THE PRESENT POSITION OF CARCINOMA OF THE OESOPHAGUS

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Now is a time of intense interest to all who are engaged in the treatment of oesophageal carcinoma. It is a time when the efforts of some fifty years of careful and patient research have been rewarded by the recent rise in the number of successful resections of the oesophagus, more often than not with restoration of normal swallowing. It is true that the procedures entail a high mortality, especially if the poor risk cases are accepted, but it is a risk more than justified by the misery and the 100 per cent. mortality in untreated cases. At the same time this is a period of some anxiety, as we gradually learn how the new food channels stand the test of time, and even more important, how many of the growths recur and where.

For some years we have seen that patients may die with surgically operable oesophageal cancers, and certainly many appear to be slow in growth. Perhaps too much optimism has been felt that if only the lesion could be removed without mortality, long survival could be confidently expected. Grey Turner (1946), however, reminds us that cancer in this organ behaves exactly like cancer in any other part of the alimentary canal, and that about one third disseminate early and rapidly.

Diagnosis

There has been no outstanding recent development to facilitate diagnosis of this disease, but there has been a revision and consolidation of our knowledge of the clinical, endoscopic and radiological aspects in numerous recent papers. In the past, the practically hopeless prognosis of the disease, diagnosed at almost any stage, has not provided the general practitioner with much incentive to seek out the cases at an early stage. Now that we can show him that early lesions are resectable without obvious disability and with at least some hope of permanent cure, an incentive to suspect and diagnose them without delay is provided.

New instruments for the diagnosis of carcinoma are always heralded with the announcement that here at last is the means for getting the lesions early. The oesophagoscope and more recently the gastroscope have encouraged these beliefs. In both cases however, there has been an aftermath of disappointment, for excellent as these endoscopes are, they cannot introduce the patient to the surgeon before he has symptoms, and in common with the majority of malignant neoplasms, carcinoma of the oesophagus is usually symptomless in its earliest stages, and the earliest symptoms are often considered too trivial to warrant detailed investigation.

It is perhaps necessary to emphasize the danger of diagnosing a neurosis in the elderly dysphagic.

Clinical aspects

The complaint which brings the patient to his doctor usually results from oesophageal obstruction. It may be of difficulty in swallowing food, the bolus seeming to be arrested temporarily somewhere between the upper and lower limits or the sternum. It may be a feeling of discomfort deeply between sternum and interscapular region—due to gradual distension with hypertrophy and oesophagitis above an obstruction, At times the patient appears as an emergency, having a lump of food arrested above a neoplasm, and causing complete obstruction. These obstructive symptoms may be associated with 'vomiting' which is really the ejection of swallowed food, saliva and mucus, the ejection tending to be sooner after swallowing in the higher neoplasms. The ejected material may be blood-stained, and is undigested. Offensive eructations may also occur.

Later, difficulty in swallowing fluids, anorexia, wasting and severe pains may arise. Allison (1946) draws attention to the rare occurrence of soreness in the right side of the neck, hiccough, and heartburn, and the same

author also points out the real disadvantage from which the surgeon suffers—the length of time the patient will persist with dysphagia before seeking advice, in his series the average time being five months. The advanced stage of the disease before the onset of dysphagia is obvious when one considers that the oesophageal diameter may diminish to 0.5 cm. before complaint is made (Chevalier Jackson).

Physical examination is usually negative, though signs of starvation appear later. Enlarged supraclavicular glands, a nodular liver or pelvic mass show that the growth has passed beyond the aid of surgery.

Radiological examinations

Several observers have made careful notes of the finer points of diagnosis. Radiological examination by means of a barium swallow should be made in all suspected cases, and should precede endoscopy. Particularly in the absence of gross obstruction, care is necessary to avoid missing an early lesion, which may appear as a superficial or deep ulcer (Fig. 1), sessile (Fig. 2) or polypoid mass, or infiltration and stiffening of the mucosa. A soft tissue shadow may be present in the bulkier tumours, and helps to distinguish it from simple peptic ulcer of the oesophagus.

Oesophageal dilatation is greatest in non-malignant lesions, but occasionally marked dilation may accompany malignant disease. Irregularity and rigidity just above the site of obstruction helps to distinguish the latter (Fig. 3).

Carcinoma of the abdominal oesophagus is often an extension of an adenocarcinoma of the cardia, there being a very free lymphatic connection between stomach and oesophagus here (Fig. 3a). In such cases the normal spurting of the swallowed material into the stomach may be replaced by a steady trickle or doubled (Fig. 4), the cardiac air bubble may be deformed, there may be an increase of the soft tissue between fundic air bubble and diaphragm, and examination in the Trendelenberg position may also give useful information (Keifer[3]).

Endoscopy

In all suspected cases, *whether radiologically negative or positive*, recourse should be made to oesophagoscopic examination. An ulcerated, bulky or infiltrative lesion may be discovered and a piece of any suspected tissue should be taken for histological examination. The presence of oesophagitis or of a simple peptic ulcer, may give rise to difficulty. A distinctive offensive odour is often noted in the ulcerative neoplasms[4].

If oesophagoscopy is negative, and symptoms persist, the examination should be repeated a month later, in case an elusive tumour was missed the first time.

The performance of gastroscopy is usually contra-indicated when an oesophageal lesion is suspected. However, the author has had an oesophageal carcinoma first brought to his attention on four occasions by obstruction to the passage of the gastroscope. This is, of course, a reversion to the preradiological method of exploring the oesophagus by passing a bougie blindly. Lesions of the lower oesophagus originating in the stomach which do not obstruct the gastroscope, can often be visualized from the gastric aspect, giving some idea of the nature and extent of the tumour (Fig. 5).

Peritoneoscopy may give evidence of inoperability by disclosing peritoneal or hepatic invasion, and thereby prevent a fruitless thoracotomy.

Preliminary laporotomy

Finally, in the diagnosis of the extent of the disease, it is well to palpate the cardia, the upper gastric lymph glands and the liver, during the performance of gastrostomy or jejunostomy if this be necessary. Garlock (1940) and Churchill (1942) recommend that a routine exploratory laparotomy should precede excision of tumours of the cardia.

Treatment

It is in the treatment of oesophageal growths that the position has most markedly changed in recent years.

Until the end of the 1930's palliative treatment alone was in vogue, with practically 100 per cent. mortality within two years. The palliation took the form of either aiding swallowing by periodic dilatation of the oesophageal neoplasm with bougies, or the insertion of a food channel within the growth,

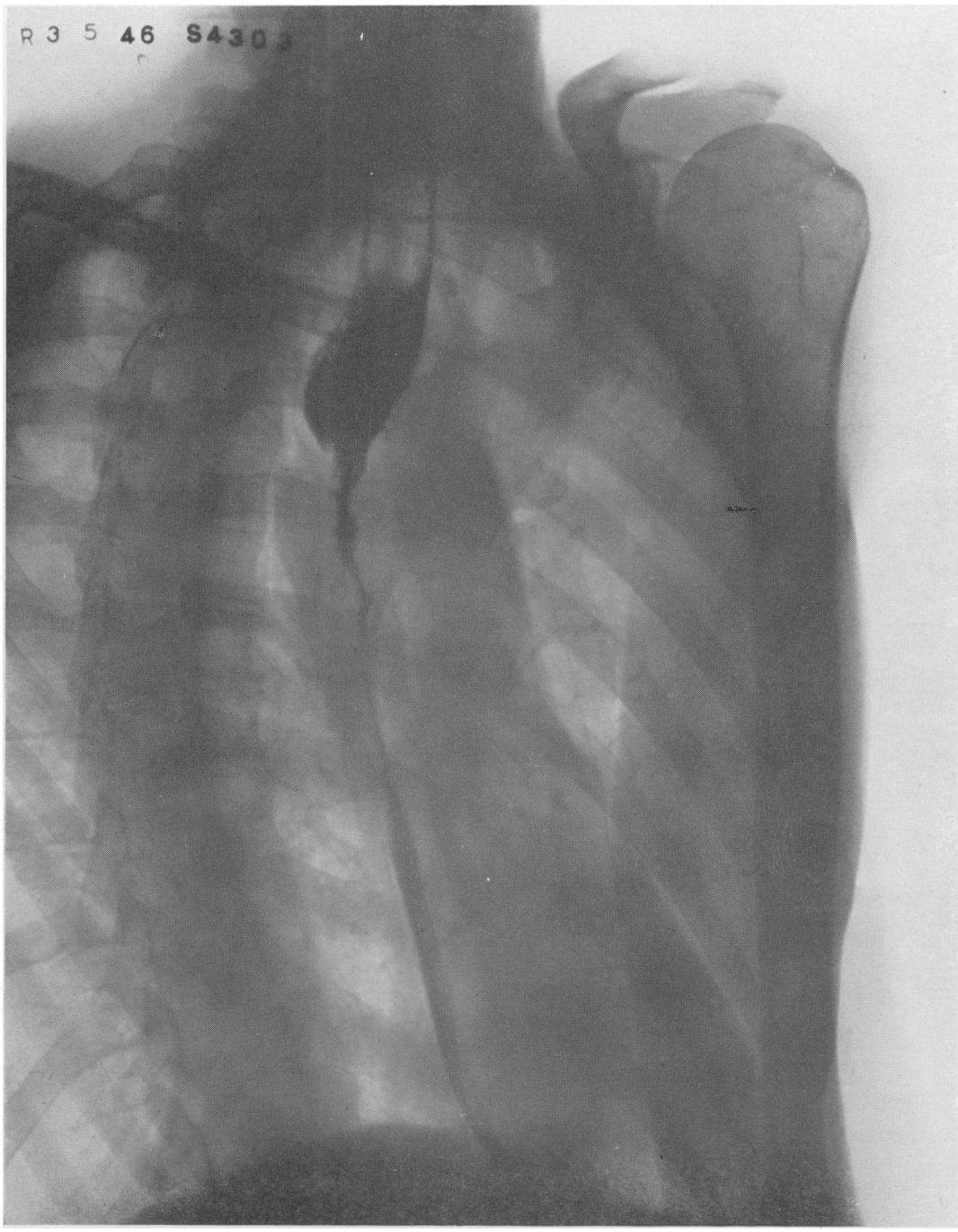

FIG. 1.—Carcinoma at junction of upper and middle third of oesophagus. Barium which appears to be outside oesophagus is in an ulcer crater. This case was irremovable and was short circuited (see Fig. 20).

