

more scientific principles. The acute infectious cases may, at least, be given trial doses of vaccine, for this does no harm, and if by its action we can control the acute process these patients may be operated on during the interval. So, too, in operations on the large intestine, where the colon bacillus is ever present, by immunizing the patient before operation, the scope of the surgeon may be greatly increased and his results as greatly enhanced.

Dr. L. L. McARTHUR, Chicago: The *Staphylococcus aureus* and the colon bacillus are the two organisms which show a very pronounced effect when used as a vaccine, and Dr. Truesdale's suggestion to use them is excellent.

INTESTINAL ANASTOMOSIS; PRESENTATION OF A NEW, SIMPLE AND ASEPTIC METHOD.*

FRANK B. WALKER, M.D.
DETROIT.

Ever since the memorable pioneer work of the late Dr. Nicholas Senn, intestinal surgery has been an attractive and fruitful field. During this brief period there have been proposed many ingenious methods of anastomosis and devices for their performance. Some of them have already become obsolete, while others are gradually being superseded by simpler means. The methods in vogue are serviceable in skilled hands, but are complicated and liable to sepsis or are incomplete. None has been stamped with unqualified approval. All except the McGraw elastic ligature are done on a wide-open gut and are essentially septic operations. The ligature method—the simplest and cleanest of all—does not complete the anastomosis for three or more days and is, therefore, incompetent for those cases in which another communication does not exist.

With the development of definite sutural methods there has arisen a disposition to discard contrivances as unnecessary if not also complicated. The Connell suture—the best representative of them—I have used in preference to all other methods, both sutural and instrumental, and taught to about six hundred graduate students. Although I have been able to adapt it readily to any form of anastomosis I observed that it was difficult for many to learn and for all to remember unless they were in constant practice. Except for the danger of sepsis from the open gut and the somewhat intricate suturing of the last part and tying of the last knot, I should regard it as ideal.

Ideal or physiologic anastomosis has been little sought. The possibility of doing the operation with safety and the advantage of this or that special technic have been reported and discussed frequently, but seldom have the principles of intestinal anastomosis been given adequate consideration. In my opinion, too much has been taken for granted. For instance, the conception of anastomosis not uncommonly held is the making of a communication merely between two attached viscera. It is true that result is accomplished, but that alone will not always fulfill the requirements. Intestinal anastomosis is purely a drainage operation, but to be of any value it must first of all be needed and in the second place unobstructed drainage must be obtained.

The conclusion jumped at, that gastrojejunostomy would cure atonic dilatation and prolapse of the stomach, because it would drain, and gastric or duodenal

ulcer, because it would rest those parts, applied only to the result and not to the cause of disease, and it is, therefore, questionable whether gastroenterostomy be a curative or a palliative measure. This doubt is strengthened by reason of the facts that not only have the symptoms attendant on dilatation returned and ulcers reappeared lower down after apparent temporary relief, but it has been found in some cases that the anastomotic openings had healed shut. In other words, intestinal anastomosis, although inapplicable in some cases, had been employed as a makeshift instead of other more rational modes of treatment.

From the viewpoints of anatomy and physiology, the normal outlet of the stomach is by way of the pylorus. The stomach contents are propelled not by gravity, but by an inherent mechanism. If drainage be interfered with by some benign abnormality at or near the pylorus, the adoption of Nicoll's or Finney's or other possible pyloroplasty in preference to gastroenterostomy would conserve the normal mechanism of drainage and give promise of permanent relief. If, however, that passageway be permanently barred and another exit must be provided, gravity would come into play and indicate that the outlet should be situated, if possible, in the lowest convexity of the stomach and, on account of the to-and-fro movement, on the posterior rather than on the anterior surface. The exact point on the stomach longitudinally will depend somewhat on the case. It should be remembered, however, that, notwithstanding the change in shape and position of the organ in the empty and full conditions, the lowest convexity remains near the junction of the middle and right thirds of the greater curvature.

In cases in which anastomosis is performed without resection, it is essential that the communication between the afferent and efferent viscera be direct, and, therefore, that there be no kinking of the distal bowel either at the opening or lower down. Violation of this rule is doubtless responsible for the occurrence of the so-called vicious circle.

