SACCULI OF THE LARGE INTESTINE, WITH SPECIAL REFERENCE TO THEIR RELATIONS TO THE BLOOD-VESSELS OF THE BOWEL WALL.

By HAMILTON DRUMMOND, Newcastle-upon-Tyne.

During the last few years the clinical aspect of sacculi or acquired diverticula of the colon, and the secondary changes consequent on inflammation of them, have been so frequently referred to that the condition is now familiar to all.

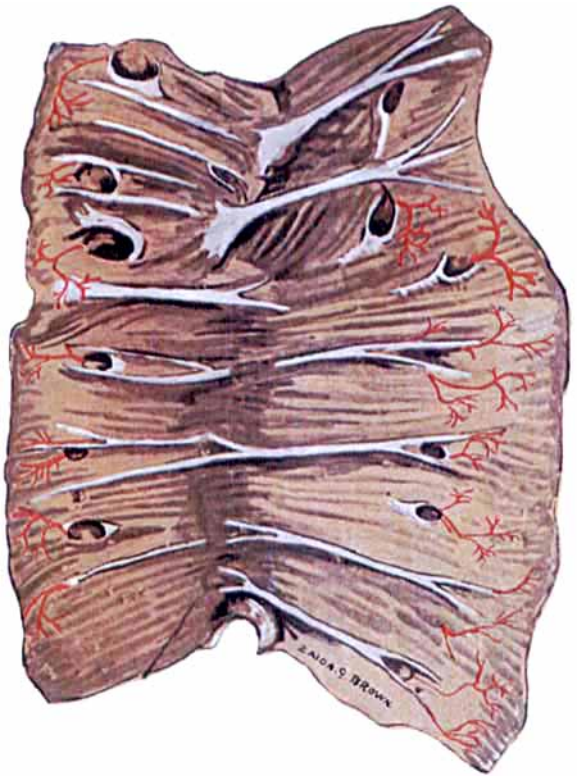

Fig. 216.—Interior of the pelvic colon laid open through the antimesenteric border. To show the common site of sacculi—appearing at a point where the vessels perforate the muscle tissue and come to lie under the mucous membrane.

The etiological side, however—at any rate in this country—has been neglected, for we are still in the dark as to their true origin, and there are many differing theories concerning their causation.

The fact that sacculi of the large bowel are acquired, and are not congenital, has long been accepted; and for this and other reasons, now well known, the term 'saccule' should be adopted in place of diverticulum, the latter being reserved for congenital conditions such as Meckel's diverticulum.

Saccules may be found in any part of the large intestine, but the great majority occur in the pelvic colon, and most of the post-mortem specimens I have obtained for the work in this paper show the pelvic colon alone to be diseased. So far as I am aware, all cases reported have occurred in elderly people. The saccules are always multiple. They vary in size from a hemp seed to a hazel nut, and are seldom larger than the latter. Several hundreds have been reported to exist in the same intestinal tract.

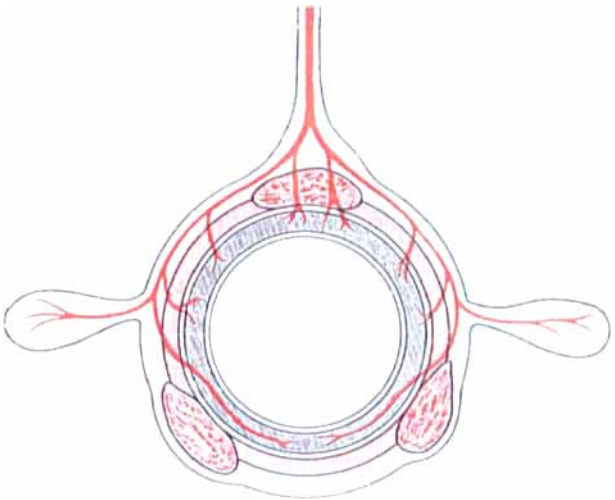

FIG. 217.—Diagram to show muscle tissue and blood-vessels of the pelvic colon.

