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The operation of making an artificial inlet into the stomach from the anterior abdominal wall is called gastrostomy. The aim of the operation is to establish an external gastric fistula through which food and drink can be introduced into the stomach, in the event the cardiac orifice of this organ or any part of the œsophagus has become practically impermeable from chronic affections which have resulted in progressive stenosis. Sédillot made the first gastrostomy November 13th, 1849. It is said that Chr. A. Egeberg, a Norwegian surgeon, first proposed the operation, but to Sédillot belongs the credit of having first made it on the living human subject, and of having devised the name by which it has been known ever since. The operation was made on animals by Bassow in Russia in 1842, and Blondlot in France in 1843, for the purpose of studying the physiology of digestion.

Indications. Practically, the indication for this operation is either a malignant or cicatricial stenosis of the œsophagus or cardiac orifice of the stomach, as the remaining causes which may interfere with the passage of food from the mouth into the stomach, such as carcinoma of pharynx, congenital absence or stricture of œsophagus, and tumors or swellings encroaching upon the lumen of the œsophagus, are so very rare that they hardly deserve separate consideration in connection with this subject. Of the two principal indications for this operation, carcinomatous and cicatricial stenosis, the former furnishes by far the greatest number of cases. Of 207 cases collected by S. W. Gross[1] 167 were of this nature.

Results and Value of Operation. Gastrostomy for malignant disease is only a palliative operation, and as it opens a new route into the stomach for gastric alimentation, it has often been the means of prolonging life a number of weeks or months. If the operation is done for cicatricial stenosis, it not only prevents death from inanition and thus affords additional time for the treatment of the stricture, but the opening in the stomach can often be advantageously utilized in dilating the stricture from below. The early operations were all done as a last resort on patients brought to the verge of the grave by inanition, and as no antiseptic precautions were employed, the immediate results of the

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[1] Trans. Am. Surgical Assoc. 1884.

operation were anything but encouraging. The first twenty-eight operations did not yield a single successful case (Albert). Death resulted usually within 48 hours after the operation, either from shock or septic peritonitis.

The first successful case occurred in the practice of Verneuil.[2] In this case the operation was performed for cicatricial stenosis of the œsophagus, July 25th, 1876. In the successful operations for malignant disease the patients lived from a few days to six or more months after the operation. In a case reported by Studsgaard the patient lived 6 months; Escher's case 4 months; in one of Schönborn's cases 3 months; in one of Krönlein's cases 2½ months; in one of Sidney Jones' cases 40 days; in Albert's cases from two to three months.

The enormous mortality which attended the first operations, twenty-eight successive deaths, has been greatly reduced by an earlier resort to the operation, by an improved technique and more particularly by the antiseptic precautions under which the more recent operations were exclusively made. The antiseptic measures which are now almost universally employed, have largely prevented deaths from septic peritonitis, and consequently saved most of the patients that survived the immediate effects of the operation. Since the first twenty-eight operations, all of which proved fatal, twenty-eight additional operations were made until the end of the year 1879. Of this number the operation proved successful in seven, in three cases of cicatricial stenosis a permanent cure was obtained, and in four of malignant stricture the intended prolongation of life was realized. Ashhurst has collected 34 gastrostomies, of which number all but two appear to have terminated fatally. The most reliable and extensive statistics of this operation have been gathered by S. W. Gross.[3] Among 207 operations, including all recorded cases up to that time, there were 61 deaths for which the operation could be held accountable, a mortality of 29.47 per cent. In those that recovered, the operation prolonged life on an average for 82 days; at the date of the last reports of these 207 operations, 167 were performed for malignant stenosis, and the remaining 40 for cicatricial stricture. The mortality in the first class was 29.34 per cent. Powers[4] has collected 99 cases operated on since the publication of Gross' paper. Of this number 26 died in consequence of the operation, a mortality of 26.26 per cent. Eighty-three of the operations were performed for malignant disease, with a mortality of 27.71 per cent.; 16 for non-malignant stricture, with a mortality of 18.87 per cent.

[2] Lancet, 1877, 1.55.

[3] Transactions American Surgical Association, 1884.