In the performance of posterior gastrojejunostomy it is a wise precaution to attach the jejunum firmly to the edges of the opening made in the transverse mesocolon. Failure to do so has been followed by a hernia into the lesser peritoneal cavity and intestinal obstruction.

If the intestine be resected and lateral anastomosis be performed, the stumps should be reasonably short and so attached, each to the other communicating bowel, as to preclude their intussusception. I have observed a long loose stump telescoped through itself into the intestine so far as to make a valvular closure of the anastomotic opening.

Besides promoting free drainage, the ideal method must be safe from sepsis and hemorrhage, simple of understanding and performance, complete in itself and applicable to all forms of anastomosis.

Sepsis is the most important factor to be contended with in intestinal anastomosis. The introduction of it from without can be controlled in this as well as in any other abdominal operation, but the possibility of infection from the open gut and of postoperative leakage is a constant menace. The danger from these sources can be minimized during the operation by walling off all the other structures with abundant sterile pads placed under and around the parts to be handled. Preoperative stomach washing, milking the intestine and the use of tapes and clamps to hold back the visceral con-

* Read in the Section on Surgery and Anatomy of the American Medical Association, at the Fifty-ninth Annual Session, held at Chicago, June, 1908.

tents serve their purposes, but an open bowel is unavoidable in carrying out any of the methods in vogue, except the elastic ligature, and is a serious defect.

Postoperative leakage is usually due to the following three conditions: (1) imperfect serous apposition at the mesenteric space, (2) sutures too tightly drawn, (3) knotting a through suture on the serous surface.

Serous apposition of the viscera produces valvular approximation of the edges and effectually prevents the escape of bowel contents. This procedure has been adopted in all the methods that have proved successful. In end-to-end anastomosis especial care must be used to

from the inside (Gregory Connell) or from the outside (Hayward Cushing). In simplicity and cleanliness the latter excels. A suture that is to be tied on the outer surface, however, should not be carried deeper than the submucous layer on account of the tendency to capillary action and seeping. No suture should be tied or drawn more tightly than is necessary to secure serous apposition. Otherwise the swelling of the tissues following operation may result in necrosis.

From a theoretical viewpoint, catgut would seem to be ideal suture material, but experience has taught that it softens and separates in the intestinal tissues too

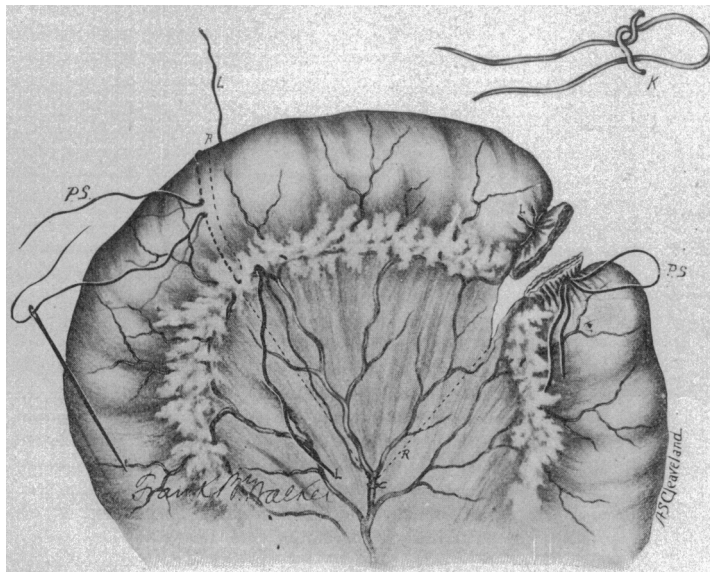


Fig. 1.—L, ligature; PS, purse-string suture; K, slip knot. The left side of Fig. 1 represents purse-string suture and ligature placed and ready for tying; the right side represents them tied and the gut cut across. In the upper right corner the slip knot is represented on a large scale.

