Observations

ON

DIVERTICULA OF THE COLON AND THEIR SEQUELAE

BY

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(With Special Plate)

The formation of diverticula in the wall of the colon and the consequences which may result therefrom have within recent years become of increasing importance in the surgery of that organ. Diverticula are the commonest pathological lesions seen in the large bowel, and they are responsible for the majority of cases of disease of the colon brought to the surgeon and to the radiologist. There is probably no abnormality or disease of the alimentary tract in which radiology has been of more service, both in arriving at a correct diagnosis and in watching the progress of the disease. Uncomplicated cases of diverticula of the colon show no external signs, and the condition cannot be recognized without the aid of x rays. Our clinical and radiological experiences will, we hope, prove of value in estimating the probable or possible results in cases of this description.

ETIOLOGY

Normally the mucous membrane of the colon is supported by the circular and longitudinal muscle coats which exist in a continuous sheath between it and the peritoneal covering, and which afford a sufficiently firm support, preventing any tendency to herniation of the mucosa. After about the age of 45 there appears to be a tendency in certain individuals for this muscle sheath to lose its tone; as a result of this, bulging of the mucous membrane tends to occur at the weakest points, these being between the circular muscle fibres, and especially where blood vessels pass through from the outside. The tendency appears to be definitely associated with a propensity to the deposit of excessive fat in the abdomen and elsewhere. Beyond the fact that advancing age has something to do with it, we do not know the cause of this syndrome. We believe that not uncommonly the condition occurs in people who in earlier life had good muscular development and led active, and often athletic, lives.

X-RAY TECHNIQUE

When the diverticulum has protruded beyond, and has therefore lost the support of the muscular coat, it becomes dilated into a circular pouch, varying in size from that of a small shot to a large hazel nut, connected to the lumen of the colon by a narrow neck. The dilated part of the diverticulum is therefore extraluminal, and when filled with barium gives the typical flask-shaped appearance of an opaque rounded shadow projecting beyond the margin of the bowel wall. It is this phenomenon, combined with the fact that these pockets retain the barium long after the lumen of the colon is empty, which distinguishes the radiographic appearances of the condition from any other, and makes it possible to estimate the extent of the disease by x -ray examination, of which there are two methods—namely, that of the barium meal and that of the barium enema. The latter is the most efficient procedure. Diverticula can often be recognized by the barium meal method, but it is a very inexact one, and

in this paper the radiographic appearances after the injection with a barium enema will be considered alone.

Although much can be written on the technique of a barium enema examination, it is unnecessary to discuss it here; there are two points, however, which are essential to a satisfactory examination, and which receive not infrequently less attention than they deserve. In the first place, immediately prior to the examination, the colon must be thoroughly emptied by means of a high colonic douche. Unless this is done, retained faeces may cause pseudo-filling defects; apart from this, previous emptying of the bowel enables an important prognostic point to be made, for if the diverticula fill with barium (as shown in Figure 1) they are capable of being emptied by the douche. On the other hand, central translucent areas surrounded by thin opaque lines of barium in the diverticula (Fig. 2) indicate that the latter contain inspissated faecal matter or concretions which have not been moved by the douche. This is an extremely important point, both in prognosis and in treatment, since it is the retained faecal matter within the pouches which sets up inflammation in the diverticulum and in the surrounding bowel wall.

Another point which is not often recognized is that x ray photographs of the colon are photographs of shadows, and since we are looking for irregularities of the colon outline, a postero-anterior view alone will give a very inadequate picture. In order, therefore, to estimate the extent of the damage accurately, and to see all the diverticula, it is necessary to take photographs in several planes. A photograph in one plane only will miss much that might otherwise be seen. The recto-sigmoidal junction almost invariably, and several inches of the sigmoid colon frequently, are concealed by the upper end of the rectum in a postero-anterior view. The lumina of the hepatic and splenic angles usually overlap one another in this position, and lesions in this region may easily be missed if the radiography and screening are confined to one position. A view in any one plane shows only two borders and one surface; thus the gut must be observed in several planes.