[4] Brief Notes on Gastrostomy, with report of a successful case. International Journal of Surgery, November, 1891.

The great mortality which still attends this operation should not be charged to the operation, as we have reason to believe that in many of the fatal cases the operation was performed under circumstances which would have proved fatal in a short time without it. The bad showing of the operation should only remind us not to postpone it until the patient has not sufficient recuperative powers left to rally from its immediate effects, and to secure a satisfactory repair at the site of operation. Since 1879 the results have continued gradually to improve so that at present the average mortality does not exceed 25 per cent. This experience is only a counterpart of nearly all of the major operations in which the causes of death of the early great mortality have been gradually eliminated by proper selection of cases and improved methods of operating.

Time of Operation. The selection of the proper time for gastrostomy is of great importance. The operation should never be delayed until the patient is on the verge of starvation. In such cases the reproductive capacity of the tissues is often at such low ebb that even adhesions between approximated and sutured serous surfaces do not take place. One of my cases was in such a condition. The operation was made in the usual manner, Fenger's incision, fixation of stomach in the wound by transfixion by two long steel needles, and suturing to the side of the wound previously lined with parietal peritoneum. The case progressed well, and on the fifth day the needles were removed and the stomach opened, and feeding through the fistula commenced. The next day the stomach was found separated from the wound and abdominal wall, and the patient died within forty-eight hours of septic peritonitis. The adhesions between the anterior surface of the stomach and the margin of the wound at the end of five days were not sufficiently firm to hold the organ in place after the removal of the mechanical support. The difficulty is to obtain the consent of the patient and friends early enough, at a time when the strength of the patient is sufficient to cope successfully with the immediate effects of the operation. In this I have not succeeded in any of my three cases of gastrostomy. In all of them the operation was declined until the patients were on the border of starvation. In one of them the stomach had to be opened twelve hours after it had been fixed in the wound for the purpose of supplying food and stimulants, as the relaxation of the sphincter ani rendered rectal alimentation impossible. The patient rallied for a short time but died at the end of forty-eight hours from marasmus and exhaustion.

In the third case the stomach was opened at the end of the third day to meet the same indications, but the attempt at establishing gastric digestion proved likewise unsuccessful, the general marantic

condition of the patient did not respond satisfactorily to this additional means of supplying nutrient material and stimulants, and he died five days after the first operation from simple exhaustion. The statement which has necessarily to be made to patients suffering from malignant stenosis of the œsophagus, that they will have to rely on the introduction of food through the gastric fistula after gastrostomy, is not a great incentive for them to submit to the operation, until death stares them in the face. In malignant disease of the œsophagus or cardiac orifice of the stomach, the operation should be advised and practiced as soon as the stenosis interferes with the introduction of a proper food supply. If the operation is postponed for a longer time, it is not probable that it will add to the length of the patient's life. In cicatricial stenosis it is indicated when the stricture is impermeable to the passage of bougies, and progressive emaciation sets in in consequence of a defective food supply.

OPERATION.

Preliminary Treatment. Thorough antiseptic measures to secure an aseptic condition for the field of operation should be instituted, at least a day before the operation, in the same manner as in making the necessary preparations for a gastro-enterostomy. Only that in these cases the impermeability of the digestive tract above the stomach renders it impossible to prepare this organ by irrigation with mild antiseptic solutions. The large intestine should be thoroughly emptied by a high enema, both for the purpose of facilitating the operation, and to prepare it for rectal alimentation. Shock should be guarded against by administering subcutaneously one-sixth to one-quarter of a grain of morphia with $\frac{1}{60}$ to $\frac{1}{100}$ of a grain of atropia, and, if special indications are present, a rectal injection of one to two ounces of whisky in four ounces of warm water can be added. If no contra-indications exist, chloroform should be used as an anæsthetic, as it is less liable to cause vomiting, during and after the operation, than ether.

