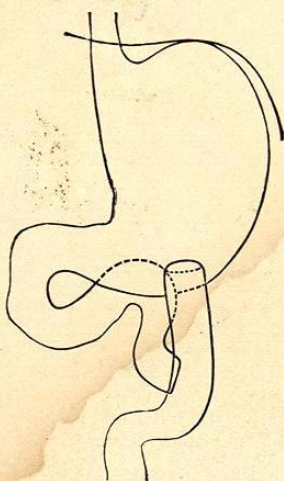


made in the mesocolon in retrocolic anastomosis. The intestine has also become strangulated by slipping in beneath the bridge of jejunum which is always caused by every anastomosis whether antecolic or retrocolic. This produces symptoms which are usually due to compression of the root of the mesentery rather than to incarceration of the intestine.

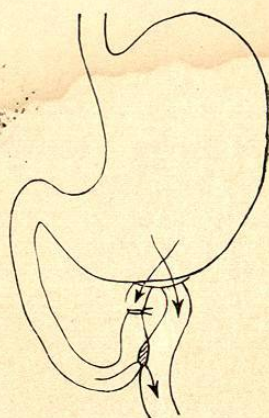
The vicious circle and other complications of gastro-enterostomy are much commoner after an ordinary antecolic anastomosis than after a well-performed retrocolic anastomosis. This has led many operators to prefer the retrocolic method, but the simplicity of the antecolic method gives it a certain advantage which should not be lost sight of.

FIG. 178.



Gastro-enterostomy according to Wölfler and Roux.

FIG. 179.



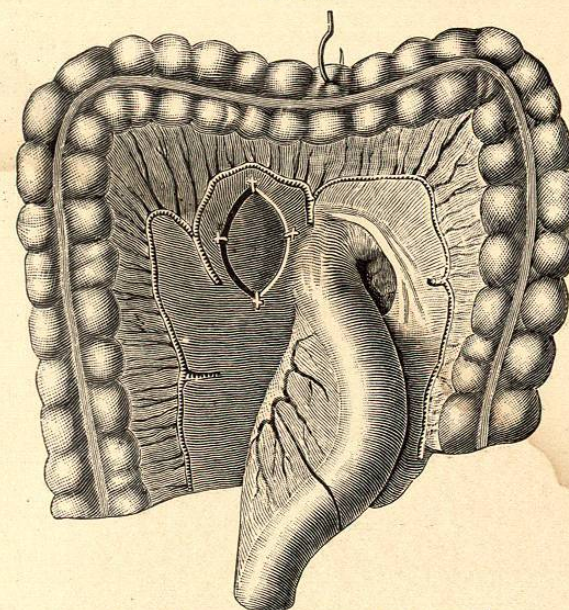
Gastro-enterostomy according to Chaput.

This is especially true in cases of contracted and only slightly movable stomach. There is another step in the technic of an antecolic operation which at least puts it on a plane with the retrocolic method in point of freedom from post-operative complication. Reference is made to the establishment of communication between the ascending and descending portions of the intestinal loop, as recommended by Braun and Jaboulay. (Fig. 176.) Mikulicz always includes this entero-anastomosis in operating upon patients in whom atony or dilatation of the stomach or some other condition indicates the possibility of vicious circle. The additional time required for this step in the operation is not more than six to ten minutes.

Other surgeons have sought in various ways to prevent the formation of a vicious circle. Hacker narrows the entrance to the afferent portion of the intestine by suture. Chlumsky twists the afferent portion through 180 degrees before attaching it to the stomach. Kocher and others try to prevent a return current into the afferent loop by the formation of a valve. (Fig. 177.) Kocher does this by

folding into the lumen of the afferent intestine some of its own wall. Wölfler divides the loop of jejunum and implants the efferent portion in the stomach and then implants the afferent portion in the side of the efferent portion. This is the so-called Y-gastro-enterostomy. Roux performs the same operation, except that he does it behind the colon instead of in front. (Figs. 180, 181.) Chaput performs gastro-enterostomy and entero-anastomosis, and then divides the afferent portion of intestine between these two anastomoses and sutures the cut ends blindly. (Fig. 179.)

FIG. 180.