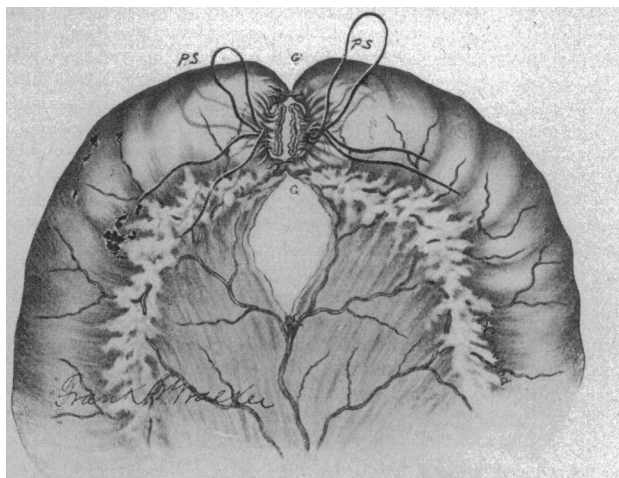


Fig. 2.—This represents the stumps closed by purse-string sutures tied with slip knots and held together by two guy mattress sutures (G).

invert the mesentery with the intestine at the mesenteric space.

A continuous through mattress suture is preferable to the interrupted form, because it prevents overdistention of the bowel and separation of the edges during the period of healing, and it is more certain than the Lembert suture to close the cut ends of bleeding vessels and to control hemorrhage. It may be introduced and tied

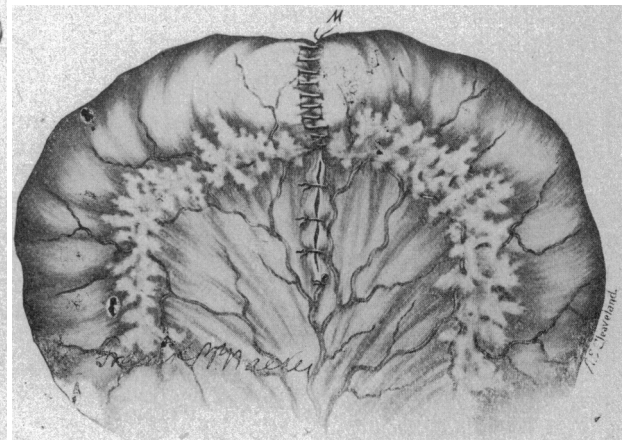


Fig. 3.—This represents the continuous mattress suture (M) placed but not drawn taut. The purse-string sutures have been withdrawn. The mesenteric gap has been closed by three sutures.

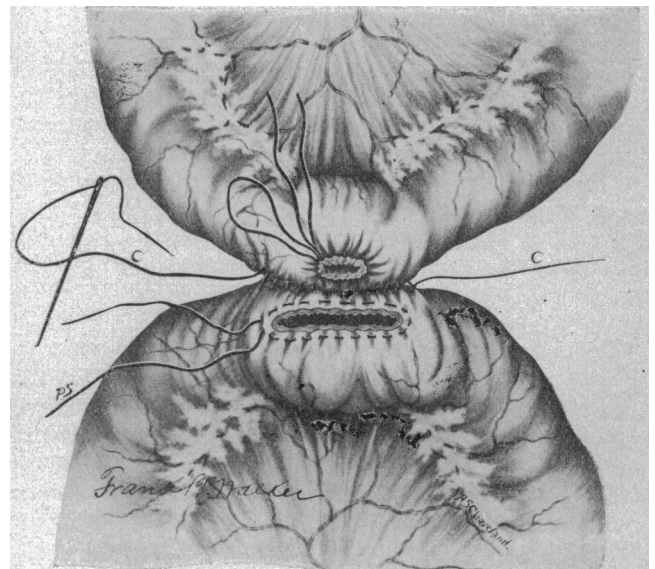


Fig. 4.—This represents two portions of intestine apposed and connected by a continuous mattress suture (C) through a short distance. In the lower gut a purse-string suture has been placed and the wall incised. In the upper gut the purse-string suture has been tied with a slip knot.

quickly to be reliable. Fine twisted silk and linen are safe and answer every purpose.