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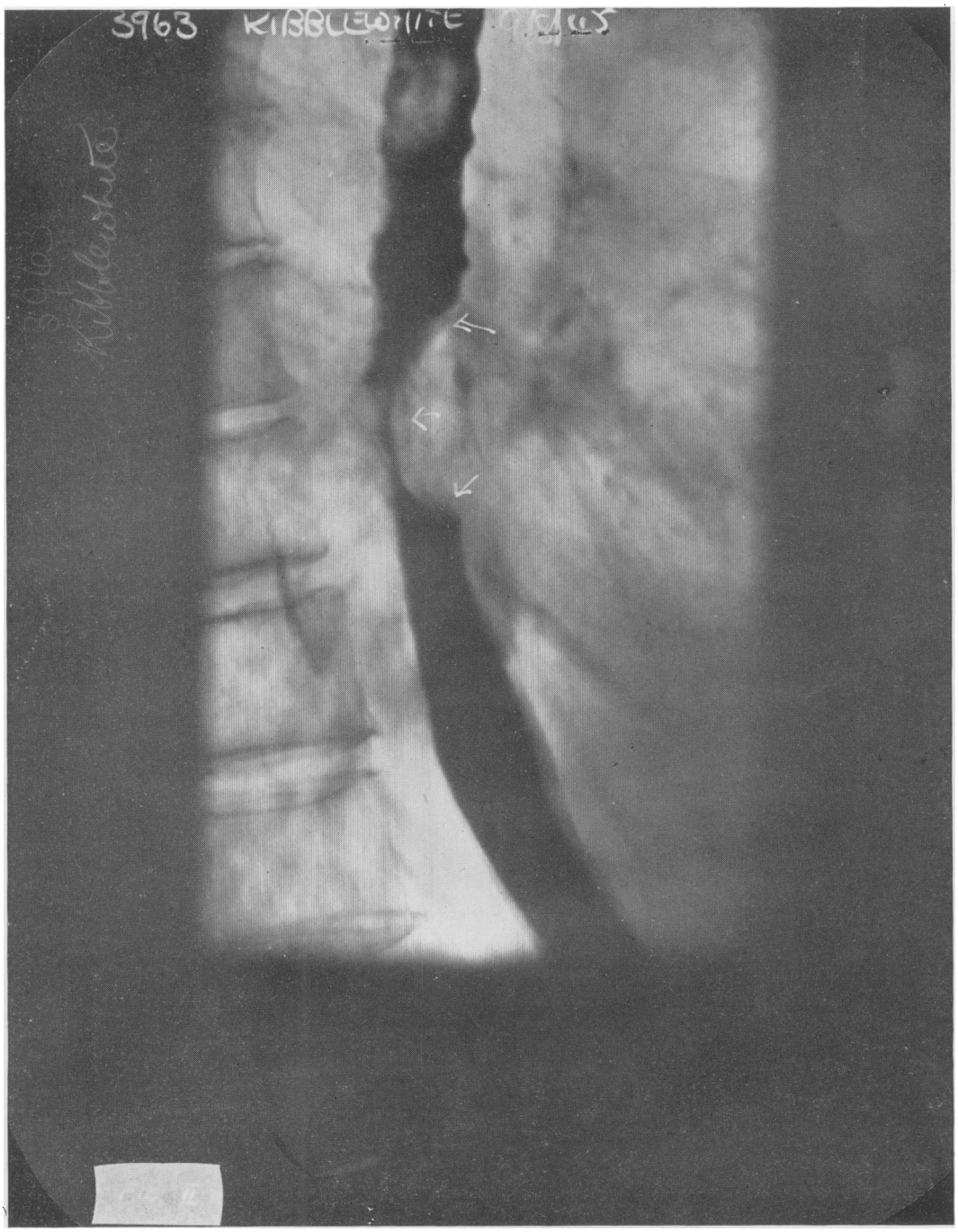

FIG. 2.—Carcinoma middle oesophagus. Irregular filling defect.

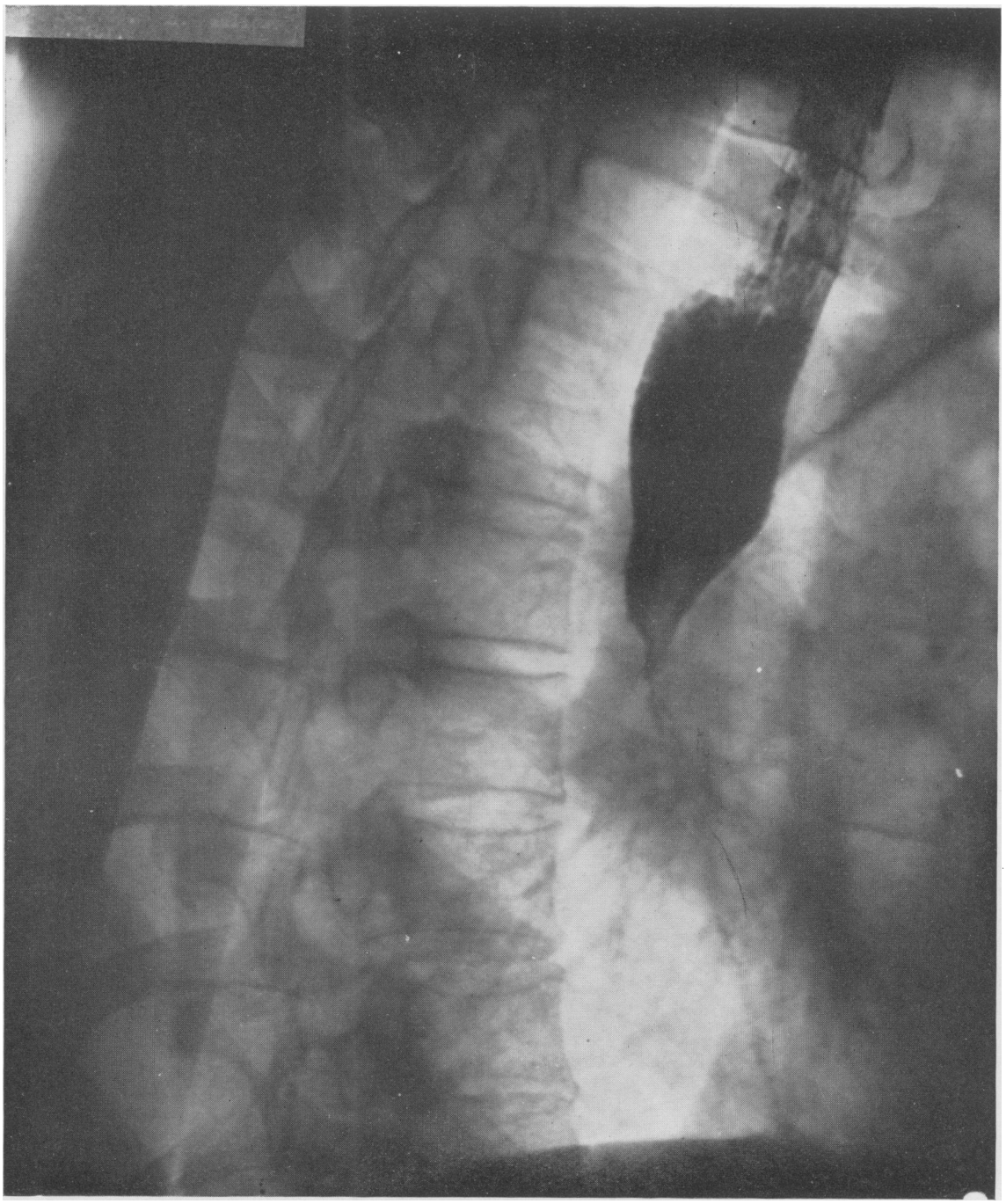

FIG. 3.—Carcinoma oesophagus. Small filling defect at upper end of narrow area, also soft tissue shadow.

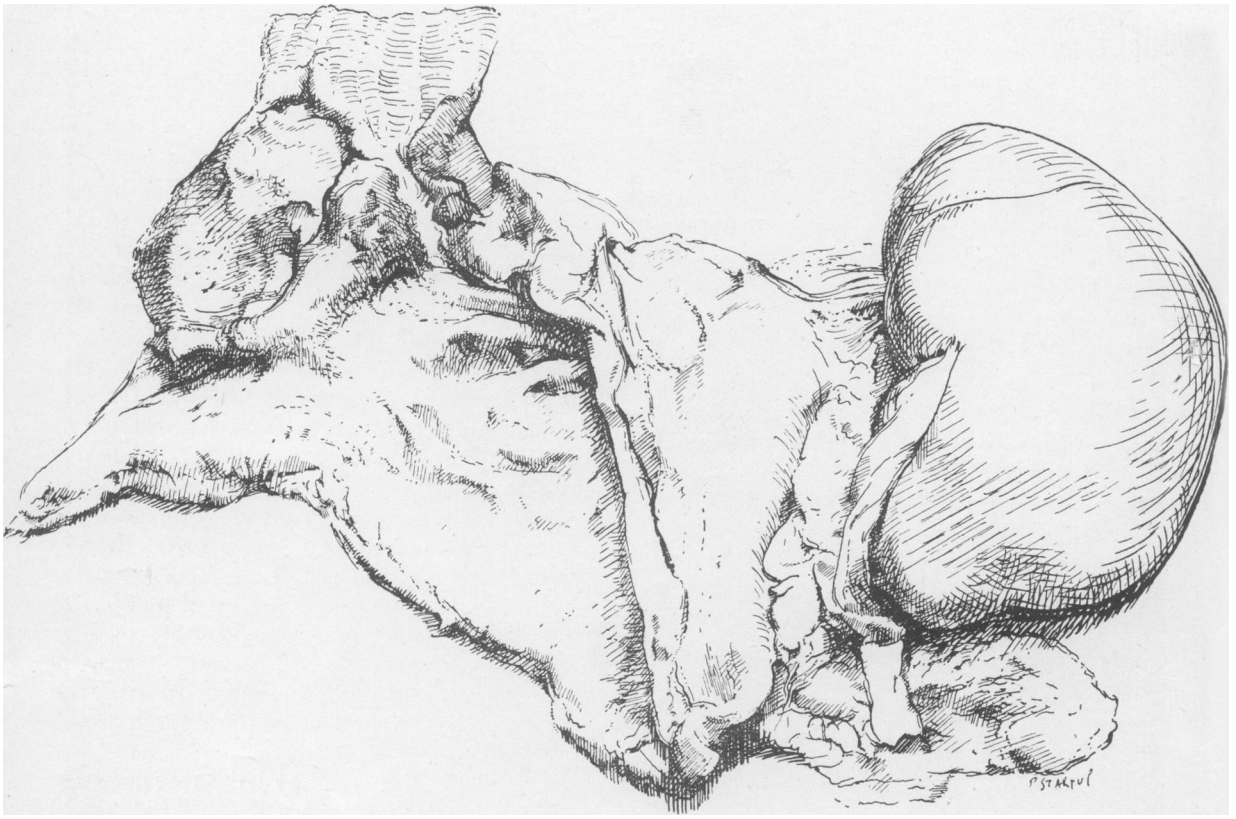

FIG. 3a.—R sected adenocarcinoma of cardia invading stomach and oesophagus.

such as Symond's or Souttar's tube, or to abandon hope of swallowing and perform a gastrostomy.

