looking man without any postural changes at all. On examining him carefully, however, there were evident stigmata of his condition—a slightly tremulous tongue and lips, a suspicion of too fixed a gaze, and so forth, but everything was minimal. He said that this surprising change had begun within a few days of taking the medicine ordered by the neurologist; that for the first time for some months he had ceased to have the feeling of being "tied up by his muscles," that he could move them freely, and that, two days before, he had walked ten miles! The prescription contained three ingredients—chloral hydrate, tincture of hyoscyamus, and tincture of belladonna. It is possible that the good effects may have arisen from the hyoscyamus, and not from the belladonna. The doses were small, about six minims of each. My previous experience with the latter, however, makes me feel sure that, even in such doses, it is quite capable of producing the result by itself, and of the three ingredients was probably the chief agent.

In thus laying stress on the effects of belladonna it must be admitted that the bulk of the improvement is something inherent in the patient's nervous system—an auto-suggestion set going by a feeling of release from some constant oppression. In these cases the oppression is described by the patients as the effort required to perform any action. Directly even the slightest relief is felt from that a condition of "euphoria" is produced, which extends its beneficent influence over every part. This soon leads to the disappearance of that great mass of functional symptoms which often, in these cases, mask the extent of the real disorder. One is familiar with a similar course of events in many purely psychasthenic cases. Once a start can be made and a definite sense of improvement in one factor obtained, the reaction of the patient's own nervous system continues the process at compound interest—a circle not "vicious," but turned to a good purpose.

The difficulty in cases of Parkinsonism is to obtain the initial change, because here we have a very definite substratum of organic disease in which mechanical factors are involved. Belladonna, by acting in some way on some part of the neuro-muscular arc which is being over-stimulated in the Parkinsonian patients, relieves the hypertonia, allows the muscles to be used with less effort, and the higher centres do the rest.

That belladonna can act in this way is not remarkable if hyoscyne can do so. Both drugs belong to the atropine group, and have many pharmacological actions in common. Theoretically, the advantage should be with atropine, seeing that it has not the same tendency to a sedative action on the higher centres as hyoscyne. Possibly some combination of atropine and hyoscyne may be found to be more useful than either drug alone. My own experience in that direction, however, does not favour such a view. One of the cases in which belladonna failed signally found relief, both before and since, from hyoscyne.

Many points of interest arise in connexion with this action of the atropine group. How long can it be maintained? How can its effects be prolonged? Is the prognosis better in those cases which respond well than in those which do not?

There is also the question why some cases in whom the hypertonus seems equally well marked do not respond at all. It is interesting to note that in Hohman's series of cases treated by hyoscyne a certain number responded only slightly. Szyska² has recorded successful results with atropine pills, given for periods of three to six days, then a two to three day interval. Very large doses may be required and tolerated.

Before concluding, some reference must be made to cases recorded from time to time in which apparently considerable improvement follows divers forms of treatment. Thus, intrathecal injections of the patient's own serum are from time to time recorded as proving temporarily useful, also various forms of mechanical therapeutics are sometimes of benefit. It is, of course, possible that in any or all of these procedures some relaxation of the hypertonus may be brought about, as effective as when the atropine group is used. Our knowledge of the exact pathological process at

work is so slight that it would be foolish to deny such a possibility.

It is, however, rather more difficult to eliminate the factor of suggestion from without in any form of treatment which involves active intervention or daily personal influence. The very fact of a lumbar puncture being performed is in itself a powerful factor of suggestion. We are all familiar with Hutchison's "chronic abdominal woman" who recovers completely for a few weeks after each successive laparotomy!

Whilst, therefore, not for a moment denying the possibility that other methods may give as much relief as the administration of the atropine group, it seems possible that the former act more directly upon the reduced mental energy of the Parkinsonian patient, whilst in the latter the approach to the patient's higher centres is through the relief given to their neuro-muscular apparatus, and is indirect. Pharmacologically, the atropine group is said to have little or no effect on voluntary muscle. Whilst this may be true in normal conditions, it is not necessarily so when these are pathological.

There is no evidence that the actual lesion is in any way affected in its condition or progress by administering these drugs. Meanwhile, amidst all that is so dark and sombre in this disease, any measure that will give even temporary relief is worth our attention.

REFERENCES.

¹ *Bull. Johns Hopkins Hosp.*, 1924, xxxv, 335. ² *Münch. med. Woch.*, 1923, lxx, 47.

An Address

ON

INTESTINAL DIVERTICULA.

