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ORIGINAL MEMOIRS.

ŒSOPHAGOPLASTY.

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IN cases of inoperable carcinoma of the thoracic portion of the œsophagus, the old methods of gastrostomy (Witzel, Kader, Ssabanejew-Frank, Senn) should be resorted to, as they are not serious operations and their functional results are good.

However, if the tumor in the œsophagus is to be extirpated, the mere establishment, for feeding purposes, of a fistula below the costal arch, is nowadays no longer a sufficient procedure. The whole operation, including the making of the gastric fistula, should be planned with a view to reconstruction of the œsophagus—"œsophagoplasty," viz., the making of a tube which will enable the patient to swallow his food and pass it down into the stomach.

Lexer and Frangenheim each succeeded at about the same time in giving a patient with impermeable cicatricial stricture of the œsophagus extrathoracically a new, useful tube by a series of plastic operations. (1910-11.)

Both employed the combined methods of Roux and Wulstein who exclude and then transpose under the skin of the chest a coil of the jejunum, of which the lower end is con-

nected with the gastric fistula and the upper end with the oral stump of the œsophagus by a skin-plasty.

Next to the necessity of the seriatim operating, the threatened necrosis of the transplanted jejunal coil represents the weak point of this otherwise ingenious procedure.

At this stage of the evolution of the subject in question, it meant real progress when Jianu proved by a number of successful operations upon dogs that the major curvature of the stomach can be used for the formation of a tube, of which one end remains in connection with the gastric fundus, while the other free end can be brought up under the skin of the thorax to a point not far from the clavicle.¹ Before him others had tried to solve the task in a similar manner, Depage² making use of the lesser curvature; Hirsch³ of the anterior wall of the stomach.

Not long after the publication of Jianu's article, Roepke tried the method for the first time on a patient with cancerous stricture of the œsophagus, and it proved a perfect success.⁴

In December, 1912, a female patient, forty-six years of age, came under my care at the German Hospital who had found increasing difficulty in swallowing for the last six months. A sound showed a stricture nine and one-half inches behind the incisor teeth, and the X-rays revealed the presence of a stricture involving several inches. Œsophagoscopy was difficult on account of abundant salivation and mucous accumulation in the œsophageal pouch above the narrowed lumen. In view of the contemplated resection of the œsophagus, Jianu's method of gastrostomy, which represents the first stage of extrathoracic œsophagoplasty, appeared clearly indicated. The operation was done on December 26, 1912, the procedure of Roepke being followed pretty closely, as follows:

¹ Gastrostomie und Œsophagoplastik. Deutsche Zeitschrift für Chirurgie, vol. 118, p. 383, 1912.

² Résultats d'une nouvelle méthode de gastrostomie, x French Surg. Congr., 1903.

³ Plastischer Ersatz des Œsoph. aus dem Magen. Centralbl. f. Chirurgie, 1911, N. 48.

⁴ Centralblatt f. Chirurgie, No. 46, November 16, 1912.

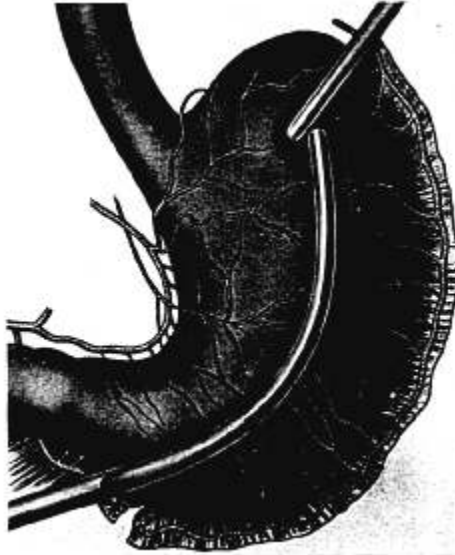
After exposing the stomach by a median incision from the xyphoid process to the umbilicus, tying off the major omentum up to the place where the left inferior gastro-epiploic artery turns on to the stomach, and after double ligation and division of the right inferior epiploic artery about two inches from the pylorus, a mattress suture of silk was run through the entire thickness of the stomach about one and one-quarter inches distant from and parallel with the greater curvature (Fig. 1, dotted line), the stomach having been lifted up by the assistants in order to have the contents run toward the lesser curvature. This part of the operation could have been simplified had a suitable clamp, better still two clamps, corresponding in shape to the major curvature, been at hand. (See Fig. 1, which is taken from Jianu's article.) In placing two equally shaped clamps alongside of each other, parallel with the major curvature, the asepsis of this part of the operation can be materially improved (see further down).

