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STOMACH AND ESOPHAGUS. (SURGICAL).—I. THE SURGERY OF THE ESOPHAGUS.—Methods of Examination.—The x-rays are very useful in locating bone; also coins and other metallic foreign bodies. It is usually best to take a skiagraph, in order to determine the exact relations of the foreign body. The fluoroscope is occasionally very useful, and the surgeon may sometimes even attempt to extract the foreign body with forceps while he looks through the fluoroscope. An esophageal diverticulum may be shown by the x-rays, if the patient has previously swallowed capsules of subnitrate of bismuth. If the bismuth enters the diverticulum, it will coat it so that the pouch will cast a shadow in the x-rays. A bougie containing a piece of metal on a small metallic chain may, in some cases, enter the diverticulum and cast a shadow with the x-rays.

The most common method of examining the esophagus is with the exploratory sound. A flexible bougie with an ivory tip will locate an obstruction, whether it be a foreign body or a stricture. In an adult, it is best to make an examination of this kind without ether. If ether is not employed, we can keep the patient sitting up; and he can help us by swallowing the instrument when directed to do so, and can also aid us somewhat in locating the obstruction. In a child, it may be necessary to give an anæsthetic. The bougie should be passed as follows, when the patient is not anæsthetized:

He sits up and rests his head against a chair-back, a bed-rest, or the chest of another person. The surgeon stands in front of him. The patient's head is thrown back and held securely by an assistant. When the patient is a child, it will be necessary to hold the arms also. The mouth may be gagged open with a bit of wood or a cork, but I usually dispense with a gag and simply wrap the forefinger which is to be inserted with some gauze. The instrument is warmed and smeared with glycerin, and is passed into the rear of the pharynx, the surgeon drawing the tongue forward and holding it with a towel. Drawing the tongue forward draws the larynx a little forward also, and enables the instrument to pass more readily over the glottis. In some cases it is necessary to guide it over with the index finger of the left hand.

As soon as the instrument strikes the back of the pharynx, the patient will attempt to vomit; but the slight respiratory obstruction met with here should not deter one, although, of course, if there is violent respiratory difficulty the instrument must be at once withdrawn, because of the fear that it may have entered into the larynx. After it strikes the back of the pharynx it should be pushed on steadily but lightly, and the patient should be directed to swallow. The passage of the instrument will thus be greatly aided. When the instrument is blocked by an obstruction, one must not attempt to force it, but should hold it gently in contact with the obstruction. If this is only spasmodic, the spasm may relax and let the instrument pass. If the obstruction is organic, it will not relax. We should always remember, however, that an organic stricture may be associated with a spasm above it, and therefore that we may be blocked by spasm before reaching the true seat of disease. If we are in doubt as to whether we are dealing with a pure spasm or with an organic stricture, the administration of an anæsthetic will solve the doubt; for a pure spasm relaxes when the patient is anæsthetized, so that the instrument is allowed to pass, but an organic stricture does not relax. The average distance from the incisor teeth to the cardiac opening of the stomach in the adult is, according to Maylard, from fourteen to sixteen inches.

The *esophagoscope* (Fig. 4518) has been used for many years by Mikulicz, but it is only of late that its real value has become recognized by the profession at large. In fact, in this country the appreciation of this seems to date from the visit of Gottstein, Mikulicz's assistant, about a

year ago. The esophagoscope is undoubtedly a useful instrument. With its aid one may see a tumor, an ulcer, a foreign body, varicose veins, or a strictured area; and may remove in some cases a foreign body and in others a tumor for examination. Of course, in order to use the instrument well a man must be specially trained, and good results can be obtained only by an expert; but the same assertion is true of the use of the ophthalmoscope, the laryngoscope, and the cystoscope. Any one can learn to use the esophagoscope, but only an expert will use it really well. One great lesson in its use is to be very gentle and never to force it, and, if it is obstructed by spasm, to wait for the spasm to subside before urging it onward.

When one has decided to use this instrument, he should first employ a sound to locate the situation of the obstruction. The pharynx, the larynx, and the upper part of the esophagus are then cocaineized with a ten-per-cent. solution of cocaine. The patient lies upon the table, on his right side, the clothing about his neck and his chest being loosened. His head rests upon a pillow, being bent back so far that a straight line through the mouth would enter into the esophagus. He is told to raise his left hand if he feels pain and wishes the instrument withdrawn, and he is ordered to breathe quietly and regularly. Then the tongue is drawn forward and the tube is introduced into one side of the mouth and carried into the pharynx.