DELIVERED BEFORE THE MANCHESTER CLINICAL SOCIETY

BY

E. I. SPRIGGS, M.D., F.R.C.P., AND O. A. MARXER,

SENIOR PHYSICIAN,

RADIOLOGIST,

RUTHIN CASTLE (DUFF HOUSE), NORTH WALES.

(With Special Plate.)

DIVERTICULA, or accessory pouches of the intestine, have been noted occasionally by pathologists from the eighteenth century onwards. In recent years we have become familiar with the condition known as diverticulitis, which is due to inflammation extending from the multiple colic diverticula to the wall of the bowel and surrounding parts. This was described in this country by Sir Berkeley Moynihan¹ eighteen years ago, and has been exhaustively studied by Dr. Maxwell Telling.² More recently the development of accurate radiology has made it possible to recognize diverticula in the course of a routine examination of the alimentary canal. A good many records have been published, including two short papers of our own some five years ago³; but in most of these the association of diverticula with symptoms has either not been recognized or has received but little attention.

Some years ago I suggested that the term "diverticulosis" be used to embrace all phases of the disease, and particularly the existence of diverticula before gross inflammatory phenomena have involved surrounding tissues and given rise to the clinical signs of diverticulitis. Since then my colleague, Mr. Marxer, has been able to show that in the colon the outset of the disease can often be recognized before the little pouches have formed. This we call the prediverticular state. The nomenclature we adopt may, therefore, be set forth as follows:

I. Prediverticular state (in colon)	} Diverticulosis.
II. Quiescent diverticulosis	
III. Diverticulitis	

Each stage passes by gradations into the next; indeed, all the stages may be present in the same patient.

Our investigations have brought out three points. The first is that diverticulosis is much commoner than has been recognized hitherto. The second is that it is frequently associated with symptoms. The third point is that, contrary to the conclusions of nearly all writers on the subject, these symptoms are frequently amenable to treatment.

Diverticula may be found in each part of the alimentary canal, but are most frequent in two regions. The first is the duodenum or jejunum. These pouches are large, up to the size of a walnut, or bigger; they are often single, but there may be two, three, or, rarely, even more. The second region is the colon, from which small pouches arise up to the size of a pea, seldom as large as a blackberry; these are usually multiple and sometimes very numerous.

A review of the literature with references and details of our cases, which time does not permit us to deal with now, is in course of publication.*

DUODENAL DIVERTICULA.

Fig. 1 shows the radiological appearance of a typical pouch of the duodenum, a mushroom-shaped shadow being seen to lie on the inner side of the second part of the duodenum; it is connected with the gut by a fairly wide mouth, which is often indicated by streaks of barium lying in the folds of the mucous lining. These streaks are more obvious in Figs. 2 and 3.

Duodenal diverticula have been detected 38 times in the last 1,000 consecutive radiological examinations of the alimentary canal. The sexes were about equal—20 women and 18 men. In 32 of these patients only one pouch was seen. In 6 there were two or more, one patient showing half a dozen duodenal diverticula as well as several in the jejunum. In all there were 51 duodenal pouches, of which 30 were in the second part, 16 in the third, 4 in the fourth, and one in the first part.

The incidence in this series was rather larger than the above figures show; for we have learned recently that certain tiny shadows which had been thought to be due to a little barium having entered the ampulla of Vater were really incipient diverticula, as shown by re-examination of the patients after some years.

If a careful routine examination of the duodenum is made, with proper manipulations of the tube so as to get the different aspects of this part of the bowel into profile, no other special technique is needed. Details of the method will be found in the above-mentioned paper.⁴ In all cases the buttermilk meal was used.

It was assumed that these pouches, detected formerly at autopsy, were congenital in origin, and no doubt congenital pouches may, and do, occur. But the facts that they are nearly always found in later life (only two of these patients were under 40 years of age), and that we have seen the shadows grow in the course of years from a small dot to the size of a walnut or more, make it clear that, whether or no there be a congenital predisposition, the actual pouches arise in adult life. In Fig. 3 such a minute pocket can be seen lying close to a well developed diverticulum. A year later the small one had doubled its size. In the large bowel there is evidence, of which I shall speak shortly, that a local inflammation precedes the formation of diverticula. In the duodenum also it is possible that a local catarrh, by weakening the wall, predisposes to extrusion.

As a rule duodenal diverticula are not associated with duodenal ulceration, but are pushed out at weak parts of the wall, which are uncovered by peritoneum, and particularly in the region pierced by the common duct. In these patients there was only one pouch from the outer aspect of the duodenum (Fig. 4).

