

CANCER OF THE OESOPHAGUS AND CARDIA.*

A DESCRIPTION OF AN OPERATION FOR ITS REMOVAL BY THE TRANSTHORACIC
ROUTE UNDER CONDITIONS OF DIFFERENTIAL PRESSURE.

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THE development of the Sauerbruch idea, rendering accessible to surgical attack the interior of the thorax, led to the hope that carcinoma of the lower portion of the oesophagus would be soon amenable to radical removal. The fatal issue, however, of the few operations of this character which have been undertaken, and the rather indifferent results of animal experimentation have somewhat cooled the interest in this province of surgery. Nevertheless the field is an important one, for carcinoma of this region is by no means of infrequent occurrence. There are to be considered not only the strictly oesophageal tumors but also cancer of the proximal portion of the stomach. The contiguous parts of these two organs, anatomically different, form one surgical region. Rokitansky¹ first formulated the rule that the duodenal walls do not become involved in cancer of the pylorus, while cancer of the cardiac portion of the stomach regularly extends to the oesophagus. For cancer of the pylorus, Lebert² found only one exception to this rule in 34 autopsies, and Brinton³ ten in 125. Few exceptions also exist at the cardia for the converse of the conditions at the pylorus. Fenwick⁴ and Robson⁵ comment on the frequency with which cancer of the oral portion of the stomach invades the oesophagus. Fawcett,⁶ out of 36 cases of malignant disease of the stomach

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occurring between the years 1826 and 1900, found 26 cases in which the cardiac orifice was involved. Of these one was a sarcoma, and, of the remaining 25, 16 had invaded the œsophagus for some distance. In all the 25 cases the stomach walls were the seat of the disease for a distance of three or four inches.

It is, therefore, a matter of interest to estimate the general frequency of œsophageal and gastric cancers, and to know what proportion of these growths in the case of each organ is situated at or near the cardia. With this end in view the accompanying tables have been constructed.

GENERAL FREQUENCY OF CÆSOPHAGEAL CANCER.

Albrecht⁷ from the Obushow Hospital records between 1873 and 1877, found 27 œsophageal cancers.

Krusenstern⁷ from the Obushow Hospital records between 1873 and 1883, found 44 œsophageal cancers.

Stroganow⁷ from the Odessa Hospital records between 1877 and 1887, found 44 œsophageal cancers.

Von Hacker⁷ from the Billroth Clinic records between 1877 and 1886, found 131 œsophageal cancers.

Collé² in Göttingen, 1877 to 1886, found 17 œsophageal cancers among 1650 patients.

Rebitzner² in Munich, 1854 to 1889, found 29 œsophageal cancers from 15,168 autopsies.

Ludewig⁴ in Göttingen, 1898 to 1905, found 48 œsophageal cancers from 9339 patients.

RELATIVE FREQUENCY OF CANCER OF STOMACH AND CÆSOPHAGUS

| | Stomach | Liver and gall-bladder | Uterus | Breast | Rectum or rectum and intest. | Æsophagus | Total number of cancers or individuals |
|--|---------|------------------------|--------|--------|------------------------------|----------------------|---|
| Borstell ⁽¹⁾ | 32.5% | ..... | 14.7% | ..... | ..... | 5.9% | 217 cancer cases. |
| Aschoff ⁽⁹⁾ | 1571 | 464 | 580 | 252 | 418 incl. intest. | 217 (4.79%) | 4574 cancer cases. |
| Prief ⁽¹⁰⁾ | 2147 | 757 | ..... | ..... | 407 incl. intest. | 359 | |
| Feilchenfelds ⁽¹¹⁾ (1901)..... | 165 | ..... | 45 | ..... | 56 incl. intest. | 58 | |
| Reichelmann ⁽¹²⁾ (1902)..... | 288 | ..... | 105 | 1 | 140 incl. intest. | 27 | |
| Bashford ⁽¹³⁾ | 14,468 | 11,531 | 11,714 | 8428 | 6389 | 2832 (10.8%) (3.35%) | 771 cancer cases. 84,448 cancer patients for 3 yrs. '01-'03 in England and Wales. (2086 cancers of tongue.) |
| Prinzling ¹⁴ (1907). | 3.15 | 1.66 | 2.5 | .9 | ..... | 3.125 | To each 10,000 inhab. |
| Redlich ¹³ (1907)... | 176 | 38 | 52 | 27 | 59 incl. intest. | 55 (11%) | 490 cases. |
| McConnell ¹⁴ (1908) | 33.7% | 13.5% | 27.6% | 15.7% | 44.7% | ..... | To each 100 deaths from cancer. |

DISTRIBUTION OF OESOPHAGEAL CANCER

| | Year | At beginning of oesophagus | At bifurcation of trachea | At cardia |
|---|-----------|----------------------------|---------------------------|-----------|
| Habershon ⁷ | 1857 | 33 | 30 | 10 |
| Petr ⁷ | 1867 | 2 | 13 | 8 |
| MacKenzie ⁷ | 1875 | 44 | 28 | 22 |
| Zenker and v. Ziemssen ⁷ | 1878 | 2 | 1 | 6 |
| Krusenstern ⁷ | 1885 | 3 | 30 | 14 |
| Morosow ⁷ | 1887 | 10 | 18 | 61 |
| Morosow (prep.) ⁷ | 1887 | 3 | 2 | 4 |
| Collé ⁷ | 1887 | 15 | 63 | 84 |
| Johansen ⁷ | 1888 | 29 | 47 | 82 |
| Voight ⁷..... | ..... | 4 | 17 | 41 |
| v. Hacker ⁷..... | ..... | 13 | 53 | 65 |
| Wright ¹¹..... | ..... | 30 | 48 | 35 |
| Piggar ¹⁸ | 1899 | 3 | 12 | 10 |
| Mampell ¹⁹ | 1889-1904 | *6 | 14 | 30 |
| ..... | ..... | 17 | 29 | 37 |
| ..... | ..... | *1 | 46 | 60 |
| Hampeln ¹⁶..... | ..... | †6 | 12 | 110 |
| Sauerbruch ²¹ | 1905 | 26 | 43 | 117 |
| Ludewig ⁸ | 1905 | 3 | 16 | 28 |
| Slavyanis ²² | 1908 | 10 | 5 | 28 |
| | | 256 (15%) | 527 (32%) | 847 (52%) |

* Autopsy. † Klin. cases.