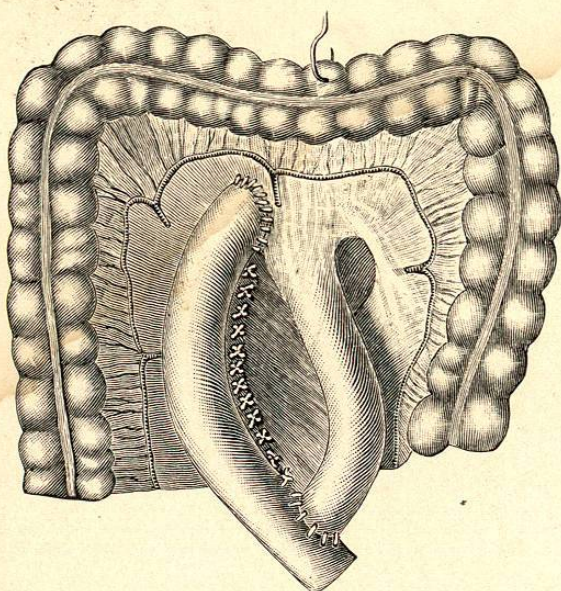
Roux's Y-gastro-enterostomy. Lines of incision.

What has been thus far stated on the subject of gastro-enterostomy applies to anastomosis by suture. This is an operation in which the Murphy button can be used with advantage.

The use of the Murphy button seems to prevent the formation of a vicious circle. This point is of great theoretical interest as indicating that the vicious circle is usually due to a valve. As the free passage of fluid is secured for at least eight days through the button, the patient will have passed the critical period before it is possible for the valve to begin to act, and by the time the button is loosened and passed on, the current in the new direction will be already well established. Mikulicz therefore employs the button for gastro-enterostomy, especially upon patients with malignant disease, for whom the operation should be made as brief as may be, while he employs a suture upon patients with beginning pyloric stenosis, adding an entero-anastomosis to the gastro-enterostomy.

Mikulicz's technic of antecolic gastro-enterostomy is as follows: An incision 10 or 15 cm. (4 to 6 inches) in length is made in the epigastrium or slightly below it. The omentum and transverse colon are raised in the left hand, while the right hand is passed to the root of the mesentery, and the fingers, beginning at the duodenum, seek out the first coil of jejunum. He who has had little practice in this should make certain by sight that his fingers have selected the first jejunal loop. A point about 50 cm. (20 inches) from the duodenum is selected and the bowel is held by an assistant in such a position that its peristaltic action shall parallel that of the stomach. A suitable portion of the stomach is then chosen and the organ is brought forward if possible.

FIG. 181.

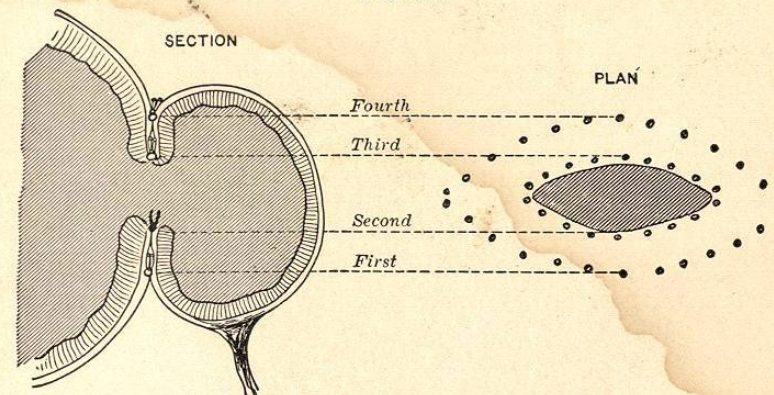


Roux's Y-gastro-enterostomy. Suture complete.