The largest diverticulum we have seen is shown in Fig. 5. Its vertical measurement was 4 inches. It arose from the second part of the duodenum. This photograph (left oblique) was taken one and a half hours after the opaque meal. The stomach was empty at five hours, but the pouch had not evacuated all its barium in three days, when the rest of the alimentary canal was clear. A large pocket arising from the third part of the duodenum is shown in Fig. 6.

Pouches of the jejunum can be seen in Figs. 3 and 7. They were observed in 7 patients in this series, in 4 of whom there were also pouches of the duodenum. In a recent case in which a solitary pocket of the jejunum was observed the abdomen was opened, for other reasons, and the pouch examined. It showed no pathological feature.

In the ileum diverticula (excluding Meckel's) were observed in 7 patients (0.7 per cent.); they were small (see Fig. 8), and more like those found in the large intestine, of which I shall speak in a few minutes. The appendix showed little pouches in 6 cases, one of which is illustrated in Fig. 9.

Symptoms.

Duodenal diverticula may give rise to no symptoms, and in such cases are found, if at all, during a routine radiological examination, made for some complaint of a different nature. In about half our cases, however—namely, in 18 (47 per cent.)—symptoms were present which, after careful clinical, radiological, chemical, and bacteriological examinations, were not otherwise explained, and were attributed to irritation from the pouch. Indeed, it is obvious that a blind alley, often slow in emptying, in which the contents of the alimentary canal can accumulate and decompose, will, on occasion, be a source of inflammation and discomfort. Further, the distension of a pouch by food, especially during contraction of the duodenum, or the pressure on surrounding structures, would be expected to cause disturbance.

The typical symptom is a heavy, tired, or distended feeling about the epigastrium coming on after food. The earliest interval given was half an hour and the longest three hours. In 6 patients the discomfort amounted to pain or aching, and in others nausea (6 cases), vomiting (3 cases), or diarrhoea (3 cases) was complained of. It appeared clear that in two cases symptoms of colitis were set up by the discharge of putrefactive matter from such a pouch.* In 2 cases blood was vomited. Headache, jaundice, and pain in the back were noted in one case each. In 5 of these patients the diverticulum was tender when gently pressed upon on the x-ray table; in one of them there was pancreatitis.

The symptoms are therefore various, as would be expected. They are usually, however, referred to the affected area. They sometimes suggest vaguely duodenal ulcer, but the time relations are less definite and relief with food is unusual; it was present in one only of this series.

Diagnosis.

The diagnosis is made by x rays. An exploration is much less certain, as these pouches are commonly not detected at an operation since they are extraperitoneal.

Treatment.

Treatment may be medical or surgical. In 13 out of the 18 patients whose complaints were due to irritation from duodenal pouches the symptoms were relieved entirely by a few weeks of medical treatment. The measures adopted were devised to aid the pouch to empty, to prevent or lessen putrefaction of its contents, and to promote the health of the rest of the alimentary canal.

It is often possible to observe on the x-ray table that a pouch will empty more quickly in a certain position. To this end it is necessary to define the relation of the mouth to the pouch itself and to the bowel from which it arises. For example, in the case shown in Fig. 5 the evacuation was helped if the patient lay on the right side. She was therefore directed to assume that position for half an hour at a time when most of the food would be leaving the duodenum—that is, about three hours after a meal, or, in practice, just before the next meal.

For lubrication of the pouch, liquid paraffin is given night and morning, and the patient is advised to take it always, in a minimum dose of a teaspoonful, and more if the bowels are not loose. Kerol is given two hours after a meal. The diverticulum lies so near the stomach that it is reasonable to expect the antiseptic to be effective. The kerol is omitted for about three days a fortnight to avoid any possible poisoning. Cream of magnesia or a carminative medicine often relieves discomfort or distension after food. If the gastric juice is deficient an acid drink is given after the chief meals. Food should be plain and well chewed; condiments and excess of meat should be avoided.

* In another patient in this series, who has since returned for treatment, intermittent epigastric pain, from duodenal pouches (Fig. 3), which goes through to the back, is followed for a few days by mucous colitis.

* This paper has since appeared (see Reference 4).

We have not found it possible to empty a diverticulum by manipulation; and if there is any tenderness or irritation it is better not to massage above the navel. The following are detailed examples of cases.

No. 2855.—Woman, aged 66. Eight months' history of discomfort in the epigastrium about an hour after food. Nausea in the night, vomiting bile in the morning; flatulence. The fractional test meal gave a normal gastric juice, but slow emptying, as of duodenal irritation. There was a diverticulum of the second part of the duodenum, which was tender (Fig. 2). No other lesion was found in the alimentary canal or elsewhere. The symptoms disappeared with treatment.