As the patient swallows, the instrument passes down to the desired point. Then the plunger is withdrawn and the panelectroscope is inserted, throwing light to the bottom of the tube. Any mucus present is swabbed away with pieces of gauze caught in forceps; the region of disease is carefully studied, and, if thought desirable, a piece of tumor is removed. A note on the use of this instrument may be found in *American Medicine*, October 25th, 1902, in the editorial comment on general surgery; and the instrument is fully described by Gottstein in his "Technik u. Klinik der Oesophagoscopie."

OPERATIONS ON THE ESOPHAGUS.

Internal Esophagotomy.—By this operation one divides a fibrous stricture. The method of performing it is to pass an instrument known as an esophagotome. In order that this may be passed, the channel of the stricture must be large enough to admit the instrument. After the latter has passed through the stricture, the blade is protruded and the instrument is withdrawn. From forty-eight to seventy-two hours after the operation, the surgeon begins to effect distention by means of bougies. Gussenbauer performs internal esophagotomy by making an opening in the esophagus above the stricture, and then, through this opening, cutting the stricture by means of a tenotome. Internal esophagotomy may be productive of dangerously severe hemorrhage and is occasionally followed by infective processes—for instance, by empyema. It should never be attempted for malignant obstruction.

Electrolysis.—Electrolysis has been much improved by Fort and others. It should not be used for malignant

obstruction, but may be of great benefit in cicatricial stricture. It will fail, however, if the stricture is very hard. It is probable that several applications will be necessary in most cases, after which bougies should be used for a considerable length of time.

External Esophagotomy.—External esophagotomy may be performed through the neck by what is known as cervical external esophagotomy; or it may be performed through the mediastinum—the intramediastinal method. External esophagotomy may be done for the purpose of treating a cicatricial stricture of the esophagus, either

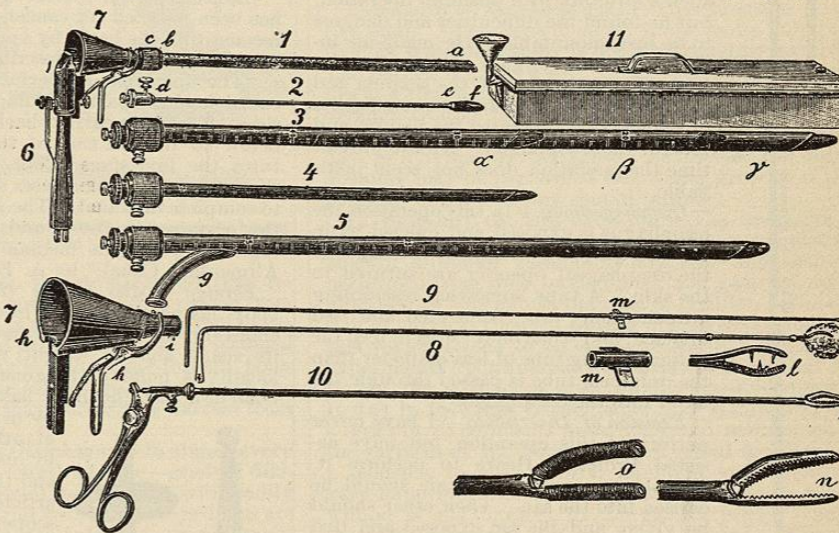


FIG. 4518.—Gottstein's Esophagoscope. 1, Esophageal tube with oblique end (a), with hard-rubber ring (b), with bayonet catch (c); 2, mandrel for the tube with screw at the upper end (d), fitting into the bayonet catch, and a hard-rubber olive point at the lower end (e), bevelled on the side (f); 3, esophageal tubes of different lengths (26, 36, and 46 cm.) and 14 mm. in diameter; 4, children's size of tubes, 10 mm. in diameter; 5, tubes with outflow tube (g) at the upper end; 6, Casper's panelectroscope; 7, the intermediate piece between the tube and the panelectroscope—external end (h), internal end (i), handle for detaching it from the tube (k); 8, sponge-bearer with double teeth (l); 9, sound with a rider (m); 10, forceps with rough jaws (n), or covered with rubber (o); 11, hot-water pan.

directly—as in Gussenbauer's method—or indirectly—as in Abbe's string-saw method. It may also itself directly divide a stricture. The chief use of the operation, however, is to remove foreign bodies, when these are lodged above the lower third of the esophagus. If the foreign body has been in the esophagus over twelve hours and has sharp edges, attempts to extract it through the mouth should not be made, but external esophagotomy should be performed at once.