External Incision. As the object of gastrostomy is to establish a gastric fistula through which food can be introduced into the stomach, it is evident that the external incision should be made as near as possible to the cardiac orifice. In all instances in which the patient's strength warrants the performance of the operation in two stages, as was first suggested by Mr. Howse, this method should receive the preference, as it is much safer than if the stomach is opened and utilized at once as a digestive organ. Sédillot made a crucial incision through the left rectus muscle, and gives the following directions for the remaining steps of the operation: The stomach is drawn into the wound where it is to be fixed by perforating the gastric wall with a steel-pointed

ivory cylinder, secured externally on a disc of cork; after some days, when adhesions have formed, an opening is made into the middle of the stomach, at a point equidistant from either curvature, and from either extremity. Förster, Durham and Verneuil made the external incision in the line of the left linea semilunaris. Fenger, of Copenhagen, devised an incision which, until recently, has been practiced almost exclusively. This incision, from three to four inches in length, is made to the left of the rectus muscle, a little below and parallel to the left costal arch. The tissues are divided, layer after layer, with a sharp scalpel until the peritoneum is reached; this is incised between two forceps, and the opening enlarged to each angle of the wound.

Sidney Jones made a nearly vertical incision in the line between the left nipple and the spine of the pubes. Howse makes nearly a vertical incision through the outer border of the rectus muscle, separating its fibres, which he believes are useful in preventing leakage from the fistula. Hawkins Ambler cuts through the left rectus muscle parallel to and half an inch from the linea alba. Girard[5] make the incision through the centre of the left rectus and parallel to its fibres. After the stomach is drawn into the wound, he takes a bundle of muscular tissue about the size of a finger, from either side, and crosses them laterally, holding each in place by sutures. It was his intention to procure in this manner a sphincter for the gastric fistula, which he expected would guard against leakage.

Lauenstein[6] maintains that in cases of marked stenosis of the cardiac end of the stomach, it is better not to resort to the formation of a gastric fistula. He has met with two such cases in which access to the stomach was prevented by the tumors which were situated under the diaphragm. The neoplasms had invaded the mucous membrane of the stomach, which had to a great extent lost its digestive functions. It may also happen that the stomach is so firmly fixed by adhesions of the tumor at the cardia that the formation of a fistula is attended with great difficulties. For these reasons the author prefers rectal alimentation in this class of cases. A cancer of the cardia can be suspected, if the œsophageal bougie encounters resistance at a depth of thirty-eight to forty-one centimeters from the teeth. In one of his cases Lauenstein noted a loud systolic sound in the epigastrium, synchronously with the heart's action, which the autopsy showed was due to pressure of the tumor on the aorta. In a similar case which came under my own observation, I could not only hear a loud and distinct bruit a little to the left and on a level with the ensiform

[5] Wiener Med. Presse, No. 25, 1889.

[6] Zur Anlegung der Magenfistel wegen Krebsiger Cardia—Verengerung, Centralblatt f. Chirurgie, No. 27, 1891.

cartilage, but a distinct impulse was imparted to the œsophageal bougie resting against the stricture, the carcinoma of the cardiac orifice thus simulating almost to perfection an aneurism of the descending aorta.

Victor von Hacker[7] states that he is not in accord with Lauenstein's conclusion that extreme carcinomatous constriction of the cardiac orifice of the stomach is an absolute contra-indication to gastrostomy. He gives brief notes of six cases, which show that this operation performed as a palliative plan of treatment may be attended with results just as good in carcinoma of the cardiac orifice, even when a tumor can be felt in the epigastrium, as in cancer of the lower end of the œsophagus. In comparing these with nine other cases in which he performed gastrostomy for cancer of the œsophagus, he can find no difference between the two series with regard to the feasibility of the operation. It is generally admitted that no good result can be expected from gastrostomy in cases in which the growth has involved a large portion of the stomach, especially the greater curvature, and has probably contracted extensive adhesions with the surrounding tissues.

Von Hacker opens the abdomen through the middle of the upper portion of the left rectus muscle parallel to the fibres of this muscle, and he maintains that by making the incision in this locality the abdominal wall can be made to approach the stomach, in the event this organ is firmly attached to the surrounding tissues, much better than when the incision is made parallel to the left costal arch. In fifteen cases in which he employed this incision for the relief of carcinoma of the œsophagus and cardiac orifice, the two objects of the operation, the formation of a gastric fistula and prolongation of life, were realized in fourteen. It is plain that in cases of carcinoma of the cardiac orifice, the external incision should be made at a point where the abdominal wall can be made to approach somewhat the adherent organ. Hahn's and Fenger's incision are not appliable in such cases, as both of these incisions are made through an unyielding part of the abdominal wall. An incision through the middle or outer border of the left rectus muscle will answer a much better purpose in such cases.