No. 2433.—Woman, aged 75. Thirty years' history of indigestion. The patient had been operated upon three years before for strangulation of bowel. Pain was present in the upper abdomen on waking; it was eased by food. There was also a tearing pain two to three hours after food, leaving a sore feeling in the epigastrium; also pain in the left flank, worse after motoring, and achylia. A very large double pouch (see Fig. 5), which retained material seventy-two hours, was connected with the second part of the duodenum. There were multiple small diverticula of the splenic flexure which were probably the cause of the pain in the left flank. Operation was not advised on account of great improvement with treatment, and of age.

No. 1424.—A man, aged 54, gave at least seventeen years' history of attacks of nausea and vomiting, discomfort in the lower abdomen three-quarters of an hour after food, and diarrhoea. Haematemesis three times. There was a double pouch, or two pouches, of the second part of the duodenum. Subacid gastric juice. There was no x-ray or faecal evidence of colitis. He recovered with treatment. Two and a half years later he wrote that he had kept well.

Surgical treatment was employed in one of these patients on whom an operation was performed for the diverticula.

No. 1571.—A man, aged 54, complained of nausea, with occasional vomiting, and attacks of diarrhoea. He had brought up blood three times in twenty-three years. Six or seven diverticula of the duodenum and three of the jejunum could be made out. X-ray photographs showed a maze of air spaces and levels of fluid secretion and of opaque food. The gastric juice contained no free hydrochloric acid, and suitable treatment for achylia, especially the administration of acid, gave much relief for a time. Vomiting recurred, however, and in 1921 gastro-enterostomy was performed. At the operation all but the postero-internal diverticula were traced. Three were seen in the second part of the duodenum, three or four in the third part, and three in the proximal jejunum. The largest pouch occupied the head of the pancreas; it showed a cicatrix at its mouth. Those in the proximal jejunum showed no evidence of former inflammation. After operation some nausea was complained of for a year, but now, four years later, it is rare. He has no other symptoms and follows an active life of work and recreation.

In cases which do not respond to medical treatment it appears that excision of the pouch would be beneficial and justifiable. It might not be possible in the case of diverticula which are embedded in the pancreas, and in these gastro-enterostomy might be done with advantage. Sir Harold Stiles, in a letter of May 24th, 1922, described the removal of a diverticulum 2½ inches long from the duodenum. "It was the size of a hen's egg, and the fundus of it presented between the stomach and the colon, covered by the upper layer of the transverse mesocolon. The neck, which admitted the forefinger, sprung from the region of the opening of the pancreatic duct, and the wall of the diverticulum contained small areas of pancreatic tissue. The muscular coat ended abruptly at the neck."

The pouches may be missed, as I have mentioned, by competent surgeons, to the detriment of the patient, even when their situation is known. We suggest that the mouth, which is seldom narrow, should be palpable, and that the opposite wall might be intussuscepted into it by the finger. It would be necessary to go behind the peritoneum to find the usual form of duodenal pouch. Mr. D. P. D. Wilkie, in a letter, states that from his experience there should be no difficulty in exposing the pouches by dissection.

Operation would have been recommended in at least two other of these patients had it not been that there were contraindications, including age, that the patients were no longer active, and that medical measures gave a reasonable degree of relief.

DIVERTICULA OF THE COLON.

The first point I wish to make about diverticulosis of the colon is that it is common. It was found in no fewer than 100 cases in this series of 1,000 radiological examinations of the bowel, of which 71 were men and 29 women. Like duodenal diverticulosis, it occurs in the latter part of life.

The average age was 58 years, whereas the average age of the 1,000 patients was 45 years. It is unlike the duodenal form in that the pouches are small and multiple, and that no one has seriously believed that they can be congenital in origin.

Diagnosis.

The diagnosis is made by x rays. The pouches may be detected with a barium enema, as shown in Fig. 10. They may be well shown with a barium meal, especially in those parts of the bowel in which the lumen is empty and the pouches remain filled, as in the descending colon in Fig. 11. They show up best, however, after the whole of the barium has left the lumen, as in Fig. 12. If the pouches are fairly large with wide necks the material in them empties readily; in those with narrow necks it breaks up and passes out in small fragments; a trail of such is shown in this figure in the left-hand part of the transverse colon at the top of the plate. If the neck of the pocket is exceedingly narrow it may, however, retain its material to form a stercolith. Faint shadows of stercoliths can be recognized along the descending colon in this photograph, and were obvious in the negative.