The thread of the mattress suture was clamped close to the fundus of the stomach opposite the last ligature of the greater omentum, and then an incision made through the stomach along this suture. (See Fig. 1, dark line.) The portion of the stomach thus dissected was temporarily wrapped in a piece of sterile gauze. Then a second continuous silk suture, commencing again at the major curvature, inverted that part which had been closed by the mattress suture, so that the width of the stomach was reduced to about two-thirds of its normal size. After this second thread had reached the place where the mattress suture had been clamped before, it was knotted to this and then continued as a Connell stitch up to the tip of the stomach flap, transforming the latter into a rather wide tube which connected with the fundus. (Fig. 2.) It was provided with a good blood supply and covered all around with peritoneum. A second continuous seromuscular suture was added alongside this new tube, as is done in gastro-enterostomy. The length of the new tube was 25 cm. (9¼ in.).

Thereupon the stomach, thus mobilized, was turned so that the base of the tube was lying at the upper end of the median abdominal incision, right below the xyphoid process. Placed upon the surface of the thorax, the free end of the tube easily reached up to the cartilage of the third rib, without any stretching of the tube. Over this cartilage, about one inch to the left

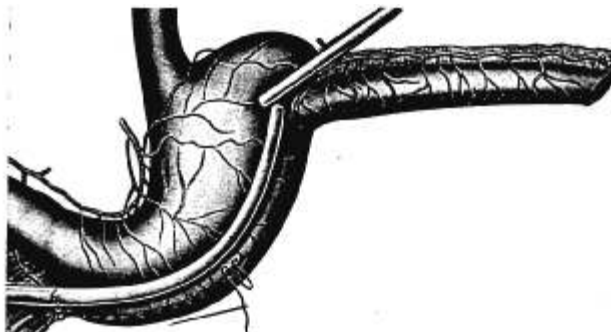
border of the sternum, a horizontal incision $1\frac{1}{2}$ in. in length was now made, down and through the fascia of the pectoralis major muscle, the fibres of the latter bluntly divided and a tunnel bored below the muscle with a large curved clamp. With the tip of the latter, when it emerged into the upper end of the abdominal wound, were caught the threads (left long) of two inverted sutures, which had been placed in order to temporarily occlude the tip of the newly formed tube, and drawn up and out of the upper chest wound, until the occluded tip of the tube projected for about half an inch. Now the abdominal wound was properly closed by sutures, the upper ones catching the stomach on their way, thus lifting it up, and the end of the new tube opened up by cutting the two inverting sutures, and fastened to the borders of the small chest wound. (Fig. 3.) Of course, this opening of the tube might be done twenty-four to thirty-six hours later, as, for instance, with the sigmoid in inguinal colostomy. However, with proper care asepsis can be nicely maintained and it is better for patient and surgeon, if the work can be finished at the time of the first operation. In this case the asepsis was disturbed later on by a fascia necrosis, due to gangrene of the seromuscular coat of the uppermost extremity of the new tube, the gangrene having been caused by fastening the tube in place with through and through sutures, which evidently constricted the vessels. This proved to be a technical mistake. In view of the fact that the nourishing vessels enter the new tube in a horizontal direction, its seromuscular coat should *not* be surrounded by the sutures which have to anchor the top end of the new tube. *The mucosa alone* should be lined to the borders of the skin wound. Nevertheless, the patient was up and about on the ninth day after operation; she was presented before the New York Surgical Society on the twelfth day, Jan. 8, 1913. (See ANNALS OF SURGERY, Transactions of the New York Surgical Society, April, 1913, No. 4, pp. 586 and 587.) So far the intended thoracotomy could not be done on account of a perichondritis of the rib cartilage and also of the border of the sternum, to which the submuscular suppuration had spread. Meanwhile the patient enjoys full diet, the food, after thorough chewing and salivation, being deposited in some kind of warm fluid and then washed down into the stomach through a funnel. Weight is slowly increasing. She permanently wears a large sized rubber