Almost any method becomes easy through practice, but no method will win universal favor that involves complicated technic or instruments or numerous assistants. A generally acceptable method must also be sur-

gically complete without the mediation of an uncertain hidden contrivance and must be adaptable in any emergency requiring anastomosis.

The method which I present here is not presumed to be a substitute for ignorance of surgical principles or carelessness in their practice, but it can be carried out by one pair of hands with scissors, needle and thread, and combines the advantages of other procedures without their defects. It is based on the closure of the gut during the operation by means of a removable purse-string suture, on serous apposition by a continuous through mattress suture inserted from the outside of the gut, and on the withdrawal of the purse-string suture after the suturing is completed, leaving an open lumen. The technic is shown in Figure 1, and is as follows:

For resection of intestine and mesentery as at R (Fig. 1), and end-to-end anastomosis, place ligatures (L) on healthy bowel proximally and distally beyond the part to be removed. Insert purse-string sutures (P. S.) about bowel one-half inch proximally and distally from ligatures (L) and tie with slip-knot (K), made by drawing only a part of one end of purse-string suture through knot. Ligature mesenteric vessels. With scissors cut across intestine close to purse-strings and divide mesentery as on dotted lines.

Bring the stumps of resected intestine together so that they shall correspond at mesenteric borders (Fig. 2). Place two or three guy mattress sutures (G) about one-eighth inch above purse-string sutures (P. S.) to hold the stumps temporarily in proper relation.

Begin continuous mattress suture (Fig. 3, M) at any point, except at mesenteric border, and with it encircle the bowel about one-quarter inch above purse-string sutures, passing from side to side six or seven times to the linear inch. The anastomotic suture should include the submucosa and may include the mucosa also, as a through suture does, except in that part of it which contains a knot. Extra care is necessary in placing the sutures evenly and in inverting the mesentery at mesenteric borders. The loops and ends of purse-strings project between the passes of the encircling suture until withdrawn. After the encircling suture has been placed around the bowel, drawn sufficiently taut and tied, the purse-strings are untied and withdrawn by pulling gently on their loose ends. The gap in the resected mesentery is closed by sutures or ligatures.

Theoretically, end-to-end anastomosis would seem to be more nearly ideal than the lateral form. It provides a more direct communication and conserves the function of the muscular mechanism of the intestine. It is impossible of adoption, however, in certain pyloric conditions as mentioned previously, and whenever the intestine is so small that inversion of the edges would make a diaphragm and closure of the lumen. In such cases, the lateral method has proved to be an excellent substitute. Moreover, it avoids the disadvantages of the mesenteric space. It is performed by the purse-string method as follows:

For lateral intestinal or gastrointestinal anastomosis bring the two viscera into the desired relation and place a continuous mattress suture (Fig. 4, C), connecting them through a length of from two to three inches, oval-shaped. Insert purse-string suture (P. S.) into each viscus one-quarter inch distant from and parallel to the continuous mattress suture (C). The purse-string su-

tures should be one-half inch shorter than the surrounding suture. With scissors or knife incise visceral wall within purse-string, trimming out strip of mucosa if desired, tie purse-string suture with slip-knot and, after both viscera have been thus treated, complete surrounding suture (C). After the latter has been placed, drawn sufficiently taut and tied, the purse-string sutures are untied and withdrawn by pulling gently on their loose ends.

DISCUSSION.

