

DIVERTICULA OF THE SIGMOID

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MY INTEREST in diverticula of the intestinal tract was first aroused by the classical contribution of Reginald Fitz in 1888, on diverticula of the intestine, although this paper was devoted largely to diverticula of the Meckel type.

Diverticula of the colon were first described by Cruveilhier, in 1849. In 1857, Habershon, a physician, published the first account of diverticulitis in English. In 1858, Sidney Jones reported a striking case of acute diverticulitis which resulted in a fistulous connection between the bladder and the sigmoid. However, attention was not generally attracted to diverticulitis of the sigmoid until 1889, when Graser of Erlangen emphasized the frequency and significance of the disease. The first comprehensive treatise embodying both etiology and classification was brought out by Edwin Beer in 1904. This has been followed by papers by Telling, Drummond, Mummery, Hartwell, Brewer, Rogers, Mailer, and others. In 1907, Moynihan's classical paper on its mimicry of carcinoma of the colon appeared, and this deservedly received much attention. In 1907, Wilson, Giffin, and I reported five cases in which a portion of the sigmoid was excised for obstructive diverticulitis with the formation of tumor; these were the first instances recorded in which an actual demonstration of the pathologic change in diverticulitis was made during the life of the patient.

There are two types of diverticula of the colon, the true and the acquired. In true diverticula of the congenital, traction, or pulsion types, all the intestinal coats cover the sac. In diverticula of the acquired type, the mucous membrane of the intestine pouches through small openings in the musculature at weak points in the wall of the colon, such as holes for vessels or defects of muscle. Such diverticula often contain small hardened fecal masses. The sigmoid nearly always is involved in diverticulosis. If the entire colon is affected, there usually is a gradual increase in the frequency of the diverticula from right to left. The diagnosis of diverticulosis now rests securely on radiographic evidence.

Records at the clinic show a total of 2,139 cases of diverticulosis. Robertson's observations on our post-mortem service show that 5+ per cent. of persons more than forty years of age have diverticulosis, and his data approximate as to frequency those based on X-ray evidence. Thus, in the period from 1924 to April 1, 1930, inclusive, 31,838 X-ray examinations of the colon were made for general diagnostic purposes, and in 1,819 of these (5.71 per cent.) diverticula were present. Only twenty of these 1,819 patients were less than forty years of age. Of our 2,139 recorded cases of diverticulosis, active diverticulitis was present in 696 at the time the patients

were examined. Inasmuch as in the earlier period, prior to 1916, only the cases of diverticulitis were recognized and properly recorded, these figures are of little value in establishing the frequency with which diverticulosis gives rise to diverticulitis. Statistics of the later period give 12+ per cent. of cases of diverticulosis resulting in diverticulitis, but for obvious reasons this is probably an overestimate. A study of the relative incidence of diverticulosis in men and women in this group of cases showed that 64 per cent. of the patients were men; 36 per cent. were women. As constipation is more common in women, these figures would seem to show that it is not an important factor in the causation of diverticulosis. Nor can much significance be attached to obesity as an etiologic factor, inasmuch as the percentage of patients who were underweight was about the same as that of those who were overweight.

CLINICAL FEATURES.—With rare exceptions, the type of inflammation of diverticula which we speak of as diverticulitis is confined to the sigmoid. The inflammatory condition usually is limited to one or several diverticula, but a considerable length of the bowel may be obstructed and greatly thickened from œdema and adhesive inflammation; thus a well-marked tumor in the lower part of the abdomen to the left of the median line often, if not usually, forms during the acute stage. Cases of the disease may be classified clinically into four groups.

Group 1. Self-limiting diverticulitis and peridiverticulitis.—The symptoms of acute diverticulitis are pain in the region of the mass, which often is palpable, a moderate degree of fever, and gaseous distention. As a rule these symptoms are not severe, and, although the temperature may be elevated one or two degrees, the patients are often ambulatory after the first day or two, and the tumor usually disappears in the course of a few weeks.

Group 2. Diverticulitis and peridiverticulitis with formation of abscess resulting in entero-intestinal, enterovesical, enterocutaneous, and other fistulæ.—This group includes those cases in which infections (either localized peritonitis with formation of abscess, or the results of infectious processes which connect the diseased sigmoid with the neighboring intestine, the bladder, or the skin) lead to the necessity for surgical interference. Rarely, an infected diverticulum in the terminal portion of the sigmoid may be the cause of an abscess resulting in an intractable fistula in the posterior anal region, as pointed out by C. H. Mayo.