Figures 3, 4, and 5 show consecutive radiograms of the same case made in three different positions. Figure 3, taken in the postero-anterior position, shows an apparently normal colon with, presumably, a sharp "kink" at the junction of the descending and iliac colons. The right oblique position (Fig. 4), however, reveals a well-marked redundant loop of the ascending colon, and shows how easily a lesion in this neighbourhood can be missed if the oblique view is not taken. The left oblique view (Fig. 5), on the other hand, shows that the sharp "kink" in Figure 3 is a gradual curve in the gut with two small diverticula projecting from it on the upper and lower extremities. This was not obvious in either of the other photographs. Finally, both the oblique views make it clear how the recto-sigmoidal junction and much of the sigmoid colon were concealed in the antero-posterior view. Figures 6 and 7 are radiograms of another case taken in the postero-anterior and left oblique positions respectively. In the postero-anterior view we get no idea of the very marked condition of diverticulosis which is so clearly seen in the left oblique view. These two cases are illustrative of many, and show how dangerous it is to rely on screening and radiographing in one position only.

OBSERVATIONS OF BARIUM ENEMA

In our practice the patient is carefully screened during the injection of the barium enema. By turning the patient to the left the whole length of the sigmoid flexure can be brought into view, and by moving him about, the superimposed shadows of the hepatic and splenic flexures can be separated. The right oblique position enables us to see the posterior wall of the caecum. The rate of

flow of the barium is noted in order to ascertain if there is any delay, as might occur at an obstructed point or narrowing of the lumen. Extramural shadows are also carefully watched for, and if any abnormalities are observed, palpation will indicate whether they correspond to a tumour we can feel or whether the colon at this point is movable or tender. Occasionally the progress of the enema will be brought to a complete standstill for a variable period. Obviously this condition cannot be a complete obstruction, otherwise the patient would not be undergoing an *x*-ray examination. Such a delay in the passage may be due to:

1. Spasm—(a) brought about by some intrinsic lesion, or (b) due to reflex irritation from some extrinsic lesion, such as gall-stones.
2. Invagination of the mucosa into a constricted portion of the lumen with consequent ball-valve effect.

It is obvious that the presence of a constriction causing delay in the flow of the enema emphasizes the necessity of filling the colon completely and of determining the exact cause of the stoppage. A report that "there is a complete obstruction to the flow of the enema" is of little help. In the majority of such cases obstruction to the flow of the enema may be overcome by lowered pressure and massage. This may have to be continued for some time, but it will be found that eventually the barium passes on and shows the condition of the bowel beyond. Increasing the pressure of the enema in such circumstances is useless, as it tends to increase the spasm. In the rare cases in which massage combined with low pressure does not have the desired effect, the only alternative is to give the patient a barium meal, and when the head of that meal has reached the area in question, to introduce a barium enema to meet it.

The "dual exposure" method has been used by one of us for some years to distinguish between spasmodic and organic narrowing of the colon. Under normal conditions, peristaltic action in the colon is infrequent, but when it is distended with warm fluid, as is the case when a barium enema is being given, peristalsis is much increased. Two radiographic exposures are made on one film at an interval of ten seconds, the patient keeping still and holding his breath during this period. A peristaltic wave passing in this interval will cause the colon to have a double symmetrical outline. When there is any fixation or thickening of the bowel wall a localized single outline will be seen in the affected portion of the colon. Figure 8 shows a dual exposure radiogram of the colon. It will be noted that there is a double outline, except in the area affected by diverticulitis.

DEVELOPMENT OF DIVERTICULA

The earliest stage in the development of diverticula is shown on a radiogram as a serrated margin on the outline of the colon. Dr. Spriggs and Mr. Marxer have described this as a prediverticular stage, and consider that it is inflammatory in origin. Dr. Dukes and ourselves have, however, been able to show that this appearance is not due to inflammation, but is caused by very small and numerous diverticular "buds" in the colonic wall. Figure A below, and Figure 9 in the special plate, if compared, make this very clear; the former is a microscopical section of the colon wall at an early stage in the development of diverticula, and the latter is an *x*-ray photograph of the bowel in a similar condition. Figure 10 shows the next stage, in which the diverticula have broadened out owing to their having passed through the muscular coat. A still later stage showing large diverticula illustrates further development (Fig. 11). Here the diverticula have completely protruded beyond the muscular coat, and, in the absence of supporting structures round them, have become

distended to form a typical globular outline. The necks connecting them to the lumen of the bowel are still narrow at the points at which they pass through the muscular coat.