DISTRIBUTION OF CANCER OF THE STOMACH

| | Pylorus | Cardia | Lesser curvature | Rest of stomach |
|--|------------|-------------|------------------|-----------------|
| Brinton ³ (1865)..... | 219 | 36 | | 105 |
| Gussenbauer and Winiwarter ²³ (1876)..... | 542 | 58 | 65 | 209 |
| Lebert ²⁴ (1878)..... | 10 | 5 | | 1 |
| Welch ²⁵ (1900)..... | 791 | 104 | 148 | 257 |
| Oster and McCrae ²⁶ (1900)..... | 27 | 3 | | 18 |
| Fenwick ⁴ (1902)..... | 173 | 24 | 29 | 39 |
| Colwell ²⁷ (1906)..... | 149 | 19 | | 59 |
| Makless ²⁸ (1907)..... | 134 | | 18 | 24 |
| Daniel ²⁹ (1908)..... | 225 | 4 | 61 | 26 |
| | 2270 (63%) | 253 (7.6%)* | 321 (8.9%)* | 738 (23%) |

* Total number of cases occurring in the cardia and lesser curvature equals 16 per cent.

A review of these tables will justify the conclusion that cancer of the stomach forms from 20 to 30 per cent. of all cancers, and that of this proportion 16 per cent. belong to the cardia and lesser curvature and 7 per cent. to the cardia alone. Taking the figures of Bashford¹³ to be the most accurate as a basis for calculation, we would have 2387 carcinomas of the cardia and lesser curvature, and 1099 of the cardia alone among 84,448 cancer cases occurring in England and Wales between the years 1901 and 1903. If we now add

to these numbers 52 per cent. of all oesophageal tumors (1472) we will have from 2570 to 3859 tumors situated at or near the cardiac orifice of the stomach for the same period—a number in either case greater than Bashford's statistics for carcinoma of the tongue and nearly equal (in its upper limits) to 50 per cent. of the number of cancers of the breast, a notoriously frequent form of carcinoma. One source of error may exist in the above method of calculation. It is possible that in the table showing the distribution of cancer of the oesophagus, a number of gastric growths may be included. Admittedly, for an absolutely correct calculation only such series of cases should be used which include both tumors of the oesophagus and stomach, and are at the same time coupled with a pathological report. Of 30 specimens of malignant disease from all portions of the oesophagus, Perry and Shaw³⁰ found that every one, with the exception of two sarcomas, was a squamous cell epithelioma, while of 44 gastric carcinomas, of which three involved the cardiac orifice, 12 were cylindrical celled carcinomas and 32 were spheroidal celled carcinomas. Haberkaut³¹ makes the following classification of 88 gastric cancers: scirrhus 32, adenocarcinoma 20, medullary carcinoma 18, "gallert" carcinoma 18. In the Matti series scirrhus carcinoma is very rare. Of the cases numbered from 53 to 97 cylindrical celled carcinoma occurred 12 times, carcinoma simplex 5, carcinoma colloides 5 times, and carcinoma medullare once, scirrhus 1, and mixed forms 12 times. There were no epitheliomas. It is excessively rare to find carcinoma as distinguished from epithelioma originating in the oesophagus. Franke³² has reported one case and refers to two others as curiosities.

We have used, however, the only data which we have been able to find, and such as they are we believe that they indicate a fair approximation to the truth. They at least clearly demonstrate the surgical importance of the cardia, and justify a serious effort in attempting to remove growths in this situation.

A number of considerations render carcinoma of the stom-

ach peculiarly suitable for radical attack if only the technical difficulties of the operation and of the early diagnosis can be overcome.

Gussenbauer and Winiwarter,²³ on the basis of the autopsy material of the Vienna Pathological Institute between the years 1817 and 1873, found 223 instances out of 542 pyloric carcinomas in which the tumors were well isolated, and of these 172 had scarcely any extensions to the surrounding organs; 41.1 per cent. of operated cases were stated to be free from metastases and 37.7 per cent. possessed no external growth. Ledderhose,³³ of 39 cases from the autopsy material of the Strassburg Pathological Institute, found 10 per cent. of such cases. Streit,³⁴ between the years 1876 and 1886 of the autopsy material of the Bern Pathological Institute, found 25.9 per cent. of these cases. Rydygier,³⁵ agreeing rather with the results of Ledderhose, found of 52 operated cases only 9.6 per cent. without extension beyond the stomach. Kramer,³⁶ of 66 cases operated upon, found 26 with extensive external growths and calculated that 33.3 per cent. are operable. Haberkaut,³¹ of 59 cases operated upon, found 20 with no external extension. Makkas²⁸ found no enlarged glands in 14 cases out of 167, and, out of the same number, in 46 only was there extension to neighboring organs. The table on page 73 shows the proportion of resections performed by the various operators and indicates the proportion of operable tumors of the stomach. It also shows the increasing number of permanent cures.