Radiotherapy

Radiotherapy had and still has an undoubted place in the treatment of the squamous-celled tumours, particularly in the cervical oesophagus where it is possible to irradiate the tumour without the intervention of too great a depth of tissue, and where there is reasonable accuracy of aim. The difficulties of irradiating the intrathoracic tumours has encouraged attempts to implant radium needles or radon seeds through the oesophagoscope, or to introduce them on intra-oesophageal carriers, but these methods have so far proved rather ineffectual and dangerous and are not in favour at the present time.

So far as irradiation of the adenocarcinomata of the lower end of the oesophagus is concerned, the most intensive radiotherapy is of little if any value, though recently claims of some improvement by direct irradiation after temporary surgical exposure or the growth have been made[7].

While admitting that a long survival has occasionally resulted from radiotherapy, these fortunate cases represent only a minute fraction of the thousands so treated.

Surgery

Between 1912 and 1930 only four successful resections of the middle oesophagus were reported (Zaaijer, Torek, Lilienthal, Eggers). In the next decade occasional successes by Grey Turner, Ohsawa, King, Muir, etc., kept alive the waning faith in the eventual solution of the problem and in 1938 a great impetus was given by the publication of three successful Torek operations by Garlock, and by the successful resection of the cardia with restoration of continuity by Adams and Phemister. Since then even the war has failed to stem the increasing number of recoveries recorded. A feature of the 1940's is the realization that restoration of continuity by oesophagogastrostomy or oesophagojejunostomy can be obtained in the majority of cases resected. Prior to this the survivors had been left with a cervical oesophagostomy and a gastrostomy though a few fortunate patients had had skin tubes successfully constructed.

The Problem

What are the main problems of oesophagectomy and how far have they been surmounted ?

1. *The surgical approach*

Fear of direct attack across the pleural cavity held up progress for a long time, one fear being that too wide an opening in the chest wall would cause mediastinal displacement or flutter and death, and another that pleural infection must supervene. Attempts to circumvent the dangers were made by operating with all but the patient's head in a negative pressure chamber (Sauerbruch), transthoracic extrapleural approach (Miculicz, Rehn, Nasiloff, Lilienthal, etc.) or abdominocervical approach with digital mobilization of the oesophagus in the mediastinum (Grey Turner). Later it was found that fears of excessive mediastinal movement (largely founded on animal experiments) were groundless in man and absolute control of pulmonary ventilation could be obtained with positive pressure anaesthesia. The importance of intercostal drainage in the prevention of pleural infection was also discovered, though Torek omitted it in his famous case. The recent advances in chemotherapy have also mitigated the dangers of pulmonary, pleural and wound infection.

2. *Restoration of continuity*

It was early realized that owing to the shortness and elastic nature of the gullet, as well as the absence of a serous coat, resection of an appreciable length and end to end union was unattainable. Failure to get end to end union necessitated making a cervical oesophagostomy and a gastrostomy. These could be connected by a rubber tube, and skin tubes were constructed in a few instances.

Attempts were made to narrow the distance between oesophagostomy and gastrostomy openings by making a dorsal oesophagostomy, even collapsing the chest wall in order to make the oesophagus reach the surface (Zaaijer, 1929) or dislocating the stomach under the skin of the chest wall, with the cardia as

gastrostomy (Garlock, Fig. 6). Great ingenuity was displayed in methods of antethoracic oesophagoplasty using jejunum, stomach or colon. In the upper oesophagus the problem remains unsolved, but in the middle and lower oesophagus continuity is nowadays restored by mobilizing the stomach freely and anastomosing it without tension to the oesophageal stump inside the thoracic cavity. Where an adenocarcinoma of the cardia is so extensive as to require total gastrectomy, then continuity is established by end in side or end to end oesophagojejunostomy. The author favours an end to end anastomosis after mobilizing the jejunum after the method of Roux.

3. *The problem of the anastomosis and stricture formation*

In an endeavour to prevent leakage at the oesophagogastric junction, and to prevent infection, various methods of implantation of the oesophageal stump in the stomach, similar to the method of implanting the rubber tube of a gastrostomy in the stomach were tried. It was found that stricture followed all such methods (Carter, *et alia*, 1929) and that direct mucosa to mucosa suturing is necessary. Stability of this anastomosis is achieved by anchoring the stomach to the chest wall to prevent gravitational or diaphragmatic pull on the suture line. Ohsawa (1933) recommended also that the suture line be reinforced with omentum.

4. *The problem of recurrence*

This problem arises in all forms of malignant disease once the problems of extirpation are overcome. Studies of the lymphatic spread and methods of block removal of the glands wherever possible are being made.

Most workers in this field are meeting a fairly high percentage of recurrences after extirpation, not only in adenocarcinoma of the cardia where a high degree of malignancy was expected, but also in the squamous-celled tumours. We must also bear in mind the possibility that in our efforts to restore alimentary continuity, we may by limiting resections, sacrifice some of the chances of long survival.

Churchill and Sweet (1942) have found that there is often a considerable growth of tumour in the submucosa and muscularis of the oesophageal wall, making it necessary to allow a wide margin from the edge of the growth. The thirteen year survival of Torek's classic case of total extirpation of the thoracic oesophagus may have been due in part to the wide excision of the growth.

Technique of Oesophagectomy

The technical difficulties vary considerably, the main consideration being the part of the oesophagus involved. It is convenient to consider it in three divisions, lower third, middle third, and upper third including the cervical oesophagus. Postcricoid growths involving the pharynx will not be considered.

Lower third of the oesophagus

In 1898 Biondie and in 1903 Gosset published their researches showing the feasibility of transthoracic transphrenic exposure and resection of the lower oesophagus and cardia, with restoration of continuity by oesophagogastrostomy. Despite attempts by Sauerbruch using his "einstulpung" an invagination method, and Wendel, using a Murphy button, no successes by this route were recorded until Ohsawa's report in 1933, and Adams and Phemister's case in 1938.

The mortality associated with the transthoracic approach encouraged the abdominal approach. The lowest half inch or so of the oesophagus lies in the abdomen and it is an area where tumours are of frequent occurrence, being either primary oesophageal tumours, or extension from upper gastric neoplasms. By mobilization of this part, and traction on the stomach some of the lowest thoracic oesophagus can be exposed, and as early as 1908 successful resections by this exposure were done (Voelker, Kummell). Improvements in this approach were made by dividing the left triangular ligament of the liver (Lambert, Grey Turner) and reflecting the liver to the right, by mobilizing the left costal margin (Marwedel), by adding to the laparotomy wound a 5 cm. incision into an intercostal space (Kirschner, Ohsawa), increasing the size of the oesophageal hiatus by an anterior incision, flexion of the neck (Moynihan), but none of these things could alter the fact that

with the patient in the dorsal position the heart and pericardium lay between the operator and most of the lower third of the oesophagus. However, by this means between 6 and 10 cms. of oesophagus may be exposed. Although the oesophagus is some 24 cm. long this does not mean that a third of the gullet was exposed, because the lowest part can be greatly elongated by stretching, a fact all too plain to the surgeon who removes a measured 4 cm. and finds only 1 cm. in the resected specimen! This forms an excellent route for plastic operations on the lowest oesophagus and cardia and it is often a satisfactory route for the extirpation of tumours of the stomach which do not quite encroach on the oesophagus, but once the oesophagus is invaded by growth, it loses elasticity and the tumour mass obstructs the view.

In such cases, too, the anastomosis must be made to the deepest and highest oesophagus in view, which is under tension and narrowed. However, although it is possible to resect some of the lower oesophagus abdominally (Fig. 7), on account of the difficulties mentioned, the present trend is to abandon the purely abdominal approach.

Abdomino-thoracic approach

An extension of the abdominal approach by making a transverse incision across the costal margin and up into the sixth, or seventh intercostal space as far as the middle or posterior axillary line, combined with partial or complete division of the diaphragm into the oesophageal hiatus and skirting the left side of the pericardium has been used by Ohsawa, Wu and Loucks (1942) and Brock (1942). This appears an attractive exposure, and excellent views of the parts are obtained. The severed costal margin projects awkwardly, however, and the interposition of heart and pericardium makes suturing distant and difficult. To my mind it is easier, if an abdominal approach is desired at all, to complete as much as is convenient from below, close the abdomen, and then turn the patient on his right side for a formal posterolateral thoractomy. The anastomosis can thus be made comfortably and without tension. Brock, who was the first in this country to use the abdominothoracic approach to the cardia, has come to the conclusion that it is not so satisfactory as a formal thoractomy (personal communication).

The thoracic approach

There is now almost complete unanimity of opinion on the desirability of operating for carcinoma of the lower third of the oesophagus and cardia through a left posterolateral thoracotomy. It increases the exposure to resect a rib though an intercostal incision is satisfactory. For the lower oesophagus the seventh or eighth rib is usually removed, for the cardia the ninth or tenth, depending on the extent of gastric involvement (Fig. 7a). The incision may be widened by the division or resection of small lengths of the posterior ends of adjacent ribs.