Diverticulosis is most frequent in the pelvic colon, though the descending part is also a common site. It may occur in all parts of the large intestine. We have also observed multiple diverticula of a similar nature, as I have already mentioned, in the terminal ileum. Fig. 13 shows graphically the distribution in the large bowel in these cases. The

FIG. 13.

sex-incidence is also shown, the upper striped part of each column representing the females.

The *prediverticular state*, the first stage of diverticulosis, was discovered by Mr. Marxer, and described briefly about two years ago.⁵ Part of the wall of the bowel, instead of showing its natural free curve of outline, appears fixed and contracted, with a profile of minute irregularities. This may only be seen on one side of the bowel, but if it involves the circumference there is the appearance of a stricture, as in the left-hand photograph of Fig. 14. In Fig. 15 several inches of bowel are involved. At the upper part formed diverticula are present, and further up there is the typical appearance of the second stage of diverticulosis, with pouches, and a normal or nearly normal segmentation of the bowel. When the *prediverticular state* involves the whole circumference the large bowel shows an appearance not unlike the normal outline of small gut. This is illustrated in Fig. 16. The *prediverticular appearance* is not the result of irritation from small herniae, as it precedes their formation. This appearance was detected in 20 out of the 100 cases in this series. If, however, we add cases investigated since, we have now recognized it in 37 cases. The areas affected are usually small and limited; but patches may be seen all about the colon, and in one case the whole of the descending colon and sigmoid were involved. It is while this stage is in progress that the minute herniae begin to be pushed through. Small diverticula can frequently be recognized in or near to the affected areas. In our experience the buttermilk meal is the best for showing the *prediverticular state*, or, indeed, for any other fine detail in the alimentary canal.

The second stage, of *formed diverticula*, may be associated with some irregular segmentation, but frequently is not. The small pouches are seen upon an otherwise normal bowel, as in Fig. 10. If the necks are narrow, material is retained within them and the barium extends partly round this residue, but does not displace it, giving a crescentic appearance, such as is seen in some of the pockets in

FIG. 1.—No. 612; male, aged 51. One hour after opaque meal; supine, right oblique. A diverticulum from the second part of the duodenum. A gastro-jejunostomy is seen on the right.

FIG. 2.—No. 2855; female, aged 66. Half an hour after meal; prone. A diverticulum from the second part of the duodenum. Note the plication of its mouth.

FIG. 7.—No. 2112; female, aged 69. One and a half hours; left oblique. A pouch beyond the duodeno-jejunal flexure, and a large one further on; there is also a typical extrapancreatic duodenal pouch, seen in its narrow profile, showing a concave outline where it lies against the pancreas.

FIG. 4.—No. 2446; female, aged 69. Five hours; supine. A large pouch arising from the free outer border about 5 inches from the pylorus. It appears to be segmented in the middle. There is also a deformity of the fourth part of the duodenum.

FIG. 3.—No. 2249; female, aged 48. Half an hour; supine, left oblique. A minute pocket can be seen close to a developed pouch. The small one was observed to have doubled its size a year later. Two jejunal diverticula are present.

FIG. 5.—No. 2433; female, aged 75. One and a half hours; supine, left oblique. A large pouch arising from the second part of the duodenum and pushing the duodenum forward.

FIG. 8.—No. 2635; female, aged 61. Eight and a half hours; supine. Small diverticula are seen along the inner border of the terminal ileum; these are comparable in appearance to the multiple colic diverticula.

FIG. 6.—No. 3022; female, aged 50. One and a half hours; prone. A good-sized pouch, with plicated neck, arising from the third part of the duodenum.

FIG. 9.—No. 1992; male, aged 48. Thirteen hours; supine, right oblique. A typical retro-externo-caecal appendix; a small diverticulum projects downwards from the highest point.

FIG. 10.—No. 2969; female, aged 44. A colon filled with a barium enema. Diverticula are seen protruding from the normal haustra.

FIG. 11.—No. 2589; male, aged 69. Seventy-two hours after the barium meal; prone. Large diverticula of the descending colon. Others are seen throughout the bowel. A kidney stone and the appendix can also be seen.

FIG. 12.—No. 1847; male, aged 69. Two hundred hours; prone. Residues in numerous diverticula; some typical crescentic shadows. Note the speckled trail, in the distal transverse colon, of fragments discharged from diverticula.

FIG. 14.—No. 2269; male, aged 61. Barium enema. The normal segmentation of the large bowel is replaced in the left-hand photograph by a rigid appearance of the wall with small irregularities. This is characteristic of the prediverticular state; in this case it involves the whole circumference of the gut for a couple of centimetres, causing an apparent constriction. The right-hand photograph shows the same piece of bowel after three months' treatment.