The incision is usually made on the left side, the cut being at the anterior edge of the sterno-cleido-mastoid muscle, and running from half an inch above the sterno-clavicular joint to the level of the superior border of the thyroid cartilage. The muscles are retracted, in some cases the omohyoid is divided, the trachea is drawn forward, great care is taken to avoid the recurrent laryngeal nerve, and the gullet is exposed. If a foreign body is palpable, the incision is made upon it; otherwise a bougie is introduced, and the gullet is opened upon that.

After the foreign body has been removed, there is a question as to how the wound should be managed. It seems certain that it should not be closed without any drainage. In fact, some surgeons do not close it at all, but simply pack it with gauze. It is wiser to suture the mucous membrane with stitches of silk or chromicized catgut, to run a piece of gauze down to the suture line for drainage, and then to suture the muscles and the skin, the gauze drain being removed within two or three days.

For the first twenty-four hours after the operation the patient is given no food by the mouth, but is fed by the rectum; and rectal feeding is continued as a supplement to mouth feeding until sufficient food can be taken by

the mouth to meet the needs of the organism. After twenty-four hours small amounts of liquid may be given by the mouth, and more and more should be given each day until the full quantity can be taken. Frequently there is a little leaking through the mucous membrane.

Intramediastinal Oesophagotomy.—Weir, Quenu, Rehn, and others have given much thought to the matter of reaching dense strictures below the arch of the aorta. Rehn endeavored to reach such a stricture by a posterior operation, but he found the difficulties and dangers to be insurmountable. He made an incision over the angles of the ribs, between the inner edge of the scapula and the spines of the vertebrae, resected parts of several ribs, separated the pleura, and felt for the oesophagus. At the present time the operation does not seem justifiable.

Oesophagostomy.—In this operation the oesophagus is exposed and opened as in cervical oesophagotomy, but the edges of the oesophageal opening are sutured to the skin. A tube, somewhat resembling a tracheotomy tube, is inserted and tied in place; and when one desires to feed the patient, a long tube of less diameter than the retained tube is passed through the latter into the oesophagus.

Excision of Diverticula.—I have never performed this operation, but have assisted Professor Hearn to perform it. Whenever possible, a bougie should be carried into the sac. Then ether should be given, and the sac exposed and tied off with a catgut ligature. The sac is extirpated beyond this ligature and the stump is sutured. In Dr. Hearn's case the diverticulum was cut off, the mucous membrane was sewed with a continuous suture of catgut, the muscular layer was closed with interrupted sutures of silk, a piece of gauze packing was carried down to the mucous membrane, and the other tissues were sewed with silkworm gut. No leaking took place, and the wound completely healed within twelve days. Several other cases have been reported.

Oesophagectomy.—By this term is meant the resection of a portion of the oesophagus. In the cervical operation an incision is made in the neck to expose the oesophagus, and this incision is identical with that for internal oesophagotomy. After the gullet has been exposed, it is separated completely from the surrounding parts, the diseased area is excised, and the lower end of the gullet is sutured to the skin. This is a very difficult operation, and is of questionable utility.

De Quervain has performed this operation in one case, and has collected thirteen other cases from literature. He maintains that the operation is justifiable in some cases, viz., those in which there is malignant disease involving the oesophagus only, and in which the lower margin of the growth is above the aorta and the upper margin is at least 20 cm. from the teeth.

Occasionally, though rarely, a preliminary oesophagostomy may be performed, but preliminary gastrostomy is much to be preferred to preliminary oesophagostomy. When a preliminary gastrostomy is performed, healing of the oesophagus is greatly favored. When preliminary gastrostomy has been performed, and oesophagectomy is carried out whenever it is possible, the upper end of the lower part of the gullet should be sutured to the wound; but if this cannot be done, a ligature should be tied about that part of the oesophagus, and it should then be dropped back into the wound.

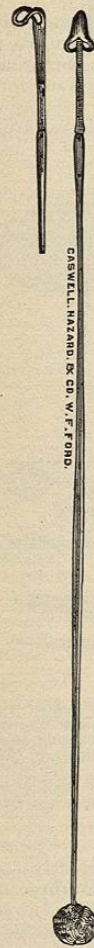


Fig. 4519.—Coin-Catcher and Sponge Probang.

This author maintains that the patient is much better off with a gastric fistula than with a contracting cicatrix of the gullet, which will be sure to establish itself if the ends are brought together. In cases in which the ends cannot be brought together, there will, of course, be a salivary fistula from the upper end of the oesophagus (*Arch. f. klin. Chir.*, 1898, Bd. lxxviii., Hefte 1-4). By some surgeons an attempt has been made to extirpate the oesophagus by what is called endothoracic resection; but at the present time the operation is not to be recommended.