The steps of the operation are briefly as follows:—

On opening the pleural cavity the lung partially collapses. The ligamentum latum pulmonale is divided to give a view of the posterior mediastinal pleura, an incision into which, in front of the aorta, exposes the oesophagus. At this stage the growth can usually be palpated and metastases looked for. A cardiac or gastric growth may be felt through the diaphragm.

Next the diaphragm is picked up with two artery forceps and incised between them, and a long incision is made in the diaphragm between its periphery at the tip of the resected rib, and the oesophageal hiatus. A few vessels require ligature here, but the main vessel encountered is the left inferior phrenic artery which runs forward about half an inch from the hiatus on the abdominal surface, and can easily be felt (and in the atheromatous sometimes seen even on the pleural surface). This incision gives a chance to inspect the abdominal extension of the tumour. The cardia and growth is first freed from the oesophageal hiatus, after which the stomach is freed along the curvatures by dividing the gastro hepatic omentum and the gastrosplenic and gastrocolic omenta. This involves division of the left gastro epiploic artery and the vasa brevia. If damaged, if there are malignant glands at the hilum, or if invaded by growth, the spleen may have to be removed, in which case the splenic vessels must be divided. It has been suggested

that this may cause post-operative splenic vein embolus to the liver. The left gastric artery in the superior gastropancreatic ligament (*falx coronarium*) is next seen as the main structure preventing mobilization of the stomach, and this, too, is carefully ligated and divided. A vas breve leaving the middle of the splenic artery and passing to the region of the incisura cardiaca is usually present and needs ligation and division (Fig. 8). When this has been done the stomach and lower oesophagus is found to be mobile and can be withdrawn from the wound. The stomach is now clamped below the growth and cardia with two Payr crushing clamps so that the coronary artery, coronary glands and paracardial glands are above the clamps. The stomach is divided between the clamps. The stomach in the lower clamp is closed in two layers, in such a way as not to shorten the suture lines.

Next the closed stomach is pulled well up, behind the oesophagus (Fig. 9) and the highest part of the stomach is fixed to the oesophagus —well above the proposed site of oesophageal division—in order to take tension off the subsequent anastomosis. After carefully packing off the surround a two-layer anastomosis of end of oesophagus to the side of stomach is made, taking the greatest care to get good apposition of mucosa to mucosa, the oesophageal mucosa being the ' master layer ' here.

Next a row of interrupted sutures brings up a fold of stomach over the front of the oesophagus—this fold being anchored at either end with a stitch which passes from stomach behind oesophagus—to oesophagus—to stomach in front of oesophagus—thus having a serous coat at either end to prevent it from cutting out (Figs. 10-15). A useful addition to the operation is to pass a small oesophageal tube up through the oesophagus, just before completing the gastro-oesophageal ' all coats ' suture. The tube is pulled from the nose or mouth by the anaesthetist. The lower end of the tube is passed into the stomach and the anastomosis completed. This tube can be used for feeding purposes but it also acts as a useful guard against over distension of the stomach. The stomach is now gently drawn upwards till all tension is relaxed, and is fixed in this position by interrupted silk sutures between it and the pleura. The operation is completed by closing the diaphragm with strong silk, and fine silk sutures between the enlarged new oesophageal hiatus in the diaphragm and the stomach prevent herniation there. Many workers suggest that the phrenic nerve should be crushed to produce temporary diaphragmatic paralysis. I feel it is unnecessary so long as there is no pull on the anastomosis, and to ensure this I finally pull the diaphragm downwards to mimic deep inspiration—and to confirm that no increased tension on the anastomosis results from it.

Penicillin is powdered into the mediastinum and the region of the anastomosis, and then the chest is closed, leaving an intercostal drainage tube projecting about one inch into the pleural cavity, this being used for closed underwater drainage (Lewis, 1946). No attempt is made to close the mediastinum, as it is better that any exudates from it should be free to enter the pleural cavity and escape by the drainage tube. If the growth should be found inoperable, a palliative short circuit by anastomosing the fundus of the stomach to the oesophagus above the growth, or lateral oesophagojejunostomy after mobilizing the jejunum (Allison) may be possible and will give relief from dysphagia.

Not infrequently, it will be found that a tumour which encroaches on the lower oesophagus, has involved so much of the stomach that a complete gastrectomy is advisable (Fig. 15a). In such a case the jejunum may be transected and the distal part brought into the chest by dividing some of the main jejunal vessels, but of course leaving a good vascular connection to the superior mesenteric artery. The proximal end is implanted ' end in side ' to the jejunum lower down (Fig. 15b). The mobilized end may then be comfortably anastomosed ' end to end ' to the oesophagus.

As an alternative to ' end to end ' anastomosis the meso jejunum can sometimes be elongated sufficiently to bring a jejunal loop into the chest, by dividing one or two of the main jejunal vessels supplying it, as suggested by Sweet.

Carcinoma of the middle oesophagus

Until recently it was considered that some modification of the original Torek procedure leaving a cervical oesophagostomy and a

FIG. 4.—Adenocarcinoma of the cardia. Irregular filling defect and double stream through the cardia.

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FIG. 5.—Gastroscopic view of the lower end of an adenocarcinoma of the cardia.

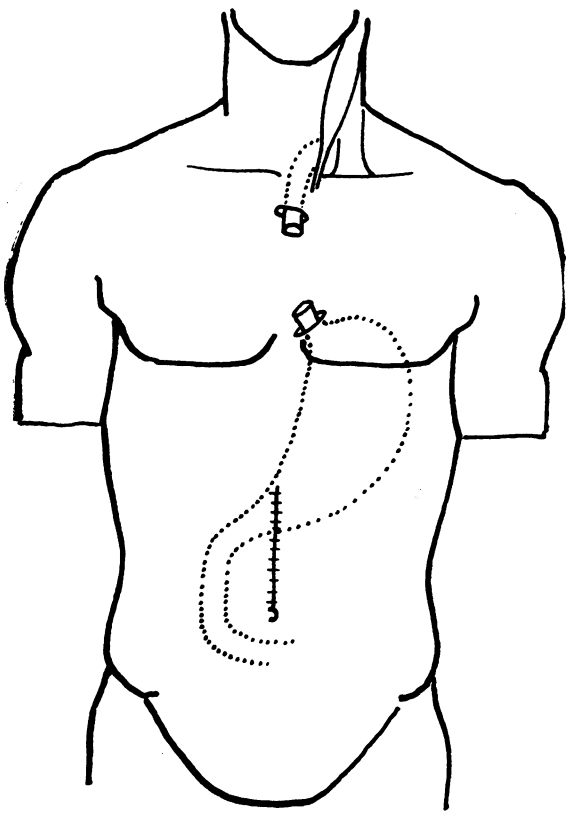


FIG. 6.—Attempt to shorten distance between oesophagostomy and gastrostomy, by using cardia of dislocated stomach as gastrostomy.

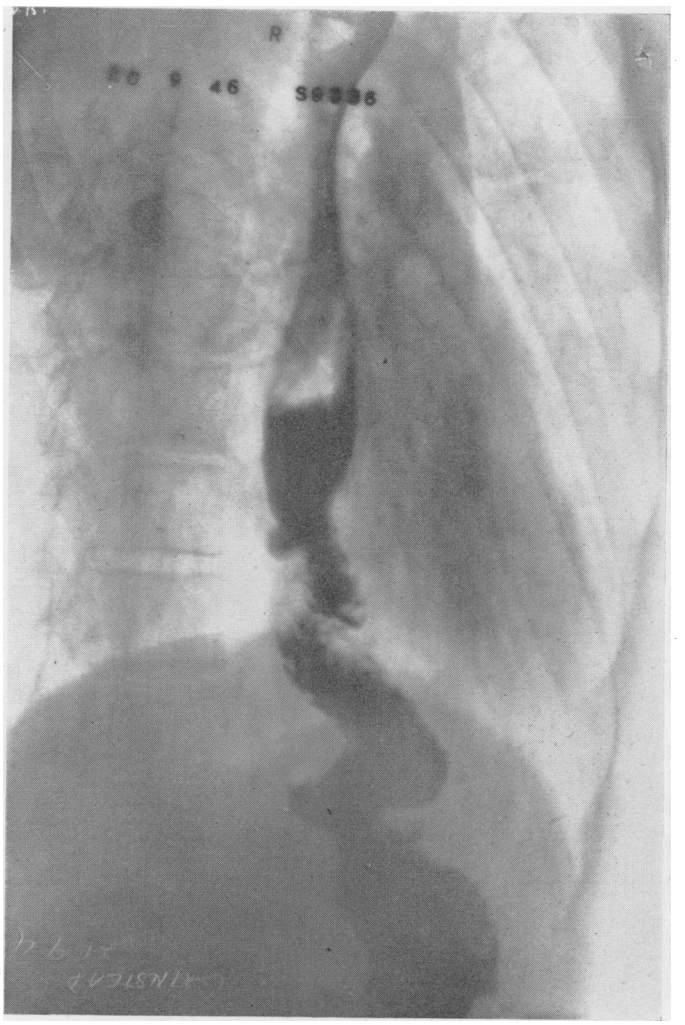


FIG. 7.—X-ray of barium swallow after abdominal total gastrectomy, and end to end oesophagojejunostomy showing resection of lowest oesophagus.

FIG. 7a.—Photograph of healed incision after resection of lower third of oesophagus.