DR. F. GREGORY CONNELL, Oshkosh, Wis.: Improvements on the present attempts at aseptic intestinal technic are demanded. Dr. Walker's method and those of Muskowicz, E. Wyllys Andrews and Parker and Kerr are similar in principle to that of an Italian, Parlavechio, which was published in 1897. They allow of a comparative asepsis, and will emphasize the necessity of the greatest care in an effort to avoid unnecessary soiling of the peritoneum by intestinal contents. Practical methods of union may now be performed in a comparatively aseptic manner; but when not to do enterorrhaphy has not been emphasized. Breaks of continuity of the intestinal wall do not unequivocally demand immediate enterorrhaphy. The self-evident truth that a live patient with a fecal fistula is a more satisfactory result than is a corpse with a successful intestinal union, has occasionally been overlooked. Many points will have to be decided in the diagnosis before, during and after the operation, that if not judged correctly will render valueless a technically perfect enterorrhaphy, such as: When (in strangulation) to leave the bowel alone, or to perform enterectomy; when (in wounds) to perform simple enterorrhaphy, or resection; when (after enterectomy) to perform enterorrhaphy by end-to-end, end-to-side, or side-to-side union, or to establish an enterostomy; when (with stenosis) to do a resection, an anastomosis or an exclusion. To procure normal tissue, of which the blood supply is perfect, at the cut ends for suturing, it is sometimes necessary to remove apparently formidable lengths of intestine. Failure to secure such tissue is undoubtedly responsible for a large percentage of unsatisfactory results. To accomplish intestinal union the method of choice is that with needle and thread alone. A prime requirement of the suture is a secure stitch, holding the cut ends in sero-serous apposition, or apposition continuously around the entire line of union, to secure which caution must be exercised at the mesenteric junction, because of the triangular space between serosa and muscularis formed by the anatomic arrangement of the peritoneum which allows a longitudinal strip of the intestine at this point to be devoid of serosa. The perforating, or through-and-through suture has been generally adopted as the important, security-giving, stitch. The use of a second row of stitches, including only the serosa and the muscularis, is at present looked on as merely a precautionary measure for the purpose of causing a broader sero-serous apposition and not to resist tension. Any stitch that enters the bowel lumen or comes into contact with the intestinal mucosa should be of non-absorbable material. This will remain in place until its usefulness is past, after which it will be eliminated into the intestinal current. Catgut, on the other hand, may be absorbed too rapidly. The secondary reinforcing sero-muscular stitch does not communicate with the lumen, and, therefore, may be of catgut. The time-saving feature and the hemostatic properties are perhaps the most important reasons why the continuous suture is employed more often than is the interrupted. Drainage will sometimes be necessary after enterorrhaphy, but not as often as in the past. The drain is to be placed adjacent to but not in contact with the line of visceral suturing.

DR. A. J. OCHSNER, Chicago: Dr. Walker's beautiful and ingenious operation must not mislead us into the idea that patients ordinarily die after intestinal operations because of the operation. They die because of the condition in which they are at the time they are operated on, or because of faulty surgical judgment. In intestinal operations, if the infection is still within the intestine, then death results from an unrecognized condition of the blood vessels. There is a thrombosis somewhere which results in a slough and kills the

patient. Either the surgeon has not gone far enough beyond the seat of the disease or has traumatized the intestine, or has made the gross blunder of infecting the patient himself, which is practically a thing of the past among those who do intestinal surgery.

CARDIOSPASM,

WITH A REPORT OF FORTY CASES.

H. S. PLUMMER, M.D.

Physician to St. Mary's Hospital.
ROCHESTER, MINN.

The first series of cases of so-called idiopathic dilatation of the esophagus was collected by von Ziemssen and Zenker in 1878. The report was based mostly on postmortem findings, little being known of the history of the cases. For our knowledge of the symptomatology of the disease we are indebted to the writings of Lichenstein, von Strumpell, Meltzer, Rumpel, Kraus, Rosenheim, Fleiner, Ewald, Netter, Kelling, Einhorn, Martin, Oppler, Gottstein, Dauber, Zausch, Strauss, Losen, Sippey, and others.

In 1904 Mikulicz estimated that 100 cases could be collected from literature. Since that time a number of cases have been reported, notably in German literature, and by Sippey, Lerche and Erdmann in this country. Gottstein, in Keene's "Surgery," states that 140 cases have so far been reported, and himself adds 25 more. This paper is based on 40 cases which have come under my observation. Eleven cases of this series were reported in a paper¹ read before the Minnesota State Medical Society in June, 1906.

The disease has been attributed to the following causes: first, primary cardiospasm (Meltzer); second, primary atony of the musculature of the esophagus (Rosenheim); third, simultaneous presence of cardiospasm and paralysis of the circular fibers of the esophagus, brought about by paralysis of the vagus (Kraus); fourth, congenital disposition (Fleiner, Zenker, Luschka and Sievers); fifth, primary esophagitis (Martin), and, sixth, kinking at the hiatus esophagi.