Oesophagoplasty.—After a portion of the oesophagus has been resected for cancer, an attempt may be made to reconstitute the canal by von Hacker's method of oesophagoplasty. Maylard describes this operation as follows: "The operation is performed in two stages. After excision of the part, two flaps of skin are raised on each side. These are carried backward and united above and below to the cut ends of the oesophagus. This constitutes the first stage. The second consists in detaching these flaps from their bases and folding them over, so as to complete the canal. The stitching is completed around the oesophagus, above and below, and they are united together down the median line" ("The Surgery of the Alimentary Canal," by A. Ernest Maylard).

Foreign Bodies in the Oesophagus.—When a foreign body has passed into the oesophagus, the surgeon should endeavor to obtain information as to its size, its nature, its shape, and its weight; and he should then seek to locate its point of lodgment. The point at which a bone or a metallic body has lodged may be determined by using the x-rays; the location of other kinds of foreign bodies by using the oesophageal sound; and the position of both classes of articles by using the oesophagoscope. In employing the sound it may be necessary to give ether; this is seldom required for an adult, but usually for a child, a nervous woman, or a lunatic.



When a soft foreign body has been swallowed, external manipulation may occasionally alter its shape to such an extent that it will pass on into the stomach or be coughed up. Not infrequently the foreign body may be reached through the mouth with forceps (Fig. 4518, 10), and these manipulations are sometimes much aided by employing the oesophagoscope. Small and sharp foreign bodies may often be carried into the stomach by swallowing mush, bread, or other food of a similar nature. To administer an emetic when a foreign body has lodged in the oesophagus is a dangerous procedure. The horse-hair probang (Fig. 4520) is an instrument that opens like an umbrella as it is withdrawn; it is very useful in extracting some foreign bodies. The coin-catcher (Fig. 4519) is also a very useful instrument. Occasionally, when it is impossible to pull a foreign body up through the mouth, it is advisable to push it down into the stomach. This may be done with such a body as a small coin that, we feel sure, will ultimately pass through the intestinal canal.

It is never proper to permit a foreign body to remain in the oesophagus until ulceration occurs; neither is it right greatly to prolong efforts to extract a foreign body through the mouth, and such efforts should not be made at all if ulceration is believed to exist. When a patient has a foreign body lodged in the oesophagus, and there is no ulceration, the surgeon should make one

Fig. 4520.—The Bristle or Umbrella Probang.

careful and thorough attempt to remove it through the mouth; and if this attempt fails, he should at once proceed to operate. If he thinks that ulceration exists he should operate. Long retention means probable ulceration.

If the point of lodgment is anywhere within the upper two-thirds of the oesophagus, external oesophagotomy should be performed; if it is in the lower third, the stomach should be opened. Then either the foreign body

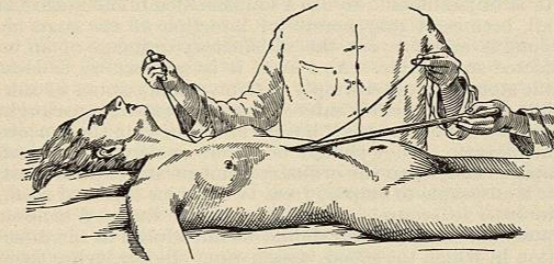


Fig. 4521.—Abbe's String-saw Operation. Method of using the bougie and string. (Abbe.)

should be drawn down into the stomach and thus removed, or else a whalebone bougie should be passed from the mouth into the stomach, a string should be tied to the bougie, and pieces of fluffed-up gauze should be fastened to the string. As the string is pulled, the foreign body is extracted. If the bougie cannot be passed from the mouth into the stomach, it may perhaps be carried from the stomach into the mouth.

Cicatricial Stricture of the Oesophagus.—In almost every case—at least for a certain length of time—gradual dilatation is employed, the largest bougie that will readily pass being used. The bougies with olive-shaped tips are not used, but the conical semisolid elastic instruments are employed. The bougie should be retained for several minutes and should be passed every second or third day. Each time it is passed it should be retained in the stricture longer than on the preceding occasion. As soon as it is found that the instrument begins to pass easily, a larger one should be employed. Gradual dilatation will be successful only if the stricture occupies a limited portion of the oesophagus.

