Surgery of the ileocecal valve : a method of repairing an incompetent ileocecal valve and a method of constructing an artificial ileocecal valve / by J.H. Kellogg.

SURGERY OF THE ILEO-CECAL VALVE

A METHOD OF REPAIRING AN INCOMPETENT ILEOCECAL VALVE AND A METHOD OF CONSTRUCTING AN ARTIFICIAL ILEOCOLIC VALVE.

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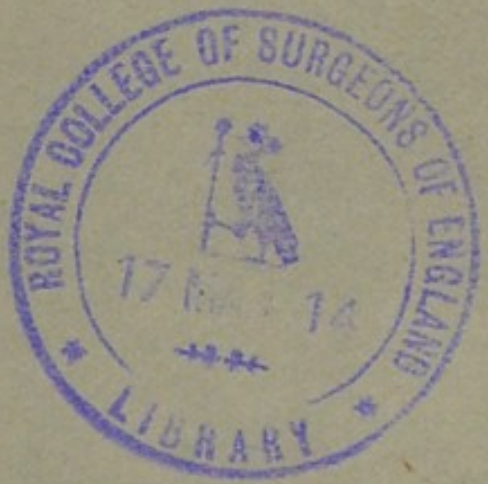
Reprinted from SURGERY, GYNECOLOGY AND OBSTETRICS, Chicago, November, 1913.



SURGERY OF THE ILEOCECAL VALVE

A Method of Repairing an Incompetent Ileocecal Valve and a Method of Constructing an Artificial Ileocolic Valve

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The ileocecal valve has been known to anatomists for more than three hundred years, but its function has been so little appreciated that it has been almost altogether neglected, and up to the present time its structure has been almost wholly ignored by surgeons in the operation of ileosigmoidostomy and other surgical procedures in which the small intestine has been separated from its normal connection with the cecum and joined to the colon at some other point. No attempt has been made to reconstruct the valve or to devise any means for preventing reflux of feces from the colon into the small intestine. The function of the ileocecal valve has evidently been regarded as of so little consequence that it might be ignored.

In another paper the writer has undertaken to summarize the facts which have been developed in recent years respecting the functions of the ileocecal valve and the pathological effects which result from its absence or incompetency. These facts may be briefly summarized as follows:

Bauhin, Tulpius, and other of the early anatomists showed that the ileocecal valve is a most efficient mechanical contrivance for preventing reflux of gas or liquid from the colon into the small intestine. John Mason Good observed that in addition to its mechanical structure the ileocecal valve possesses also a muscular function capable of acting as a sphincter. Elliott demonstrated in 1904 that the valve behaves as a true sphincter in the dog,

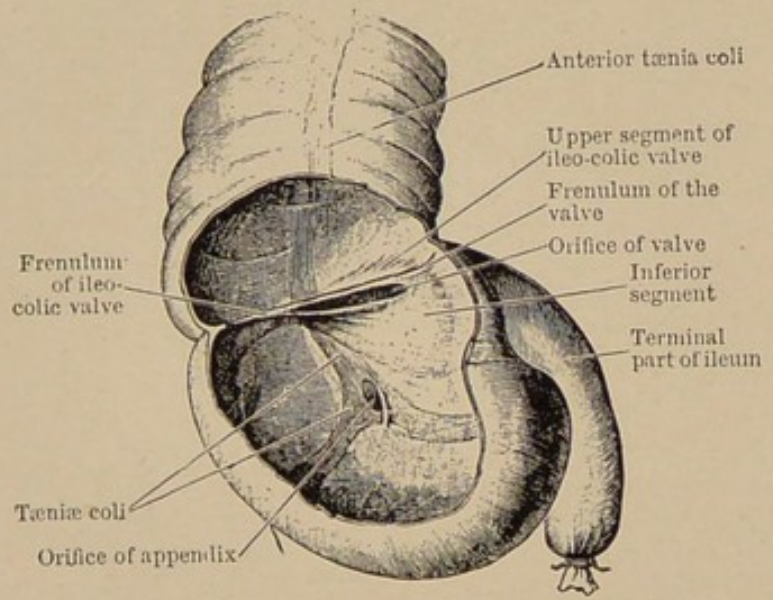


Fig. 1. Ileocecal valve viewed from the interior of the cecum (Cunningham).

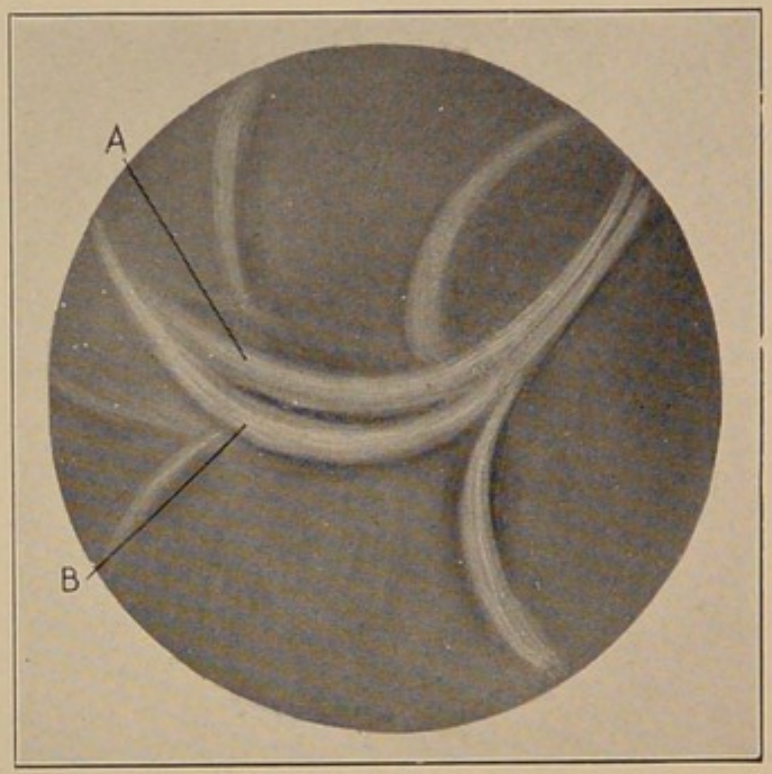


Fig. 2. Ileocecal valve closed (Kraus).

possessing like the pylorus a special nervous mechanism distinct from other parts of the alimentary canal. Sir William Macewen recorded the results of observations made upon a case in which as the result of the destruction of a portion of the anterior wall of the cecum it was possible to watch the action of the ileocecal valve and a reciprocal activity of the appendix.

Case, Cannon, and others, who have made a systematic study of the alimentary canal by the aid of the X-ray and the bismuth meal, have demonstrated that the ileocecal valve not only prevents reflux of material from the colon into the small intestine but also regulates the movement of material from the small intestine into the colon in a manner quite analogous to the action of the pylorus in passing digesting food from the stomach into the small intestine.

That these functions of the ileocecal valve must be highly important to the welfare of the body is a necessary inference from the fact that the structure is present in practically all vertebrate animals above the level of amphioxus. The pylorus and the ileocecal valve divide the alimentary canal into three parts, the functions of which differ in such a way as to require their isolation. These are known to anatomists as the fore-gut, reaching from the mouth to the pylorus; the mid-gut, the small intestine, extending from the pylorus to the ileocecal valve; and the end-gut, the large intestine. When, as the result of disease, reflux from the small intestine into the stomach occurs, the result is nausea, vomiting and serious interference with the functions of the stomach.

The possible injury from reflux of material from the colon into the small intestine seems to have been quite generally overlooked. In another paper the writer has summarized the results of observations in some sixty cases, in which the ileocecal valve was incompetent, which seem to show a clear

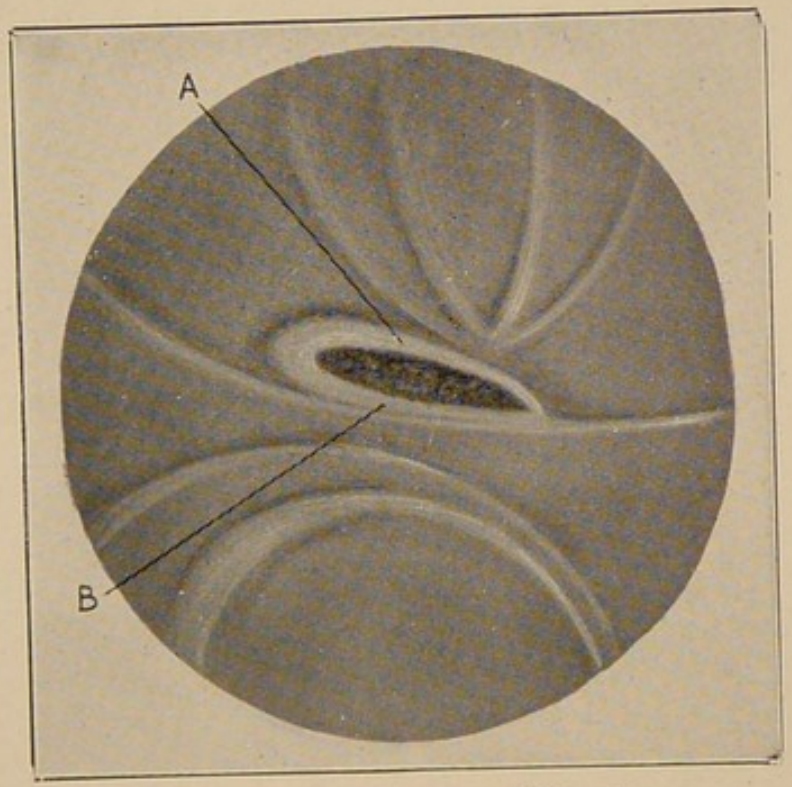


Fig. 3. Ileocecal valve open (Kraus).

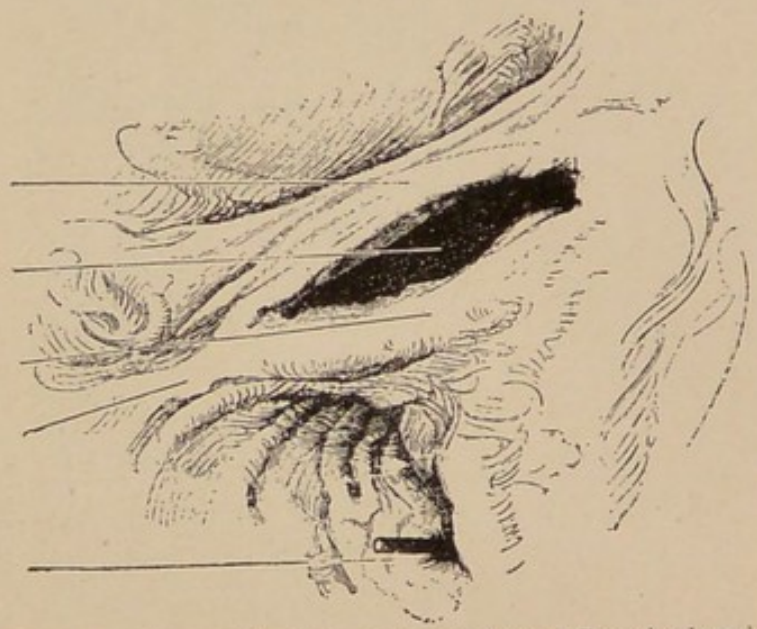


Fig. 4. Ileocecal valve, common form (Cunningham).

relation between incompetency of the ileocecal valve and a distinct group of pathologic conditions. In the paper referred to the writer has detailed a variety of non-surgical methods which have been found of very great service as a means of mitigating, and in many cases almost wholly relieving, the ill effects resulting from an incompetent ileocecal valve. The chief purpose of this paper is to point out a method by which an efficient ileocolic valve may be constructed in cases in which this important structure has been destroyed by disease or is necessarily sacrificed by surgical procedure. A method will also be described by which an incompetent ileocecal valve may be repaired and rendered competent.

As usually performed, the operation of ileosigmoidostomy leaves the ileum with no protection against the reflux of fecal matters from the colon. Through this backing up of fecal matters the small intestine, by dilatation may in time present as large a storage chamber as did the colon before the operation. On one occasion the writer was present at an operation performed upon a patient who had previously undergone the operation of ileosigmoidostomy at the hands of a good surgeon but who was suffering as badly as before the operation, so that a second operation had become necessary. When the abdomen was opened, many adhesions were found present and the small intestine was so greatly distended that for some distance from the point of junction with the colon it was fully as large as a normal colon. It is evident that when the small intestine is deprived of the protection against reflux with which nature provides it, the mid-gut may readily become the seat of pronounced stasis with all the evil consequences which result from this condition. All these difficulties and dangers may be obviated by the construction of a valve, when it becomes necessary to abandon the normal ileocolic junction and form a new one.