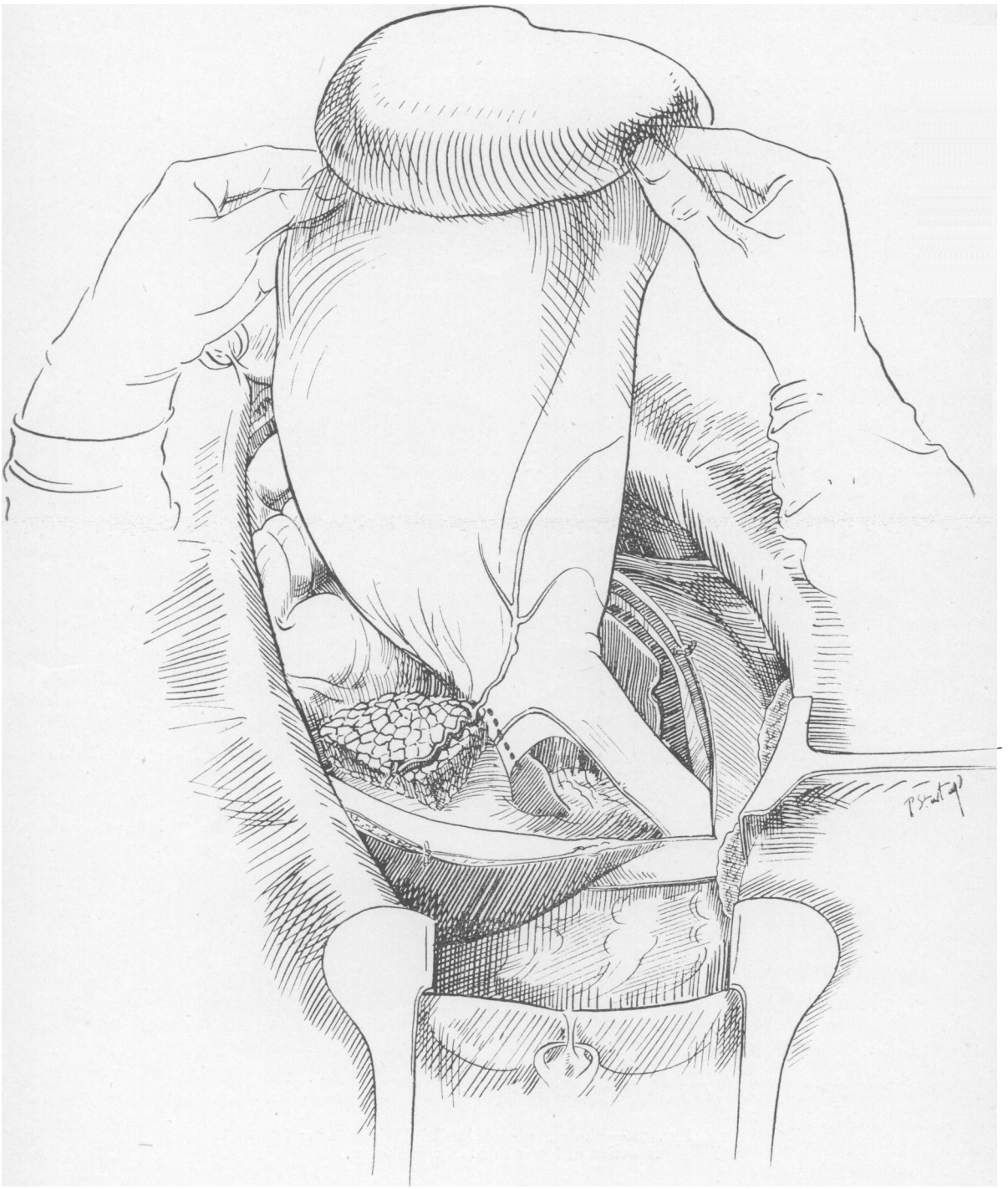


FIG. 8.—Transthoracic, transphrenic approach. Greater curvature of stomach mobilized with spleen, and a vas breve from the middle of the splenic artery is seen passing to the incisura cardiaca. The dotted line shows where hepatogastric ligament must be divided from liver.

gastrostomy was the best we could do for these patients.

This procedure was sometimes followed by attempts at the construction of a subcutaneous skin tube. Attempts to make jejunal tubes though successful in youthful sufferers from simple oesophageal stricture (Judin, 1944) are almost always a failure in elderly sufferers from carcinoma. Attempts to transfer the whole stomach subcutaneously up to the cervical region were more promising, though the author found that repeated leaking eventuated in nearly every case.

Garlock overcame the difficulty by making a wide left thoracic approach (excising the seventh rib, and dividing the fifth, sixth, eighth and ninth), mobilizing the growth and stomach, and then pulling the oesophagus above the aortic arch after resecting the tumour, and anastomosing stomach to the oesophageal stump high in the chest to the left side of the arch. Most surgeons find this method difficult, for at one part of the operation one is working deeply through the diaphragm, and at the end a rather difficult anastomosis has to be made at the apex of the pleural cavity. In addition, the oesophagus, perhaps the part containing the tumour, has to be freed blindly from behind the aorta.

In 1935 Churchill had practised mobilization of the stomach through an abdominal incision prior to resection and anastomosis through the left chest, for tumours of the lower third of the oesophagus. This is, generally speaking, abandoned, as the upper stomach can be well mobilized through the lower left chest.

In 1944 Ivor Lewis in a case of carcinoma of the middle third of the oesophagus used a new procedure. A laparotomy was first made, and the greater and lesser omenta of the upper stomach was freed, dividing left gastric, left gastroepiploic artery and vasa brevia, but preserving the gastroepiploic arch and right gastric artery. A feeding jejunostomy completed the first operation. Twenty-one days later (he recommends 10-15 days) through a formal right thoracotomy removing the sixth rib, the vena azygos major was tied and divided and mediastinal pleura incised down to the diaphragm. The growth was freed. A specially devised sickle shaped retractor was next inserted into the oesophageal hiatus and the lower oesophagus and cardia were dissected free and the peritoneum divided round the oesophagus. Then the stomach was pulled up into the right chest, breaking the adhesions which had formed since the first operation. The growth and cardia were excised and oesophagogastrostomy performed. The patient, and others subsequently done by the same technique recovered[14].

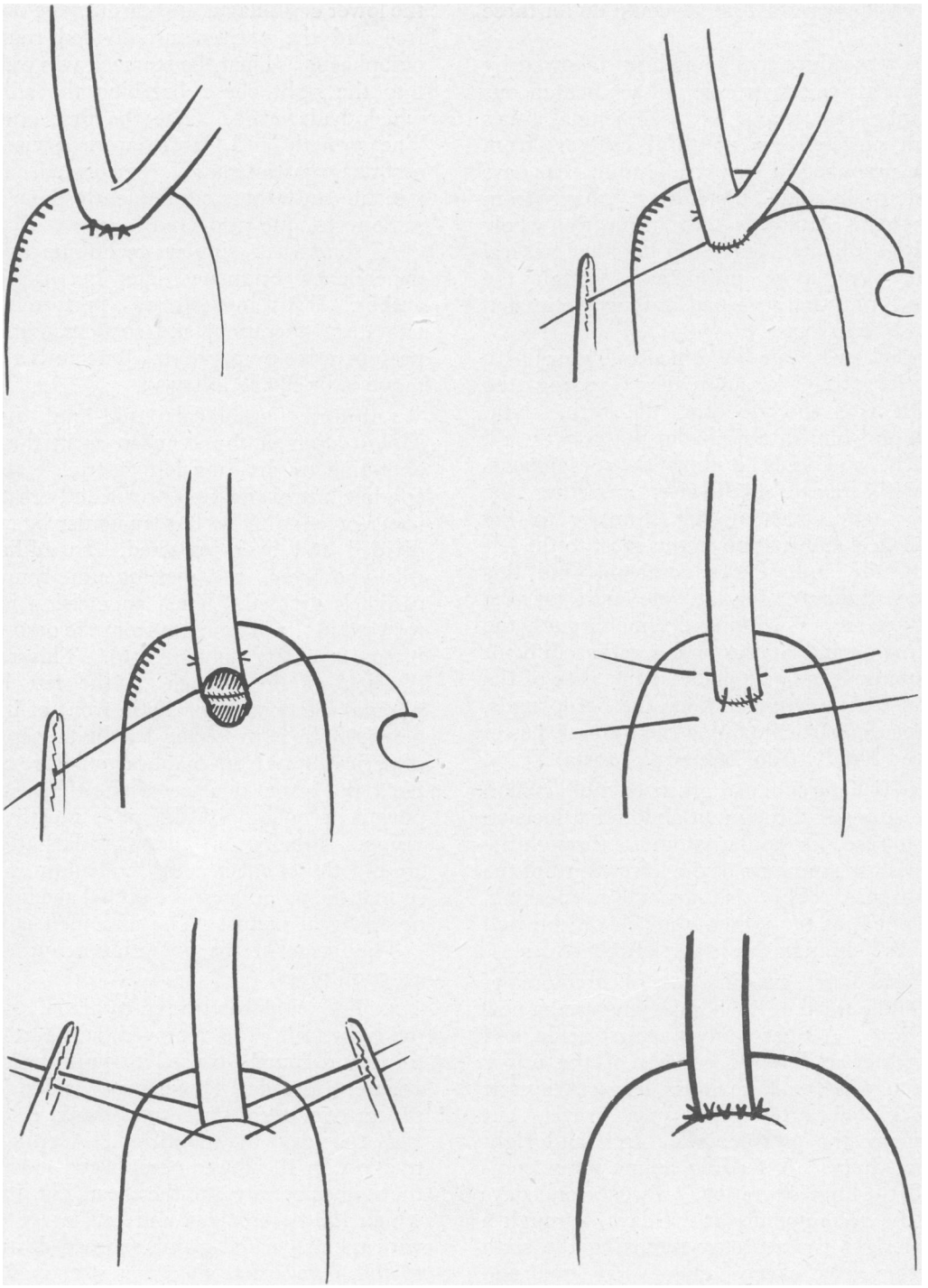
A somewhat similar technique was independently originated later in 1944 by the author. This method was performed as a one stage operation, and so demands careful pre-operative preparation. The author's technique is briefly as follows :—

1. Supra umbilical mid-line incision. Mobilization of the stomach as in the Lewis operation by dividing left gastric, left gastroepiploic artery and vasa brevia and greater and lesser omenta. The left triangular ligament is divided and liver retracted. In addition to this, however, the peritoneum round the cardia is divided. Then an incision is made forward in the diaphragm from the oesophageal hiatus to enlarge it (Fig. 16). This requires division of the branch of the left inferior phrenic artery which runs in front of it. The pericardium is protected by digital separation of pericardium from diaphragm before cutting. Next the lower quarter of the thoracic oesophagus is mobilized digitally, mostly under vision. Finally, all non-vascular adhesions around the stomach and duodenum are freed so that the pylorus can be pulled as high as the oesophageal hiatus. The abdomen is closed.