Symonds inserts a tube through the stricture, leaves this in place until it becomes loose, then inserts a larger tube, and so on, the patient being fed through the retained tube. In some cases, when gradual dilatation from above is impossible, a gastric fistula is made, the patient swallows a shot to which a silk thread is fastened, the thread is brought out through the fistulous opening in the stomach and fastened to a bougie, and the dilating instrument is drawn up through the oesophagus.

I have already pointed out that a cicatricial stricture of the oesophagus is often associated with swelling and spasm, and that if a gastrostomy is performed the swelling and spasm abate, because of rest. In this way a stricture previously impassable may become passable. Some surgeons have employed forcible dilatation by way of the mouth or through an opening in the stomach. Electrolysis is used by Fort and some others.

We have already discussed the operations of internal and external oesophagotomy. If there is a dense stricture in the thoracic portion of the oesophagus, and this stricture is not dilatable, one should treat it by Abbe's method. Abbe performs gastrostomy, passes a conical rubber bougie carrying a silk thread from the stomach into the mouth. The end of the string is grasped and withdrawn, the stricture is made tense by introducing a conical bougie from below, and the string is drawn tight. One end of the silk emerges from the mouth and is carried back into the pharynx, and the other end comes out of the opening in the stomach. The string is moved rapidly to and fro and divides the stricture. After the division of the stricture, the silk is withdrawn and full-sized bougies are passed. In some cases Abbe opens the stom-

ach and also the oesophagus above the stricture, and brings one end of the string out of each wound (Figs. 4521 and 4522).

Ochsner has devised an operation in which he draws a small, soft-rubber drainage tube, caught up in the middle with a thread, through the stomach wound and into the stricture. When traction is made upon this tube it becomes smaller; and it is made smaller by traction until its size is sufficiently diminished to allow it to enter the strictured portion of the oesophagus. The tube is drawn out by its free ends, and increasing sizes of tubes are employed.

Carcinoma of the Oesophagus.—This disease is necessarily fatal. Operations done for it are really only palliative, as oesophagectomy is not a satisfactory procedure. The patient is given a soft, bland diet, in small quantities at a time and very often. When there begins to be distinct trouble in swallowing even this food, a soft bougie should be carefully passed every third or fourth day, or a Symonds tube should be inserted; or oesophagostomy may be performed below the growth, if this is possible, or gastrostomy should be done.

II. SURGERY OF THE STOMACH.—The operative surgery of the stomach is to a very great extent distinctly modern, although gastrostomy has now and then been performed from time immemorial, and gastrostomy was practised as long ago as the time of Sedillot. The direction of surgical thought toward operative possibilities in this region seems to have begun in 1875, when many experiments upon animals were made to show that resection of the stomach is a thoroughly possible operation. It was in 1876 that Gussenbauer and Winiwarter made a series of experiments upon dogs, and maintained that the surfaces of the stomach, when sewed together, have a tendency to heal by first intention, and, further, the very important fact that the mucous membrane near the wound is not digested by the gastric juice. They resected the stomachs of seven dogs, and, as Dr. Keen says in his Cartwright Lectures, showed that a partial resection may be successfully accomplished; that the resulting stricture does not interfere with the motor or secretory power of the stomach; and that pyloric resection does not permit of a too early escape of food into the intestine, or of the regurgitation of the intestinal fluids into the stomach. Kaiser and, shortly after, Gussenbauer performed gastrostomy upon dogs, and obtained better results than their predecessors because they employed antiseptic methods with more care (Arthur E. Barker).

These and numerous other experiments upon animals have not only indicated that extensive operations may be performed upon the stomach with the retention of life and the repair of damage, but have pointed the way to the various refinements of technique that are found to be such valuable accessories in securing a successful result. In this field of surgery the principles of Lister have secured a notable triumph.

The above-cited experiments gave a stimulus to human visceral surgery, and in 1877 Billroth successfully sutured

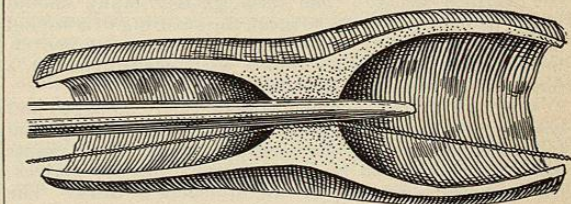


Fig. 4522.—Abbe's String-saw Operation. String dividing the oesophageal stricture kept tense by bougie. (Abbe.)