Hahn[8] has quite recently devised a new incision for gastrostomy, for the purpose of making the opening in the stomach nearer the cardiac orifice than has been done heretofore, thereby bringing at the same time the fistula in a place where food could not so readily escape from the stomach.

[7] Zur Anlegung der Magenfistel wegen Krebsiger Cardia—Verengerung, Centralblatt f. Chirurgie, No. 37, 1891.

[8] Eine neue Methode der Gastrostomie, Berliner Med. Wochenschrift No. 14, 1890.

He opens the abdomen by Fenger's incision in order to gain access to the anterior surface of the stomach. A small oblique incision dividing the superficial structures is then made in the eighth intercostal space on the left side. Through this incision a closed hæmostatic forceps is pushed through the remaining tissues into the abdominal cavity. Through the lower incision the point of the forceps is directed toward the part of the stomach in which it is intended to make the opening. As soon as the end of the forceps has grasped the stomach, a conical portion is brought out to a point about one centimetre above the surface of the wound, and in this position it is secured by suturing. After this has been done the lower incision is closed in the customary manner. The cartilages of the ribs on each side of the fistula, in Hahn's operation, render material assistance in preventing leakage from the gastric fistula; at the same time the opening in the stomach is nearer the cardiac orifice than in any of the other operations, another important element in the prevention of the escape of gastric contents through the new opening. Hahn reports eight successful gastrostomies by his method.

Fixation of Stomach in External Incisions. In Hahn's operation the desirable part of the anterior wall of the stomach is selected through the lower incision, which is then grasped with the forceps and drawn into the upper wound, where it is firmly fixed by suturing the serous surface of the projecting little cone to the surrounding skin. If the stomach is approached through the abdominal wall below the costal arch, it is essential to protect the muscular and connective tissue against the action of pathogenic micro-organisms and the gastric juice; hence the first thing to be done after opening the abdominal cavity is to suture the parietal peritoneum to the skin with fine catgut or silk stitches. The next step of the operation consists in finding the stomach and bringing that portion of the anterior wall into the wound best adapted for making the gastric fistula. As this operation is invariably made for obstructive lesions which have for a long time prevented the ingress of a proper amount of food, the stomach will always be found greatly diminished in size, and its walls usually in an atrophic condition from prolonged inactivity. It is, under such circumstances, not always easy to find and properly identify the stomach.

Serious mistakes have been made during this step of the operation, as the duodenum and transverse colon have been mistaken for the stomach, and thus a duodenostomy or a colostomy have been made unintentionally instead of gastrostomy. The anterior wall of the stomach is thicker and its vascular distribution different than that of the duodenum and transverse colon. If the stomach cannot be readily found and identified, this organ should be inflated from above, a

procedure which will greatly facilitate and expedite this part of the operation, and will preclude the possibility of anchoring and opening the wrong organ. The inflation will bring the anterior wall of the stomach against the external incision, where it can be examined, identified and drawn into the wound. By taking advantage of this procedure the operation is greatly facilitated, and the surgeon will avoid the possibility of opening the duodenum, as was done by Clarke and Hadra, or the colon as happened in the practice of Maunder. All agree that the opening in the stomach should be made some distance from the pyloric end and as near the smaller curvature as possible. Coupland opened the stomach so far to the right that fluids regurgitated, and it is a fact that is generally acknowledged, that the organ under these circumstances lies much farther to the left than is generally supposed. Although it is desirable to open the stomach as near as possible to the smaller curvature and the cardiac orifice, it would be dangerous to drag it down into the wound by undue force, and fix it in that position, as later the traction would interfere with the union between the projecting portion of the stomach and the circumference of the external wound, or it may even become the cause of a complete separation of the stomach from the external wound after the removal of the fixation needles and stitches.