The parts to be sutured are then temporarily tamponed so that the rest of the peritoneal cavity is protected. The intestine in a line near its mesentery is sutured to the stomach for a distance of 5 or 6 cm. (2 to 2.4 inches). This is done with a continuous Lembert suture. (Figs. 105-108.) This suture, although inserted first, is the posterior half of the external or serous suture. (Fig. 182, *first*.) The line of suture upon the stomach is not exactly horizontal, but extends from the left side upward and to the right at an angle of about 45 degrees. When the stomach is left long, this suture-line will be horizontal. Both ends of the thread are left long so that they may be fastened to the anterior half of the serous suture when this has been inserted. A piece of gauze with a slit cut in it as long as the suture-line is placed over it and gauze compresses

are placed on either side, so that no drop of gastric or intestinal contents shall escape to soil the peritoneum. The stomach and intestine are then opened 2 or 3 mm. (0.1 to 0.2 inch) from the suture-line. These incisions are from 0.5 to 0.75 cm. (0.2 to 0.3 inch) shorter than the suture-line at either end. All bleeding vessels must be seized and ligated with fine catgut, as it is not safe to trust to their compression by suture. Gastric and intestinal contents are wiped away. Special clamps and other contrivances to compress stomach and intestine and so prevent soiling of the wound are unnecessary if the stomach is previously empty and the operator commands the services of a good assistant. A continuous suture through all the layers of both stomach and intestine is next inserted. This suture is begun in the middle of the external suture and continued until nearly half of the anastomosis is completed. (Fig. 182, *second*.) A second continuous

FIG. 182.



Showing application of sutures in gastro-enterostomy. (Richardson.)

suture is begun at the same point as the first and continued in the opposite direction until nearly the whole circumference of the anastomosis has been sutured. The thread is then tied. Both knots and both threads will thus rest within the lumen of the bowel. (Fig. 182, *third*.) The gap which remains is closed by two or three interrupted stitches which must be knotted externally. As these are tied the mucous membrane is inverted. It remains only to complete the external or serous suture, beginning where it was left off before the bowel was opened. (Fig. 182, *fourth*.)

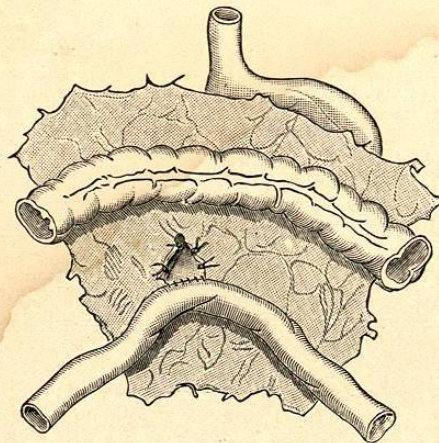
If an entero-anastomosis is needed, it is carried out in exactly the same way at a point 10 or 15 cm. (4 or 6 inches) away from the gastro-enterostomy. The incision for this purpose does not need to be more than 2 or 3 cm. (0.8 or 1.2 inches) long.

If a Murphy button is employed, it is inserted in the manner described on page 405, the male portion being placed in the intestine and the female in the stomach.

In performing a retrocolic gastro-enterostomy the omentum and

transverse colon are raised upward and a sagittal opening is made through the transverse mesocolon in a manner to avoid wounding the large bloodvessels. The posterior gastric wall is brought to the opening and fastened there by three or four catgut stitches. (Fig. 183.) An anastomosis is then established between the stomach and the jejunum at a point as near to the duodenum as may be without bringing tension upon the parts. This anastomosis may be by suture or by the button. The vicious circle is less likely to follow if the anastomosis is at a point near the duodenum. Entero-anastomosis is unnecessary. When Mikulicz performs gastro-enterostomy behind the colon, he does not draw the stomach out to the transverse mesocolon, but passes the jejunum through the slit in the mesocolon until it reaches the stomach. The mesocolon is then stitched to the jejunum and not to the stomach.

FIG. 183.



Posterior gastric wall stitched to mesocolon.

Resection of the Stomach.—The principal reason for resection of a portion of the stomach is the existence of a tumor in its wall. Such tumors are for the most part carcinoma. It occasionally happens that resection is necessary on account of gastric ulcer or some of its sequelæ. For the sake of clearness the following definitions are given in connection with Fig. 184.

Excision is the removal of a portion of the stomach less than its circumference.

Resection is the removal of a larger or a smaller portion of the whole circumference of the stomach.

Extirpation is the total removal of the stomach from the œsophagus to the duodenum.