These results are the more remarkable when we remember the comparatively late period at which many patients submit to operations. In practically 90 per cent. of the cases a diagnosis is not reached until a tumor or resistance can be felt through the anterior abdominal walls. Out of 167 cases reported by Makkas,²⁸ there were only 10 in which no tumor or resistance could be felt. Of the Matti⁵⁰ series, a tumor existed in 77.3 per cent. and a resistance in 8.2 per cent. Of 50 resected cases reported by Creites,⁴⁰ only 3 came for treat-

ment inside of the first three months. Only eight presented themselves before six months from their first symptoms, and 39 submitted to operation between six months and one year, and 10 between 1½ years and 6 years. Of 665 cases reported by Hoffman,²¹ 25 were operated upon inside of the first two months, of which 4 were resected, 117 inside of three months, of which 24 were resected, 187 between three and six months, of which 53 were resected, 303 at six months, of which 77 were resected, 193 between six months and one year, of which 58 were resected, 144 after one year.

Of 285 cases reported by Daniel,²⁹ 35 were operated on before two months from their first symptoms, 78 between two and three months, 77 between four and six months, 81 between seven and twelve months, 49 later than one year.

Leaving out of consideration the technical difficulties of resection at the cardia, the accessibility of this portion of the stomach to direct observations through the gastroscope should render it possible to obtain the same if not better results than at the pylorus. From our own experience we are convinced that it is not a difficult matter under local anæsthesia thus to remove bits of tissue for microscopical examination from growths even though situated some distance within the stomach. We base this belief upon the fact that we have confirmed the diagnosis of gastric carcinoma involving the cardiac orifice by the removal of bits of tissue through the gastrosopic tube, and upon the fact that in the normal individual we are able to examine the cardiac portion of the stomach for a distance of three or four inches. Though our observations cover as yet a limited number of cases, it is certain that the large number of inoperable growths of the stomach would not exist if the gastroscope could be introduced as a routine method of examination in all new gastric cases.

The preceding discussion is necessary not merely to show the importance of the surgical field at the cardia, but to define just what this field is, and to demonstrate that the cardiac portion of the stomach is as important if not more important, than the lower end of the œsophagus, and must be included

in any plan of operative attack directed against carcinoma of this locality.

The introduction of thoracic surgery under conditions of differential pressure has demonstrated the accessibility of both these regions. Notwithstanding, however, the good exposure which this method of operating affords, every intrathoracic oesophageal operation thus far undertaken has been fatal.

OPERABILITY OF CANCER OF THE STOMACH.

| Author. | No. cases. | No. resections. | Mortality. | No. traced. | Died later. | | | Well when rep. | Cases well over 3 yrs. |
|---|------------|-----------------|--|-------------|---------------------|----------|--|------------------------|------------------------|
| | | | | | 1/2-1 yr. | 1-2 yrs. | 2-3 yrs. | | |
| Rydygier ²⁷ (1901)..... | 100 | 25 | 17 | 23 | 2 | 2 | 1 | | |
| Clairmont ²⁸ (1905) (Eis-elsberg)..... | 258 | 32 | 6 | ... | 7 | 6 | 2 | 6 | 3 |
| Mayo ²⁹ (1906)..... | ... | 100 | 14 | 63 | 17 | 8 | 2 | 65 | 5 |
| Crite ³⁰ (1907, Braun)... | 211 | 50 | 19 | ... | 24 (16 mo. - 1 yr.) | | | 6 (6 mo. - 1 1/2 yrs.) | 1 |
| Maklas ³¹ (1907) Mickulicz..... | 458 | 167 (4 extirp.) | 1891-'98, 25 out of 55; 1899-1900, 9 out of 40; 1901-'02, 23 out of 68 | 82 | 21 | 26 | 6 (6 died of recurrence bet. 4-6 yrs. later) | 27 | 3 |
| Riese ³² (1908)..... | 89 | 24 | 7 | ... | | | | 5 (7 mos. - 5 yrs.) | 1 |
| Daniel ³³ (1908)..... | 395 | 73 | 21 | 71 | 40 | 10 | 29% operable | | |
| Derjushinsky (1909) quoted from Rasumowsky..... | ... | 6 | 1 | ... | | | | | |
| Rasumowsky ³⁴ (1909)... | ... | 5 | 2 (1 in 17 days from hemiplegia) | ... | | | | | |
| Kocher ³⁵ | ... | 92 | 14 (2 out of last 27) | ... | | | | | 18 |
| Kindl ³⁶ (1909)..... | 122 | 16 | 7 | ... | | | | | |
| Poncet ³⁷ (1909)..... | 169 | 40 | 14 | 18 | 7 | 7 | | 5 (1-5) | 3 |
| Kocher ³⁸ (1909)..... | ... | 144 | 4† | 100 | | | | | 22 |
| Mayo ³⁹ (1910)..... | ... | 266* | 34 | 88 | | | | | 18† |

Leriche⁴⁰ has collected 93 cases from various authors free from recurrence 3 years after operation.

Paterson⁴¹, 86 resections, of which 21 have lived for 3 years and 12 for 5 years.

* 117 previous to 3 years ago. † Out of last 44. ‡ 13 over 4 years; 8 over 5 years.

Only about 15 (10 by Sauerbruch) have been performed, and of these the most noteworthy are three attempted resections (Sauerbruch,⁵² Wendel,⁵³ and Tiegel⁵⁴).