FIG. 16.—No. 2620; male, aged 56. Barium enema. The outline of a prediverticular area is compared with that of normal small intestine.

FIG. 15.—No. 1638; male, aged 35. Barium enema. Shows the prediverticular state involving the whole circumference of a long stretch of bowel; formed diverticula are seen in the upper part.

FIG. 17.—No. 1163; male, aged 63. Barium enema. Shows the rigid spoked appearance of diverticulitis, with inflammatory thickening of the bowel walls. The haustra near by showed overactivity.

FIG. 19.—Diverticulitis. Twenty-four hours after barium meal. A constriction of the sigmoid is seen, and the bowel at this region was adherent to the bladder. Further up are diverticula of the iliac colon.

Fig. 12, especially in the ascending colon. When the necks are not so narrow the intestinal contents pass freely in and out, and pouches photographed when full show their natural globular shape.

The third stage, of *diverticulitis*, has been recognized for several years and has been well described. It is due to inflammation of a pouch or pouches which involves the wall of the bowel in the first instance. Surrounding tissues are implicated later, causing a soft tender tumour, usually in the left iliac fossa, which may lead to obstruction, and frequently is thought at first to be malignant. The x-ray appearance is characteristic. Instead of rounded pouches are seen palisade or spike-like processes (Fig. 17) set at various angles to the lumen. They are the remains of the pouches squeezed to this shape by the oedematous and inflamed bowel wall around them. They are rigid, whereas the neighbouring haustra not involved in the inflammatory process are overactive, frequently changing their shape.

Inflammation may, of course, occur in or around a single diverticulum, and diverticulitis, in the strict sense, may arise at any time after the little pockets have become established; but the developed surgical diverticulitis I have just described is a late phenomenon, and most cases of diverticulosis never reach that stage. For example, in this series there were 5 cases only—that is, 5 per cent. Obstruction, for which colostomy was done, supervened in two of these.

Etiology.

The discovery of the prediverticular state alters the previous conception of the nature of diverticulosis. The pockets were thought formerly to be mere passive extrusions of mucous membrane through weak places in the bowel, particularly where the blood vessels pierce the wall, pushed through by internal pressure. But these observations suggest that some antecedent process takes place in the parts which are to be affected, weakening or thinning definite areas and making them liable to herniation. There is apparently a local irritation or inflammation in the first instance, the nature of which is not at present known. A bacterial cause is naturally suspected, as the mucous lining of the bowel is bathed continually with material which swarms with a variety of micro-organisms. Our colleagues, Dr. Patterson and Mr. Jeffery, have found that haemolytic streptococci are much more frequent in the faeces of patients showing the prediverticular state than in those of others; but these organisms may be found in as many as 30 per cent. of non-diverticulosis patients, so that the investigation must be extended to a much larger series of cases before conclusions can be drawn. It may be noted that the commonest site of diverticulosis—namely, the sigmoid flexure—is one that is especially exposed to toxic or bacterial damage from faeces; for after defaecation there is often some semi-fluid material from the transverse colon left lying here which inspissates gradually until the next movement—one, two, or more days later.

There is further evidence of a different nature to suggest that diverticulosis may be due to, or associated with, a chronic infective process. Mr. Marxer noted that spondylitis, with liability to lumbago and fibrositis, was often found in the patients with multiple diverticula. Arthritic changes are, of course, often observed, if looked for, in the spines of elderly people; and we therefore made a comparison of the films of the vertebral column obtained in the routine screening of 100 non-diverticulosis patients of the same average age (58 years) as the diverticulosis patients in this series. In the former arthritic changes could be observed in 20 per cent.; in the latter in 72 per cent. In 1,000 consecutive cases arthritic changes were seen in 19 per cent. Further, apical granulomata of the teeth, which were present in 38 per cent. of the non-diverticulosis control patients, were found in 65 per cent. of the diverticulosis. These relationships are shown in Fig. 18. In many other cases some established infective or septic condition was present, such as appendicitis, gall stones, or arthritis. Fig. 15, for example, which shows a large area of the prediverticular state, was taken from a young man with a progressive subacute arthritis.

It is obvious that the association of diverticulosis in its late stages with infective states may be, and no doubt

frequently is, in the reverse sense to that suggested; that is to say, that septic absorption from purulent material in infected diverticula may give rise to, or favours, sepsis in various parts of the body.