The unsatisfactory condition of our knowledge of the etiology of this disease is indicated by the variety of the titles under which the cases have been reported—idiopathic, fusiform, diffuse dilatation; dilatation without anatomical stenosis, etc.

Gottstein classifies motor disturbances of the esophagus as follows:

1. Hyperkinetic, in which spastic contractions of the muscle exceed the physiological normal.
2. Hypokinetic, in which there is an impairment of the normal muscular tone.

While it is probable that primary atony of the esophageal muscle rarely occurs, I doubt very much its being a frequent factor in the cases which have been reported under the headings, idiopathic dilatation of the esophagus, cardiospasm, etc. In the study of a considerable number of cases the almost invariable history of spasm at the onset, followed at a later period by the evidence of dilatation—that is, retention of food in the esophagus—is most convincing evidence that the spasm precedes the dilatation and that primary atony is relatively a rare condition. This conclusion is further borne out by the evidence of early muscular hypertrophy in nearly all cases which have come to postmortem; by the frequent observation of severe cardiospasm unaccom-

panied by dilatation of the esophagus, and by the good results which have followed forcible dilatation. The occasional case in which spasm can not be demonstrated does not exclude its being the primary factor. The spasm is in many cases periodic, and after dilatation takes place little if any more than the normal tone of the cardiac muscle is required to produce evidence of stenosis. Rosenheim, in support of the theory of primary atony, reports cases in which the food passed slowly through the esophagus, causing discomfort or pain, but he fails to show that these cases ever develop spasm at the cardia or dilatation of the esophagus.

The history, as given in Cases 11 and 24, suggests the possibility of dilatation almost from the onset. These histories date back eighteen and twenty-six years, and it is very probable that the more striking symptoms that came on with the dilatation overshadowed the early symptoms of spasm in the patient's memory. Severe spasm was present at the time these cases came under observation. Atony of the musculature of the entire gastrointestinal tract, without obstruction, is frequently observed, but it is almost invariably associated with other neurotic manifestations. There is no reason why spasm should exist in primary atony unless we accept Kraus' theory of a simultaneous atony and spasm from degenerative changes in the vagus. His theory rests on the finding of degenerated fibers in the vagus in one case which came to postmortem. His observations have not been confirmed.

The theory of congenital disposition is interesting but not susceptible of demonstration. That Anlage may be a factor in some instances is suggested by the few rare cases reported as occurring congenitally or in early childhood (Luschka, Fleiner, Zenker, Gottstein). In six cases of this series sufficient angulation at the cardia was present to prevent the passage of a sound by the usual method. Whether this exaggeration of the normal obliquity of the insertion of the esophagus through the diaphragm is the cause of the spasm, or is a result, I am unable to state.

The cause of the spasm is largely speculative. A few cases have been reported associated with gross lesions of the esophagus, such as ulcers, fissures and small carcinoma in the cardia, carcinoma of the stomach, etc. We have seen three cases of carcinoma complicated by cardiospasm, and one case of hour-glass stomach due to syphilis with secondary cardiospasm. Esophagitis and ulcer of the esophageal wall not in close proximity to the cardia are to be looked on as secondary to cardiospasm and dilatation, not as primary factors. In the majority of cases, however, no such possible etiologic factors are to be found. Cardiospasm is not often present in inflammatory conditions of the esophagus which come under observation. Evidence of esophagitis previous to the onset of the cardiospasm could not be elicited from any of the cases. With three exceptions, none of the forty cases reported had neurasthenic symptoms. The age and sex of the patients may be seen by referring to the accompanying table. The average age at the onset is 29 years; twenty-two patients are females, eighteen males.

Deglutition is a complicated, reflex act in which many muscles cooperate. Without entering into a discussion of the exact part played by each, it may be stated that food is carried from the mouth into the esophagus by the omohyoids, hyoglossi, pharyngeal and associated muscles. In the upper portion of the tube the bolus is rapidly carried down by the cross striated muscles of its

1. Northwestern Lancet, September, 1906.