Klebs, who investigated the condition, emphasized the fact that sacculi occurred in fat people. Hanseman pointed out that in his cases they occurred chiefly in thin people Other observers have stated that they are most commonly found in people who at one time were well nourished and have become thin. I cannot verify any of these statements from my own cases, for some of the patients from whom post-mortem specimens were removed were extremely fat, whilst others were thin, and inquiry into their history showed that they had always been so.

Edwin Beer, in an excellent article dealing with this subject, states the results of his own experimental work and that of others performed with a view to discovering, if possible, the cause of these hernial protrusions. He and other observers found that on distending the intestines of corpses with water, the large bowel ruptured on the side opposite to the mesentery, and the small bowel as a rule into the mesentery itself. Beer rightly points out the absurdity of these experiments, as the effects of distention of the bowel in post-mortem subjects differs considerably from the distention of the gut

during life, for in the former the distention is brought about acutely, while in the living the process is seldom other than slow and chronic.

Hanseman, who regarded these sacculi as pulsion diverticula caused by pressure from within the bowel, made similar experiments with human corpses. He found that the point at which the bowel ruptured when distended was between the leaves of the mesentery, and the ruptures formed small diverticula which originated at the point of entrance of the veins running from the bowel into the mesentery. He described these 'acutely formed' sacculi as being similar to those found in the living subject.

Klebs was the first to associate sacculi of the large intestine, and their formation, with the vessels of the bowel wall. In 1898 this view was strongly supported by Graser, who made a thorough microscopic examination of portions of healthy colons.

FIG. 218.—Pelvic colon laid open to show the most common site for sacculi to make their appearance, between the mesenteric and two lateral longitudinal muscular bands.

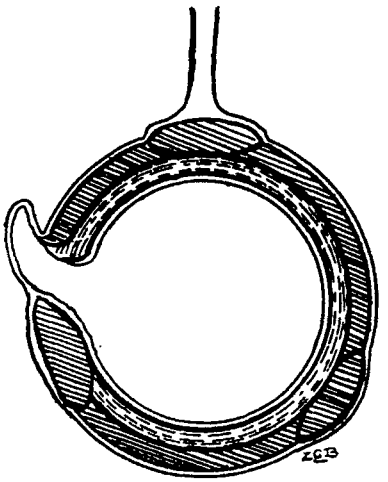

FIG. 219.—Diagram to show the common site for a sacculus of the large bowel, between the mesenteric and lateral longitudinal muscular bands.

He found, in many cases, small gaps in the muscle tissue through which the vessels passed, and in many instances he was able to demonstrate small sacculi of the mucous membrane only which pushed their way along the line of the vessels. He described the stages as, first, gaps in the muscle tissue of the bowel wall, then the protrusion of the mucous membrane into these gaps, extending later to the longitudinal muscular layer; and finally their extension under the peritoneal covering. On careful microscopical examinations of twenty-three portions of gut, he was able to discover more or less typical small sacculi in the region of the pelvic colon, and in no case was there evidence of such change to the naked

eye. He also found, and laid great stress on the fact, that in many cases of sacculi of the colon, chronic venous congestion existed, his view being that the distended vessels, as they passed through the bowel wall, enlarged the gaps in the muscle tissue, and in this way assisted in the production of the hernial protrusions.

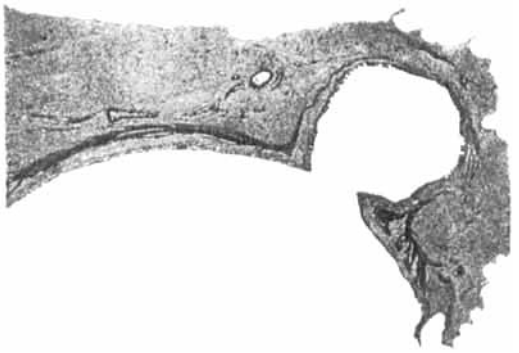

FIG. 220.—Saccule of the colon, showing a narrow neck at the base, and marked atrophy of all the coats of the bowel wall.