Group 3. Diverticulitis complicated by obstruction of the bowel.—In acute diverticulitis the obstruction is the result of infection and œdema. Chronic obstruction is due to hyperplasia, adhesions, and angulation (the hyperplastic stenosing type). The conditions are practically identical with those in Groups 1 and 2, but the additional factor of obstruction in these cases is so serious a feature that it seems best to classify them independently. It is surprising, however, when the entire mass is dissected out and the diseased bowel laid open, to find so little actual obliteration of the lumen of

the bowel, and, unlike cases of carcinoma of the sigmoid, the obstruction is rarely complete.

Group 4. Carcinoma developing on a diverticulum.—This group is of great interest. In rare cases the carcinoma may have such a definite relationship to the diverticulitis as to make it reasonable to assume that infection and irritation by hardened fecal masses in diverticula might have been the cause of chronic irritation and pre-cancerous change. Until recently, the only known fact of significance in the etiology of carcinoma was its relation to chronic irritation. Today the question of individual susceptibility to carcinoma is beginning to attract scientific attention. The term "pre-cancerous" is used to denote certain cell changes taking place in areas of chronic irritation, which would be typical of carcinoma if found in connection with invasion of the tissues.

It has often been pointed out that carcinoma of the sigmoid may progress very slowly. Cases have been reported in which colostomy was performed for the relief of obstruction due to supposed carcinoma; the patients lived for a number of years, and died from carcinoma of the sigmoid, a fact which was taken to prove that the condition had been carcinoma from the beginning, and that the natural course of the disease had continued for eight or nine years. This inference is unwarranted. In the clinic we have operated in several cases of this type, and on resection of the growth have found carcinoma developing in a sigmoid in which the results of an ancient deforming type of diverticulitis were present. In tracing the early histories of the patients it could be seen that the diverticulitis had been present from the beginning of the illness, and that the malignant change had been a more recent development.

In reviewing a series of specimens of sigmoid which had been resected for supposed carcinoma at the clinic, Wilson found that three, resected years ago, before all specimens were subjected as a routine to microscopic examination, showed diverticulitis and not carcinoma. The possible association of carcinoma with diverticulitis leads to the conclusion that when a tumor, appearing to be diverticulitis, but without acute symptoms, is found in the sigmoid or colon, and especially if the tumefaction subsides only partially and then continues as a chronic mass causing more or less marked symptoms, carcinomatous change is to be suspected, but the relation between the two remains conjectural. Some idea of the relative frequency of the two conditions in the sigmoid may be obtained from our own figures. In the stated period we dealt with 696 cases of diverticulitis and 2,354 cases of carcinoma of the sigmoid.

The distinction between diverticulosis and carcinoma of the sigmoid can usually be demonstrated by radiologic methods. These methods will usually also show a carcinomatous change in a diverticulous area of the sigmoid, but if diverticulitis is present, this diagnostic agent cannot be used so freely during the more acute stages of the process.

SURGICAL TREATMENT.—The treatment of diverticulitis of the sigmoid

depends on many factors. In acute cases, especially if the patient is old, obese, and a poor risk for operative procedures, it should be tentative. In our series of 696 cases, operation was performed for this condition in 26.18 per cent. If the infection goes on to the formation of abscess, the pus should be evacuated, instead of waiting for its spontaneous discharge, as the latter course tends to lead to the formation of a fistula, with its attendant evils. If more radical treatment appears to be necessary to effect a cure, it can be postponed to a later and more favorable time. If acute obstruction results, colostomy should be performed as close to the obstructed point as is convenient, so that at a subsequent operation the stenosed portion of the sigmoid and the colostomy opening may be excised simultaneously through the same incision; or, as advised by Stiles and by Burgess, cecostomy may be performed for temporary relief and the radical operation performed later if it becomes necessary. In other cases, colostomy may be resorted to for temporary relief, and the opening in the colon closed later, if the infective process regresses spontaneously sufficiently to restore the lumen of the colon.