Owing to the arrangement of the muscular fibres diverticula do not occur in the rectum. The commonest situation is the pelvic colon. Diverticulosis may be found throughout the large bowel, and it has occurred in the appendix. All cases start as a simple pouching of the mucosa through the muscular coat without any complicating, or preceding, inflammation. It is the occurrence of inflammation within the walls which is the dangerous element; the presence of diverticula without accompanying inflammation is usually harmless, but we have reason to believe that diverticula unaccompanied by inflammation may occasionally be the cause of very serious mischief. We have seen a case in which an apparently uninfamed

FIG. A.—Early diverticulitis.

diverticulum has suddenly given way by perforation into the peritoneal cavity. In one case of this type the patient had been under observation by both of us for some time. He had extensive diverticulosis of the entire colon, including the appendix (Fig. 12), but had never shown symptoms of it; indeed, the condition was originally discovered by accident. A sudden perforation in one of the diverticula occurred, with disastrous consequences, while he was travelling abroad.

When inflammatory changes have occurred in the walls of the diverticula, as proved by symptoms of pain and tenderness, and by *x*-ray evidence of adhesions and fixation of the bowel wall, the danger is very much greater, and further trouble is inevitable, although with proper care and suitable treatment such trouble may be modified or postponed for long periods. The following is a good example of this:

The patient was a lady, aged 65, who was originally examined because she was thought to be suffering from a neoplasm of the colon. She was very stout, there being a considerable layer of abdominal fat. There was tenderness, inflammation, and an easily felt tumour; the diagnosis was diverticulitis of the pelvic colon. She was carefully treated and kept under observation for two years. She improved very much and remained well, except for occasional slight attacks of pain, but in spite of the treatment she eventually developed obstruction, and a colostomy had to be performed above the damaged area. Since then she has remained in good health.

It has been our custom to interview and *x*-ray our patients every six months. We believe that this practice has proved of value, as it allows us to check treatment and, if possible, to evade perforation or other disasters.

PROGRESS OF THE DISEASE

The mode of progression of the disease varies very much. When inflammation of the colon wall occurs at an early stage in the development of diverticula there is a tendency for the deposition in the bowel wall of fibrous tissue, which in course of time forms a dense stricture.

Under x rays such a condition will show a filling defect, and fixation of the colon. Recently at operation on two cases of this type there was found in both a section of the colon wall, several inches in length, acutely inflamed and densely thickened, with the minute diverticula bulging through the peritoneum. The condition resembled a sort of cellulitis of the bowel wall.

When there is a simple diverticulosis we have noticed that if photographs taken at different periods are compared fresh diverticula can usually be seen, and that some of the previously existing ones are larger. From a study of a number of such cases it seems that, while inflammatory complications may be held in check and often made to retrogress by appropriate treatment, it is not possible to prevent the diverticula from becoming larger or to make them decrease in number unless the faecal contents are deflected from the affected area by a colostomy or short circuit. From the patient's point of view the diverticula do not cause any symptoms as long as inflammatory complications can be avoided. Unfortunately, patients tend to get careless when they have no symptoms, and they think they are quite well and need not continue the treatment. This too often results in acute complications, which may be disastrous. One patient, after being quite well for several years, perforated suddenly while travelling from Paris to London, and died from acute peritonitis. Another patient suddenly developed a perforation into the bladder.

CANCER AND DIVERTICULITIS

Occasionally cancer undoubtedly occurs as a direct result of previously existing diverticulitis. It is, however, a rare complication, and in the only cases met with in which diverticulitis was a direct causal factor there had been extensive inflammatory complications lasting over very many years. One patient had septic sinuses communicating with the colon on the abdominal wall and in the perineum; cancerous changes had occurred in two of the sinuses and had spread to the skin. In another case, an adenocarcinoma had developed and spread on to the abdominal wall along the track of a septic faecal sinus. In a number of patients carcinomatous growth has been found associated with diverticula in the colon. There has been nothing to prove, however, that one condition was a causative factor of the other, and it is more probable that the association was accidental. We have to remember that both diverticula and carcinoma tend to occur at about the same period of human life, and it is therefore not improbable that they may occasionally be found associated in the same individual. The only fact of importance that seems to be established in this connexion is that cancer may sometimes supervene upon a neglected and chronically septic diverticulitis.