a wound in the stomach. From that time to this stomach operations have multiplied, until it is now considered proper to open the stomach, not only for the removal of foreign bodies or to secure ingress for food by a permanent artificial mouth when there is obstruction of the oesophagus or of the cardiac end of the stomach, but also

to remove ulcerations, to separate constricting adhesions, to extirpate malignant tumors, to arrest hemorrhage, to side-track a malignant tumor or a fibrous constriction by the operation of gastro-enterostomy, to diminish the size of a distended stomach by placing numerous tucks in its wall, and even to remove the entire stomach—any of which operations may be done with the retention of life and digestive capacity. The number of cases of disease of the stomach in which operation is now performed is simply amazing, and may be especially gathered from a study of the reports of Professor Mikulicz, of Breslau; Professor Weir, of New York; Dr. Doyen, of Paris; Dr. Mayo, of Rochester, Minn.; Mr. A. W. Mayo Robson, of Leeds, England; Professor Keen, of Philadelphia; Prof. Arthur E. Barker, of London, and many others.

The surgery of the stomach may be presented to the reader in two ways: First, by describing in detail the different operations upon the stomach and setting forth the morbid conditions to which they should be applied; and, secondly, by discussing the surgical treatment of certain diseases of the stomach. In an article such as this, neither of these methods can be followed purely; it will be necessary first to discuss a number of the particular operations, and next to consider the surgical treatment of certain special conditions.

The operations to be considered are.

1. Gastrorrhaphy, or the suturing of a wound or a perforation in the stomach.

2. Gastrolisis, or the separating of perigastric adhesions.

3. Gastropexy, or the lifting of a stomach that has dropped downward, and the fastening of it in a normal position.

4. Gastroplication, or the diminution of the size of a dilated stomach by making tucks in its wall.

5. Gastrotomy, or incision of the stomach, followed by the subsequent closing of the wound.

6. Gastrostomy, or the making of a more or less permanent opening into the stomach—an opening that is usually employed for the purpose of administering food.

7. Gastro-enterostomy, or the making of a permanent opening between the stomach and the duodenum or the ileum.

8. Gastrogastrostomy, or the making of a permanent opening between two portions of the stomach itself, when there is a constriction existing between the two portions; and gastroplasty, an operation performed for the same purpose and similar to pyloroplasty.

9. Pyloroplasty, a procedure for enlarging the calibre of a strictured pylorus.

10. Gastrectomy, or the excising of the stomach wall—called partial gastrectomy when a portion of the wall is removed, and called complete gastrectomy when ablation of the entire stomach is practised.

11. Pylorotomy, or the excising of the pyloric end of the stomach and of the gastric end of the duodenum.

12. Jejunostomy, the making of a permanent fistula in the jejunum.

1. *Gastrorrhaphy*.—The term gastrorrhaphy should really be employed only to mean the suturing of a wound or perforation of the stomach wall. It has, however, been employed as synonymous with gastroplication, a usage of the term that is very objectionable.

A wound in the stomach is more easily managed and can be more firmly and securely closed than can a wound in the intestine. The blood supply, as Dr. Mayo points out, is excellent, and is derived from different sources; the mucous membrane of the stomach is thick. The stomach is fairly well fixed, the gastric juice is antagonistic to bacteria, and the sutures can be firmly placed and are not apt to cut out. In doing this, it is necessary to bear in mind certain general principles:

The needle that is employed should be fine and round, and not one with a spear-shaped or an edged point. A flat needle is very objectionable.

Fine sterile silk is the best suture material. Whereas it is permissible to use catgut to close the mucous membrane, it is not proper to use catgut to close the wound

in the other coats. Strong gut is too large in diameter, it may be wiry and may cut when tied, it swells more or less after insertion, the stitch holes may leak, and it is of doubtful cleanliness; it is, therefore, an improper material.

Some surgeons advocate first closing the mucous membrane by means of a continuous suture of catgut. This method has its advantages. If this is done leakage in the suture line of the outer coats is prevented for many hours after the operation. Some have maintained that it is objectionable to use a mucous-membrane suture at all, because it may permit of infection of the coats beyond it and prevent the satisfactory drainage of an infected suture line. As a rule, it is satisfactory to close the stomach wound simply with inversion sutures of silk; but Halsted's plan is safer. Inversion sutures are caught in the submucous coat, but do not penetrate the mucous membrane. They should be about one-sixth of an inch apart; and when the ordinary Lembert stitches are used, it is advisable to employ from two to four layers of them, in order to secure an unleaking suture line. Whenever possible, these sutures should be introduced in the direction in which the blood-vessels run. Before tying them some surgeons scarify the peritoneal surface of the wound edges, believing that by so doing they expedite union. It is not necessary to trim the edges of a bullet wound or of a perforated ulcer, because the area of contusion or thrombosis can, in such cases, be deeply inverted and closely covered over.