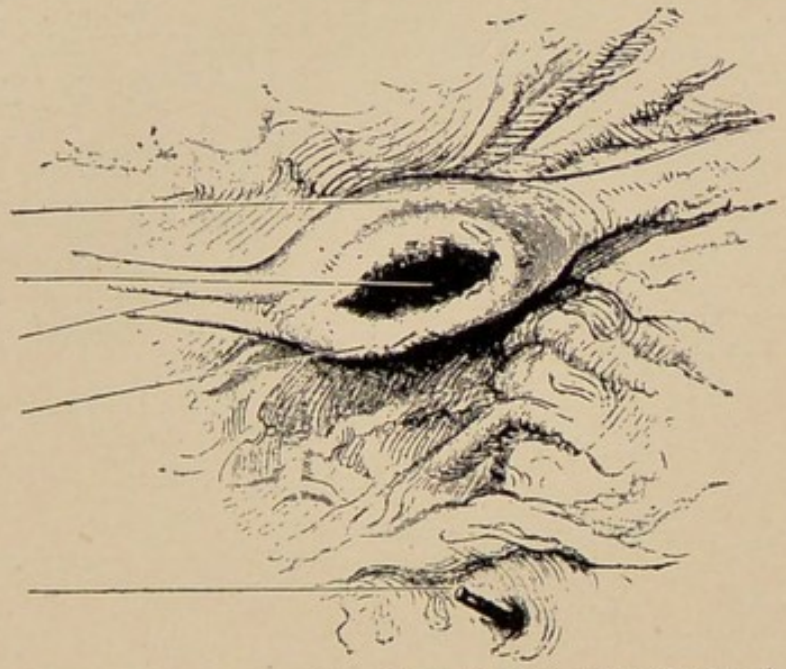


Fig. 5. Ileocecal valve, circular form (Cunningham).

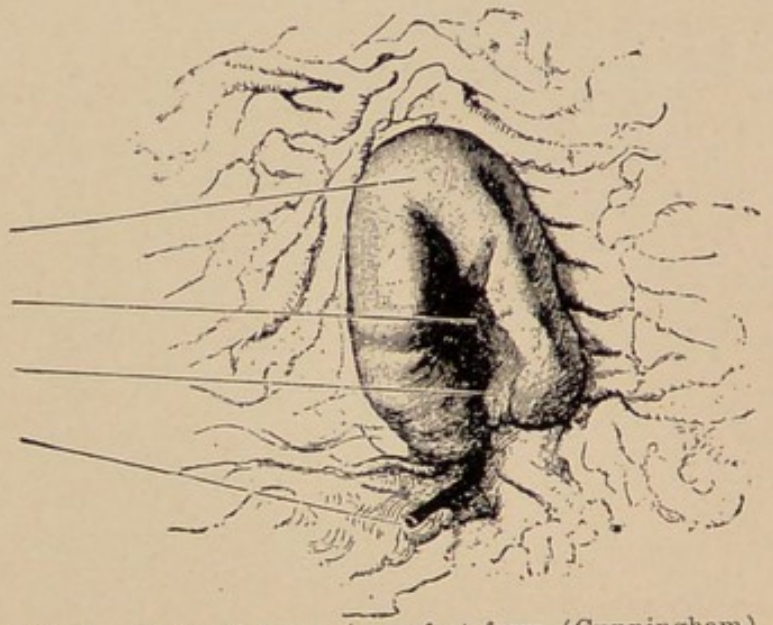


Fig. 6. Ileocecal valve, imperfect form (Cunningham).

First, it is necessary to briefly consider the structure of the normal valve. Cunningham gives the following excellent description of the ileocecal valve as found in human beings:

"Where the ileum enters the large intestine the end of the small gut is, as it were, thrust through the wall of the large bowel, carrying with it certain layers of that wall, which project into the cecum in the form of two folds, lying respectively above and below its orifice, and constituting the two segments of the ileocecal valve (Fig. 1). The condition may be compared to a partial inversion or telescoping of the small into the large intestine; it must be added that the peritoneum and longitudinal muscular fibers of the bowel take no part in this infolding; on the contrary, they are stretched tightly across the crease produced on the exterior by the inversion, and thus serve to preserve the fold and the formation of the valve.

"As seen from the interior, in the specimens which have been distended and dried (Fig. 2), the valve is made up of two crescentic segments—an upper, in a more or less horizontal plane, forming the superior margin of the aperture; and a lower, which is also larger, placed in an oblique plane, and sloping upward and inward (*i. e.*, toward the cavity of the cecum). Between the two segments is situated the slit-shaped opening, which runs in an almost anteroposterior direction, with a rounded anterior and a pointed posterior extremity (Fig. 3). At each end of the orifice the two segments of the valve meet, unite, and are then prolonged around the wall of the cavity as two prominent folds—the frenula (frenula valvulæ coli). It is thought that when the cecum is distended, and its circumference thereby increased, these frenula are put on the stretch, and, pulling upon the two segments of the valve, they bring them into apposition, and effect the closure of the orifice.

"In bodies hardened *in situ* with formalin, the

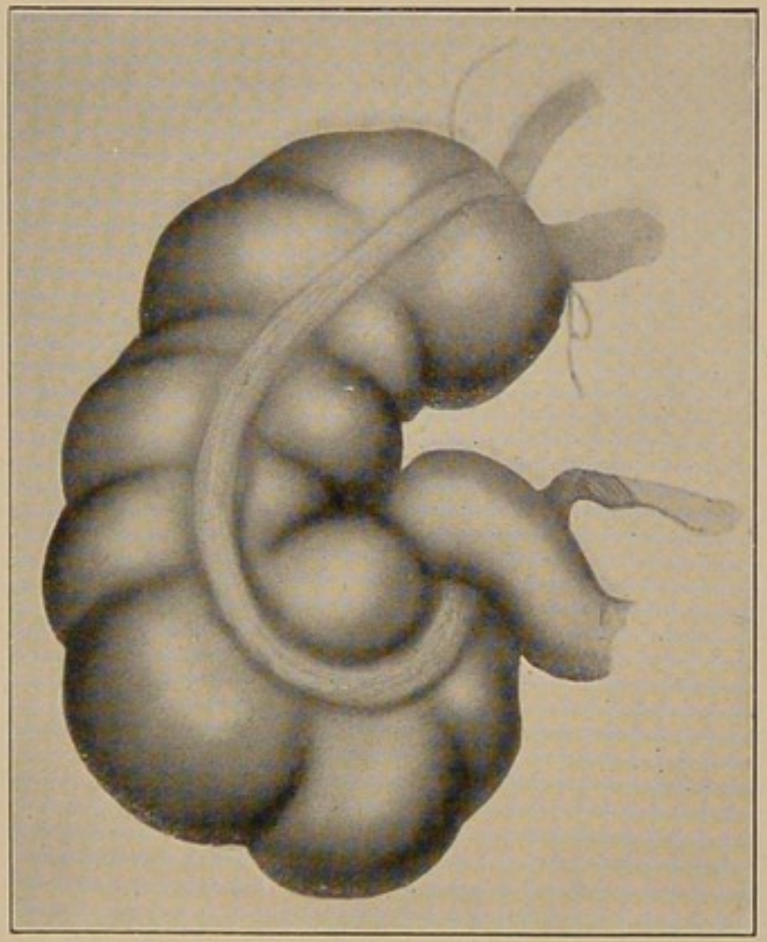


Fig. 7. Cecum, ascending colon and terminal ileum, showing ileocolic junction.

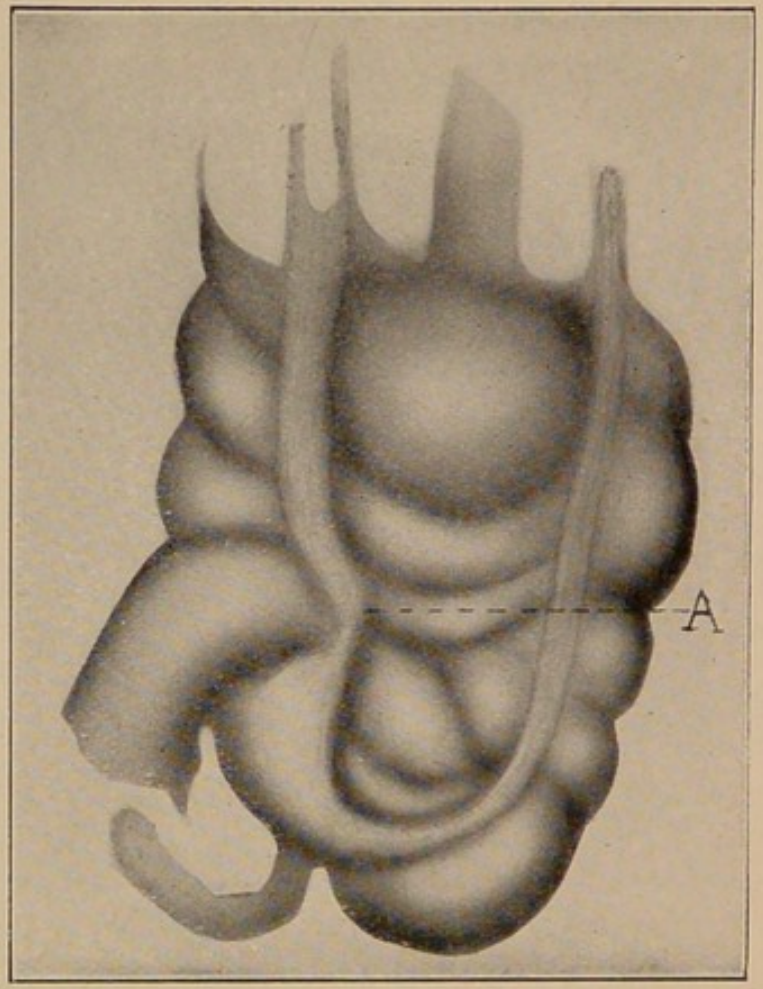


Fig. 8. Same as Fig. 7, bowel rotated outward, showing habenula, A.

valve and orifice present an entirely different appearance (Figs. 4 to 6, in which three different forms of hardened valves are shown), suggesting, much more closely than in the dried state, the appearance of telescoping or inversion mentioned above. In them also the two segments of the valve are much thicker and shorter, but they can always be distinguished, and are found to bear the same relation to one another as in the dried condition, although this may be obscured by foldings or rugæ. The aperture may be slitlike or rounded, with sloping or infundibuliform edges; the frenula are not so prominent at times; but the whole valve projects much more abruptly into the cavity of the cecum than in the distended and dried specimen.

"Each segment of the valve is formed of an infolding of all the coats of the gut, except the peritoneum and the longitudinal muscular fibers, and consequently it consists of two layers of mucous membrane, with the submucosa and the circular muscular fibers between, all of which are continuous with those of the ileum on the one hand and of the large intestine on the other. The surface of each segment turned toward the small intestine is covered with villi, and conforms in the structure of its mucous membrane to that of the ileum; while the mucous membrane of the opposite side resembles the mucous coat of the large bowel.

"In the dried specimen the upper segment projects further into the cavity of the cecum than the lower, so that the aperture appears to be placed between the edge of the lower segment and the under surface of the upper.

"There is little doubt, as pointed out by Symington, that the efficiency of the ileocecal valve is largely due to the oblique manner in which the ileum enters or invaginates the cecum; this oblique passage alone, as in the case of the ureter piercing the wall of the bladder, would probably be sufficient to prevent a return of the cecal con-

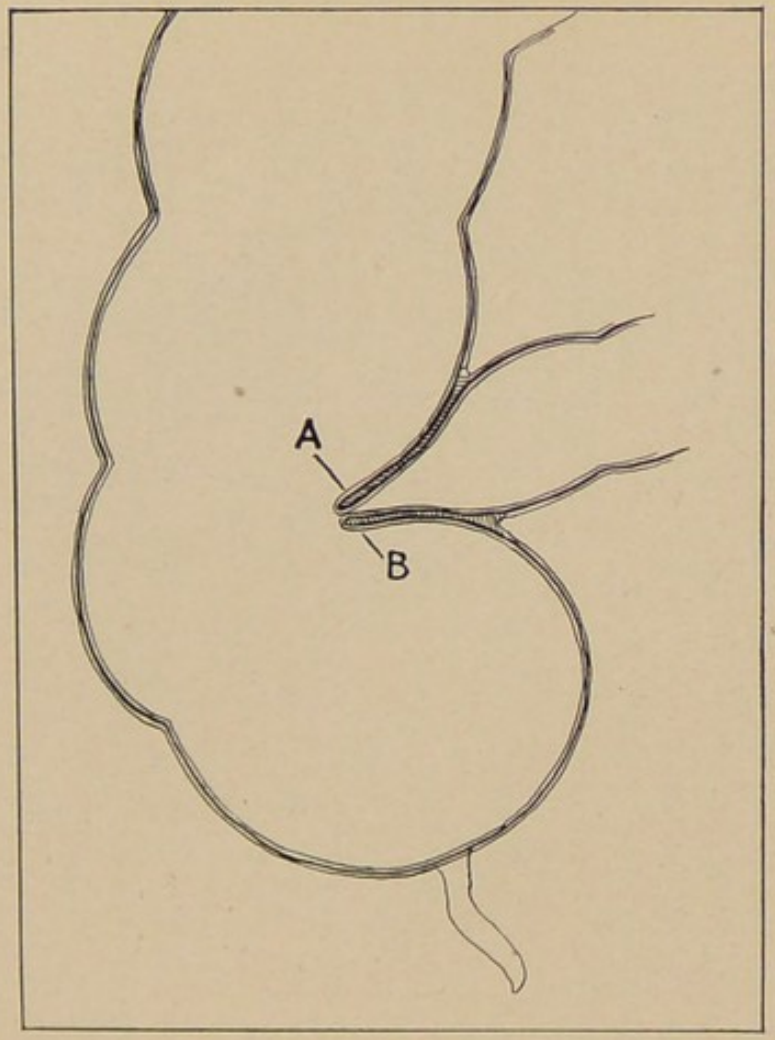


Fig. 9. Diagram showing structure of ileocecal valve, intussusception of small intestine forming anterior and posterior lips, A, B.