Concerning operations upon animals, we are unacquainted with any successful series of typical resections of what would constitute a satisfactory length of oesophagus and stomach. Sauerbruch⁵⁵ has stated that in his hands an anastomosis by

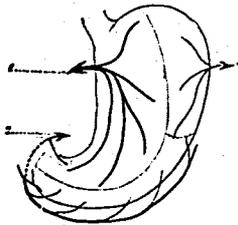
suture has failed, and his only successes have been obtained by either an anastomosis with the lateral wall of the œsophagus or by a two-staged operation in which at first the cardia is invaginated into the stomach and subsequently amputated through an abdominal gastrotomy. Tiegel's experience confirms that of Sauerbruch, but in order to save length of the œsophagus, and to avoid the formation of a blind pouch, he has devised a special button which permits of an anastomosis of the end of the œsophagus with the lateral wall of the stomach. He reports only one animal which lived after such an operation. Our first experience confirmed the views of both these workers. In the first series of resections in which the end of the œsophagus was anastomosed to the lateral wall of the stomach by suture, every animal died. We, therefore, also adopted the use of a button, a modification of the one described by one of us (N. W. G.), which had materially facilitated in his hands the operation of œsophagogastrostomy without resection. This button enabled us to make an aseptic union of the end of the œsophagus with the lateral wall of the stomach. The results, however, were not good, only 5 out of 60 dogs lived.*

These results and certain other considerations led us to attempt an entirely differently planned operation. We became convinced that the preservation of perfect asepsis was not the solution of the problem. Willy Meyer⁵⁴ and Carrel⁵⁵ had each accomplished one successful resection of a limited portion of the gut by an end-to-end union with suture. On the only two occasions upon which we have performed a plastic operation upon the wall of the thoracic œsophagus, we have obtained permanent healing in spite of considerable soiling of the pleural cavity with intra-œsophageal fluid. Further than this, no one of the procedures, thus far described as successfully worked out upon animals, permits of anything but the removal of a very limited segment of the œsophagus and

* It is important to note in connection with what follows that these dogs did not vomit and lived until they were killed, 3 to 8 months after their operations.



General view of the subperitoneal network of the stomach, injected by Gerota's method (Cuñéo). 1, left pneumogastric; 2, precardiac glands; 3, right pneumogastric; 4, coronary artery; 5, coronary vein; 6, gland of the small curvature; 7, hepatic artery; 8, right gastro-epiploic artery; 9, subpyloric gland; 10, right gastro-epiploic vein ending in the middle colic vein.



Lymphatic territories of the stomach (Cuñéo). 1, the coronary or the principal current; 2, right gastro-epiploic current; 3, splenic current

stomach. The worst of them all in this respect is the union of the lateral wall of the stomach with the lateral wall of the œsophagus (Sauerbruch and Wendel). A valuable length of the gut is thus sacrificed in a location where every millimetre counts. The same criticism to a lesser degree is true of an anastomosis of the end of the œsophagus with the lateral wall of the stomach (Tiegel⁵⁴ and Green and Maury⁵⁸). The sacrifice of distance by this procedure is also great and in addition results in the placing of a considerable weight upon the circle of union and much difficulty in the repair of the diaphragm.

In order to render an operation of resection of the cardia of practical utility, we believe that, first, an end-to-end union is necessary, and, second, that the stomach must be removed down to at least the prepyloric region. Only by adopting such a method can the parts be reunited without tension and the disease, against which this operation is designed, wholly eradicated. Aside from what has been previously mentioned regarding the situation of malignant disease of the lower portion of the œsophagus, a study of the lymphatic supply of the stomach will demonstrate why it is desirable to resect most of the lesser curvature. Cuneo⁵⁹ has shown that the lymphatic vessels of the cardia and lesser curvature of the stomach converge toward the point at which the gastric branch of the cœliac axis approaches the stomach returning over the course of distribution of the branches of this vessel. The accompanying cuts have been photographed from his work. Such a lymphatic distribution is perhaps one reason for cancer of the cardia so often invading the stomach for a considerable distance. It is, therefore, not simply for the purpose of broadening the scope of operation for cancer of the cardia that it is desirable to amputate so large a portion of the stomach, but rather to eradicate also, in one piece, the associated lymphatics.

We believe that an operation planned in the manner which we have indicated in addition to the advantages already outlined is also far more practical from a technical stand-point than any other hitherto described. We have mentioned the poor results which we have had in our first two series of dogs

in which we made limited resections. In our last series, however, operated upon by a method worked out by one of us (H. H. J.), herein described in detail, and to which reference is made in the preliminary report on page 58, an end-to-end anastomosis is made with suture and the stomach is resected as far as the prepyloric region, thus utilizing the pyloric portion of the stomach to bridge the gap left by the resected gut. Of this series 10 dogs have made perfect operative recoveries out of 17, and of the last six only one was lost. These dogs healed well and continued to live for four weeks to two months after the operation. During this time they seemed in perfect health except for more or less vomiting. As a rule they redevoured and eventually retained a good deal of their vomitus. Between four weeks and two months after operation all of the dogs died in an emaciated condition. With the exception of one dog which had an ulcer of the stomach and another which died of pneumonia, the autopsies revealed a perfectly normal mucosa from the beginning of the œsophagus to the end of the duodenum. Nothing pathological was found in the other organs, and we believe that the dogs must have died from inanition. Pachon and Caballo⁶⁰ have shown that a dog may gain in weight and remain in perfect health after the removal of the entire stomach. The greatest care as regards feeding was conspicuous in their experiment. If it had been possible for us with the help at our command to have given our dogs an equal amount of care, particularly concerning the frequent feeding of small quantities, they might have continued to live.

It has seemed to us that the subsequent death of our animals was due to an insufficient amount of food passing the pylorus, and this in turn dependent upon two factors, first, a loss of propulsive force on the part of the stomach and, second, the presence of a more or less unrelaxing pylorus. Contributing toward the first of these factors are both the absence of a sphincter at the cardia and the failure of the stomach walls to receive vagus stimulation, this nerve having been divided as a consequence of the operation. Contributing toward the

second of these factors is the loss of any inhibitory action of the vagus upon the pyloric sphincter.