FIG. 1.



Major omentum has been divided (proximal ligatures are not shown in illustration. Right inferior epiploic artery doubly ligated and divided. It is wise to clear about three-fourths to one inch of the major curvature of the stomach toward the pylorus of omentum plus vessels. (This step, also, is not brought out in the illustration.) In the case reported no clamps were placed, but only the mattress suture (dotted line) which shut off the new tube from the rest of the stomach. The heavy black line represents the direction in which the scissors divided the stomach. (Taken from Jianu's article.)

FIG. 2.



"Jianu tube" turned up; the second row of sutures (Lembert) is placed; note the splendid blood supply and pointing upward of the proximal portion of the major omentum which, after transposition of the tube to the outside of the chest, points to the right side of the patient. The one end of the tube remains in connection with the fundus of the stomach; the free end represents the gastrostomy opening, which eventually can be sutured to the lower end of the transposed oral stump of the esophagus, after resection of the intrathoracic carcinoma has been accomplished. (Also taken from Jianu's article.)

FIG. 3.



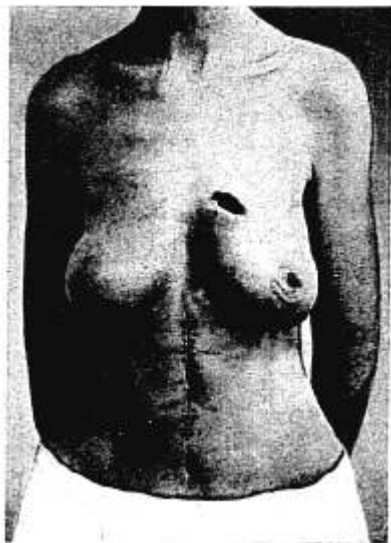
Photograph of the first patient, forty-six years old, who was operated upon at the German Hospital according to Jianu-Roepke's method on December 26, 1912, as described in this article.

FIG. 4.



The second case, male, sixty-eight years old, operated upon at the German Hospital, March 24, with the help of Hültl's wire stitching instrument.

FIG. 5.



Third case female, forty-one years of age, also operated upon with the help of Hültl's instrument on March 27, 1913.

tube within the Jianu-tube because the latter—also in consequence of the sub-muscular suppuration—developed a leak in the line of the continuous silk suture.

Ordinarily it will not be necessary for the patient to wear a rubber tube; a small piece of dry gauze will close the Jianu opening between meals. If this is not satisfactory, either a permanent tube can be worn, with the outer end plugged, or, as our observations have shown, the tube may be compressed with a piece of gauze held down by a strip of adhesive plaster placed across the chest. A truss-pad, filled with water or glycerine, held in place by straps around the thorax, will answer the same purpose. The new tube communicates freely with the fundus of the stomach. Regurgitation of food and stomach secretion can occur, producing excoriation of skin.

On basis of operations on dogs, we have recently made use to great advantage of Hueltl's wire stitching instruments in the formation of the Jianu tube in two patients, March 24 and 27. The operation on the stomach is thereby rendered absolutely dry and, of course, more aseptic; the time of the operation is also shortened. Both patients were operated upon with the help of intravenous ether anaesthesia and are doing nicely. In one the new tube is 19 cm. long (Fig. 4), in the other 21 cm. (Fig. 5.) In both the gastrostomy opening corresponds to the level of the third rib. In one of them I could have easily placed it level with the second rib, had I put the tube on the stretch.