The stomach should be drawn forward gently, but sufficiently to make a small cone, and in this position it is fastened by suturing it to the sides of the wound. Langenbeck made use of two long steel needles in anchoring the stomach more securely in the wound. These needles were made to transfix both margins of the wound and all of the coats of the stomach. Krönlein only transfixed with the needles the wall of the stomach without entering its lumen and leaving out the margins of the wound, which is much preferable to Langenbeck's method, as the latter has given rise to unpleasant complications, as in several cases the tracks of the needles in the abdominal wall became the seat of a phlegmonous inflammation. The presence of the needles not only furnishes an efficient support for the stomach, but they also serve a useful purpose as a guide in making later the incision in the stomach, which is done with a tenotomy knife, which is passed through the anterior wall of the stomach, between the two needles. As an additional support for the stomach and for the purpose of at once shutting out the peritoneal cavity from the fistula, the projecting portion of the anterior wall of the stomach is next sutured to the margins of the wound with fine catgut or silk stitches. This completes the first part of the operation.

Formation of Gastric Fistula. The next step consists in making a small incision in the most prominent and central part of the visible

portion of the stomach, thus accomplishing the final object of the operation, the formation of a gastric fistula. The time when this should be done must necessarily vary according to special indications presented by the general condition of the patient. If the patient's strength warrants it, the operation should be done *a deux temps*, that is, the opening in the stomach should not be made until a sufficient length of time has elapsed for firm adhesions to form between the stitched portions of the stomach and the circumference of the external wound. In patients not too much debilitated firm adhesions will form in from two to five days, when the stomach can be opened without fear of peritonitis ensuing from the escape of food or gastric juice. Before the stomach is opened, it is well to cover the space between the stomach and the margins of the wound with a thick layer of iodoform collodium, which can be made more flexible and durable by incorporating with this substance during its application, films of cotton. If the patient is much prostrated or becomes so soon after the operation, and life depends upon a prompt recourse to stomach feeding, the gastric fistula should be established at once. Golding-Bird and others have aimed to obviate early opening of the stomach by injecting into the stomach from time to time, through a small hollow needle or trocar, fluid nourishment and stimulants for the purpose of meeting urgent indications. This method of supplying the stomach with food and stimulants is certainly very unsatisfactory, and if the symptoms indicate imminent danger to life from absence of food in the stomach, it is much better to make immediately after the stomach has been fixed in the wound, or any time thereafter when dangerous symptoms point to approaching death from inanition, to establish the gastric fistula without delay, and at once utilize the physiological functions of the stomach.

Terillon, Zesas and von Hacker are in favor of opening the stomach at once after it has been fixed in the wound in all cases, irrespective of the general condition of the patient, but there can be no question that, in the practice of general surgeons, it is much safer to make the operation in two stages sufficiently far apart to insure firm adhesions before the stomach is opened. If the stomach has to be opened earlier, a ring of iodoform collodium should be applied over the line of suturing, so as to furnish an additional protection to the peritoneal cavity against the entrance of gastric contents, after the stomach has been opened. It is generally agreed that the opening in the stomach should be small, not larger than to admit an elastic catheter or rubber tube the size of an ordinary lead pencil, as leakage from the fistula is more liable to occur if the opening is larger, although in one instance I examined a gastric fistula that was large enough to

admit a rubber tube the size of an adult's thumb, and yet very little leakage occurred. The incision is to be made with a small tenotomy knife, in the use of which care must be exercised to carry the incision directly through the wall into the lumen of the stomach without injuring the opposite or posterior wall. If fixation needles have been used, the cut is made between them.

Powers resorted to the use of two loose stitches in the exposed portion of the stomach between which, later, the stomach was opened. As soon as the stomach has been opened, a rubber tube eight to twelve inches in length is inserted, and fastened in place by a small safety pin and strips of adhesive plaster. By attaching a small funnel to the distal end of this tube, liquid and finely divided solid food can be poured into the stomach. After the introduction of food, the rubber tube is either clamped or acutely flexed in order to prevent the escape of food during gastric digestion.