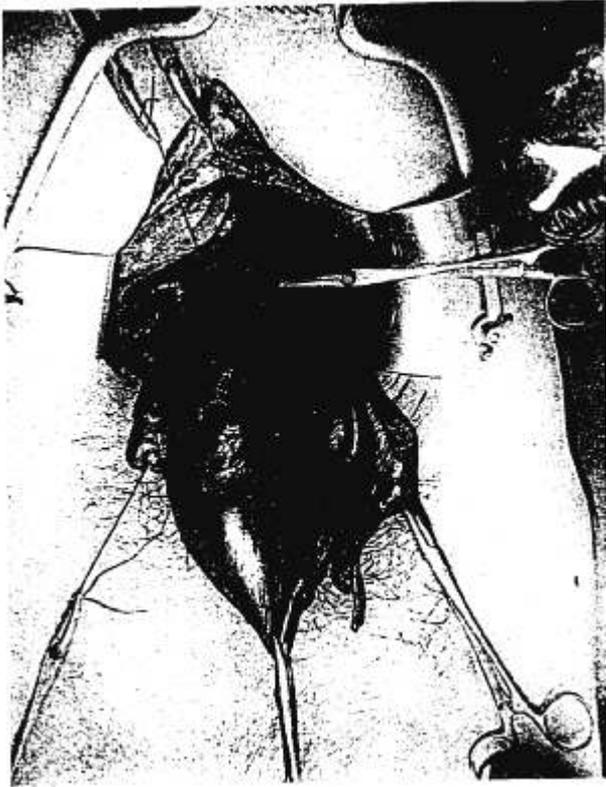
In human beings, to whom it is possible to give better care in the matter of feeding, death may not follow in the same manner. Paterson⁴⁰ has collected 27 cases of total gastrectomy in the human being. Of these 17 have made perfect operative recoveries and lived in health for some time later. At the time of his report 12 were still well. Since then Moynihan⁶¹ has reported another case and Pauchet⁶² and Viannay⁶³ each two additional ones. There is abundant evidence, therefore, that the mere removal of the stomach is not a fatal operation. Should, however, the resection of the lower extremity of the œsophagus with the cardiac portion of the stomach as far as the pyloric region present in human beings the same difficulty which we have met with in the dog, two additional operations which we have performed both successfully and consecutively indicate the proper method of overcoming the trouble. In these operations the same œsophago-gastrectomy was performed, but with the additional step of the division of the pyloric sphincter down to, but not through, the mucous membrane; and repair of the incision, as in pyloroplasty, by sewing the wound up in the direction of its length. These dogs eat well and practically have not vomited since the operation. They present a marked contrast to all the other animals referred to, and thus far (three and four weeks after operation) have held their weight. In the end-to-end anastomoses which we have performed upon dogs, the larger opening upon the stomach side has not first been narrowed down after the first method of gastroduodenostomy by Billroth, but the redundant portion of the mucous membrane around the opening into what remains of the stomach is gathered in by a running stitch, which sews the œsophageal mucosa to the mucous membrane of the stomach, taking more stitches through the latter than through the former.

The series which we present is small and our work may be held to be still incomplete because of the fact that no dog has yet lived longer than 2½ months. Nevertheless, we believe

that as far as it has yet gone it is worth reporting and demonstrates the technical possibilities of the operation which we are discussing. In the first place, a successful end-to-end suture in the type of operation which we have described has not yet been accomplished to our knowledge by any other observer. Secondly, it offers a very considerable number of advantages over the methods hitherto advocated for dealing with carcinoma of the cardia.

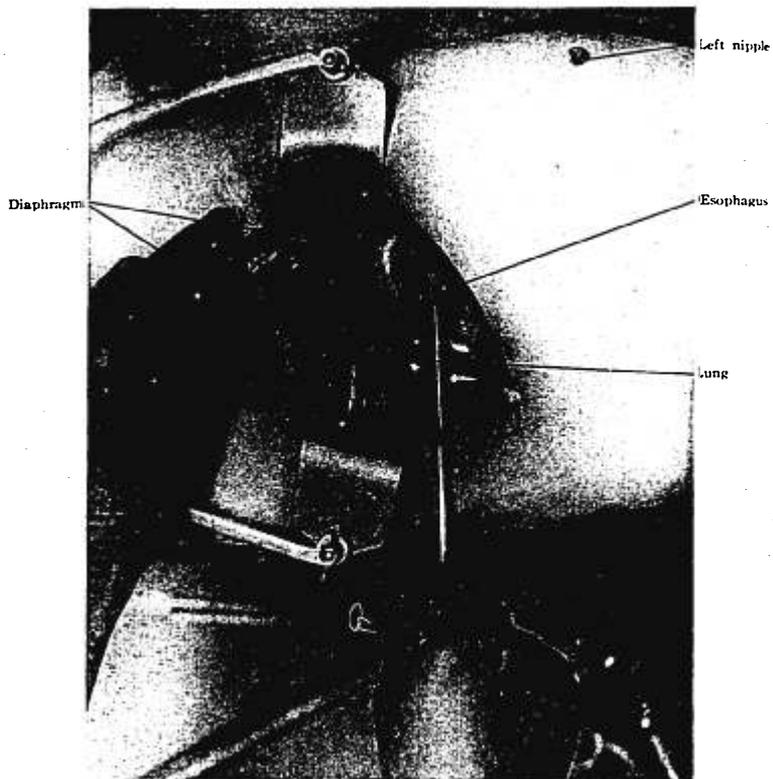
We have worked out the details of this operation upon the human cadaver and photographed the various steps. The reproduction of these photographs shows how real are the advantages claimed. In the dog the entire operation is performed through the thorax, but in the human being it is much more convenient to do the first stage within the abdomen. Figure 1 represents the stomach delivered through a median abdominal incision. The gastric, pyloric, and right and left epiploic arteries are tied and the lesser and greater omenta have been divided. The patient is now turned on the side and the eighth rib is resected. The costal cartilages of the next one or two ribs above are divided, and self-retaining retractors are inserted. Figure 2 illustrates the œsophagus hooked forward. The fold of the left crus of the diaphragm is in front of it, and the tip of the lower lobe of the left lung is at the side. The pneumogastric nerves may now be separated from the œsophagus. Should this prove impossible they may be divided. We have divided the pneumogastric nerves immediately before they pierced the diaphragm in five dogs (this being the only operative procedure on these animals). Two of these dogs died suddenly about five to six weeks after their operations. The autopsy revealed no cause for their death. The mucosa of the stomach showed, contrary to the opinion of Zironi⁶⁴ no sign of ulceration. The other three dogs are alive and healthy. An incision is now made between the left crus and the œsophagus into the peritoneal cavity. Through this opening the stomach may be pulled up. This procedure renders it very easy to tie off the gastrohepatic and gastrosplenic ligaments.