The knots are tied firmly, but never tightly. To tie them tightly means either that there will be some cutting of the suture, or that there will be subsequent necrosis about the stitch hole, with loosening of the suture and probable infection. I believe that tying stitches too tightly is a most powerful predisposing cause of wound infection.

Interrupted sutures are better than the continuous suture; and the continuous inversion suture should not be used, except as a final stitch over previous layers of interrupted sutures. The continuous suture makes irregular lines of traction and unequal apposition of surfaces. If one part breaks or loosens, the whole suture line gapes, and there is much greater probability of leakage than when well-applied interrupted sutures are used.

Halsted's principle of suturing is the correct one; that is, that each stitch must catch up a portion of the fibrous submucous coat. The Halsted mattress sutures, when applied with care, will certainly approximate the margins of a stomach wound so that they will give broad surfaces for union, and will make such even pressure and give such thorough closure that even a single line of sutures is practically safe. Professor Halsted has employed the following method with great satisfaction for many years: When feasible he uses three rows of sutures. The inside row is continuous and includes the mucosa and submucosa and the edge of the serosa. The middle row is continuous, interrupted here and there. The outside row is made with mattress sutures. In other words, Halsted uses the Czerny suture with an outside row of mattress sutures. Halsted's method is the safest and hence the best. The various sutures that may be used upon the stomach will be found described in detail in the article on *Intestinal Surgery*. The chief of these are the Lembert suture, Cushing's right-angle suture, Gussenbauer's suture, Czerny's suture, Wölfler's suture, Bishop's suture, and Halsted's mattress suture.

When a gap in the stomach wall is too large to invert, or when, because of great thickness of the edges of the opening or of the existence of dense encompassing adhesions, the edges cannot be turned in, some other course must be followed. In some cases union has been secured by first suturing the mucous membrane and then the other layers of the stomach wall, just as we would suture an ordinary wound, without inversion. Another method, and a better one, is to use such a suture and then cover the suture line, after the plan of Senn, with a portion of omentum that is still left attached to the great mass of the omentum, or with a separate omental graft. In some cases an opening in the wall of the stomach has been suc-

cessfully closed by sewing over it a graft of omentum, without suturing the opening at all or by pushing a piece of omentum through the opening, just as a cork is pushed into a bottle. If it is found impossible to close the wound in the stomach by any of these plans, then the wound must be surrounded by iodoform gauze, in order to protect the peritoneal cavity from infection; a drainage tube must be carried down to the opening, and a gastric fistula must be deliberately formed. At a later period this fistula will probably heal of itself; but if it does not do so, it can be closed by a plastic operation.

When a surgeon deals with a wound of the stomach, he should always be alive to the possible existence of a wound of the posterior wall; and, in order to determine whether or not such a wound exists, he should tear through the gastrocolic omentum and inspect the posterior wall. If a wound is found in this situation it should be sutured according to the ordinary rules. When there has been a wound of the posterior wall of the stomach the pancreas must be inspected to see if it has been injured, and it is usually advisable to make posterior drainage of the lesser peritoneal cavity.

After the operation of gastrorrhaphy a piece of gauze should be carried down to the suture line, and should be retained for at least twenty-four hours. Such a manoeuvre never does any harm; it aids in the formation of adhesions that will eliminate the stomach wound from the peritoneal cavity; and, if leakage does occur, it gives exit to it and thus probably saves the patient's life. I utterly disbelieve in the propriety of closing a wound of the stomach without drainage.

2. *Gastrolisis*.—By this operation we separate or partially extirpate perigastric adhesions. Such adhesions are far more common than was once thought, and are frequently productive of much suffering. They may result from traumatism, from tuberculosis, or from syphilis, but are most commonly due to fibrous thickening about an ulcer of the stomach, or to gall stones or cholangitis.

Such adhesions may attach the stomach to the gall bladder, to the gall ducts, to the omentum, and to other parts. The pain produced by them is particularly appreciated on taking food, and is usually relieved on lying down. They may also cause constriction of one of the orifices of the stomach, and usually induce the condition that Calwell named adhesion dyspepsia. Mayo points out that dilatation is often present, but, unlike what occurs in the dilatation due to ulcer, there are few symptoms of ordinary indigestion.