This stage of the operation requires some 40-50 minutes.

2. The patient is turned to his left side and the right fifth rib is removed, and parts of the third and fourth excised to improve the exposure. The vena azygos major is divided, the pleura over the upper oesophagus is divided and the growth mobilized. Gentle blind traction on the lower oesophagus now brings the stomach easily into the chest (Fig. 17), after which the oesophagus and cardia are excised with the associated glands (spread downwards to the paracardial glands is not uncommon) (Figs. 17, 17a). The wound in the stomach is closed by the 'sewing machine' stitch which does not shorten it.

The high exposure makes oesophago gastric



FIGS. 10-15 inclusive.—Two layer anastomosis with final row of interrupted stitches drawing up an anterior seromuscular fold.

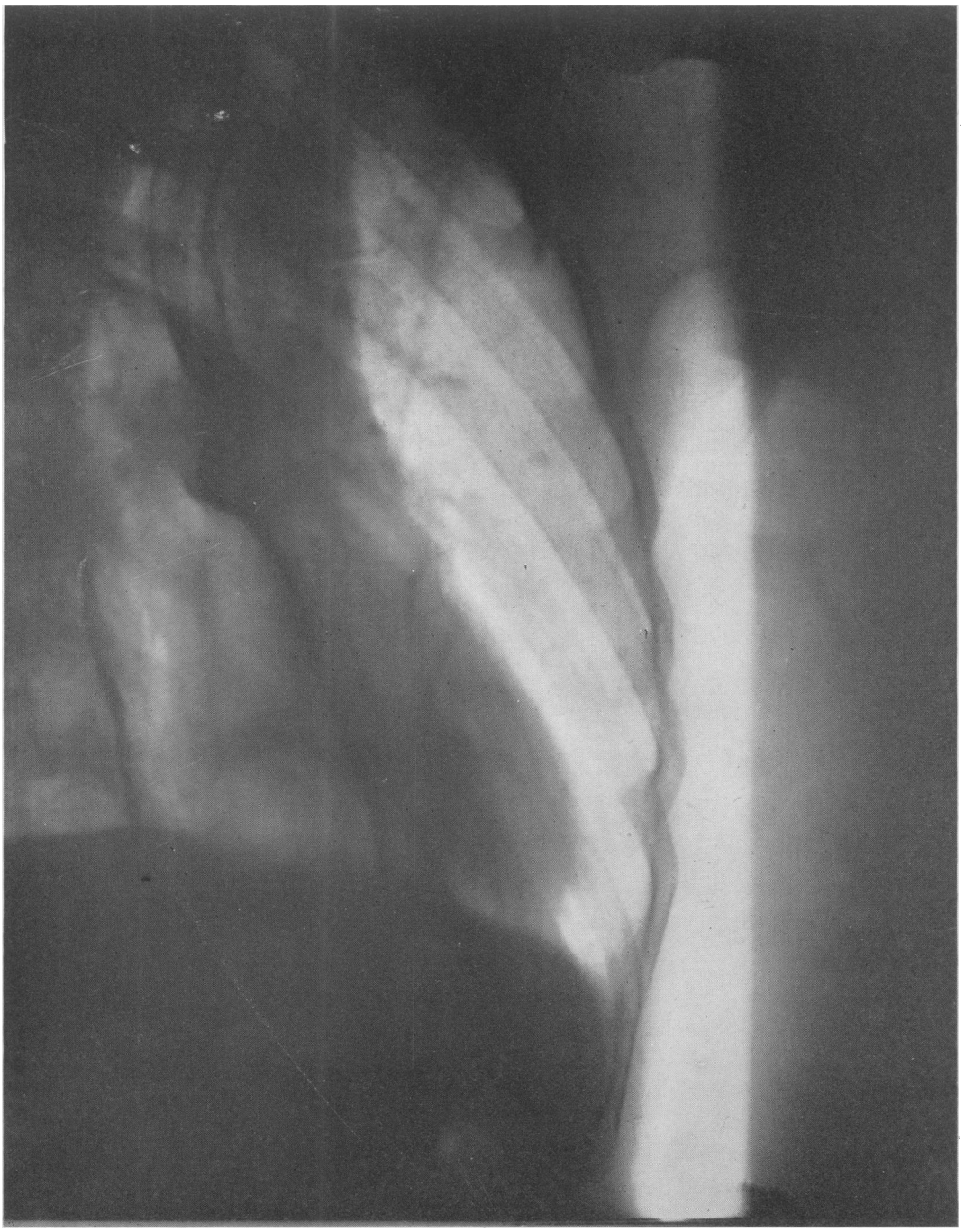


FIG. 9.—Post-operative radiograph, showing how stomach is fixed up behind the oesophagus, making stoma on the anterior wall.

FIG. 15a.—Bulky adenocarcinoma invading lowest oesophagus and requiring total gastrectomy.

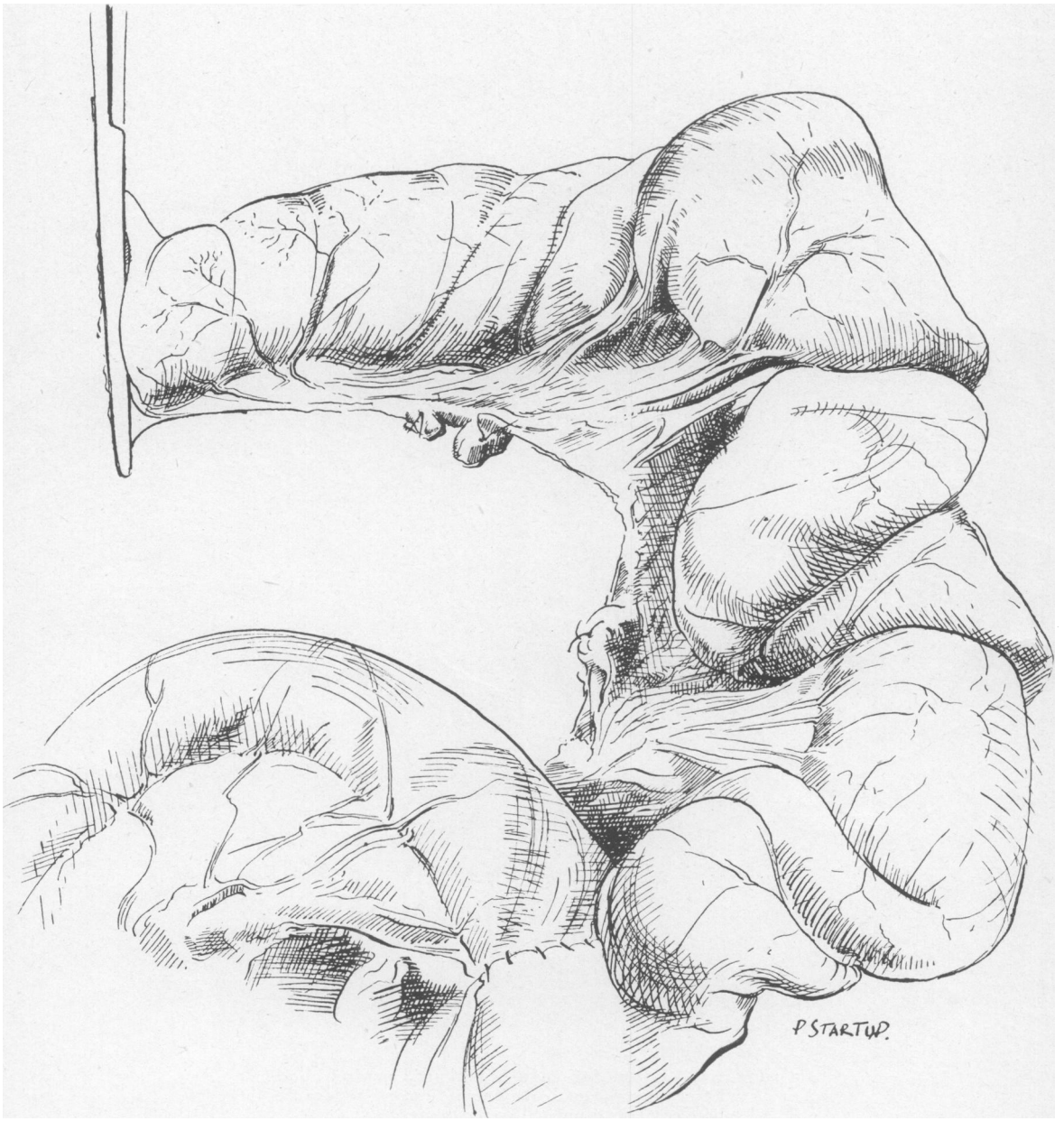


FIG. 15b.—Mobilization of jejunum and Y anastomosis.

FIG. 16.—Abdominal mobilization of stomach and lower oesophagus, diaphragm incised to expose base of pericardium. Liver retracted.