Excision.—If a portion of the stomach is excised, it should be either a sector (Fig. 184, 6) or a segment (Fig. 184, 5). The removal of an irregular-shaped piece is to be avoided in the interest of a simple suture-line. If a sector is removed, the suture is transverse; and if a

segment is removed, it is longitudinal unless this would narrow the lumen of the organ too much. In that case it is to be made transverse.

Resection.—The pyloric portion of the stomach is the usual site of resection. The upper margin of carcinoma of the stomach may vary from the cardia to near the pylorus, but the lower margin is pretty constantly just beyond the pylorus. Only in rare cases is there a normal gastric wall between the tumor and the pylorus. It is possible to make the line of resection as low down as the entrance of the biliary and pancreatic ducts, although this is seldom necessary.

The numerous methods of resection which have been proposed vary chiefly in the suture of the wound. Thus the duodenum may be united to the stomach, or it may be closed and an anastomosis made between the stomach and jejunum.

Billroth developed the operation of gastric resection and carried it out successfully for the first time in 1881.¹ His method at that time

FIG. 184.

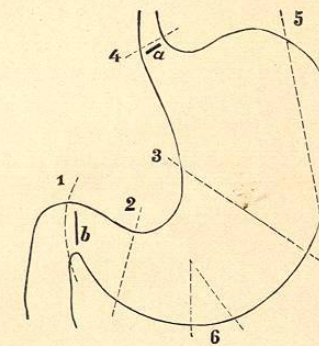
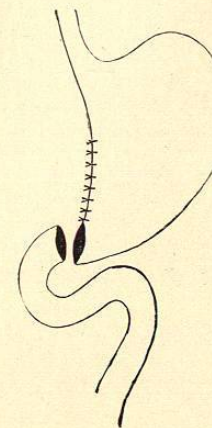


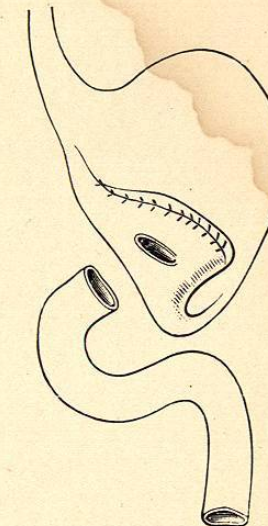
Diagram of the stomach for operative purposes; a, cardia; b, pylorus; 1-2, resection of the pylorus; 2-3, resection of the body of the stomach; 1-4 extirpation of the stomach; 5, excision of a segment, or of a sector 6.

FIG. 185.



Resection of the pylorus according to Billroth's first plan.

FIG. 186.



Resection of the pylorus according to Kocher.

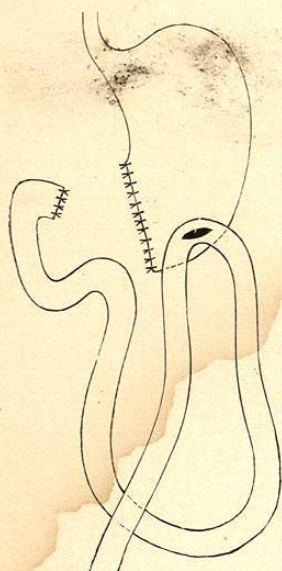
was to unite the duodenum and stomach as shown in Fig. 185. Kocher

¹ The first resection of the stomach was performed by Péan, in 1879; the second by Rydygier, in 1880. Both of these patients died from the operation.

closed the opening in the stomach and implanted the duodenum in its posterior wall. (Fig. 186.)

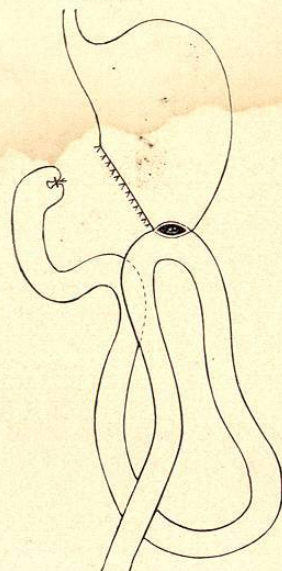
Either because a large portion of the stomach has been resected or for some other cause it may be impossible to unite the duodenum with the remains of the stomach. Under such circumstances Billroth performs antecolic gastro-enterostomy and then resects so much of the stomach and duodenum as may be necessary, closing each opening blindly. (Fig. 187.) Either step in the operation may be performed first. A portion of the wound in the stomach may be utilized for anastomosis with the duodenum. (Fig. 188.) While the method first

FIG. 187.