With regard to the question of the subpectoral or subcutaneous placing of Jianu's tube, I feel inclined, even with the limited experience thus far had, to favor the subcutaneous way, for, though usually the operation will run an aseptic course, a local infection may nevertheless occur, and in that event it will be easier to cope with the subcutaneous than with a submuscular seat of inflammation. Besides, the latter may spread to periosteum of rib and sternum, or the perichondrium of the ribs, which always means a tedious convalescence.

Furthermore, since recent developments have shown (Ach's patient living 17 days after resection of the œsophagus, Torek's first successful case of resection of the œsophagus for a carcinoma behind the aortic arch) that the subcutaneous transposition of the oral stump can be done also in the human being without endangering nutrition, it would seem an advantage to have both tubes, the œsophageal stump from above and the Jianu tube from below, meet on the same level, for if they should not be long enough to make end-to-end union possible, a skin plasty would have to be done.

In thinking over this plan of operation, the question has arisen in my mind: How shall we proceed if the first stage of œsophagoplasty has been done by Jianu's method of gastrostomy in a case of carcinoma of the œsophagus with the idea of resecting the tumor in the second stage, and the case is then found inoperable.

It seems to me it would be advisable in such an event, nay, even indicated, to go ahead, same as we do within the abdomen in the case of an inoperable carcinoma of the pylorus. Here we do a gastro-enterostomy to alleviate the patient's misery. We tell his relatives the true state of affairs, but he believes—at least for a time—that he is cured; a palliative, humane treatment.

The greatest hardship for patients with malignant œsophageal stricture is their inability to swallow. Their principal desire is to have this restored. Why not then, if on thoracotomy a case is found inoperable, divide the œsophagus proximal to the tumor and invert the distal end. Then transpose the oral stump under the skin of the neck and chest and, if long enough, unite it with the opening of the Jianu tube. If it proves too short, a connecting rubber tube (Gluck, Perthes) will re-establish swallowing of liquid and semifluid food. If this should prove unsatisfactory, a skin plasty will have to be made to bridge the defect and thus complete the extrathoracic œsophagoplasty.

Even in cases where the tumor apparently totally ob-

structs the œsophagus, there is usually still sufficient drainage through a narrow and tortuous canal in the centre of the tumor down into the stomach, same as Madelung's operation (division of the sigmoid, inversion of the distal end and implantation of the proximal end in the abdominal wall) has shown the practicability of this method in cases of inoperable rectal carcinoma.

Further experience and observation is needed to find out how long the transposed oral stump of the œsophagus may be without becoming necrosed. It certainly is of the greatest importance for the patient's future, that partial gangrene with the ever-occurring subsequent phlegmon of the surrounding tissues should not set in.

In cases, in which examination previous to operation shows the cancer to be located between the aortic arch and the cardia, or right at the cardia itself, then, it has been my recent practice in animal experimentation, assuming this condition, to bring up the tube *intrathoracically*, through the foramen œsophageum of the diaphragm into the pleural cavity, and to make an end-to-end anastomosis between it and the oral stump of the œsophagus. (Intrathoracic œsophagoplasty).⁵ A patient cured by this procedure would live on after the operation the same as he did before he became afflicted with the cancer. The only drawback of this latter, seemingly ideal procedure is, that according to present indications, the entire work has to be done in one sitting, whereas in extrathoracic œsophagoplasty Jianu's operation can be done in the first sitting and resection of the œsophagus with transposition of the oral œsophagus stump in the second. Perhaps a way can be worked out experimentally how to make the intrathoracic œsophagoplasty also a two-stage operation.

The introduction of Jianu's operation, comprising as it does, the first stage of extrathoracic œsophagoplasty—very likely also the possibility of carrying out intrathoracic œsophagoplasty—appears to have advanced by another great step the surgery of the œsophagus, which is now making headway by leaps and bounds.

⁵ Centralbl. f. Chirurgie, February 22, 1913, No. 8.