TREATMENT

We do not propose in this paper to discuss at length the treatment of diverticula of the colon. We have still very much to learn, and there is ample room for improvement of our methods to-day. At present we can do little, if anything, to prevent the development of diverticula, or to stop their increase either in size or in number. Nevertheless, careful treatment will do much to prevent complications, or, if complications have occurred or are obviously threatening, to obviate such fatal or serious results as perforation into the bladder or peritoneal cavity. Operations for diverticulitis, the inflammation from which has spread to other organs, or has resulted in obstruction, are among the most difficult of surgical procedures. Results are often excellent, however, and patients who have become hopeless invalids can be restored to good health and usefulness. A chronic septic condition, as

exists in diverticulitis, is apt in time to be a source of similar trouble in other parts of the body not within the immediate neighbourhood of the lesion. Cases of chronic septic arthritis, phlebitis, thrombosis, empyema, and meningitis, have all come within our experience, while chronic sepsis of the urinary tract is quite commonly associated with the condition.

The best results have been obtained in cases in which the affected portion of the colon could be completely resected and the bowel joined up again; this is the one condition which can be completely cured. We have had several such cases, but unfortunately it is rare to find the lesion sufficiently localized at one portion of the colon to render resection possible.

CONCLUSIONS

1. Diverticula of the colon are not the result of inflammation, and inflammatory conditions of the colon wall which often follow diverticula are always secondary.
2. In spite of treatment, diverticula of the colon, once formed, tend to increase both in size and in number.
3. This increase is often very slow, and may be unaccompanied by symptoms.
4. In the absence of secondary inflammation, diverticula do not, as a rule, cause trouble, but we have reason to believe that exceptionally sudden perforation from the giving way of a diverticulum may occur, apart from any complicating inflammation.
5. A definite diverticulitis is always a very serious lesion, with grave possibilities.
6. A sudden disaster from perforation is not so uncommon as is often supposed.
7. Suppurative diverticulitis is occasionally followed by carcinoma, but it is not a common causal factor of cancer.
8. Operative treatment should not be left until after some grave complication has occurred, but should be timed so as to anticipate and to prevent such disaster.

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THE KELOID OVARY*

BY

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The uterus is the passive partner in the group of sexual organs. Its function is not to originate impulses nor to elaborate hormones, but simply to be *sensitive* to impulses or hormones originated by the more active partners, of which the most prominent, if not actually the most active, are the ovaries. It is important, I think, when considering diseases of the uterus, to bear in mind its state of physiological dependence. It is important because it may possibly lead to the view that symptoms of disease of the uterus—for example, uterine haemorrhage and dysmenorrhoea, associated, perhaps, with definite pathological changes in the endometrium—may be due to a disease or disorder of function originating in the ovary. For instance, the ovary may fail to send any message at all to the uterus, or, on the other hand, it may send so disordered a signal that the endometrium is left, as it were, in a state of uncertainty how to react to it.

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J. P. LOCKHART-MUMMERY AND H. GRAHAM HODGSON: DIVERTICULA OF THE COLON AND THEIR SEQUELAE

FIG. 1.—Showing the homogeneous filling of the diverticula.

FIG. 2.—Numerous diverticula in the distal colon, differing from those seen in Fig. 1, in that they do not fill homogeneously, but show a central translucency and a peripheral opacity.

FIG. 3.—Postero-anterior view. Note the seemingly normal ascending colon and the apparent "kink" in the descending colon.

FIG. 4.—Same case as in Fig. 3. Radiogram taken in the right oblique position. Note redundancy of ascending colon. A filling defect, if present in such a loop, might be overlooked in the postero-anterior view.

J. P. LOCKHART-MUMMERY AND H. GRAHAM HODGSON: DIVERTICULA OF THE COLON AND THEIR SEQUELAE

FIG. 5.—Left oblique view. Same case as in Figs. 3 and 4. Apparent kink in Fig. 3 is here shown to be a smooth curve. The diverticula are indicated by arrows. The whole extent of the sigmoid colon is seen only in this figure and in Fig. 4.

FIG. 6.—Postero-anterior view, showing an apparently normal colon.

FIG. 7.—The same case as in Fig. 6, but shown in the left oblique position. Note the numerous diverticula, completely concealed in Fig. 6.

FIG. 8.—Showing the cessation of the double outline in the constricted area.

J. P. LOCKHART-MUMMERY AND H. GRAHAM-HODGSON: DIVERTICULA OF THE COLON AND THEIR SEQUELAE

FIG. 9.—The earliest stage: serration of the bowel wall, due to "diverticular buds."

FIG. 10.—A later stage: "diverticular buds," together with some fully formed small diverticula.

FIG. 11.—Large diverticula, small diverticula, and "buds."

FIG. 12.—Showing numerous diverticula throughout the colon, a few being present even in the appendix.