Resection of the pylorus according to Billroth's second method.

FIG. 188.



Resection of the pylorus according to Krönlein and Mikulicz.

employed by Billroth is still in use by Mikulicz and other surgeons, the tendency to cut wide of a malignant tumor often makes it impossible to approximate the stomach and duodenum without too great tension.

The technic of resection of the pylorus is as follows: The incision is an epimesogastric one, 15 to 20 cm. (6 to 8 inches) long. The pyloric portion of the stomach is brought forward and surrounded with pads, and the size of the tumor and the presence of affected lymph-glands determined. If it appears that the duodenum cannot be sutured to the stomach, the proper loop of jejunum is selected for anastomosis and isolated by gauze, and the direction in which it is to be placed is marked by passing threads through its mesentery. This is done at this stage of the operation so that the peritoneal cavity need not be searched through after the stomach has been opened.

The gastrocolic ligament is ligated in sections and divided. The

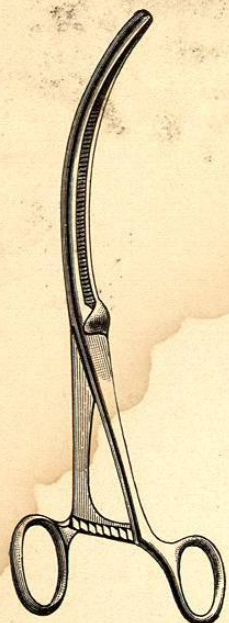
portion next the stomach may be secured by clamps instead of ligatures in order to save time. If this ligament is much thickened by fat, grooves should be pressed in it by a strong clamp before the ligatures are applied. (Fig. 112.) Sometimes affected lymph-glands are embedded in this ligament. If so, these should be removed. (Compare the description of the spread of cancer in the section on Gastric Carcinoma.)

If the mesocolon is involved in the disease, a portion of it must be removed. If this necessitates ligation of the median colic artery, the central portion of the transverse colon will be deprived of its chief blood-supply, and not receiving sufficient nourishment through the right and left colic arteries it may become gangrenous. This risk of gangrene will be increased if the small anastomosing branches of the artery are also ligated close to the colon. If such a serious condition is recognized when the abdomen is opened, the operation had better be abandoned. If it is not recognized until after the resection has been performed, it will be necessary to resect also the central portion of the transverse colon. This had best be done in two steps. In spite of this complication several successful operations of this sort have been reported. Usually the appearance of the colon during the operation will indicate an impending necrosis. Its wall loses its normal vascular appearance and it appears like a flabby empty sac which soon has a disagreeable odor like that noticed at autopsy. The lesser omentum is next divided. Search should be made in it as high as the cardia for affected lymph-glands. If any are found, it is best to remove the entire membrane. This step in the operation is made easier by the prolongation of the incision as far as the ensiform cartilage. The vessels of the small omentum should be ligated with great care since torn or divided arteries and veins may retract and be found again only with difficulty. If the tumor has involved lymph-glands in the neighborhood of the pancreas or the pancreas itself, the removal must include a portion of this organ if radical operation is persisted in. Hemorrhage from the pancreas is troublesome, but can be controlled by mass ligatures and deep sutures. Ligation of the pancreatic artery produces necrosis of the pancreas. In this region one may easily wound other large vessels, such as the splenic artery or vein, the hepatic artery, large branches of the portal vein, etc. In exposing the pylorus and the upper portion of the duodenum the surgeon should be on the lookout for the common bile-duct, especially if old cicatrices or malignant tumors have altered the normal relations of the parts. When the portion of the stomach to be resected has been freed all around, the duodenum is crushed transversely with the enterotribe, 1 to 2 cm. (0.4 to 0.8 inch) below the edge of the tumor, and ligated with silk. (Fig. 113.) About 1 cm. (0.4 inch) above this ligature a second one is applied to control the intestinal contents and the duodenum is divided between these ligatures after the parts have been protected by gauze. The stump of the duodenum is closed by a purse-string suture. (Fig. 114.)