Constipation has been regarded as an important cause of diverticulosis. It was present, and proved radiologically, in half of these patients, but was not more frequent than in the non-diverticulosis. Most were taking purgatives, and would periodically be irritating the bowel wall therewith and producing stools which were more fluid than normal. We do not know whether the constipation or the aperients are the more harmful, on the average, to the vitality of the bowel wall. No association could be traced with colitis.

Symptoms.

No symptoms could be certainly recognized as pertaining to the prediverticular state, but in some instances the area involved was tender to palpation on the x-ray table.

In the second stage, of established diverticula, in about one-third of the cases there were no symptoms and no x-ray evidence of irritation of the bowel. The earlier irritation of the bowel seems to have subsided and the condition may be quiescent for long periods. In many others there were symptoms which were unexplained by any other pathological state which might be present and must therefore be ascribed to the diverticulosis. Out of the

FIG. 18.—Comparison with 100 patients of same average sex and age (58) but without diverticulosis.

whole 100 cases, flatulence and abdominal pain or discomfort were frequent in nearly a half. Other symptoms, in more advanced cases, were pain or discomfort before or after defaecation, diarrhoea, alternating constipation and diarrhoea, and irregular micturition.

The following two cases may be quoted—one in the first stage and one with established diverticula:

A man, aged 51, who had frequently had influenza, complained of repeated lumbago, headaches, passage of much flatus by the bowel, and constipation. The teeth were defective; x rays showed abscesses at the apices of some of them, also exostoses in the region of the fifth lumbar vertebra, and a prediverticular state of the descending and pelvic colon. The affected teeth were extracted and the bowel and general health treated, with complete relief.

A man, aged 57, had noticed for four years a sense of incomplete evacuation of the rectum. His abdomen had been opened twice in that time, and the appendix removed, but no adequate reason for his discomfort was found. The sigmoid had been stitched to the anterior abdominal wall. On admission he complained of constant discomfort in the left iliac fossa, a sense of incomplete evacuation, and frequent micturition after an action of the bowels. X-ray examination showed diverticulosis of the descending colon and the sigmoid with mild diverticulitis. With treatment the general health improved steadily and the symptoms diminished. On readmission eighteen months later for another condition, no complaint was made of the abdominal symptoms, which had gradually disappeared.

whole 100 cases, flatulence and abdominal pain or discomfort are pain, intermittent and subacute, usually in the left iliac fossa, and a tender tumour. There may be obstruction, but it is surprising how long an inflamed, thickened, oedematous bowel may continue to be patent, with reasonable care. Adhesion to the bladder is frequent

and a vesical fistula may form. Fig. 19 shows a constriction which was adherent to the bladder. Perforation into the peritoneal cavity is rare, but may occur.

Carcinoma may arise in a diverticulous bowel, but is not frequent. There were 5 cases in our series, a smaller number than was found in 100 control patients of the same age.

Treatment.

Nearly all writers hitherto have been pessimistic about the treatment of a diverticulous bowel, some going so far as to suggest that nothing but excision of the affected bowel, which is often dangerous and not always possible, is likely to help. I can assert confidently that a practical trial of systematic treatment leads to an opposite conclusion. Nearly all cases of diverticulosis of the large bowel can be kept in health by simple medical measures; and the very few who are not can be relieved by surgery.

Paraffin is given morning and evening to permeate the faeces, grease the pockets, and help them to empty easily, without the irritation of purgatives. Even if the bowels are open naturally the oil is not omitted though the dose may be reduced to a teaspoonful twice a day. The risk of putrefaction and inflammation would be eliminated if faecal matter could be prevented from lying and putrefying in the diverticula.

It is doubtful how far antiseptics given by the mouth can affect the contents of the large bowel. In some cases I have thought that benefit has followed the use of kerol, dimol, or similar drugs. We usually douche the bowel with saline on alternate days for a few weeks with the same object. Such douches must be given at a low pressure, not more than 18 inches, the patient lying first on the left and then on the right side, and taking half a dozen deep breaths in each position. With this procedure the whole of the large bowel can be filled, as is shown daily in the x-ray room with the barium enema. The use of the so-called high or long tube, which I still find practised, is futile. It nearly always curls up, and if it did not might be harmful. It is only necessary to let the fluid run into the rectum. More than two pints should never be used. Fig. 14 shows the improvement in the prediverticular state which followed a course of douching. The constriction seen on the left is no longer obvious in the right-hand figure.

The action of the bowels is aided by the use of an anti-constipation lacto-vegetarian diet, modified to suit the individual. The following is an example:

7 a.m.—1/2 oz. of paraffin in 2 oz. of warm milk.

