestinal arteries and of ignoring the veins. In many cases of gut ischaemia the condition was due to venous thrombosis; sometimes this was confined to the small intramural or juxtaintestinal veins draining to the terminal



Fig 1 Whole section of part of colon showing thrombosis in small intramural and juxtacolonic veins with patent arteries.  $\times 3$

arcades. At operation the surgeon might detect no vascular abnormality. The arteries of the mesentery might be patent and pulsatile. The neighbouring veins could produce arrest of the local circulation and infarction of gut just as surely as did arterial occlusion.

One example of this presentation was a man of 70 who was admitted under Mr Murley's care in December 1967. The oral temperature was 93.4°F (34°C) and there was evidence of colonic ischaemia. A successful exteriorization resection was done by Mr Paul Weaver. Whole sections of the gut wall (Fig 1) showed thrombosis in the smaller veins. The arteries were patent. Ischaemic changes in the gut were seen mainly in the mucosa and submucosa.

He had seen a number of other cases with thrombosis in the veins of the gut giving rise to a variety of clinical pictures, including profuse bleeding due to mucosal infarction, so-called ischaemic colitis, and extensive infarction of small and/or large gut. A feature in some of these cases was that the area of gut involvement did not correspond with the visceral territory of the main vessels. Thus, changes in ileum or colon might stop short at the ileocaecal valve instead of involving both areas.

A fuller report was in the course of preparation.

**Mr H H G Eastcott** thought that they ought perhaps not to look for major obstruction of the mesenteric artery or its branches in every case of intestinal gangrene. Heart failure on its own could be a sufficient cause. Of 136 patients with mesenteric infarction reported by Ottinger & Austen (1967), no fewer than 67 had no recognizable obstruction of the arterial or venous channels. There was splanchno-cutaneous vasoconstriction in heart failure. Raised levels of catecholamines had been demonstrated in the blood and urine of patients with heart failure (Braunwald & Chidsey 1965). This might be nature's way of protecting the failing heart. Most surgeons and anaesthetists knew that the colour and arterial pulsation of the exposed gut was one of the best indications of a patient's general condition.

#### REFERENCES

- Braunwald E & Chidsey C A (1965) *Proc. roy. Soc. Med.* 58, 1063  
 Ottinger L W & Austen W G (1967) *Surg. Gynec. Obstet.* 124, 251

The following papers were also read:

#### Radiology of Intestinal Arterial Disease

Professor Eric Samuel  
 (*Royal Infirmary, Edinburgh*)

#### REFERENCE

- Samuel E (1967) *Proc. roy. Soc. Med.* 60, 839

#### Acute Small Bowel Ischaemia

Mr G E Mavor  
 (*Royal Infirmary, Aberdeen*)