Prevention and Management of Leakage from Fistula. The escape of food through the gastric fistula is one of the great drawbacks and inconveniences after all operations for obstructive disease on the proximal side of the stomach. One of the causes of leakage, a large opening in the stomach, has already been mentioned, and for this reason it has been stated that the incision in the stomach should be only sufficiently large to permit the insertion of a rubber tube the size of an ordinary lead pencil. The tube should fit the opening in the stomach accurately, so as to prevent the escape of fluid between tube and the margin of the wound. If the fistula enlarges subsequently, and the tube no longer fits its lumen, it must be exchanged for a larger tube. Another contrivance to prevent the escape of gastric contents is an inflatable, double rubber balloon through which the tube passes. Such an instrument has been used with benefit by Carmichael, Terillon, von Hacker and others.

Leakage of gastric juice is liable to cause troublesome irritation of the surface of the wound and the surrounding skin, which can be best obviated by sprinkling the surface, from time to time, freely with carbonate of magnesia, or by protecting the skin with a thick layer of vaseline or lanolin. Witzel [9] has devised a method of dealing with the exposed portion of the stomach with a special aim to prevent leakage through the fistula. The object of this procedure is to establish a canal, formed by stitching together the free borders of two parallel folds of the exposed anterior wall of the stomach.

The stomach is drawn forward sufficiently into the wound so that two oblique folds (Fig. 1 *a a' b b'*), from left to right can be raised, sepa-

[9] Zur Technik der Magenfistel Anlegung Centralblatt f. Chirugie No. 32, 1891.

rated by a gutter from 1.5 to 2 ctm. in width. At three or four opposite points sutures are passed through the folds, penetrating down to but not through the mucous membrane; these sutures are tied over a rubber tube (*c*) the size of a lead pencil; the lower end of this tube is inserted into a small opening (*d*) in the stomach. A few additional sutures are inserted so as to bury the lower portion of the tube in a canal about four ctm. in length (Fig. 2). The canal thus formed is left exposed at the bottom of the wound when the stomach is fixed by sutures to the margins of the external incision.

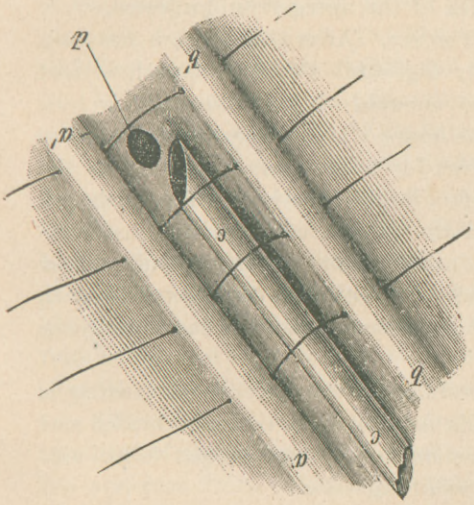

Fig. 1.

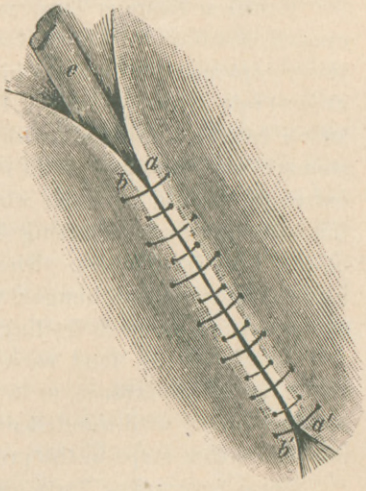

Fig. 2.

This modification does not necessitate any change in the other steps of the operation, and the surgeon can make the external wound according to his usual practice. Hahn's operation, of course, would preclude the addition of this modified method of dealing with the anterior gastric wall. Witzel exposes the sheath of the rectus by an incision made parallel to, and at a distance of a finger's breadth from the margin of the ribs; then, as is done in Howse's operation, he separates the fibres of this muscle in a vertical direction, and incises the transversalis obliquely from above downwards and from the right to the left. The division of the rectus thus crosses the wounds made through the skin and transversalis.

He has operated on two cases by this method and in both instances leakage did not occur, the valvular action of the long channel containing the tube preventing the escape of stomach contents.