If the patient comes for relief of an internal fistula, especially one communicating with the bladder or with another part of the intestinal tract, a serious problem confronts the surgeon, the operative risk being proportionate to the number of internal fistulæ and to their situation. I know of no more trying operations than some of this character. In several instances I have dissected out multiple entero-intestinal fistulæ communicating with the bladder and have carefully sutured the bladder and each intestinal opening; after several days, leakage to the surface has followed the line of drainage with temporary discharge of urine and fæces. However, these wounds eventually have healed. A very excellent technical step in such cases was first suggested, I believe, by C. H. Mayo. This consists in completely separating the involved sigmoid from adherent intestines and bladder, and, after suturing the fistulous openings, or resecting the diseased segment of bowel, in bringing the omentum into the operative field. An opening is made in the omentum through which the sutured portion of the sigmoid is brought to the peritoneal surface of the abdominal incision, where it is attached by a few sutures. The omentum is thus thrown between the defects in the colon, bladder, and adherent intestines, and, if leakage occurs later, a safe exit is provided.

CONSIDERATIONS ON THE ORIGIN OF ACQUIRED DIVERTICULA OF THE SIGMOID

The romance of medicine lies in inductive philosophy, in which tomorrow is the great day. Yesterday furnishes the deductive philosophy, which acts as a compass to keep our directions true.

In mammals the testis is the primitive procreative organ, and because of its long heredity it is relatively free from disease; the ovary, secondary to the testis, is a more recent acquisition which has not yet achieved the same resistance. So, too, the sigmoid, a convenient storage organ but of more recent development, has not yet achieved the stability of the primitive small intestine. The right half of the large intestine is derived from the midgut, and in the embryo has the same type of epithelium as the small intestine

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and carries on an absorptive function. The sigmoid is derived from the hind-gut, and has relatively little absorptive function. By reverse peristalsis derivatives of the food end-products are returned for further elaboration and absorption until the fecal stage is reached.

Certain recent investigations by Alvarez and his colleagues have shown the influence of food products on mass. Among the various types of food which form a mass, such common articles of diet as potatoes and milk form a relatively large mass, whereas red meats induce a large amount of bacterial action. Three-fourths of the peoples of the world eat rice for carbohydrate, and more or less fish for protein. Rice not only has a high-calorie content, but it also liquefies and forms only a very small mass; such articles of diet as fish also form a small mass. It would be interesting to know whether diverticulitis is as common in the rice- and fish-eating countries as it is in the potato- and red-meat-eating countries.

To one who has watched through the fluoroscope the spastic colon struggling with a barium content, it is not difficult to understand how and why pits form in the areas of weak musculature of the colon and along perforations made by its blood-vessels. Again, now that we are getting new light on the sympathetic nervous system, which acts as a brake on intestinal progress, we see a possible explanation of some of the phases of the development of diverticula. Learmonth and Markowitz have shown that after section of the inhibitory nerves to the colon of the dog, in certain cases, a barium meal may show appearances suggestive of early diverticulosis.

Speaking picturesquely, one notes various types of control over the vegetative functions, for example, the linking up of nonstriated muscle with the nodal system and with the internal secretions so largely instrumental in carrying on gastro-intestinal functions. These controls are shown in the occurrence of intestinal peristalsis once or twice in each minute and intestinal contractions eighteen or twenty times in each minute, the latter movements serving as a motor pump to propel venous blood in the portal system to the liver. All of these forms of stimulation are linked with the sympathetic nervous system, and through the sympathetic ganglions with the central nervous system. Our knowledge of this interrelationship we owe to the fundamental work of Gaskell and Langley.

The work of Hunter and Royle has stimulated fresh surgical interest in the sympathetic nervous system. In this field Adson and his associates have been able to relieve megacolon, which so closely resembles the dilated œsophagus in cardiospasm, by removal of the lumbar sympathetic ganglions and their communicating branches. The operation effects its purpose probably by leaving the sacral sympathetic outflow, which is motor to the distal part of the colon, in sole control of this part of the bowel. Adson and his co-workers have also brought about marvelous relief in Raynaud's disease, in certain types of contraction of the blood-vessels of the extremities leading to gangrene, and in certain types of arthritis, by removal of the appropriate sympathetic ganglions and their communicating branches.