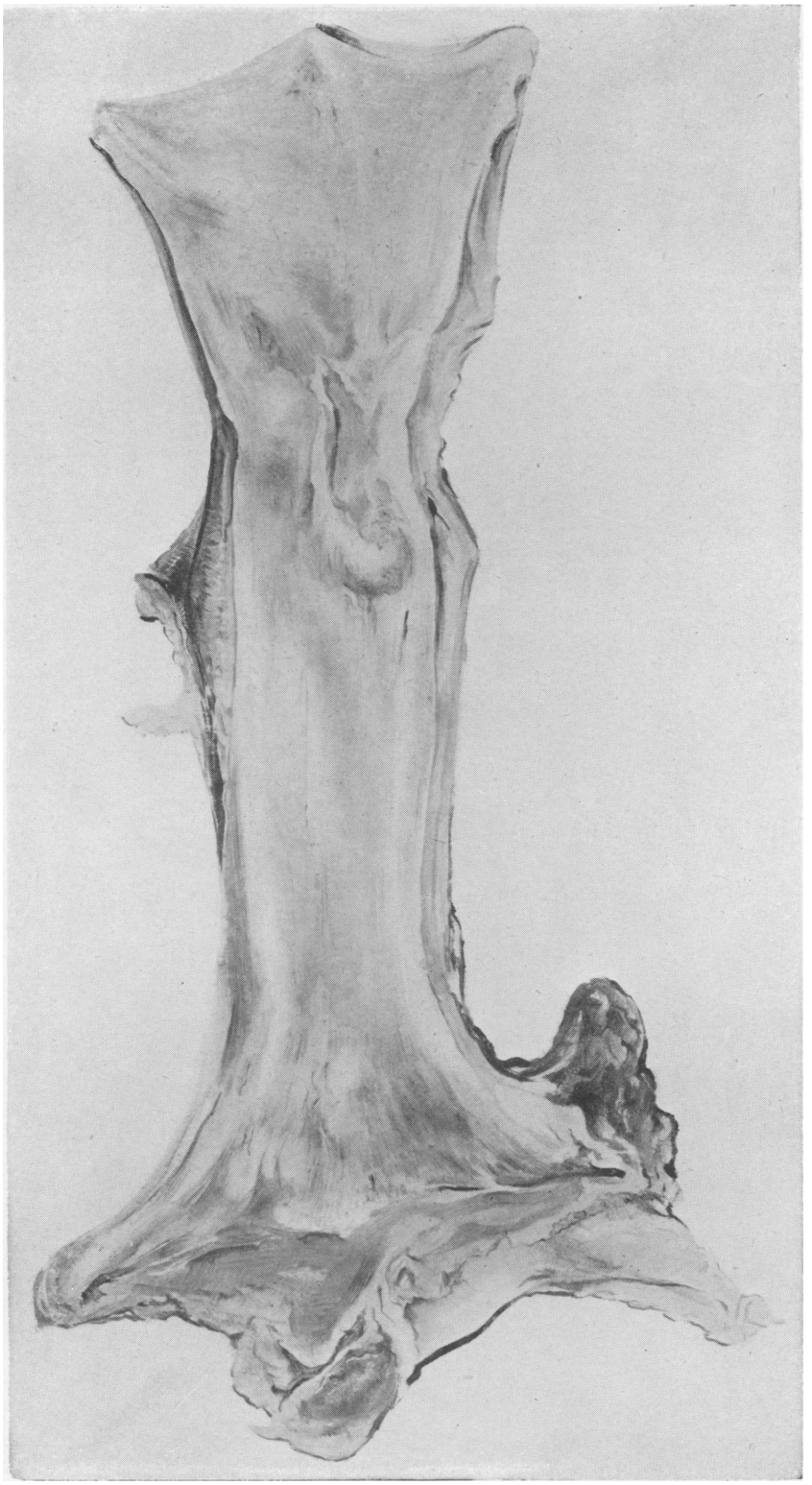


FIG. 17a.—Specimen of carcinoma of mid-oesophagus resected by author's technique.

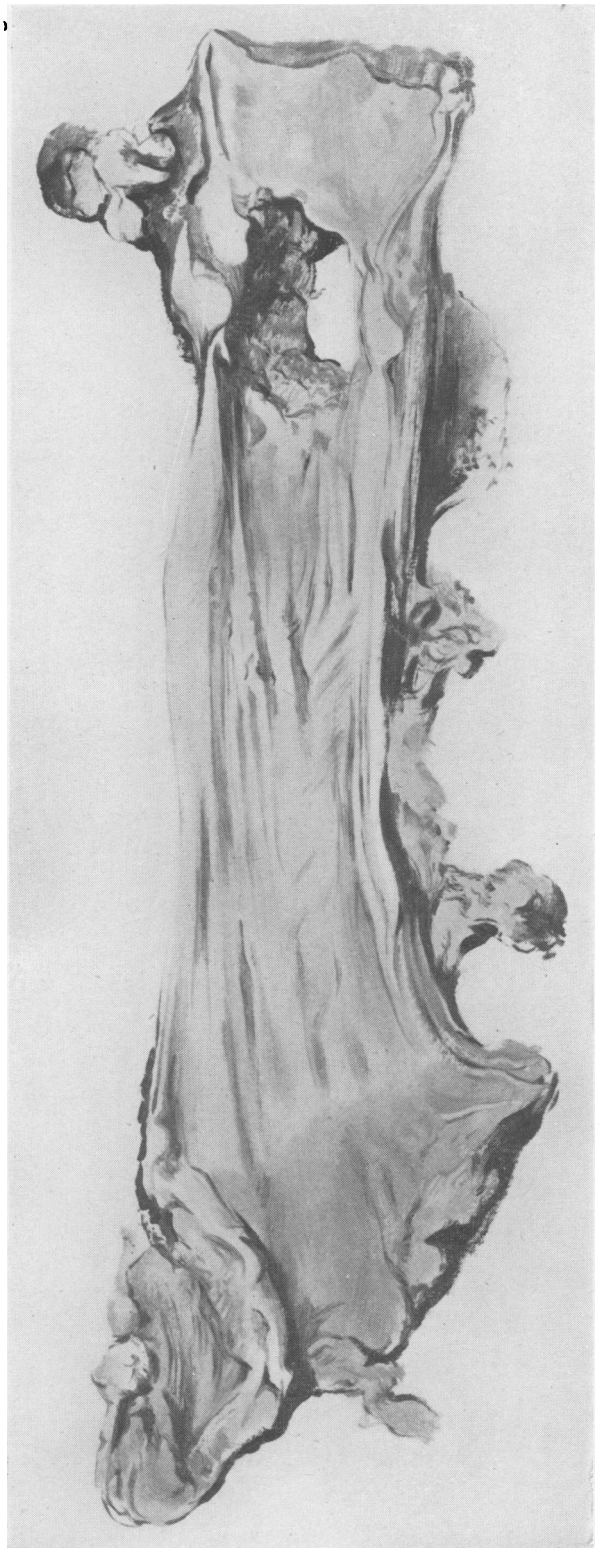


FIG. 17b.—Specimen of carcinoma of mid-oesophagus resected by author's technique

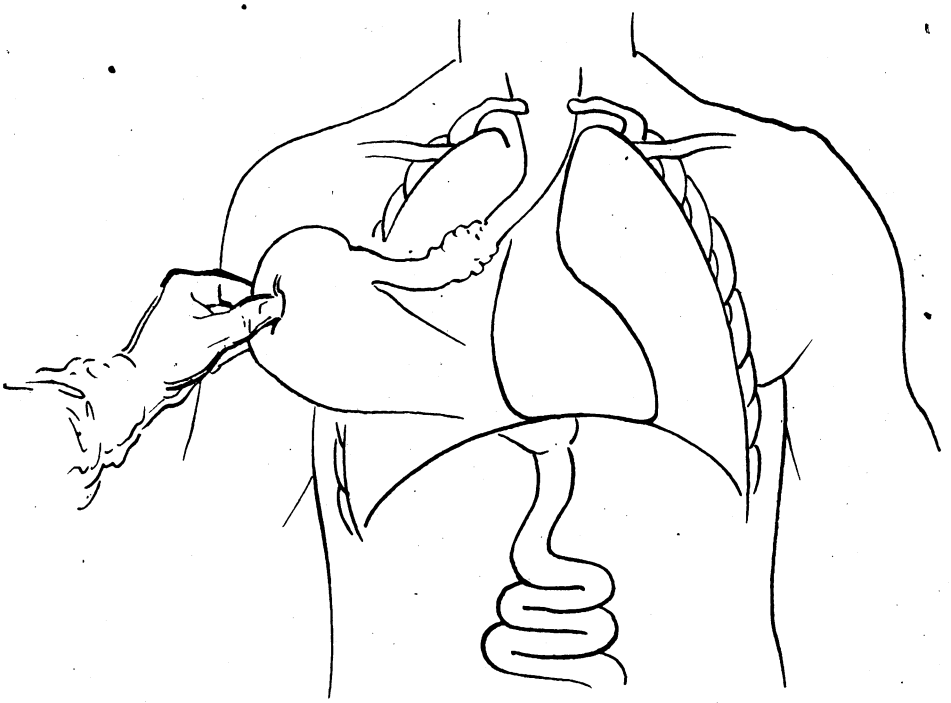


FIG. 17.—Drawing showing stomach and lower oesophagus mobilized into the right chest.

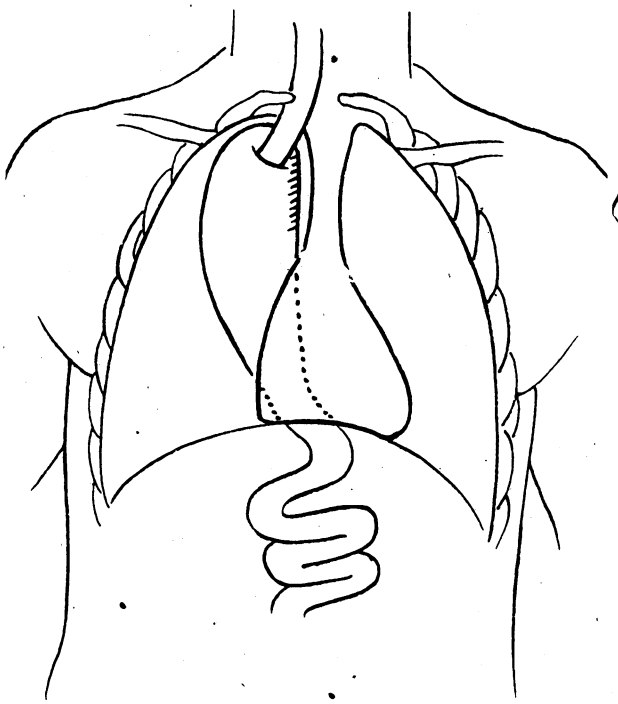


FIG. 18a.—Diagram of high oesophagogastrict anastomosis.