Rectal Alimentation. The patient should be nourished exclusively by rectal enemata until food can be introduced into the stomach through the gastric fistula. Peptonized milk, beef tea, raw eggs treated with sodic chloride, 15 grains to each egg, and brandy or whisky, are the articles which will prove most beneficial when administered in this manner. If the lower portion of the rectum becomes irritable and rejects the injections, the nutrient substances should be thrown higher up through an elastic rectal tube. About four ounces should be administered every four or five hours. The addition of a few drops of tincture of opium will often render the rectum more tolerant, and prevent the expulsion of the nutrient fluid injected.

Stomach Feeding Through Fistula. After the stomach has been opened, small quantities of easily digestible liquid food, such as beef juice, peptonized milk and whisky, should be injected through the tube at intervals of every three or four hours. If necessary rectal alimentation can be continued in addition for a few days. As soon as the stomach can dispose of solid food, a larger tube with a funnel-shaped extremity should be used, when the patient can chew and insalivate the food, and by transferring it from the mouth to the funnel, pour or blow it into the stomach. The act of mastication satisfies at least in part the sensation of hunger, which is not always the case by relying exclusively on stomach feeding.

Mastication of food as a preliminary step to stomach feeding is also of great importance, as in this act the food is finely divided and becomes mixed with the first digestive fluid, which cannot fail in aiding the further steps in the process of digestion.

Some interesting facts pertaining to feeding through a gastric fistula have been recorded. In one of Langenbeck's cases 1500 grammes of milk, eight raw eggs and a tablespoonful of Leube's meat solution were poured into the stomach daily through an irrigator. Some time after the operation the patient was able to swallow liquids, and could thus quench his thirst, which could not be done by conveying fluids directly into the stomach. Even the sense of hunger was not satisfied completely by this liberal stomach feeding. The patient expressed himself that below in the stomach he was satisfied, but not above in his mouth.

Schönborn's patient masticated daily two to three beefsteaks, and then introduced the masticated material into the stomach. Escher's patient received into the stomach daily a thick porridge made up of finely divided food, followed by milk, bouillon, chocolate, wine, etc. After the third week he commenced to chew the food, and enjoyed this part of the eating process immensely, after which the food was transferred to the stomach through a rubber tube.

In one of Albert's cases the patient could only swallow fluids which satisfied the sense of thirst completely, while solid food was introduced into the stomach exclusively through the fistula, and the patient gained eleven kilo in weight during a few weeks.

In one of Trendelenburg's cases the patient masticated the food, transferred it from the mouth to the funnel-shaped extremity of the rubber tube, from where it usually reached the stomach by its own weight; but if this did not occur, the patient made a sudden expiratory movement, when the food was aspirated into the stomach. At the time of operation, the patient, a boy, suffering from cicatricial stenosis of the œsophagus, weighed 16,500 grammes, twenty days later 16,800 grammes, four weeks later 18,000 grammes, after another five weeks 19,300 grammes, and after additional five weeks 20,800 grammes.

In gastrostomy for malignant stenosis of the œsophagus or cardiac orifice of the stomach, the fistula is used exclusively for the introduction of food and drink to prevent death from starvation. Such patients die within a few weeks or months from marasmus, hemorrhage or perforation of the carcinoma into the pleura or lung. If the operation has been undertaken for an impermeable stricture of the œsophagus, the gastric fistula is not only used to supply the stomach with the requisite quantity of food, but the original obstructive disease is approached from below, and very often it is possible to pass a bougie from the stomach, after all such attempts from above have proved inefficient.

Dixon [10] made recently a gastrostomy in a case of impermeable stricture of the cardiac orifice, and subsequently succeeded in dilating the stricture from below. The patient was fifty-four years old, who had lost 156 pounds of his normal weight, which was 230 pounds. The abdomen was opened by an incision four inches in length, extending from a point an inch below the ensiform cartilage, and an inch and a half to the left of the median line extending through the rectus muscle in a downward direction. The stomach was drawn forward into the wound and fixed with a silver pin, which was made to pass through the entire thickness of the wall of the stomach, as suggested by Weir.