FIG. 1.



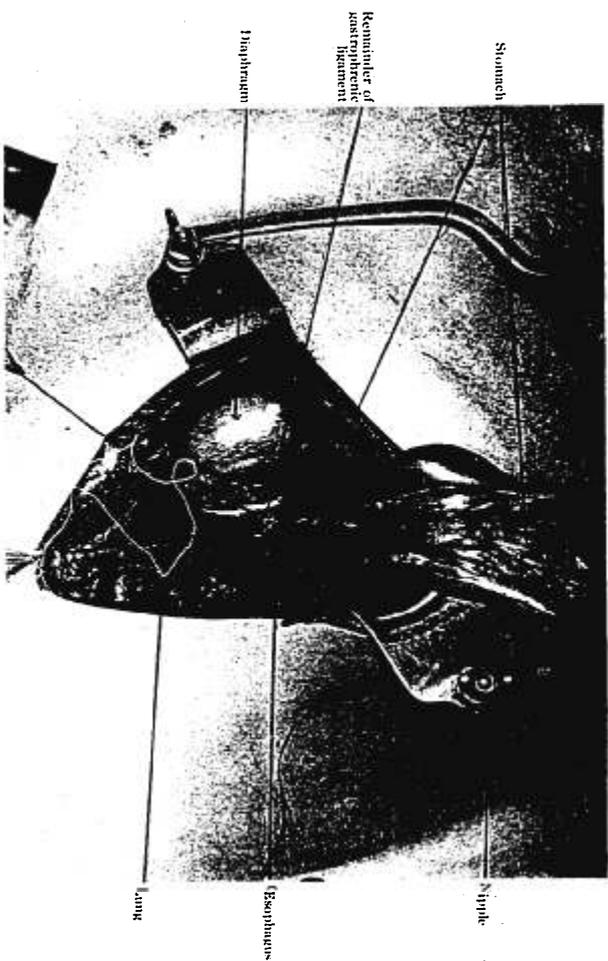
Stomach delivered through median abdominal incision.

FIG. 2.



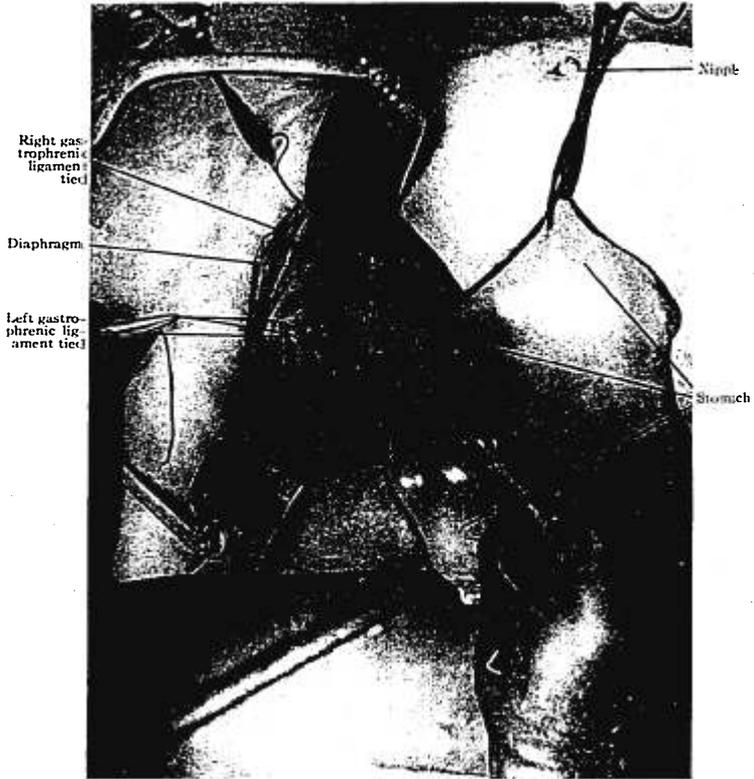
Chest open through floor of eighth rib. Esophagus hooked forward over aneurism needle which crosses the left lower lobe of lung. Diaphragm held down by spatula.

FIG. 3.



Stomach pulled into the thoracic cavity. Pyrene entering through the diaphragm to left, and esophagus disappearing behind him to right. Ligature passes around the remains of the left gastroepiploic ligament.

FIG. 4.



Gastrophrenic and gastrohepatic ligaments tied, and stomach and esophagus entirely free within the thorax.

FIG. 5.