When such a condition is suspected to exist, we should, after opening the abdomen, follow the advice of Bird (*Inter-Colonial Medical Journal of Australasia*, December 20th, 1900) and inspect first the region of the gall bladder, in which such adhesions are most commonly met with, and then the other neighborhoods in which they may exist. When the adhesion is trivial, is very slender, or is in the form of a narrow band, we can simply separate it; and when this is done, most patients will be cured and practically all will be benefited. When an adhesion is very firm and long, it may be necessary to ligate it at each end and excise it. In separating adhesions the bleeding is generally so slight that ligation is rarely necessary. In severe cases in which the adhesions constrict the pyloric outlet of the stomach, gastro-enterostomy should be performed, the anterior operation being employed for posterior adhesions and the posterior operation for anterior adhesions. Always remember that adhesions may mark the site of an unhealed ulcer, and if they do so the ulcer should be treated surgically.

3. *Gastropexy*.—When the stomach droops the condition is known as gastroptosis; and this may exist alone or in association with the drooping of other abdominal viscera. When the stomach droops it passes into a more or less vertical position. The condition is not at all unusual in women, and its frequency may be estimated from the report of Steele and Francine that, in the Medical Dispensary of the Hospital of the University of Pennsylvania, sixty-three cases of gastroptosis have been recognized during the last two years.

When gastroptosis exists, the supports of the stomach are elongated. These supports are the gastrohepatic omentum and the gastrophrenic ligament. Duret advocates treating such cases by suturing the stomach to the peritoneum of the anterior abdominal wall. In view of the fact that dilatation of the stomach is a frequent secondary consequence of gastroptosis, some surgeons advocate gastro-enterostomy as the proper operation. If the liver likewise droops, it should certainly be lifted back to its place and sutured.

The most promising operation is that devised by Henry D. Beyer (*Pennsylvania Medical Journal*, November, 1902). He describes his operation as follows:

Make an incision three inches long, midway between the ensiform cartilage and the umbilicus. Place three transverse rows of interrupted silk sutures, from above downward and from right to left, through the gastrohepatic omentum, and another series through the gastrophrenic ligament. Tie these sutures, and thus form a broad transverse fold, or plication, in each ligament, that will shorten the ligamentous supports and lift the stomach into its normal position. Beyer says that seven cases have been operated upon, up to the present time, by himself and other operators. Six of these cases have now been observed for from sixty-five days to three years after the operation. In every patient the symptoms have been completely relieved and the health has been remarkably improved.

4. *Gastroplication*.—In this operation we seek to diminish

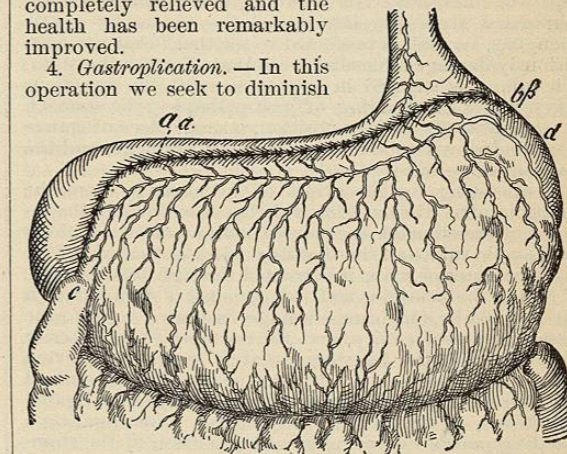


FIG. 4523.—Bircher's Method of Gastroplication. (Keen.)

the size of a dilated stomach by taking tucks in its wall. The term gastrorrhaphy has likewise been employed to designate this operation; but, as before stated, the name gastrorrhaphy should be restricted to the suturing of a wound or a perforation.

Gastroplication has been used to prevent the perforation of an ulcer, but its chief use is in dilated stomach. Clearly, however, when this dilatation is due to pyloric obstruction, such an operation must fail of effect, because it does not remove the cause of the difficulty; therefore when dilatation of the stomach is secondary to pyloric obstruction, that obstruction should be abolished by some of the methods subsequently to be considered, or gastro-enterostomy should be performed. The operation of gastroplication, if employed at all, should be restricted to cases of dilatation due purely to muscular atony, in which the digestive powers are at a low ebb because of the atony.

Different methods have been employed. One is to turn the greater curvature upward upon the lesser curvature and suture the two together (Fig. 4523). Two broad and lengthy layers of the anterior wall may be sutured together, or a very great number of small areas may be approximated by inversion sutures. Brandt, for instance, employed over two hundred sutures in one case.

The value of this operation is very questionable; and we lean to the view of Wölfler that, as the causative con-