Graser was able to demonstrate venous congestion in a certain percentage of cases only, showing that this complication was not necessary for the production of a sacculated colon.

Amongst my own material, chiefly post-mortem specimens, numbering about thirty in all, I found no case showing heart disease with chronic back pressure. At the same time, the veins of the bowel were engorged in a few cases (see *Fig.* 216).

Though it is impossible to regard venous congestion as having nothing to do with the formation of sacculi, it seems more probable that the back pressure in the veins may be a secondary development, as it is very common to find the colon in sacculus cases densely embedded in adhesions and firmly fixed to the abdominal and pelvic walls, with considerable shortening of the mesentery. For several years I have noted carefully in this connection cases coming to the post-mortem room as the result of heart disease with chronic venous congestion, and in no single instance was the colon the seat of macroscopic sacculi.

Obstruction of the large intestine from constipation has always been regarded as an important factor in the formation of sacculi, but in my opinion it is not of primary importance. Multiple sacculi of the colon above the site of the obstruction in cases of cancer of the colon are very rarely seen, but may occur. Two of my post-mortem specimens showed well-marked small multiple sacculi above a constricting carcinoma of the pelvic colon, while the gut distal to the obstruction showed no sacculi at all.

FIG. 221.—Old-standing saccule, showing extreme atrophy of all coats of the bowel wall.

A most important factor with regard to the production of sacculi of the large intestine is an inherent muscular weakness of the bowel wall. It

may be a weakness not only limited to the large intestine, but to the non-striated muscle throughout the body. In four post-mortem specimens I have observed sacculi of the large and small intestine existing in the same individual. Further evidence in support of this view is offered by the following case, which came under the care of Mr. Grey Turner A man, age 56, died from peritonitis, the result of a perforated sacculus of the pelvic colon. In addition to multiple sacculi of the large gut, he had numerous sacculi of the bladder, some of which were of large size and very thin-walled. The largest of these originated from a point close to the right ureter orifice, and was the size of a large walnut.

FIG. 222.—Longitudinal section through two sacculi. Note the vessels at the apex of the upper saccule.

Sacculi of the large bowel rarely enter the leaves of the mesentery, and a glance at the anatomy of the bowel wall and the blood-vessels, bearing in mind the importance of the latter in the development of these protrusions, will show plainly why this does not occur. As an instance examine the structure of the normal pelvic colon (*Fig.* 217), since this portion of the large bowel is the most common site in which to find sacculi.

FIG. 223.—Transverse section through the apex of a saccule of the colon, showing vessels at apex. (*High power.*)

The three longitudinal muscular bands common to all parts of the colon show a definite relation to one another in the pelvic colon. The largest one, known as the mesocolic band, is always to be found at the mesenteric attachment. Concerning the two others, the outer one is the continuation of the omental band in the transverse colon, whilst the other is known in the transverse colon as the free band. These two antimesenteric bands terminate by fusing together on the anterior aspect of the rectum.

Between the three longitudinal muscular bands lie the normal haustra or sacculations, devoid of longitudinal muscular fibres. From the fat of the mesentery there extend out prolongations of fat on each side, closely adherent to the bowel wall, usually as far as the two antimesenteric muscular bands. These prolongations of fat, which serve to protect the vessels, terminate in the appendices epiploicæ, which, in the normal state, hang free in the peritoneal cavity Beyond the lateral longitudinal muscular bands no prolongations of fat from the mesentery or appendices epiploicæ are found.

The vessels supply the bowel wall in the following way: After leaving

the mesentery. numerous big branches pierce the strong longitudinal muscular band lying in the mesenteric attachment; others run round in the prolongations of fat and pierce the circular muscular layer; while the main branch continues on to the edge of the lateral longitudinal muscular band, where it gives a branch into the appendices epiploicæ. The continuation dips under the tænia, and comes to lie under the mucous membrane of the intestine, anastomosing with a similar branch from the opposite side. The vessels entering the appendices epiploicæ may be of considerable size, and this is especially the case if any inflammatory condition be present.