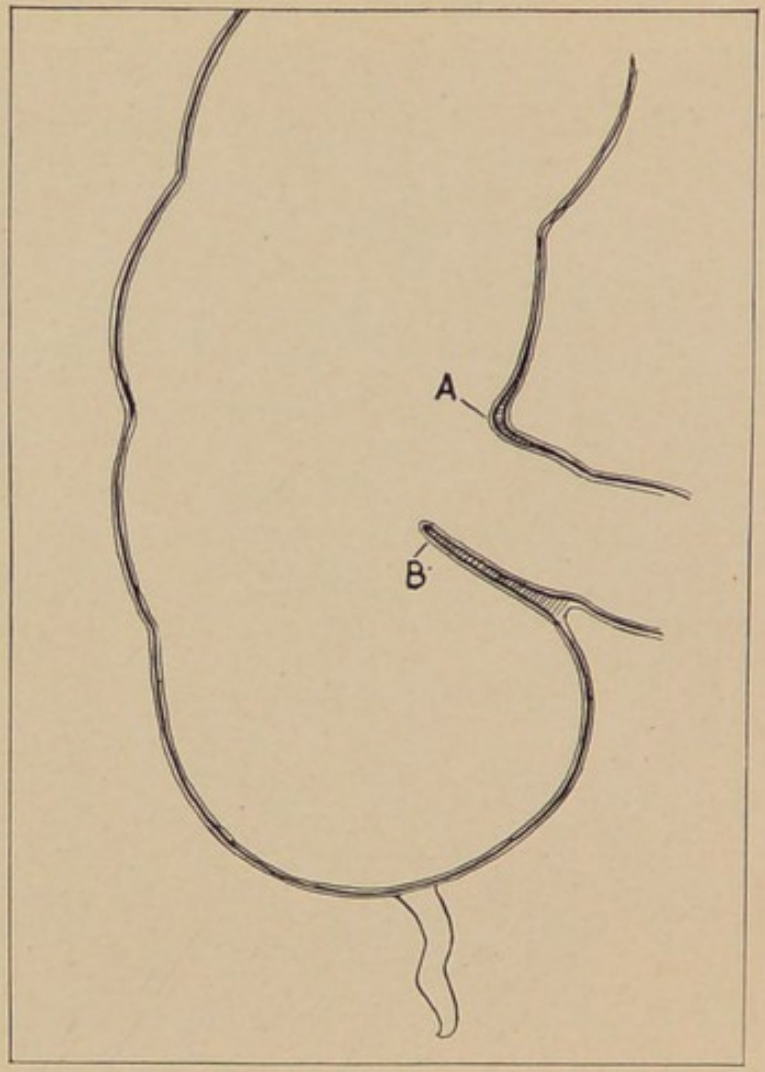


Fig. 10. Partially incompetent ileocecal valve, anterior lip damaged by over-distention of the colon.

tents. In the great majority of cases, when in position with the body, the ileum is perfectly protected from such a return, although when the parts are removed, and then distended with fluid, this often passes through the valve, and reaches the small intestine. Still, the efficiency of such a test, applied when the parts are deprived of their natural supports, cannot be relied upon.

"The size of the segments of the valve, as seen in the dried condition, varies considerably; they are sometimes very imperfect and even the absence of both has been recorded. But here again there is danger of falling into error, through examining the parts under such artificial conditions."

It thus appears that the ileocecal valve is in the human subject ordinarily a buttonhole-like aperture, although it may also have a different appearance, as shown in Fig. 5, a form which is frequently found in human beings and is the usual form in the dog and the pig.

A clear understanding of the mode of construction of the valve may be obtained by careful study of Figs. 7 to 11. First of all, it is to be noted that the axis of the cecum is not parallel with that of the lumen of the ascending colon. In man and the higher apes the cecum is strongly curved inward. This is well shown in Fig. 12, which represents the cecum and ileocolic junction of the chimpanzee. The evident purpose of the curve in the gut at this point is to infold the ileocolic junction and to cause it to project into the lumen of the colon as shown in Fig. 9.

By rotating the colon outward, as shown in Fig. 8, it will be seen that a narrow muscular band passes just behind the ileocolic junction. This has been called by German anatomists the *habenula*. This band is generally so stretched and attenuated as to be scarcely perceptible. When present, as in a perfectly normal colon, the *habenula* serves to pucker the gut, forming several small haustra,

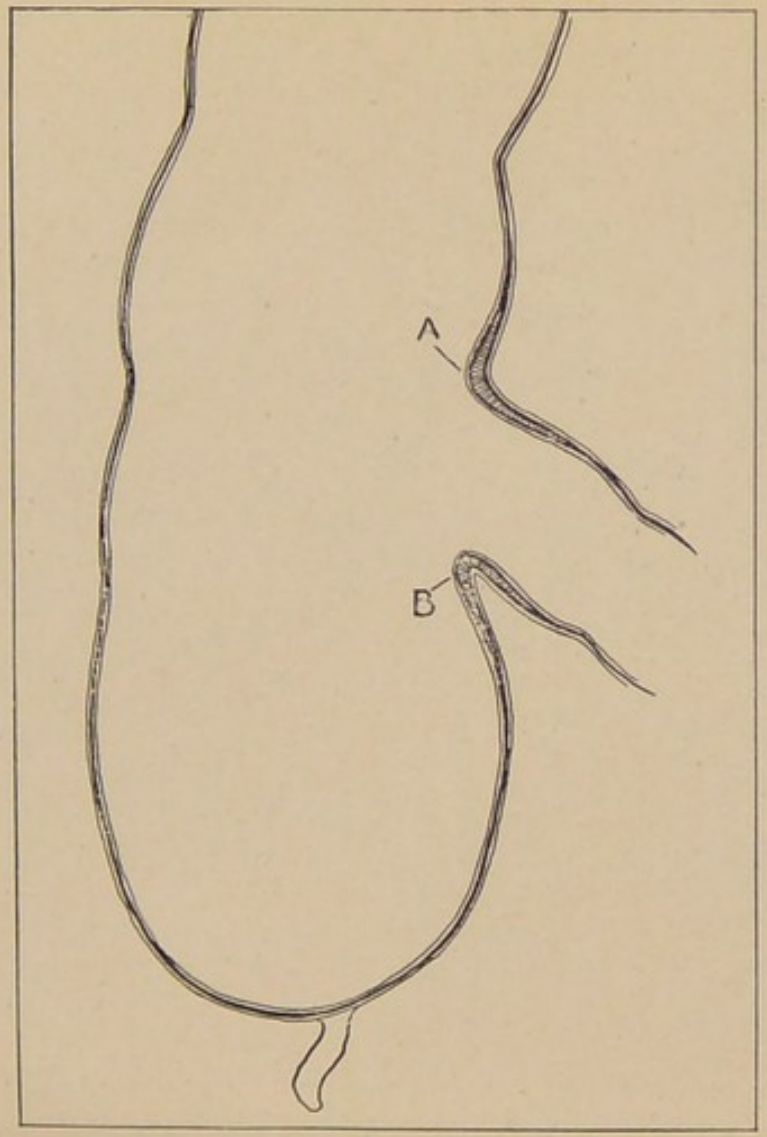


Fig. 11. Completely incompetent ileocecal valve, both lips destroyed by over-stretching of the gut.

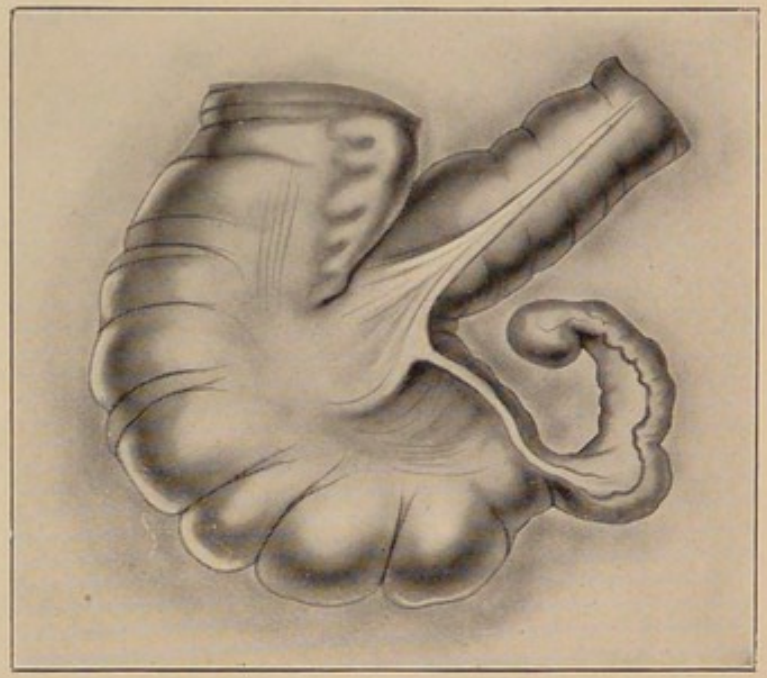


Fig. 12. Cecum and terminal ileum of the chimpanzee.

which infold the end of the ileum, and carry into the lumen of the colon the point of junction between the ileum and the corresponding structures of the colon. A division or stretching of this band causes an unfolding of the intestine and more or less complete disappearance of the haustra contiguous to the ileocolic junction and damage to the ileocecal valve, which may be thereby rendered partially or completely incompetent. If the peritoneum and outer muscular layer are stretched or divided at the ileocolic junction, the ileum may be pulled out of the large gut and the valves disappear, leaving a large funnel-shaped opening instead of a buttonhole opening guarded by overlapping lips.

The appearance of the gut produced by rupture of the habenula or stretching of the serous and outer muscular coats is shown in Figs. 13 and 14. Fig. 13 shows the condition most commonly found present. I have noted the condition shown in Fig. 14, in which the habenula is ruptured, in several cases. In one of these the point at which the muscular band had broken off at its lower insertion was very distinct. This accident must be the result of some very violent and comparatively sudden distention of the gut.

In numerous cases in which I have had an opportunity during operation to examine the ileocecal junction, after an X-ray examination in which the valve had been found to be incompetent, I have found the funnel-shaped opening described above and the appearance shown in Fig. 13. In many cases the funnel shape is much more pronounced. In these cases the form of the colon is changed. The curve of the lower portion of the gut is lost. The haustra contiguous to the ileocolic junction have disappeared, and evidence of incompetency may be easily obtained by making the gas and liquid present in the cecum pass back into the ileum by the application of slight pressure. By compressing the ascending colon and then making light pressure

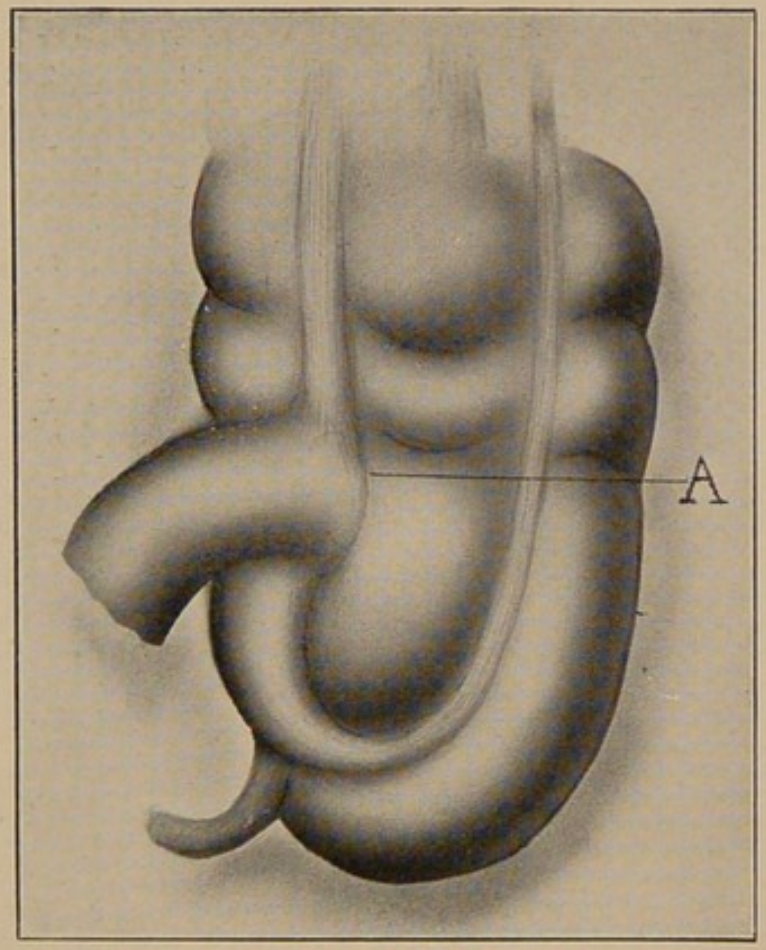


Fig. 13. External appearance of the ileocolic junction showing ileocecal valve rendered incompetent by rupture of the habenula (redrawn from Kraus).