If the conditions are such that the duodenum and stomach can be

united, the former is compressed with a special clamp instead of with the enterotribe. (Figs. 189 and 190.) Pressure-clamps are also placed upon the stomach 5 to 10 cm. (2 to 4 inches) above the margin of the tumor. The upper clamp must be 3 to 5 cm. (1.2 to 2 inches) from the line of incision. The affected portion of the stomach is then resected and removed. Asepsis in operations upon the alimentary canal is preserved, first, by a careful temporary tamponade; second, by an immediate sponging up of gastric or intestinal contents; and third and most important, by the fact that the lumen is either not at all exposed or is exposed for the shortest possible time. The possibility of blind closure of the intestine by means of a purse-string suture without

FIG. 189.



Doyen's intestinal clamp.

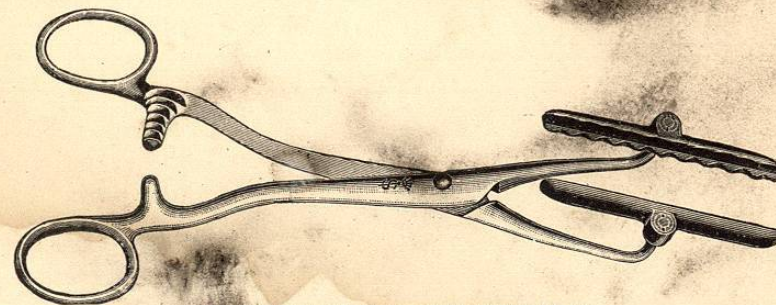
FIG. 190.

Mikulicz's gastric and intestinal clamp ($\frac{1}{2}$ natural size).

the escape of any contents is described on page 403. Under such circumstances the risk of infection is scarcely worth mentioning. This method also prevents hemorrhage. For these reasons it is almost universally employed when the duodenum is to be closed blindly. Doyen also uses the purse-string suture for closure of the stomach even if its diameter in the plane of resection is 10 or 15 cm. (4 or 6 inches). Such a broad wound, however, can be much better closed in another manner. An enterotribe larger than that shown in Fig. 112 is applied to the stomach and mattress sutures are inserted in the groove. The stomach is resected close to this line of sutures. The whole suture-line is then dimpled into the stomach and covered by a Lembert suture. Kocher

clamps the stomach (Fig. 191), and without removing the clamp stitches across its whole breadth just above the clamps with a mattress suture. He then resects the stomach, applies a running suture to the free edges, inverts this and the mattress suture, and covers both in with a Lembert suture. These procedures are only possible in Kocher's operation and in Billroth's second method of operating. (Figs. 186 and 187.)

FIG. 191.



Kocher's stomach-clamp with movable blades.

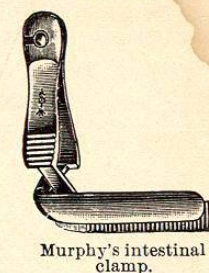
These closed methods of operating prevent hemorrhage and the escape of gastric contents, but they have the disadvantage that the operator is prevented from inspecting the interior of the stomach, a step which may be of great importance in determining the extent of the carcinoma. For this reason the methods should not be followed in all cases.

Even with the best of intestinal clamps discharge of intestinal secretion and hemorrhage may not be perfectly controlled, hence clamps find their chief use in cases in which the clamped intestine is to be utilized for anastomosis. It is obvious that the clamp must not injure the intestinal wall, and hence it must not press too powerfully. If it does so, it may also occlude some large vessel, which may thus be overlooked and not ligated. Under such circumstances hemorrhage may occur within the stomach or intestine after the suture has been completed and lead to fatal results. A properly constructed intestinal clamp should permit some blood to flow from the larger vessels, which, of course, must be ligated. There are a great number of these clamps on the market.

(Fig. 192.) Some surgeons prefer to use a temporary ligature made of silk or a strip of gauze which is passed around the intestine through an opening in the mesentery. Indeed, pressure upon the intestine made by the fingers of the assistant does away with the necessity for any clamp.