8 a.m.—Coffee and milk; one tablespoonful of milk sugar; wholemeal bread, butter, honey, or marmalade.

10.30 a.m.—A glass of buttermilk; wholemeal bread and butter.

1 p.m.—Fish (cooked any way); butter sauce; salad and dressing; compôte of fruit; cream; toast and butter.

4 p.m.—Coffee, with milk or cream; marmalade; wholemeal bread (toasted if desired) and butter.

7.30 p.m.—Vegetable soup; some egg dish (poached, scrambled, or omelette) with vegetables or fruit—for instance, jam or jelly omelette or omelette aux fines herbes; cream cheese; wholemeal bread; butter.

The patient is told not to strain at stool, but to take plenty of time, making a short effort every third breath.

The general treatment consists, in the first place, of removal, so far as possible, of all septic states, such as diseased teeth or tonsils, or an inflamed gall bladder or appendix, provided that the state of the patient justifies the appropriate operation. A regular life with prescribed rests and exercise is of great assistance in improving the tone of the body generally and with it that of the alimentary tube. Flatulent indigestion and lack of appetite are treated by carminatives or tonics and such other measures as are indicated.

A diverticulous area should never be massaged. In a recent case in which the disease had doubtless from the appearances been present for years, severe symptoms were aroused by a course of massage which had been given about three months before the patient sought admission.

The results of medical treatment in this series were that, out of 53 patients who complained of symptoms, complete relief was obtained after a few weeks' treatment in 36. In 5 others the only symptom left was occasional flatulence, and in others there was improvement. There was no mortality.

Surgical treatment is needed if perforation of a pocket into the general peritoneal cavity takes place. This is rare, and there was no case in the series. It may also be called for if a fistula forms between the bowel and the bladder or other viscus. The most frequent need of operation is for obstruction. I have mentioned that a colostomy proved necessary in two of these cases. I should, however, not be in a hurry to operate unless there were unmistakable clinical or radiological evidence of dilatation of the bowel above the affected area or unless the condition of the patient were becoming serious; for an area of diverticulitis is capable of a remarkable degree of recovery with douching from below and paraffin from above, with perhaps a simple purgative, such as salts, as a preliminary measure; and, once recovered, it will continue patent for an indefinite period, if kept clean. The advantage of avoiding a colostomy is obvious.

The excision of an obstructed area of bowel affected with diverticulitis is frequently not possible because of adhesion or because the affection is not localized enough. I have, however, recently seen Mr. Lockhart-Mummery remove with success such a diverticulitic tumour from the sigmoid, doing an end-to-end resection.

SUMMARY.

Diverticula of the duodenum are not uncommon. They are usually single, or few, can be seen to arise in adult life, and to increase in size over the course of years. They frequently cause symptoms, which can usually be relieved by medical treatment. Intractable cases can be treated surgically.

Multiple diverticulosis of the colon is frequent. The formation of the small herniae is preceded by irritation or inflammation of the area of the bowel involved—the prediverticular state. Diverticulosis is frequently associated with various infective states elsewhere, and particularly with arthritic changes in the spine and apical tooth abscesses. It is suggested that it may be infective in origin. In late stages it is a source of sepsis.

The diverticula when formed may give rise to no disturbance for long periods. In half of the cases, however, there were symptoms referable to the diverticula. These symptoms were amenable to medical treatment in nearly all cases. The terminal stage of surgical diverticulitis was present in 5 only out of 100 cases.

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THE HAEMOCHROMOGEN CRYSTAL TEST FOR BLOOD.

BY

DOUGLAS J. A. KERR, M.B., M.R.C.P., D.P.H.,

AND

VICTOR H. MASON, M.C., M.B., Ch.B.

(From the Forensic Medicine Department, Edinburgh University.)

SINCE Teichmann in 1853 succeeded in producing haemin crystals, this chemical blood test has been generally regarded as a valuable and conclusive proof of the presence of blood in a stain. The procedure is simple, but unfortunately the test is not always successful, either owing to overheating, to the acid not being pure, to the inhibitory influence of rust, fat, etc., or to some change in the blood.

Numerous modifications of Teichmann's process have been advocated, but while some are an improvement the fact remains that even in experienced hands the test frequently gives negative results in the undoubted presence of blood. The uncertainty of the successful production of haemin crystals led to attempts to utilize other crystal tests for medico-legal purposes.

In 1889 Hoppe-Seyler was able to crystallize haemochromogen, and later Donagány, and also Bürker in 1909,¹