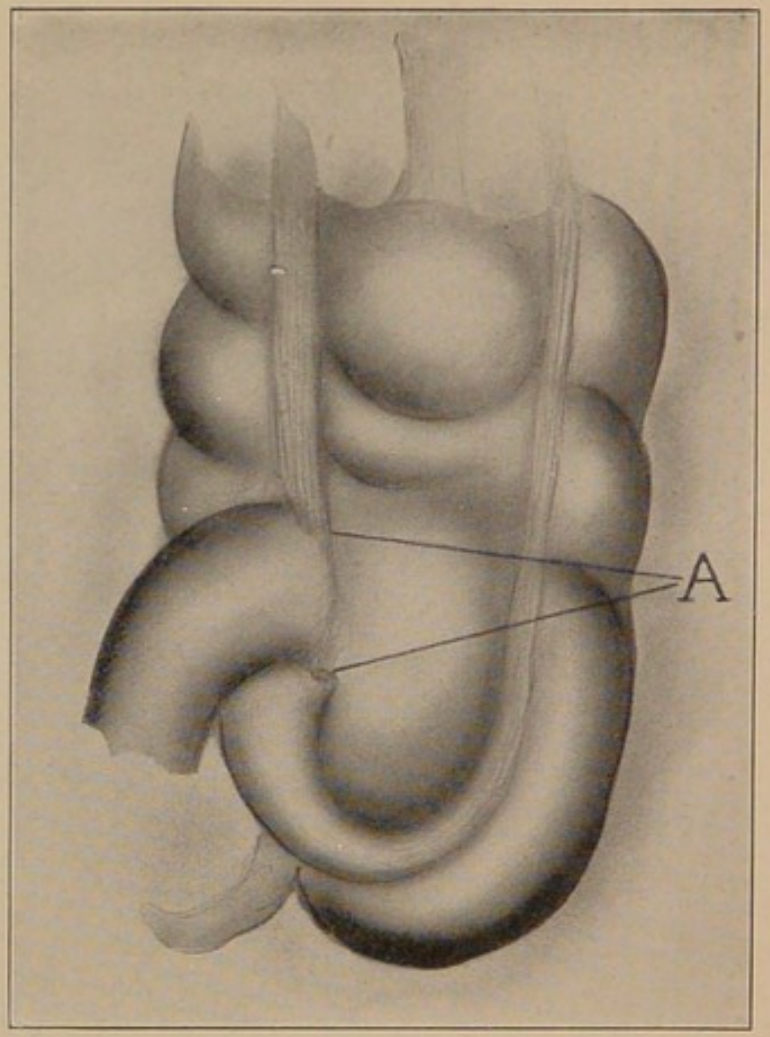


Fig. 14. External appearance of the ileocolic junction with incompetent ileocecal valve, A, due to overstretching of habenula.

upon the cecum, the ileum, previously emptied, will be instantly distended. The movement of gas or liquid from the colon into the ileum may be accompanied by a slight sound, or, when the opening is very large, no sound may be heard. By this simple method the competency of the ileocecal valve may be tested at any time when the abdomen is opened for removal of the appendix or other operation in the lower abdomen.

I am firmly convinced that incompetency of the ileocecal valve is a serious cause of disease and that the matter is one of sufficient importance to deserve surgical attention. I do not, however, advocate the opening of the abdominal cavity solely for the purpose of repairing an incompetent ileocecal valve, although it is possible that such a procedure may in some cases be justified. But it does seem to me to be the duty of the abdominal surgeon to make a careful examination of this structure and when the valve is found seriously incompetent to repair it by a simple procedure which I shall describe or some other method by which the same result may be obtained.

Figs. 9 to 11 show diagrammatically the condition of the ileocecal valve in health and disease. Fig. 9 shows a normal valve in which the two lips composing the valve are shown at A and B. Fig. 10 shows a valve incompetent because of longitudinal stretching of the ascending colon which has destroyed the upper lip of the valve shown in A. Fig. 11 illustrates a case in which the cecum and colon have been so greatly stretched that both lips of the valve have been destroyed. Of course the ileocecal valve may be rendered incompetent by other causes than stretching of the gut and the resulting unfolding of the valve lips. They may become attenuated by degeneration of the mucous and muscular tunics to such a degree that the valve ceases to be effective in preventing regurgitation into the ileum. The valve may also be de-

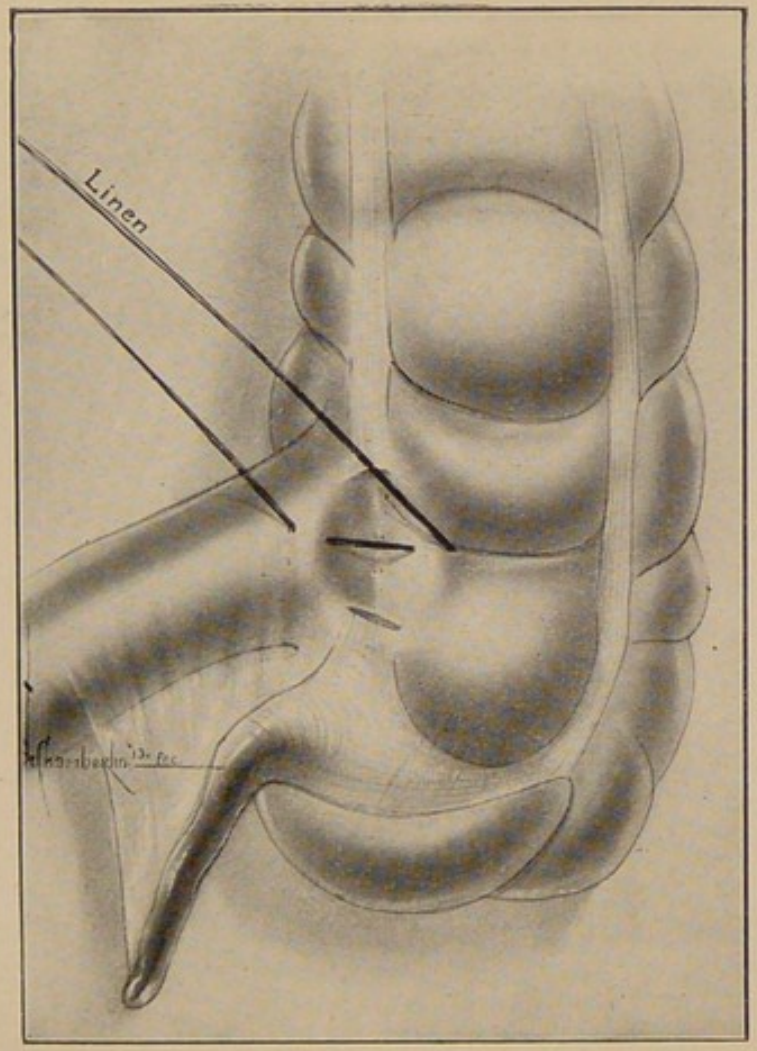


Fig. 15. First step in repair of incompetent ileocecal valve. Suture placed to restore posterior lip.

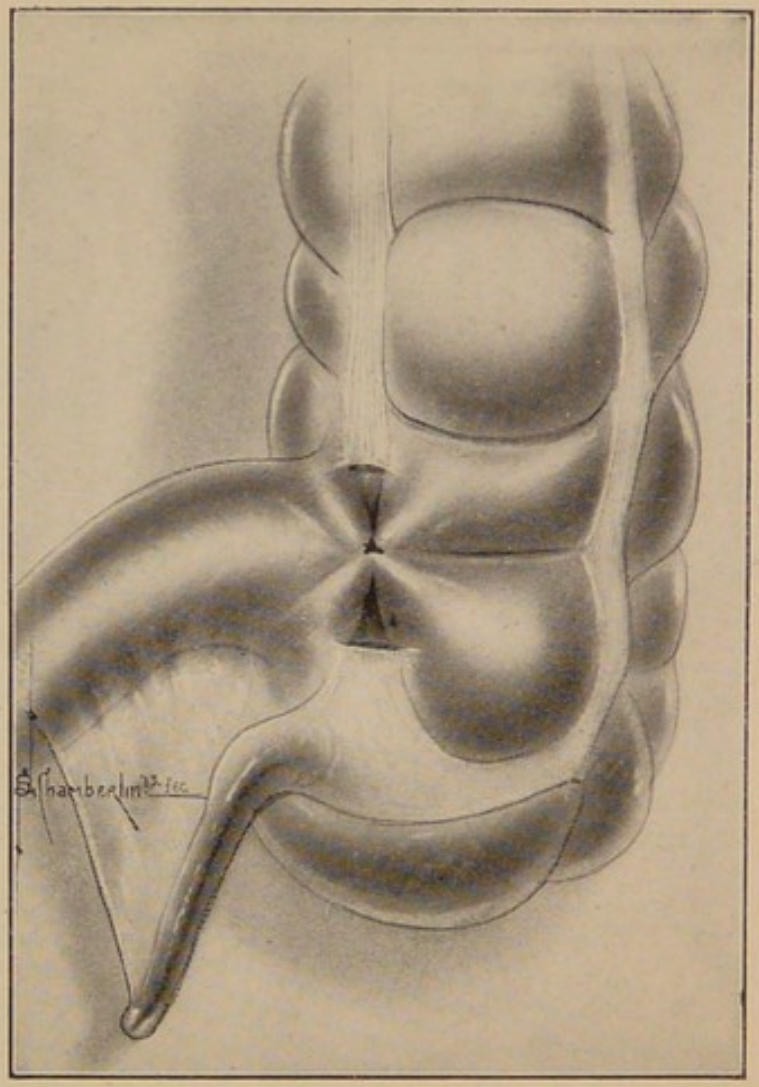


Fig. 16. Suture tied.

stroyed by tubercular disease or by simple ulceration. I believe, however, that destruction of the lips of the valve by long overstretching of the gut is by far the most common cause of incompetency. The position of the valve opening, lying as it does crosswise of the gut, renders it specially liable to damage by stretching of the colon and cecum in the long axis of the gut.

METHOD FOR REPAIR OF AN INCOMPETENT ILEOCECAL VALVE

The procedure is simply an attempt to restore the valve as nearly as possible to its normal condition. The method of accomplishing this will be readily understood by reference to the accompanying cuts, Figs. 15 to 31.

First, of all, the bowel is rotated upward so as to bring the under side of the ileocolic junction into view. The usual normal appearance of the parts is shown in Fig. 8. Supposing the case to be one in which the habenula has been ruptured as shown in Fig. 13, the first step is to insert a suture through the sero-muscular coats of the colon and the ileum at such points as will cause a slight intussusception of the ileum (Fig. 15). The suture is then tied (Fig. 16). Next a suture is passed through the separated ends of the ruptured habenula (Fig. 17). When the suture is tied and the ends cut, the opening will be narrowed and the intussusception of the gut will be restored (Fig. 18).

The operation may be done with a single linen or silk suture placed as shown in Fig. 19. When the suture is tied, one side of the intestine is invaginated into the colon and the size of the enlarged opening is reduced. I find the single suture method to be on the whole the most satisfactory.