When the affected portion of the stomach has been removed, a broad wound in this organ is partially closed by a double row of

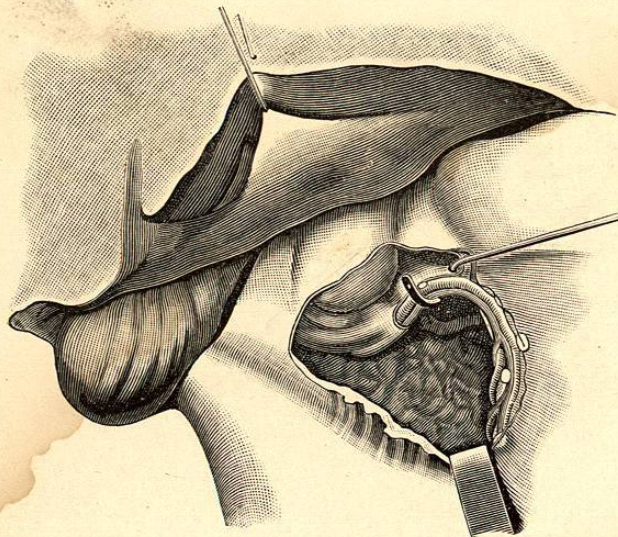
FIG. 192.



Murphy's intestinal clamp.

sutures until it adapts itself to the duodenum or jejunum. The first suture is applied from within, beginning at the lower curvature; the second one is applied from without. The suture of stomach and intestine must be an exact one, and even with the greatest care the point where the gastric and anastomotic sutures meet is apt to be weak. This extra care prolongs the operation, which is an important point if the resection is an extensive one. A Murphy button may be employed with advantage. The funnel shape of the stump makes it almost impossible for the button to fall into the stomach instead of into the intestine. The button is not only adapted

FIG. 193.



Resection of the stomach. Ligation of the coronary artery. (Hartmann.)

to those cases in which the jejunum is attached to the stomach at a lower portion of the gastric wound, but also to those cases in which operation is performed according to Billroth's first method. (Fig. 185.) In all these cases, however, the operation is simplified if the wound in the stomach is completely closed and a new opening is made for anastomosis of the intestine, provided, of course, that the portion of the stomach which remains is sufficiently large for the purpose. It is a matter of indifference whether the duodenum is implanted in the anterior or posterior wall. In many cases after extensive resection what is left of the stomach is not much more than a narrow tube, and to make a second opening in this for the sake of anastomosis would be inadvisable.

Figs. 193 and 194 show the method of resection advocated by Hartmann.

If a Murphy button is not employed in operating according to

Billroth's first method, the posterior surfaces of the stomach and duodenum are first attached by a number of deeply placed Lembert interrupted stitches. These threads are left long so as to keep the wounded surfaces well in view. They are inserted from within outward and tied. When they are all in place, they may be cut off short. An inner continuous suture is then applied, as in gastro-enterostomy; and finally the serous suture is completed anteriorly. Two or three

FIG. 194.



Resection of the stomach. Ligation of the gastroduodenal artery. (Hartmann.)

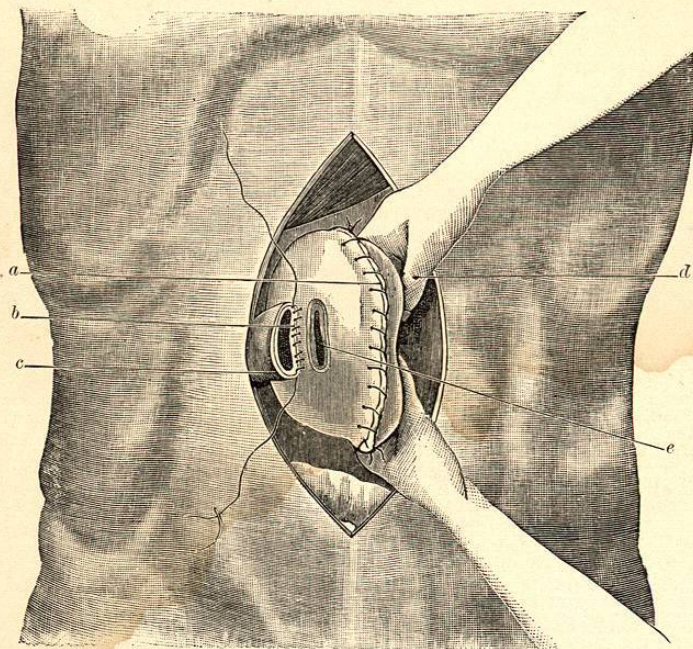
extra sutures are inserted at the point where the gastric suture joins the gastrojejunal one. At the close of every gastric or intestinal suture a little iodoform powder should be dusted upon the suture-line. The abdominal cavity is completely closed. Drainage is inadvisable in these cases since experience has shown that it is likely to produce a gastric fistula. If this occurs, the patient will soon die from starvation.