Diaphragm



Nipple

ESOPHAGUS

Lamb

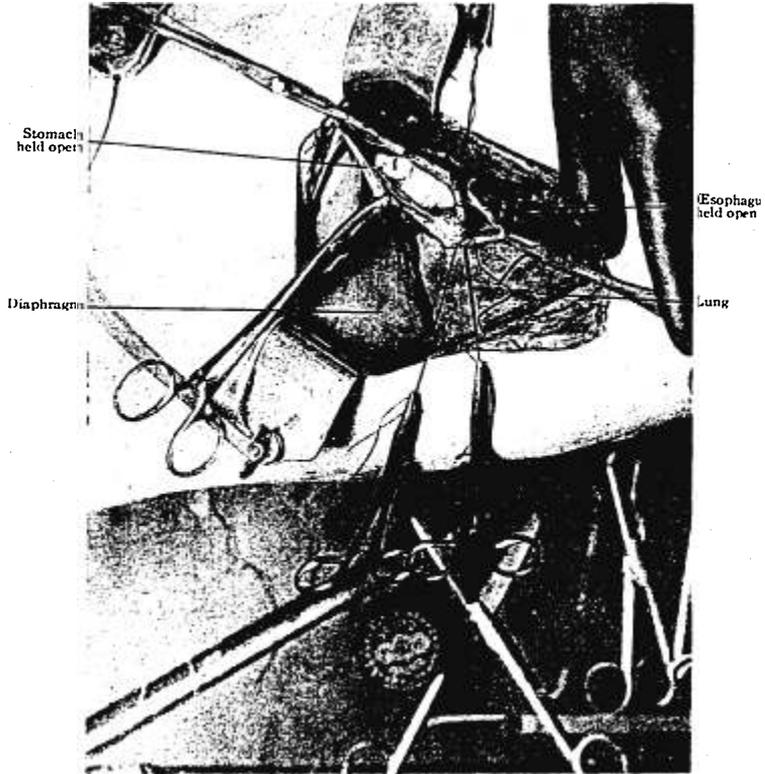
Esophagus clamped

Snaring clamp on esophagus to prevent sailing.

Pyloric portion of stomach clamped

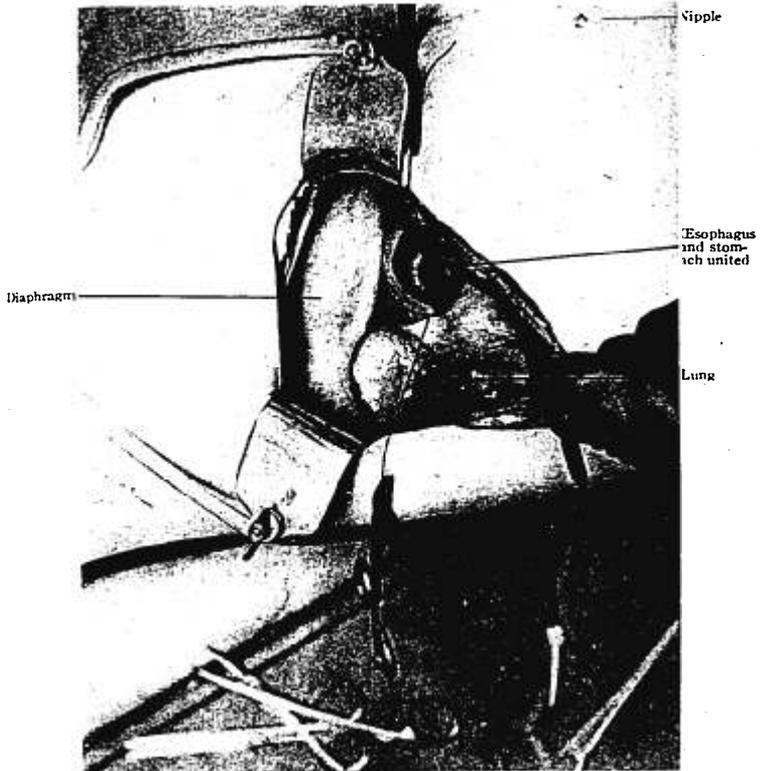
Portion of stomach and esophagus to be amputated between the clamps.

FIG. 6.



Divided stomach to left and esophagus to right. The mucosa of the two organs have been sewed together for half the distance around each. Diaphragm to left and lung below and to right. Sponge has been placed within the open lumen of the stomach.

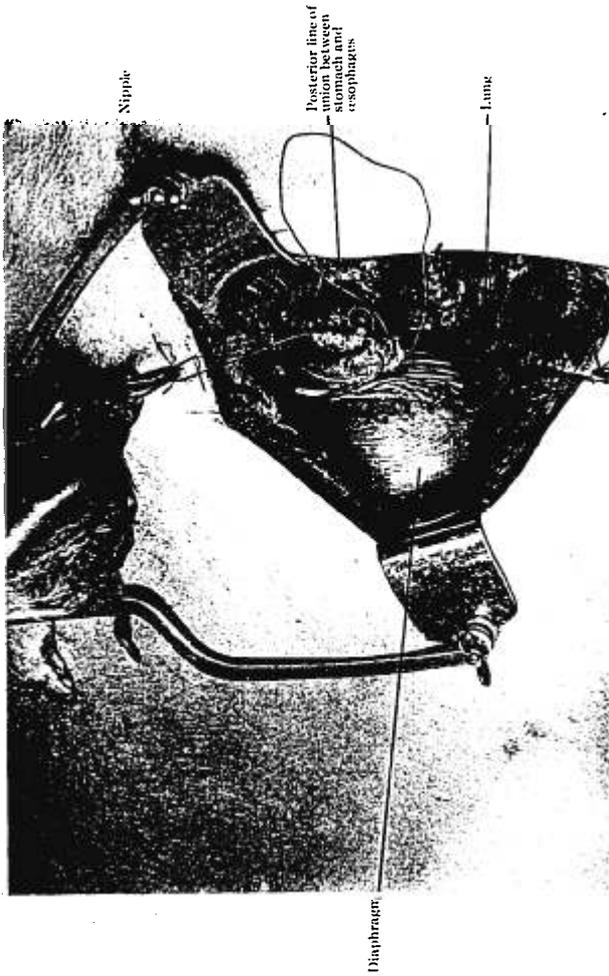
FIG. 7.