Firm adhesion of the surfaces thus brought to-

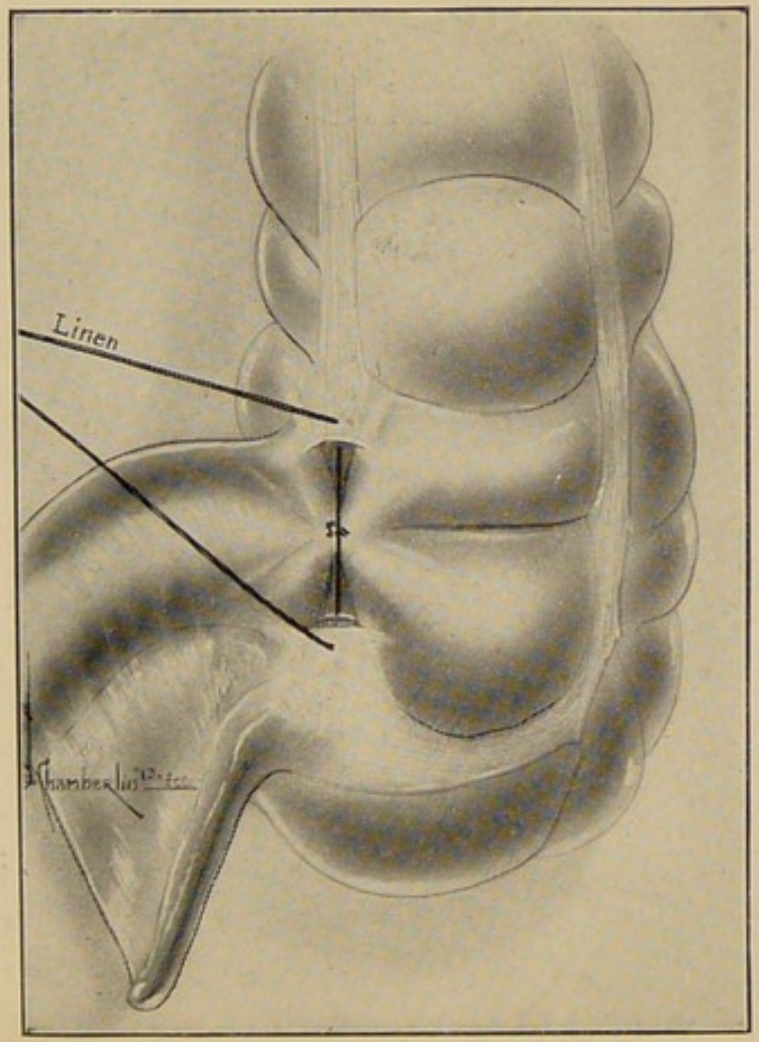


Fig. 17. Second suture placed to approximate ends of torn habenula.

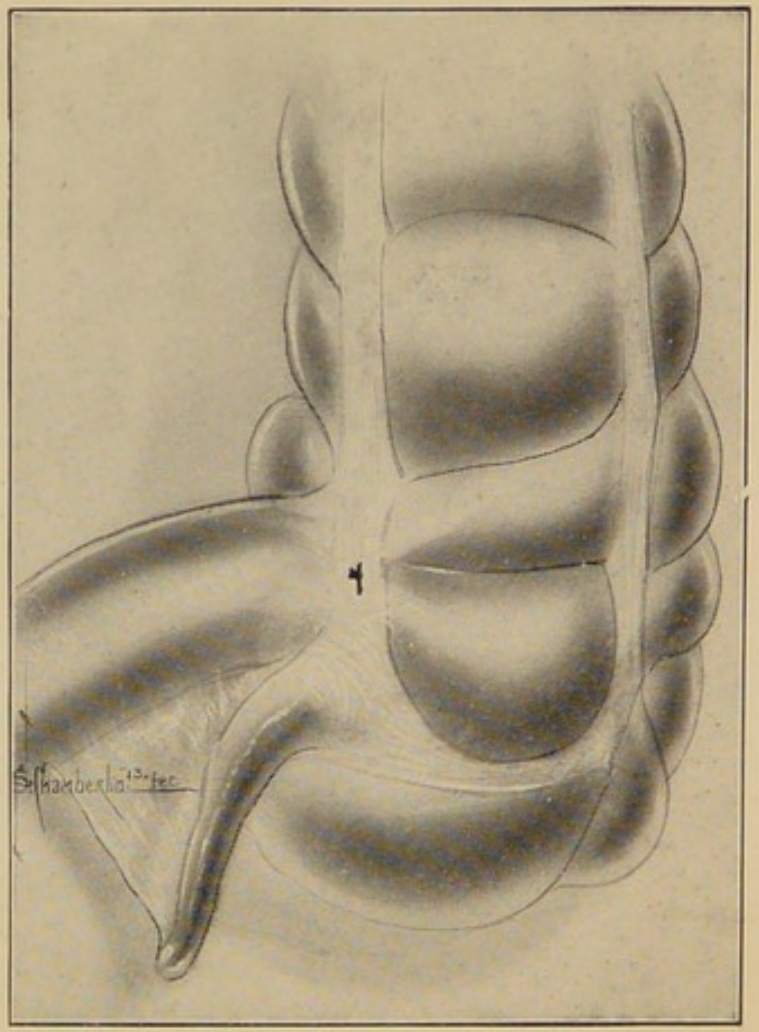


Fig. 18. Suture tied. Repair of valve completed.

gether is secured by abrading the peritoneum or painting it with tincture of iodine.

In the great majority of cases this is all that is required to completely restore the competency of the valve. In some cases, however, in which the bowel has been greatly dilated and elongated, both lips of the valve are destroyed and it is then necessary to suture the opposite side of the junction. Care must of course be taken to avoid narrowing the opening too greatly. The size of the opening may be tested by grasping the valve with the thumb and finger through the walls of the ileum and colon. The competency of the valve may be proved by stripping the ileum toward the colon and then compressing the ascending colon and making pressure upon the cecum so as to cause reflux if the valve is still incompetent. When the repair of the valve has been properly done, gas and liquid will pass easily from the small intestine into the colon but will not pass backward into the small intestine even when considerable pressure is made upon the cecum.

I have performed this operation in thirty cases (June, 1913), with satisfactory results. Examination after the operation by Dr. Case, röntgenologist of the institution, has shown the repaired valve to be competent in each case.

Necessarily, good judgment must be exercised to avoid producing too great narrowing of the valve and obstruction. In all cases in which the operation has been done the small intestine appears to perform its function in a perfectly normal manner.

It is of course necessary that the patient should, after operation for repair of the ileocecal valve, receive such instruction as will enable him to avoid the causes likely to induce a return of the difficulty, as it is conceivably possible that the incompetency may be reproduced, although as yet I have seen no case of relapse.

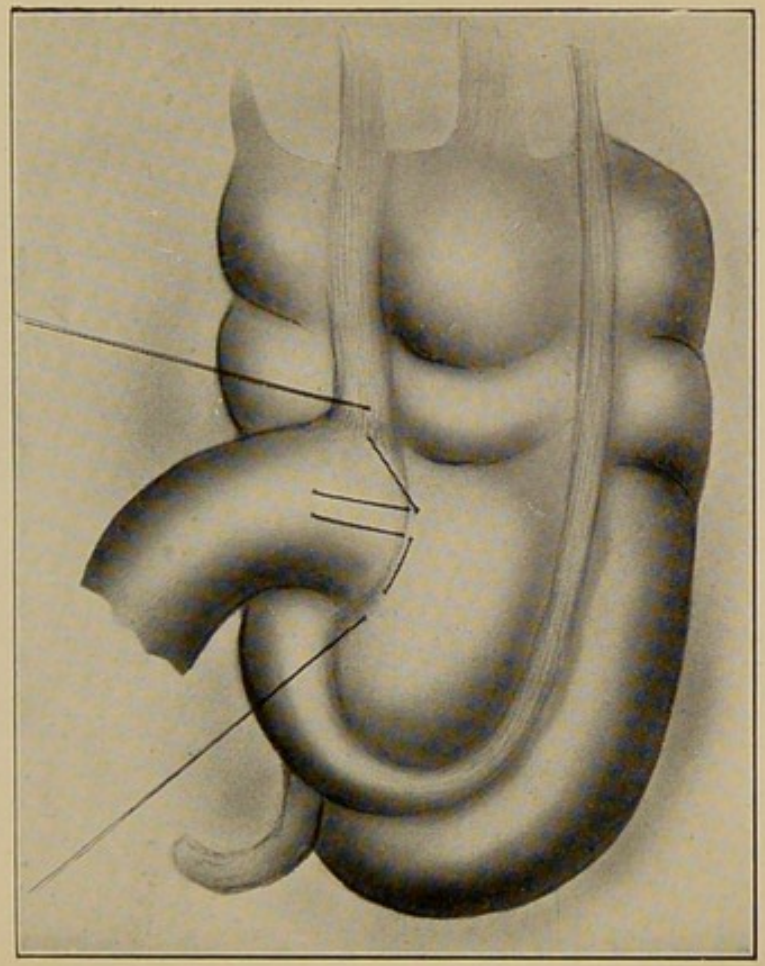


Fig. 19. Method of repairing valve by means of a single suture.

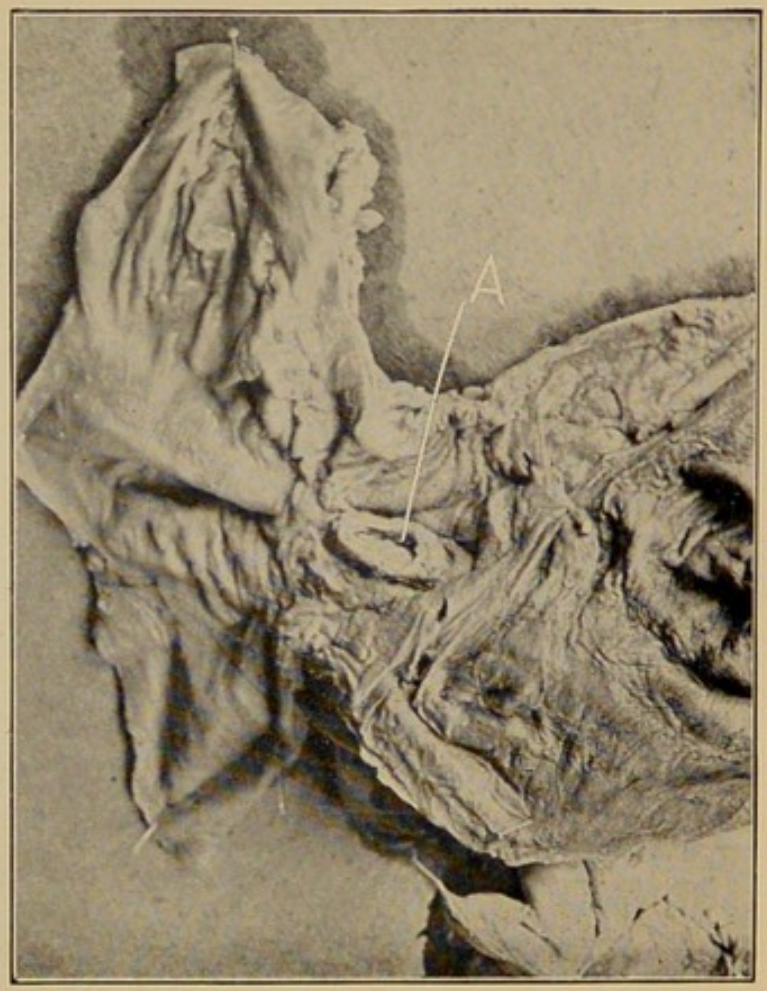


Fig. 20. Artificial ileocolic valve.

METHOD OF CONSTRUCTING AN ILEOCOLIC VALVE

In the writer's experience most cases of chronic constipation are curable by proper regulation of diet and the application of other physiologic means, but a certain proportion of cases resist all such measures, intestinal stasis persisting in spite of the most thoroughgoing application of remedies.

The remarkable advances made in the technique of the X-ray study of the alimentary tract within the last few years have rendered invaluable service in making it possible to locate the cause of obstruction in these obstinate cases.

The remarkable results which Mr. Lane, of London, has obtained by his operation of ileosigmoidostomy, under the guidance of X-ray findings, have furnished the most convincing evidence that stasis in the colon is responsible for a large number of grave chronic disorders which have heretofore been attributed to other causes. Mr. Lane's experience has further demonstrated that these conditions are entirely curable by the elimination of colonic stasis either by removal of the colon or by the short circuiting operation.