From this description of the technic of resection of the stomach one can easily follow out the other modifications mentioned. (Fig. 195.)

Extirpation of the Stomach. Gastrectomy.—The technic of extirpation of the stomach is exactly like that of an extensive resec-

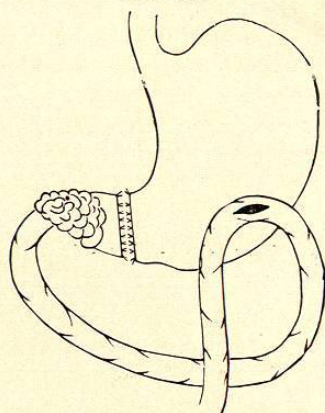
tion of the stomach, except that the necessity for reducing the lumen of the upper extremity no longer exists. The œsophagus and intes-

FIG. 195.



Gastroduodenal implantation. The operation of pylorotomy and gastro-enterostomy (Kocher's method): *a*, continuous serous suture closing the stomach; *b*, post-serous suture between stomach and duodenum; *c*, duodenum; *d*, assistant closing stomach and duodenum by pressure; *e*, opening in posterior wall of stomach.

FIG. 196.



Elimination of the pylorus according to Eiselsberg.

tine are directly united. It should be remembered that if necessary the œsophagus can be brought out through the diaphragm for a distance

of several centimetres. Care should be given to this suture if the œsophagus is not covered with peritoneum. Here too a Murphy button has advantages over the anastomosis by suture. The œsophagus and duodenum will usually be found too far apart for anastomosis, hence the jejunum will be employed. Schlatter was the first to remove the whole stomach with success.

Elimination of the Pylorus.—After every gastro-enterostomy the amount of gastric contents which passes the pylorus is more or less reduced; and gangrenous secretion from a pyloric tumor and contents of the duodenum may enter the stomach after gastro-enterostomy. Therefore Eiselsberg recommends that the stomach be divided above such a tumor and the lumen on either side of the incision closed by suture. Gastro-enterostomy may or may not be previously performed. As far as known, this operation has not yet been performed. The technic is similar to that of resection of the pylorus.

OPERATIONS UPON THE INTESTINE.

Puncture of the Intestine.—Puncture of the intestine through the unopened abdominal wall may be of service as a temporary means of relieving excessive meteorism when one is not in a position to apply a more radical remedy. In rare instances it may be so combined with gastric lavage and irrigation of the colon that a cure results.

There are two objections to puncture of the intestine. The first is that a cannula may not permit the escape of sufficient gas to relieve the condition of meteorism. The second and more important objection is that infectious material escaping from the punctured wound of the intestinal canal may set up an infectious peritonitis. The result of puncture depends not only upon the degree of meteorism, but also upon the contractility of the intestinal muscles. If the intestine is completely paralyzed, for example in well-advanced peritonitis, puncture will relieve only the portion of the intestine immediately in the neighborhood of the cannula; whereas if the muscles of the intestine are still active, the effect of puncture may be far greater. The discharge of gas through so small a tube is naturally slow, so that it must be left in position from a half hour to an hour in order to relieve the patient. To use this instrument satisfactorily requires therefore both time and patience; but under favorable circumstances a great deal can be accomplished by it to relieve the patient of distention. In certain cases time is gained for a radical operation, and in others in which ileus is due to a mechanical obstruction the relief of the distention may be followed by disappearance of the mechanical obstruction.

The risk of infective peritonitis following puncture of the intestine is a real one, particularly if a large cannula is employed, or if the intestine is paralyzed so that its muscles cannot contract and close the wound of puncture. If the intestinal wall still possesses some contractile power and the puncture is made with a fine cannula, the risk of escaping intestinal contents is extremely slight.