Shows the mucosa of the stomach completely sutured to that of the œsophagus, and the anterior serous covered walls of these viscera ready to be united by the external layer of sutures.

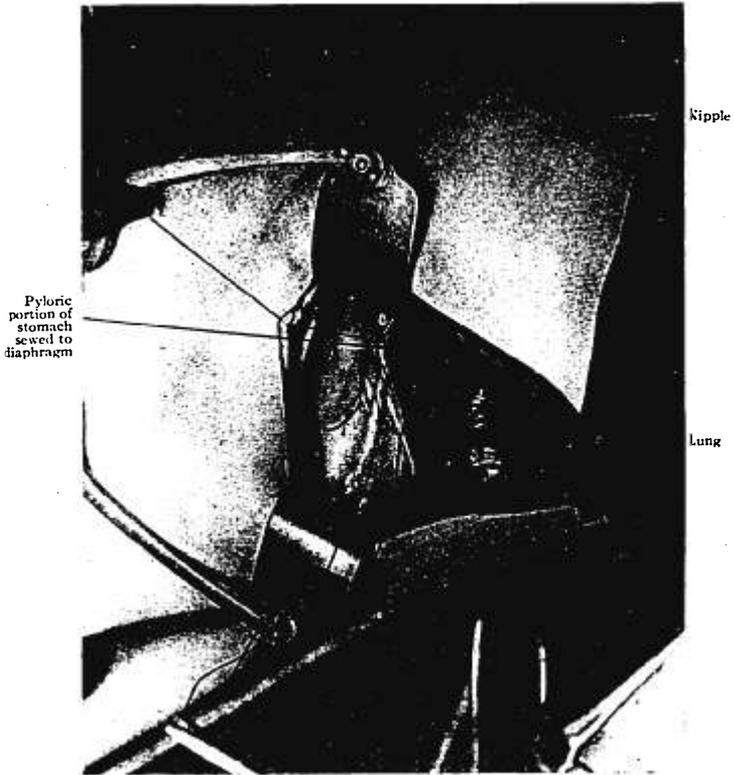
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FIG. 8.



The stitching of the serosa of the stomach to the anterior pleural covered wall of the esophagus has been completed in front, and this illustration shows the posterior walls of these two organs pulled around to the front in order that the external layer of sutures may be completed all the way around.

FIG. 9.



Pyloric portion of the stomach being sutured to the opening through the diaphragm. The line of suture between stomach and oesophagus is covered by lung.

Figure 3 shows the stomach delivered into the thorax and a ligature passed around the remainder of the left gastro-phrenic ligament. Figure 4 shows the right and left gastro-phrenic ligaments tied off, and the stomach and oesophagus entirely free within the thorax. Now the resection may be completed and it is easy to see from the photograph how readily the resected portion of the oesophagus may be replaced by the pyloric end of the stomach, permitting in this way an anastomosis without tension. Figure 5 shows the portion to be resected isolated by two clamps, and two retention sutures placed on each side above and below the clamps. A light spring clamp is now applied to the oesophagus above, and the whole area well padded off. The portion to be resected is now removed by the scissors. The two retention sutures previously tied hold the open ends of the gut together. By a running suture, which Figure 6 shows completed for one-half the circle of an anastomosis, and all the way around in Figure 7, mucous membrane is sewed to mucous membrane. The redundant portion of the stomach mucous membrane is gathered in by taking more stitches through it than are taken through the oesophagus. External to this layer a row of interrupted silk sutures uniting the peritoneal surface of the pylorus to the external wall of the oesophagus finishes the anastomosis. The anterior walls of these two organs are first sewed together and lastly, by simply pulling the gut around by the retention sutures, the posterior half is completed. Figure 8 shows the anastomosis completed, and Figure 9 the gut being sewed to the margin of the opening through the diaphragm.

CONCLUSIONS.

1. The aboral end of the oesophagus and the cardiac portion of the stomach must be considered as one surgical region.
2. Cancer in this location is by no means infrequently met with.
3. We believe that it permits of an early diagnosis by means of the gastroscope.

4. An operation of practical utility for resection of cardiac cancer must remove not only a portion of the œsophagus but also a considerable part of the stomach, in particular the lesser curvature.

5. Such an operation can be accomplished without undue tension by an end-to-end anastomosis with suture.

6. By an operation of this character it has been possible for us to obtain 10 operative recoveries out of 17 dogs and 5 out of the last 6.

7. As a preliminary report it may be stated that the death of the recovered animals about six weeks after the operation is due to an interference with the normal physiology of the pylorus, and may be prevented by the simple pyloroplasty herein described.

8. From a technical stand-point such an operation can easily be performed upon the human being.

POSTSCRIPT.—Since returning the manuscript of the above to the printers the authors have operated upon a patient with cancer of the cardiac portion of the stomach involving the œsophagus, by the method which they have herein described. The patient had had symptoms for the preceding nine months, and the operation required was an unusually severe one. The spleen was involved in the carcinomatous mass and was removed in one piece together with the stomach and lower portion of the œsophagus. The patient died fifty-four hours after operation, of empyema, starting, apparently, in a small perforation situated in the circle of anastomosis, a complication which we believe can be more carefully guarded against in the future. This experience, however, and the condition of the specimen removed demonstrate that the technic employed was satisfactory and that the operation is feasible and justifiable. In the future, instead of making two incisions in extensive cases, we should advise the use of one incision beginning a little posterior to the axillary line over the eighth rib, running over this rib to its cartilage, then curving downwards, and ending at the umbilicus. Through this incision the costal cartilages attaching the lower ribs to the sternum may be

divided, and a good approach obtained to the upper abdomen and the thorax. The chest should not be opened until the completion of the intra-abdominal work. We desire to thank Dr. Geo. Brewer for material assistance rendered at this operation.

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