Notwithstanding the excellent results demonstrated by Mr. Lane and verified in a number of cases by his own experience, the writer has from the first felt misgivings respecting the permanent results of the operation because of the elimination of the ileocecal valve. In the first case in which I performed this operation, seven years ago, the results were extraordinarily good. Scores of cases have been reported not merely by Mr. Lane but by other surgeons in which most excellent results have followed the operation; but good results have been by no means uniform. On one occasion, the writer witnessed a second operation by a prominent surgeon for relief of adhesion in a case in which the larger part of the colon had previously been removed and a junction made between the ileum and

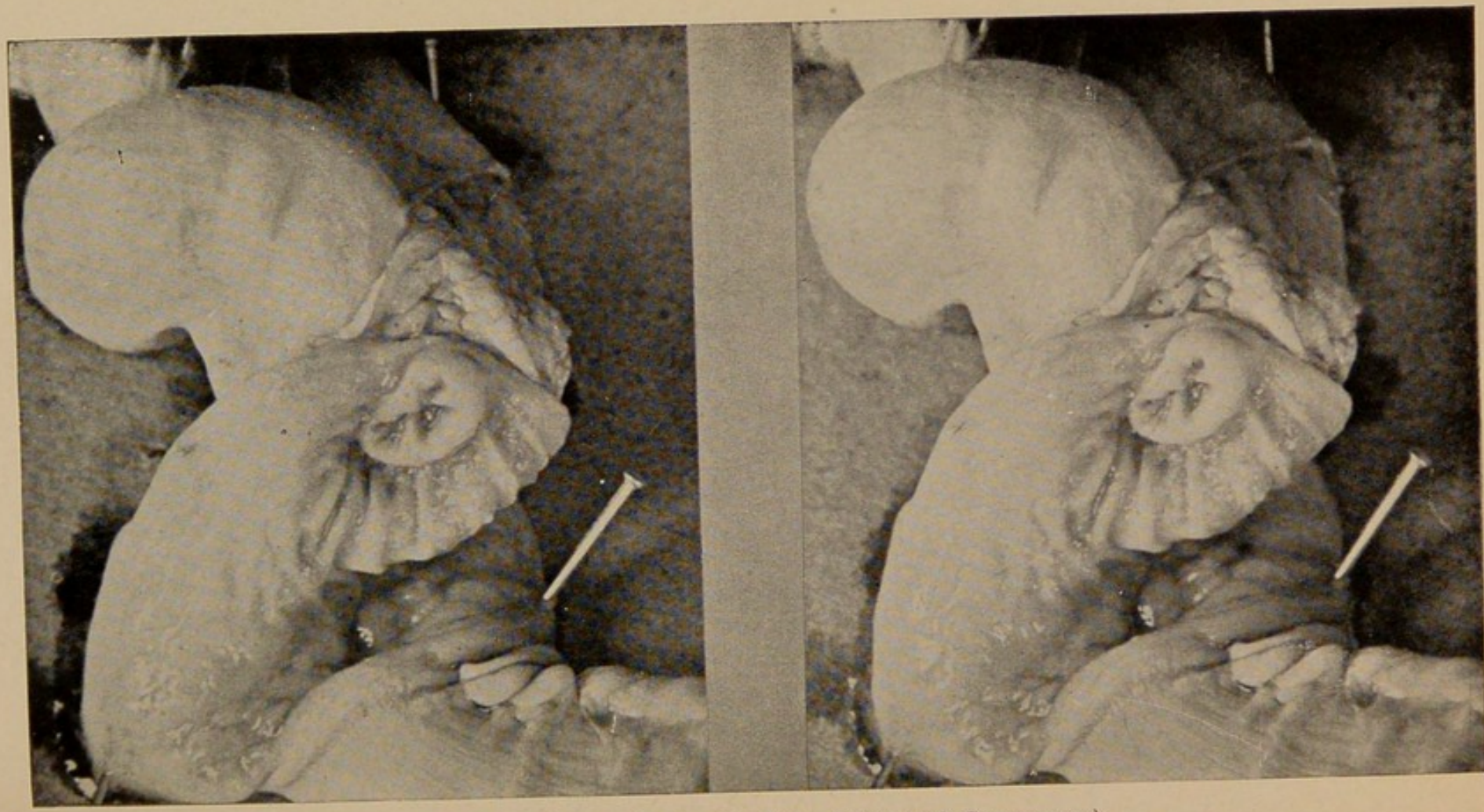


Fig. 21. Ileocecal valve of a dog. (View with Stereoscope.)

the pelvic colon. In this case the ileum had become distended to nearly the size of a normal colon. It was evident that the small intestine had been distended by backing up of material from the colon, and it may be easily believed that the infection of the small intestine resulting from such reflux may have been the cause of the very extensive adhesions which were present and which had become the cause of obstruction necessitating a second operation.

Dr. J. Walter Seawell, of Healdsburg, Cal., recently told me of a case in which the colon was removed by Dr. Wallace I. Terry, of San Francisco, and in which death occurred four months after the operation from cholangeitis and cholecystitis, the result of infection which traveled up from the colon through the ileum. Such an infection must be greatly facilitated by the absence of a valve at the ileocolic junction.

A study of the structure of the ileocecal valve and its functions confirmed me in the belief that the natural barrier which nature has erected in all vertebrate animals between the putrefying waste materials of the colon and the foodstuffs undergoing digestion and absorption in the small intestine is a condition necessary for the maintenance of the structural and functional integrity of the mid-gut and of the organism. I accordingly determined that in the next case in which I was called upon to form a new junction between the ileum and the colon I would undertake to make some kind of a valve capable of preventing reflux. A study of the ileocecal valve of the pig and later of the dog showed me that an efficient valve may be produced by simple intussusception of the ileum into the large intestine. Having constructed such a valve I found that it worked perfectly. It was possible to inflate the colon through the ileum and distend it with very considerable force without the occurrence of the slightest reflux.

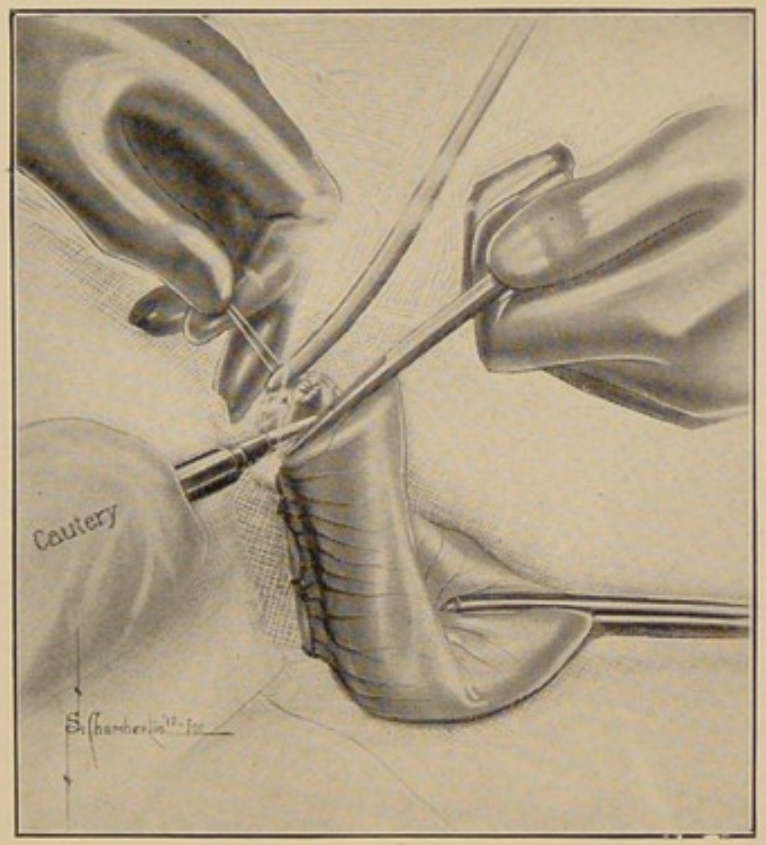


Fig. 22. First step in operation of short circuiting the colon and of making an artificial ileocolic valve. Division of the ileum.

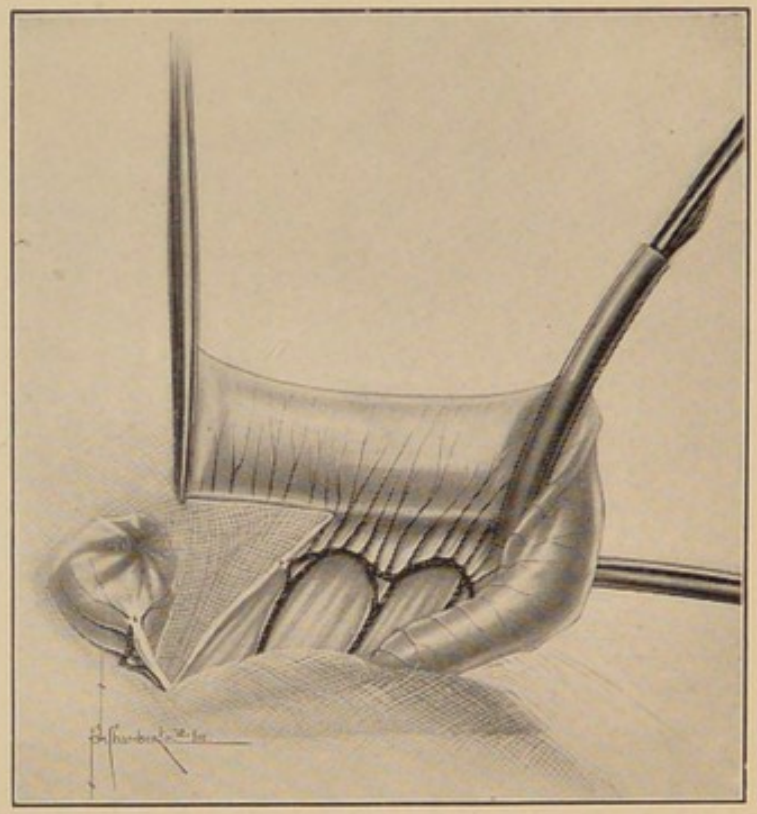


Fig. 23. Second step; mesentery separated from end of ileum.

Very shortly after making these experiments I had occasion to remove the cecum and ascending colon on account of complete obstruction due to malignant disease. In making the new junction of the ileum with the colon at a second operation I produced an intussusception of the ileum to the extent of about half an inch, and with the result that a perfectly competent valve was obtained as shown by subsequent X-ray examination after injection of the colon with bismuth by Dr. Case, röntgenologist of the Battle Creek Sanitarium. Although considerable force was used, it was impossible to cause any portion of the bismuth to pass into the ileum. The valve was perfectly competent and at the same time offered not the slightest resistance to the passage of food into the colon. The patient made an excellent recovery from the operation, but several weeks later died of acute pneumonia with gangrene of the lung. The opportunity afforded for examination of the valve by a post-mortem examination made by Drs. Harris and Case enables me to show the result of this first attempt to produce an artificial ileocolic valve (Fig. 20).

The valve shown is somewhat distorted because the photograph was not taken until after the tissues had been hardened with formalin. When first removed from the body the valve had a very regular appearance and very closely resembled the ileocecal valve of a dog shown in Fig. 21. The technique of the operation will be readily understood from the accompanying cuts.

Fig. 22 shows the ileum cut off at a point about six inches from the colon. With a Paquelin cautery the mesentery is being cut down close to the small intestine so as to leave about three centimeters of the ileum detached from the mesentery as shown in Fig. 23.

The loop of colon, generally the pelvic colon, with which the junction is to be made, having been

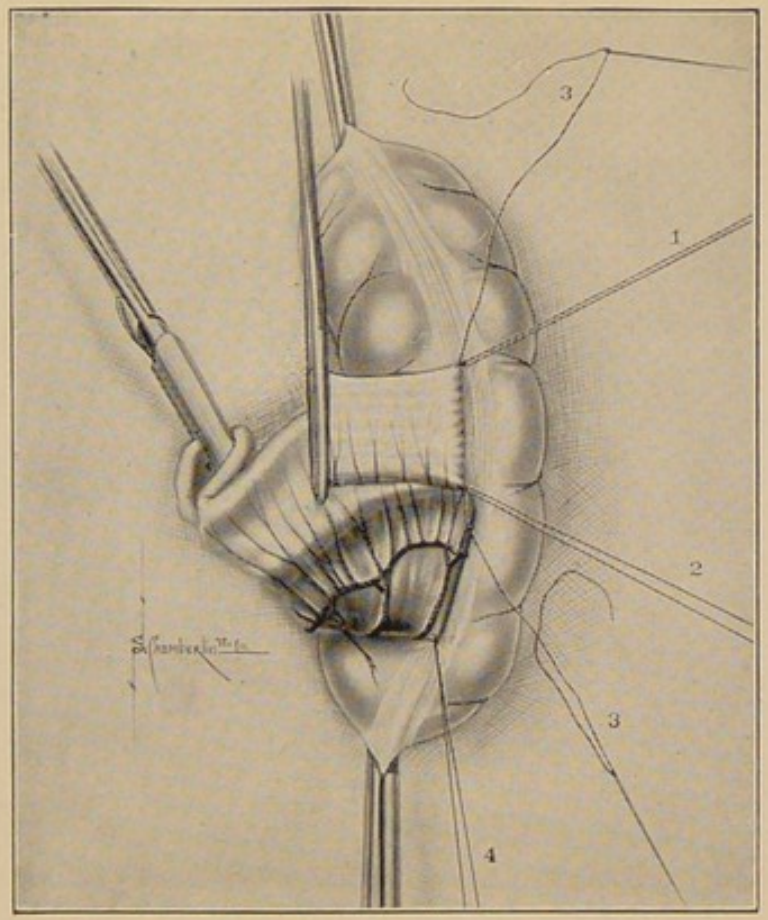


Fig. 24. Third step; first half of outer suture line connecting ileum and pelvic colon in end-to-end anastomosis.