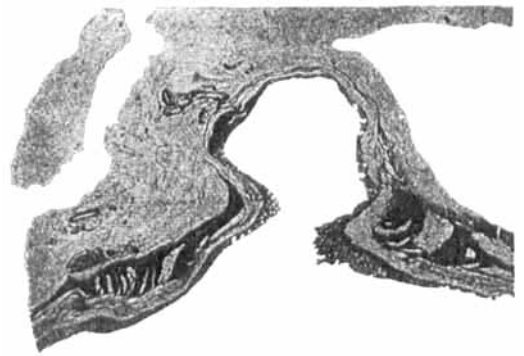

FIG. 224.—Saccule opening into an appendix epiploica. Note the vessels at the apex.

FIG. 225.—Transverse section through a saccule, showing vessels at the apex.

From the above brief anatomical description of the bowel wall, and from the knowledge that sacculi develop at weak spots in it produced by the presence of blood-vessels, it is easy to guess where sacculi should make their appearance. By far the most common position is between the mesocolic and one of the lateral bands. As a rule, they commence close to the side of the lateral band, and often open directly into an epiploical appendix.

Sometimes a small sacculus makes its appearance on the antimesenteric border between the two lateral longitudinal bands. They are rare in this position, and when appearing there usually have no relation to vessels. The reason that sacculi do not enter primarily between the leaves of the mesentery, as sacculi in the small intestine do, is now apparent, for the strongest of the three longitudinal muscle bands lies in this position (*Fig.* 217).

When a sacculus has made its appearance through the bowel wall in the common site described above (see *Figs.* 218

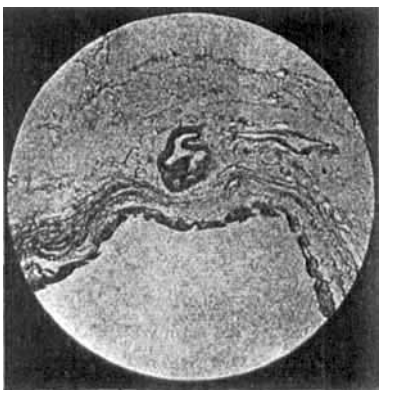

FIG. 226.—Apex of saccule, showing vessels. (*High power.*)

and 219), it tends always to follow the path of least resistance, along the course of the vessels—that is, towards the mesentery—and by doing so it frequently comes to lie close to the edge of the mesentery and to suggest at first sight primary sacculus of the mesentery

When a sacculus opens into an epiploical appendix, as is frequently the case, it is often so well surrounded by fat that it escapes notice until the portion of bowel bearing it has been distended with fluid or air.

The accompanying microphotographs show several points with regard to sacculi that are worthy of attention.

FIG. 227.—Transverse section of a saccule of the colon, showing the direction in which it extends at the apex towards the mesentery.

Figs. 220 and 221 show marked atrophy of the bowel wall, and especially of the muscular coats and the mucous membrane at the apex of the saccules.

Figs. 222–226 show the relation the saccules have to the vessels of the bowel wall.

Figs. 227 and 228 show the tendency sacculi have to point towards the mesentery of the bowel, following along the line of the blood-vessels.

FIG. 228.—Transverse section through a saccule, showing a tendency to point in line of the blood-vessels towards the mesentery.

CONCLUSIONS.

1. Sacculi of the large intestine are multiple, they only occur in old people, and are acquired.

2. They are probably due to a general deficiency of the non-striated muscle tissue of the individual, as is shown by their tendency to occur in various viscera of the same individual. Chronic venous congestion and intestinal obstruction are not of prime importance in their etiology

3. Sacculi may occur in any portion of the colon, but the pelvic colon is by far the most common site.

4. Sacculi make their appearance almost invariably at one point in the colon wall, viz., between the mesenteric and lateral longitudinal muscular bands. After piercing the muscle coat they follow the sheaths of the vessels towards the mesentery They never open primarily into the leaves of the mesentery as do sacculi of the small intestine.

5 The blood-vessels of the normal colon may be said to predispose to sacculi to the same extent as the spermatic cord does to an inguinal hernia.