The peritoneal coat was then stitched to the skin by a continuous suture, and the balance of the wound closed in the usual manner, and the wound dressed with iodoform gauze. Two days later the stomach was opened by cutting with a tenotome down upon the pin, which was then withdrawn and the mucous membrane stitched to the skin. A rubber tube was then inserted into the stomach and iodoform collodium liberally applied around the tube and over the abdominal wound, and another gauze dressing applied.

[10] Journal Amer. Med. Association, Oct. 31, 1891.

The tube was fixed externally by two threads which were fastened to the surface of the abdomen by adhesive strips. Stomach feeding through the tube was commenced at once. An ordinary spring clothes-pin was used as a clamp for the tube. In ten days the patient left the bed, and in two weeks he was walking about the house. Twenty-four days after the primary operation, a small-sized olive pointed bougie passed readily from the stomach into and through the stricture. The stricture was dilated rapidly by passing in succession larger bougies, and the next day a large stomach tube was passed down the œsophagus and without much difficulty was made to enter the stomach. Dilatation was repeated every few days. Later the stricture again returned and became impermeable to the passage of instruments. Nearly two months after operation the cardiac end of the stomach was subjected to a digital examination. The tissues around the contracted cardiac orifice were much indurated. A bougie *a boule* was passed first through the stricture followed by a uterine sound, and finally the stricture was dilated with a uterine dilator.

The next day another dilatation was made and a small fragment of tissue which was removed was examined under the microscope, and the true nature of the stricture determined. It was believed up to this time that the stricture was cicatricial, but this examination showed it to be of a malignant character. This case illustrates well the advantages of retrograde dilatation in strictures of the œsophagus or cardiac orifice impermeable to the passage of instruments from above. Giesler[11] reports a case of stenosis of the cardiac orifice of the stomach of unknown origin and nature which was successfully treated by retrograde dilatation. The gastrostomy was made in two stages. After the fistula was established the operator succeeded after many vain attempts in passing a thread through the stricture from above, after which dilatation by the use of olive-pointed bougies was carried to the desired extent. After two months the opening in the stomach was allowed to close.

CONCLUSIONS.

1. Gastrostomy is indicated in all cases of cicatricial and malignant stenosis of the œsophagus and cardiac orifice of the stomach as soon as a sufficient quantity of food can not be introduced into the stomach by simpler measures *per viam naturalis.*

2. Gastrostomy for malignant obstruction on the proximal side of the stomach, if performed at a time when the patient is sufficiently strong to survive the immediate effects of the operation, is a comparatively safe procedure and adds from a few weeks to six or eight months to the patient's life.

[11] Bruns, Beiträge zur Klinischen Chirurgie, B. VIII.

3. In the treatment of impermeable cicatricial stenosis of the œsophagus gastrostomy not only furnishes a new inlet for the introduction of food into the stomach, and thus prevents death from starvation, but it often proves a curative measure in such cases, as the gastric fistula can be utilized for another purpose—successful retrograde dilatation of the stricture.

4. The upper central part of the left rectus and the eighth intercostal space between the cartilages of the ribs are the most desirable points for the formation of the gastric fistula.

5. If the patient's strength warrants it, the operation should be done *a deux temps*, as it is safer to postpone opening of the stomach until firm adhesions have formed between stomach and the circumference of the external incision, than to establish the gastric fistula at once.

6. Fixation of the projecting cone of the anterior wall of the stomach in the abdominal wound is best secured by two long needles passed through the serous and mucous coats only, and suturing of the surface to the circumference of the wound.

7. Leakage from the fistula can be prevented most effectually by making the opening in the stomach small, by the use of an inflatable double rubber bulb through which the feeding tube reaches the stomach, or by making an oblique tunnel in the anterior wall of the stomach as devised and practiced with success by Witzel.

8. Solid food should first be subjected to thorough mastication and insalivation, when it is transferred by the patient from mouth to a small funnel connected with the distal end of the feeding tube, from where it is made to enter the stomach by its own weight, by blowing it through the tube or, finally, it is aspirated into the stomach by the patient's sudden expiratory efforts.

9. Mastication of food, as a preliminary step to its introduction into the stomach, satisfies, at least in part, the sense of hunger, which is not always accomplished even by liberal exclusive gastric feeding through the fistula.

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