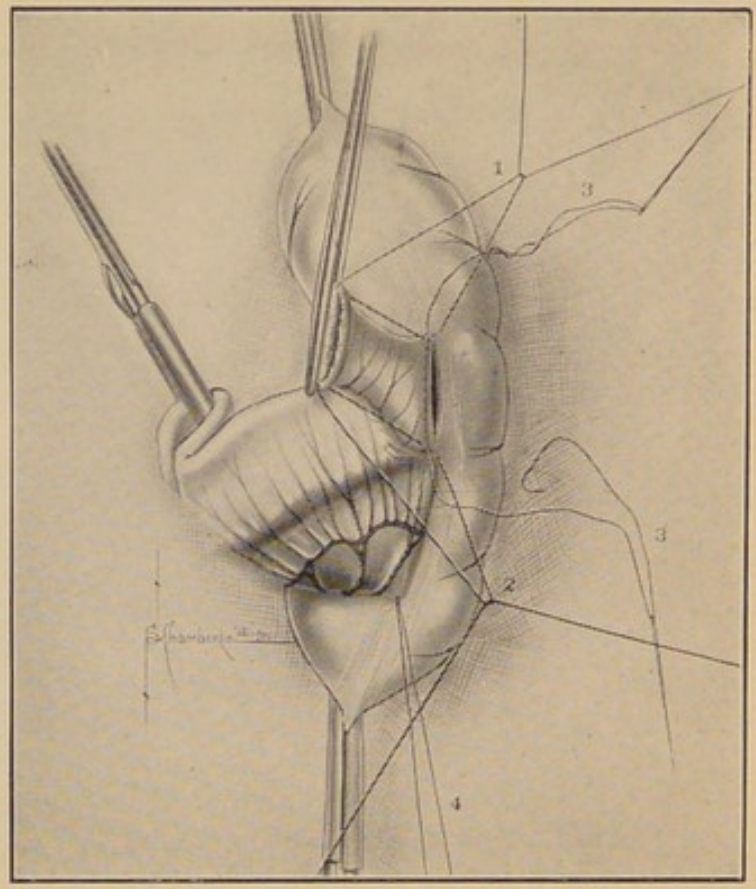


Fig. 25. Fourth step; incision of colon preparatory to application of inner suture line.

brought up to a proper position and clamped with rubber covered forceps, the end of the ileum is brought up against the side of the bowel and attached by suture to the bowel close to the border of the anterior longitudinal band as shown in Fig. 24.

A slit is made in the colon at a distance of about a quarter of an inch from the first suture line and the cut end of the intestine is attached to the opening as shown in Figs. 25 to 30.

Fig. 26 shows the inner suture line half completed.

Fig. 27 shows the inner suture line finished, and the fold of intestine which by the next step is to be tucked into the colon through the anastomotic opening, thus producing a valve.

In Fig. 28 the fold of intestine has been inverted into the colon.

In Fig. 29 the outer suture line has been completed. In placing this suture, care must be taken to make sure that the intussuscepted portion of the small intestine is not pulled out, and to avoid distorting the gut.

The edge of the cut mesentery is attached along the edge of the longitudinal band for a short distance as shown in Fig. 30, so as to avoid direct traction upon the line of union. Care is of course taken to attach the cut edge of the mesentery to the mesentery of the colon throughout its entire length, so as to avoid leaving an opening in which loops of small intestine might become tangled, producing obstruction.

Fig. 31 shows the appearance of the ileocolic junction as viewed from the interior of the colon.

Fig. 32 is a side view of an artificial ileocolic valve made in a case of advanced malignant disease of the stomach involving the transverse colon in which the pylorus was nearly closed and the lumen of the gut occluded. A gastro-enterostomy was done and an ileocolostomy, but the patient's condi-

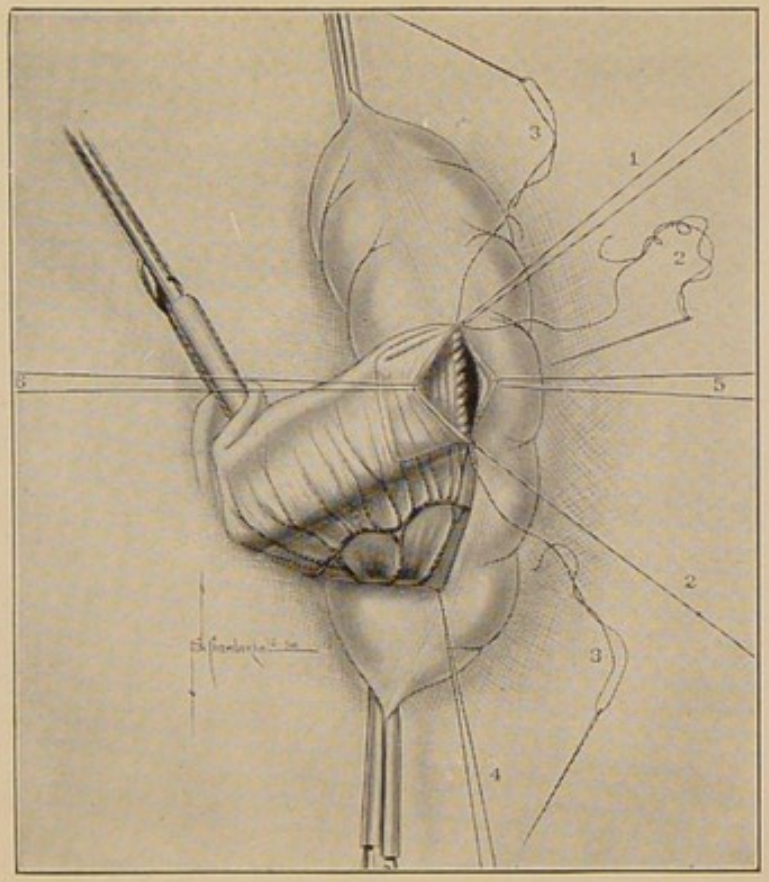


Fig. 26. Fifth step; application of inner suture, first half completed.

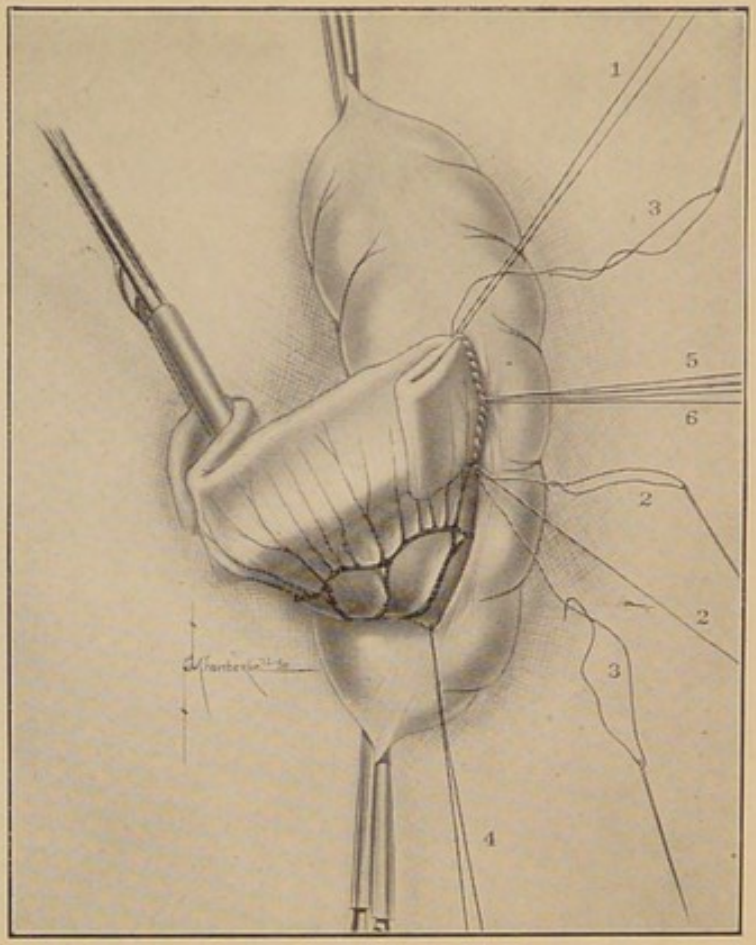


Fig. 27. Sixth step; inner suture line completed.

tion before operation had become so desperate that he survived the operation only a few days. The valve was tested before and after death and found to be entirely competent.

As will be seen by the foregoing description, the operation does not differ from the ordinary mode of procedure in end-to-side anastomosis of the small intestine with the colon except in one important particular—that there is a distance of two to three centimeters, measured along the surface of the intestine, between the inner and the outer suture lines. This permits the inverted small intestine to project into the colon about half an inch. The portion of the ileum thus intussuscepted forms a good valve for the reason that the folds of mucous membrane readily fall together whenever there is the slightest backward pressure.

In the opinion of the writer the so-called short-circuiting operation or ileosigmoidostomy, or any other operation whereby an anastomosis is made between the ileum and the colon, should never be performed without the construction of a valve for the prevention of reflux from the colon into the ileum. Without an ileocolic valve to prevent reflux, an ileosigmoidostomy performed for the purpose of getting rid of the intestinal intoxication arising from stasis in a looped, kinked or otherwise crippled colon may leave the patient in a condition as bad or even worse than before the operation by practically converting into a colon many feet of his small intestine.

The best point for attaching the ileum to the colon is near the upper end of the distal leg of the pelvic colon. Great care must be taken to avoid bruising or unnecessary handling of the intestine, so as to prevent adhesions, the formation of which about the point of anastomosis may become a source of obstruction.

[The above paper was sent to the publishers June 23, 1913. Between that time and the present

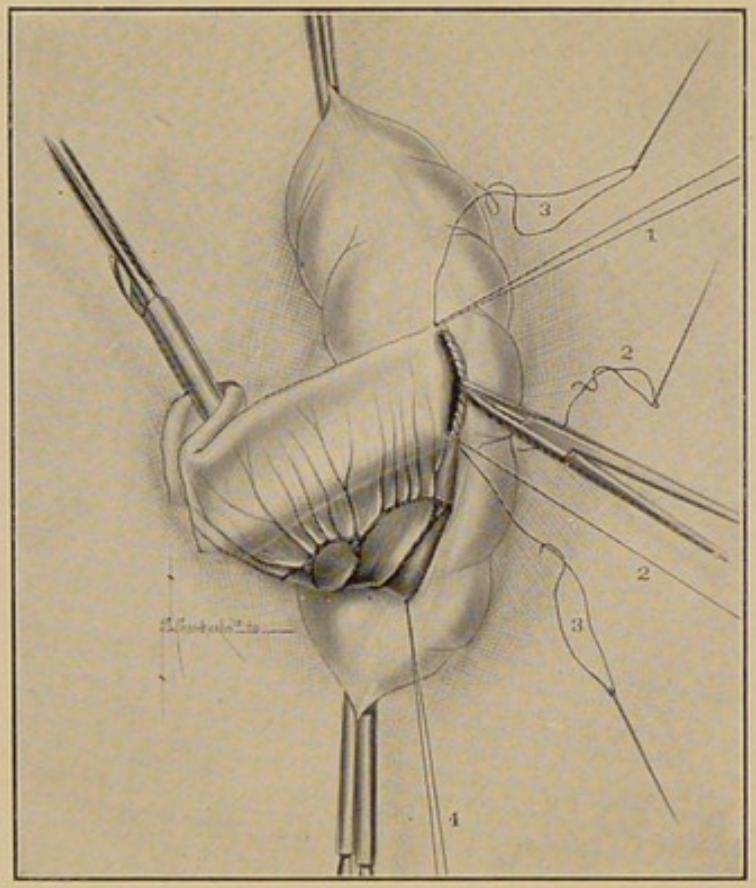


Fig. 28. Seventh; end of ileum invaginated into the colon.

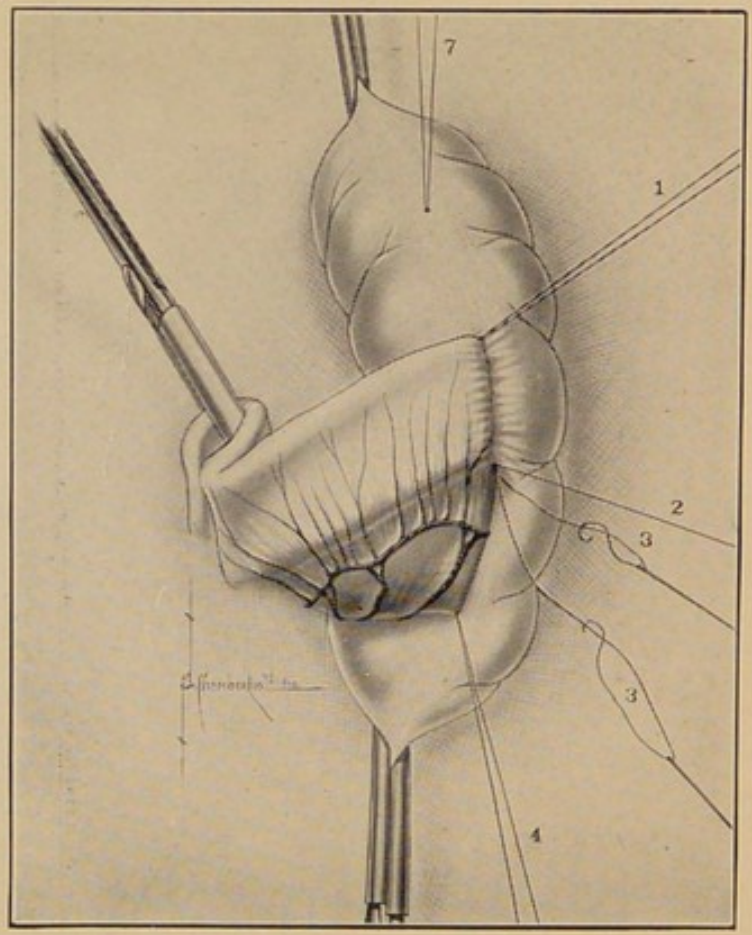


Fig. 29. Outer suture line completed.

date, November 15, I have operated for repair of the ileocecal valve in 36 cases, making 66 in all. Of these all but two or three have been examined by Dr. J. T. Case, röntgenologist of the Battle Creek Sanitarium, and in each case the valve has been found to be competent. In every case the pre-existing ilealstasis was found to be notably diminished and with the exception of two or three cases the ileum was found to empty itself within normal time, or in less than ten hours. A full report of the operative results in these cases and of some improvements in technique will be made in a subsequent paper.—J. H. K.]

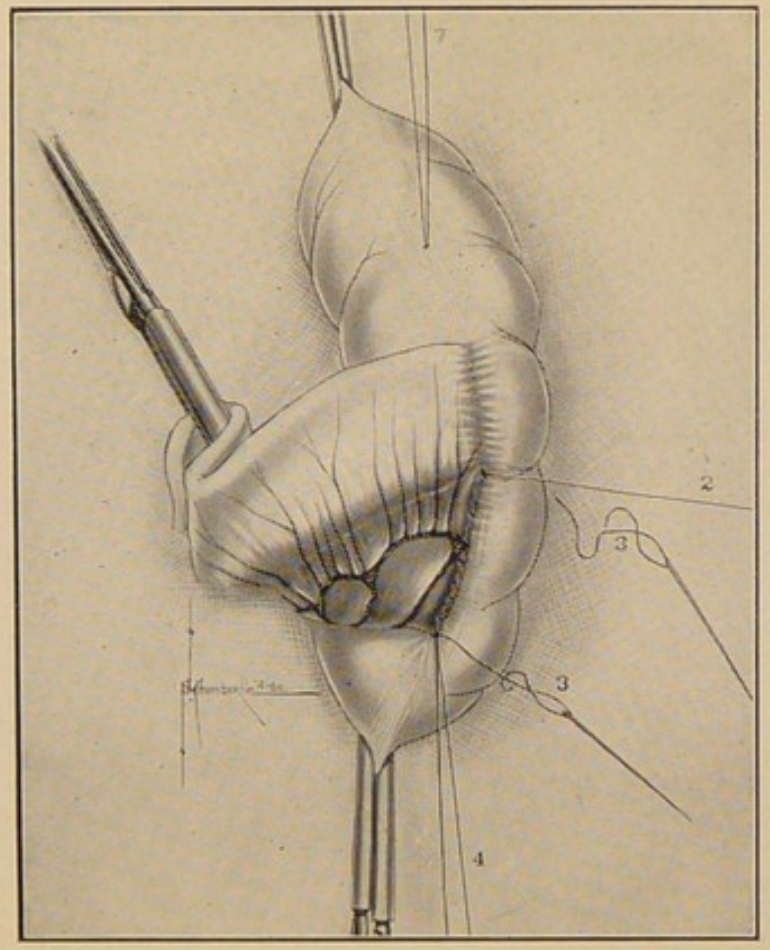


Fig. 30. Operation completed by attaching a portion of the mesentery to colon to prevent contraction at the point of anastomosis.

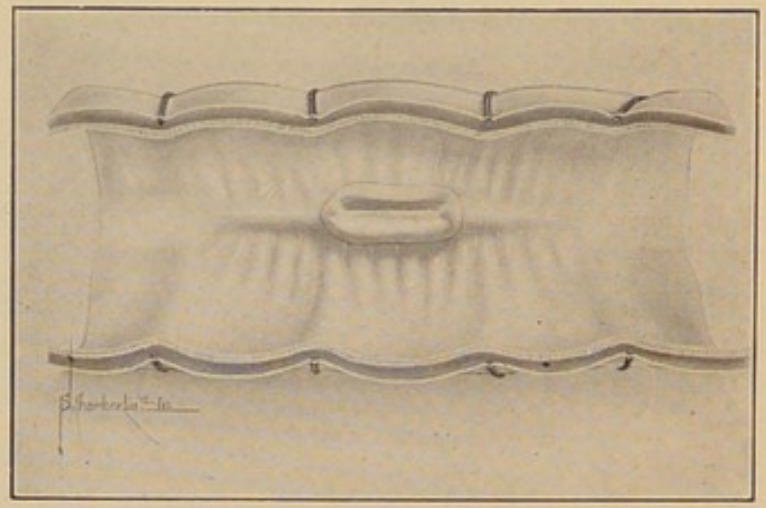


Fig. 31. Appearance of artificial valve from the inside.

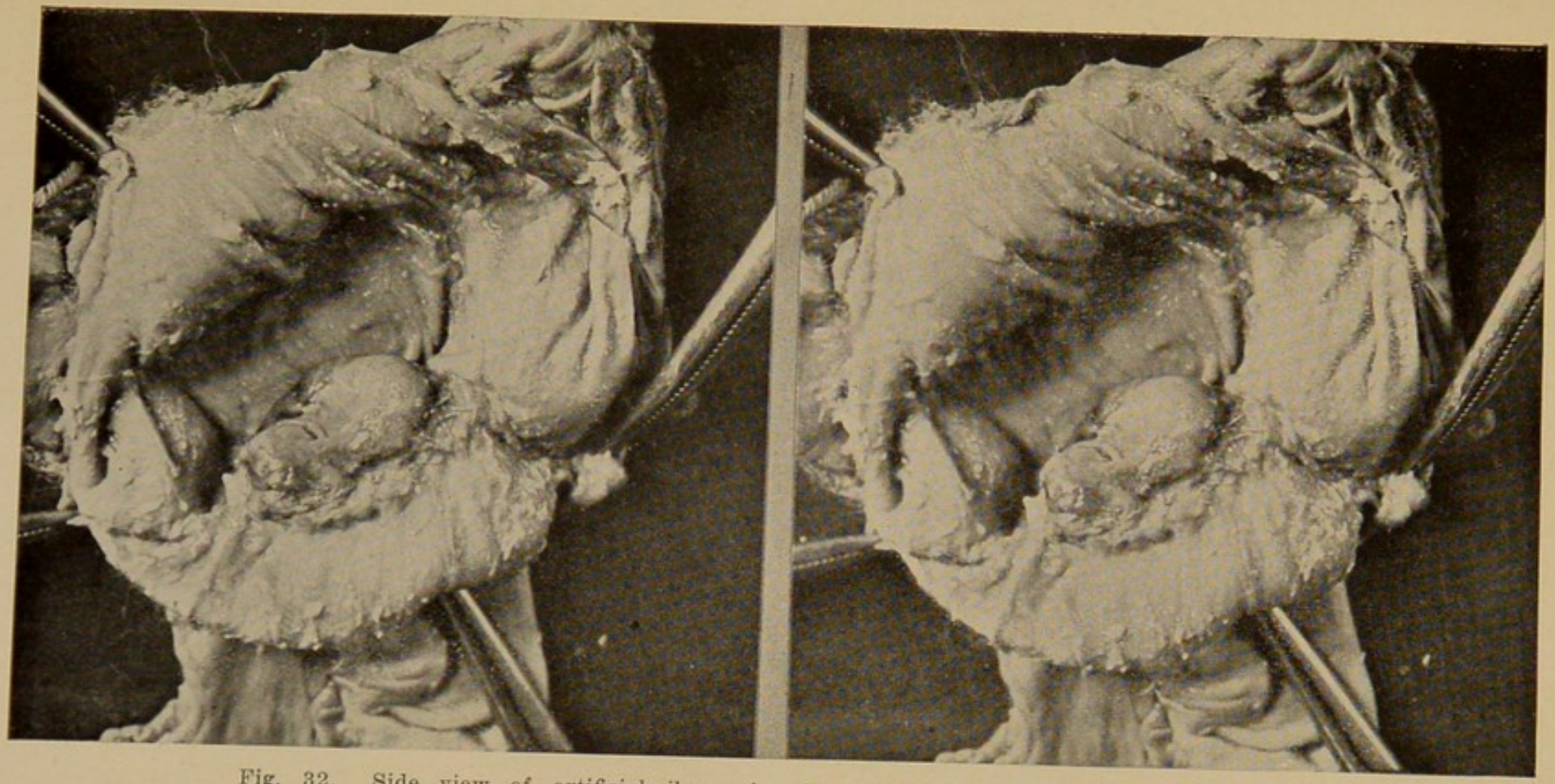
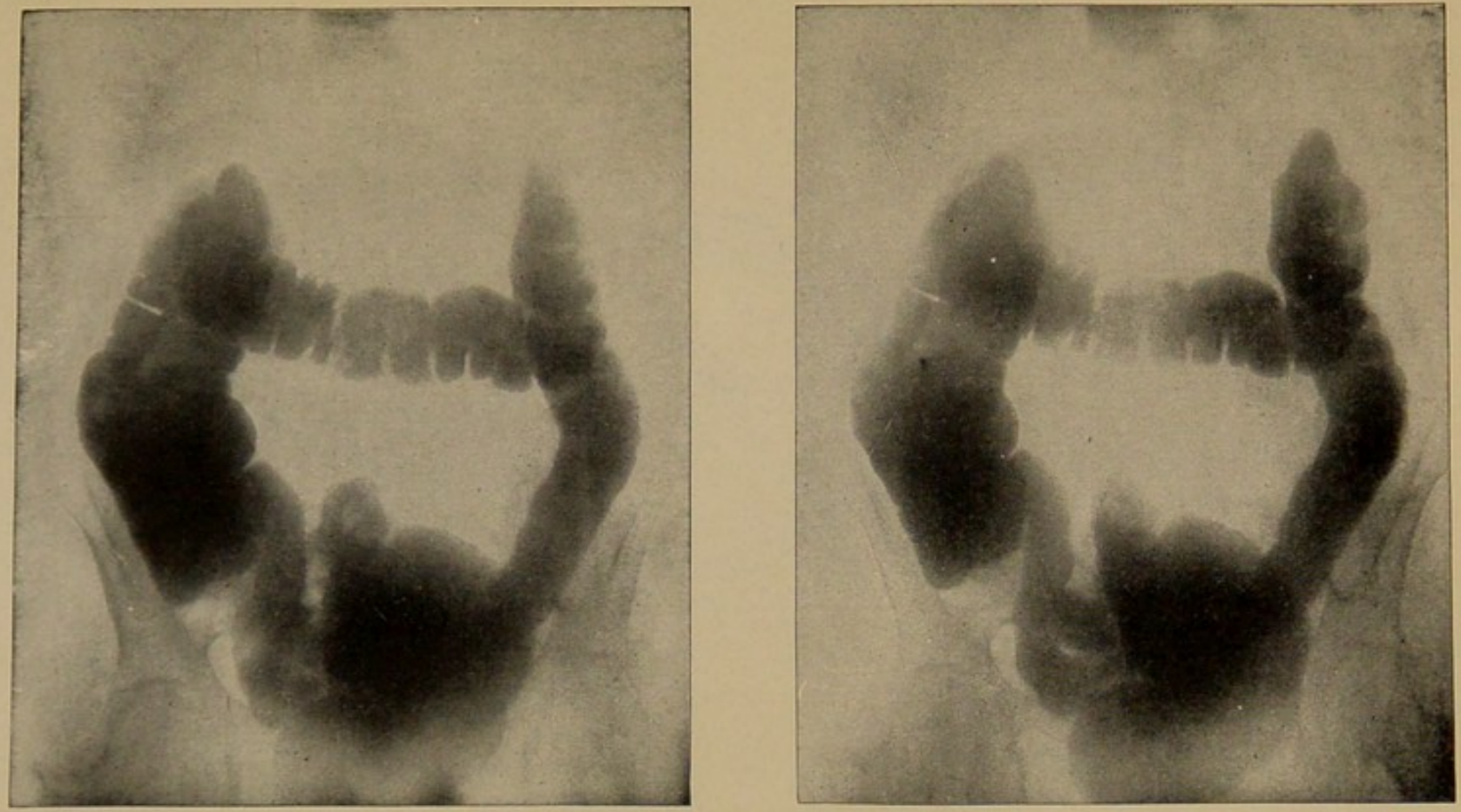


Fig. 32. Side view of artificial ileocecal valve from the inside. (View with Stereoscope.)



Stereoradiograph showing incompetency of the ileocecal valve, indicated by the presence of bismuth in the terminal ileum. (View with Stereoscope.)