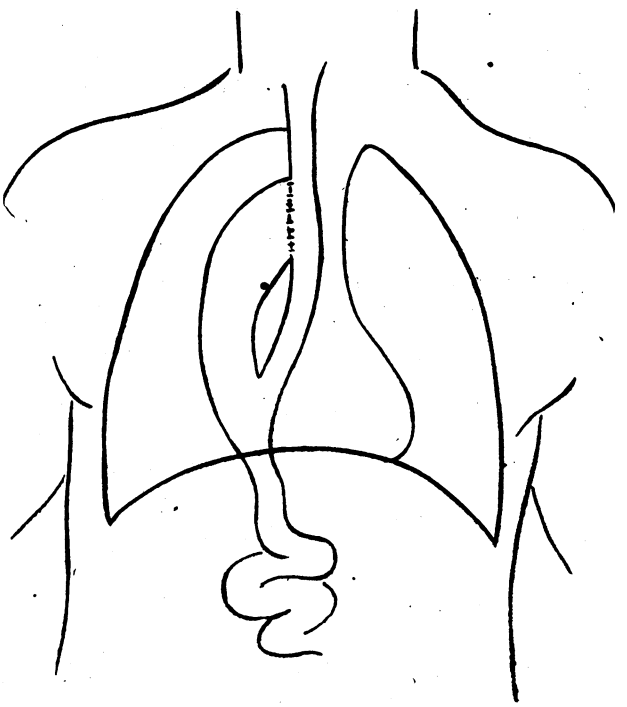


FIG. 19.—Palliative short circuit for irremovable high carcinoma oesophagus.

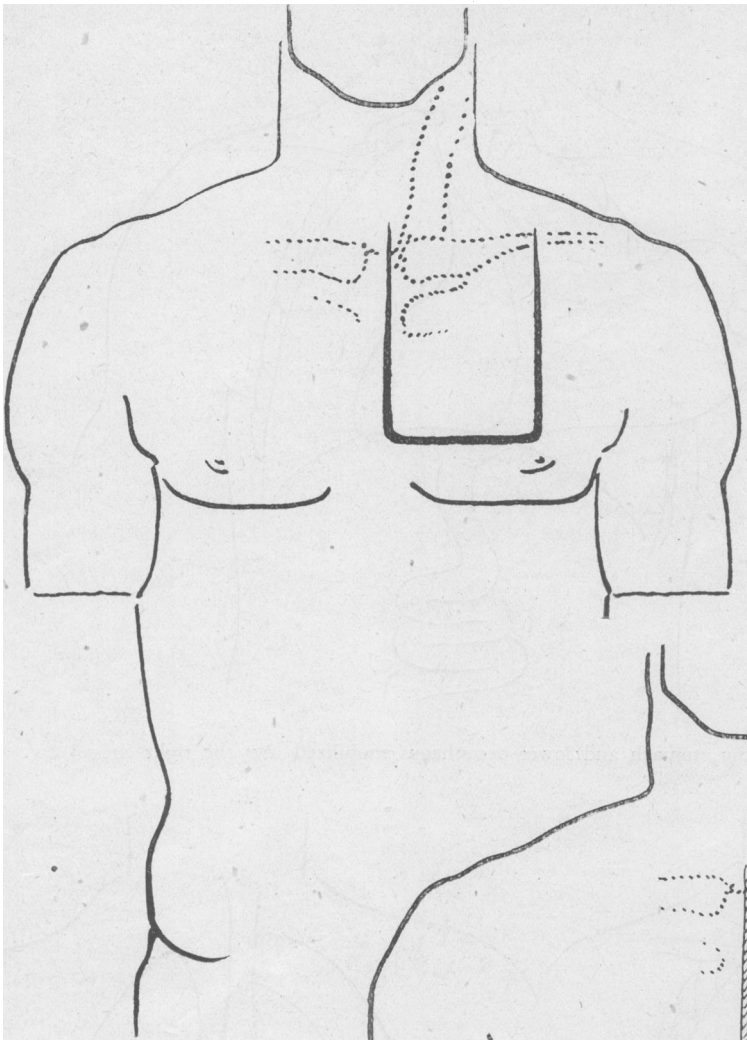


FIG. 21.—Outline of skin flap.

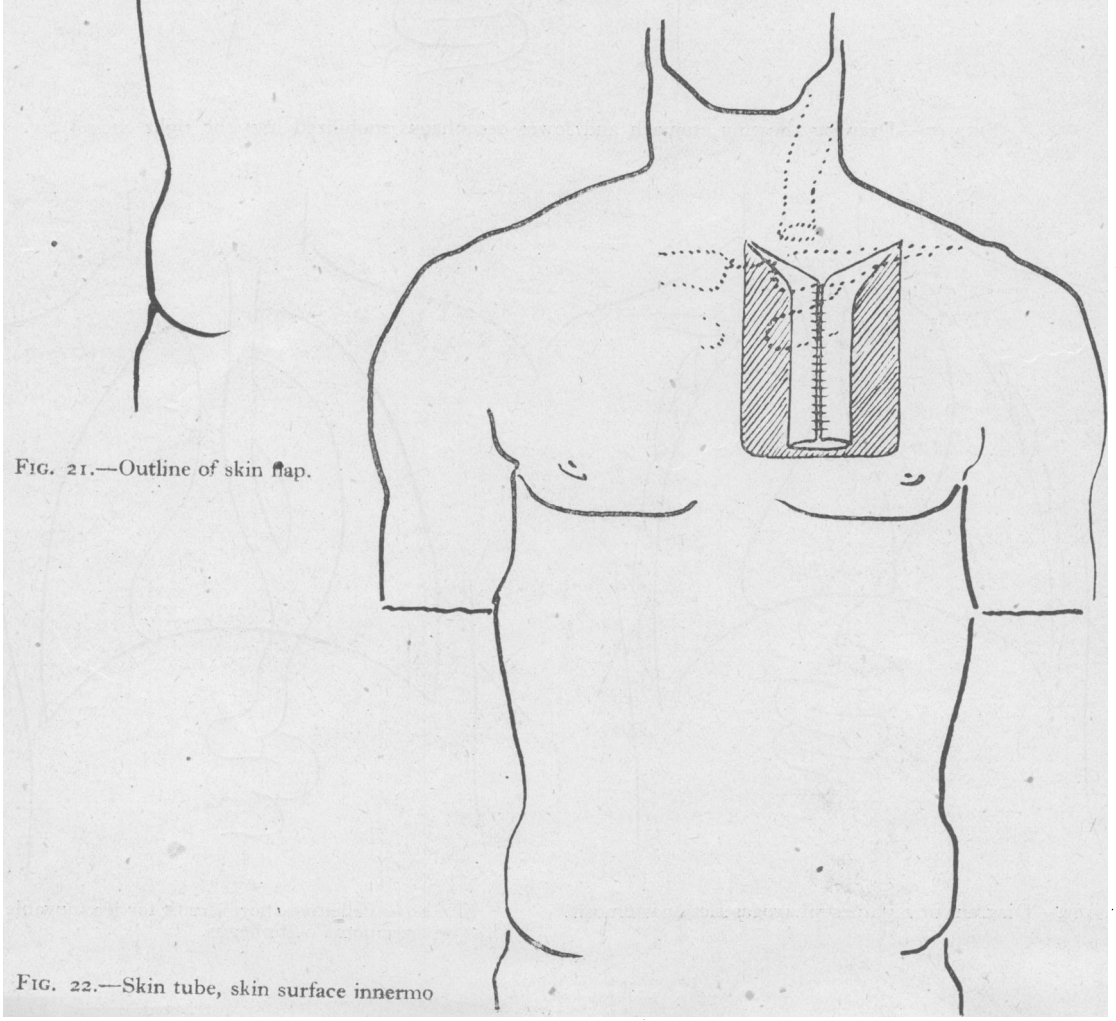


FIG. 22.—Skin tube, skin surface innermo

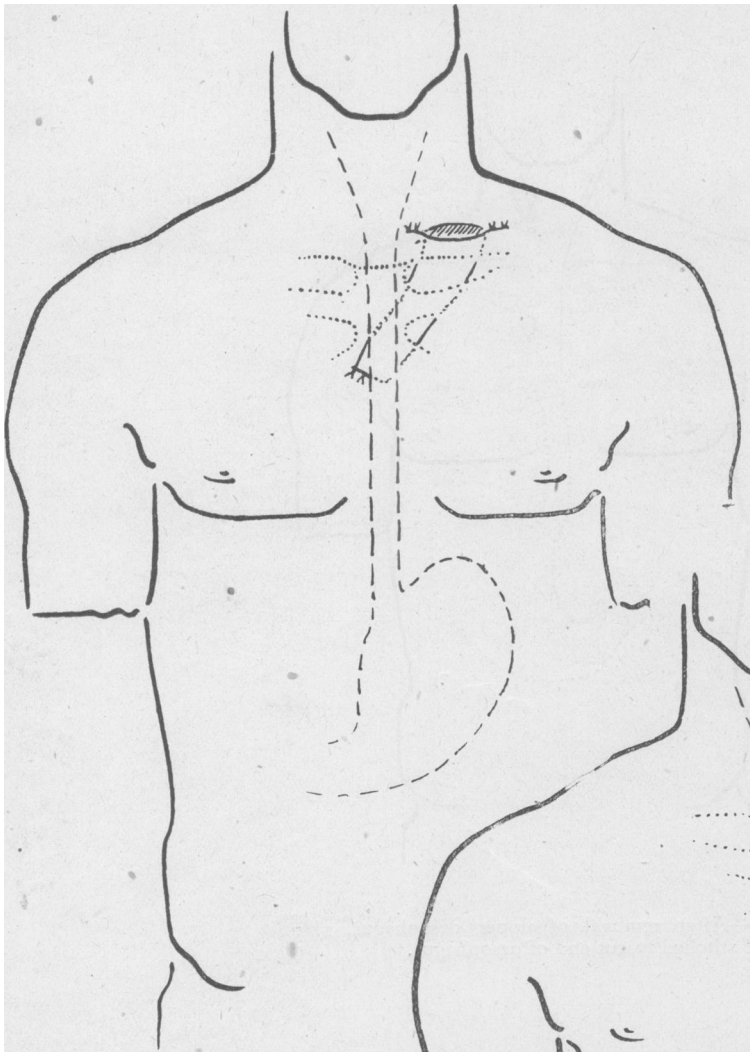


FIG. 23.—Skin tube free behind oesophagus. Bare area grafted (not shown).

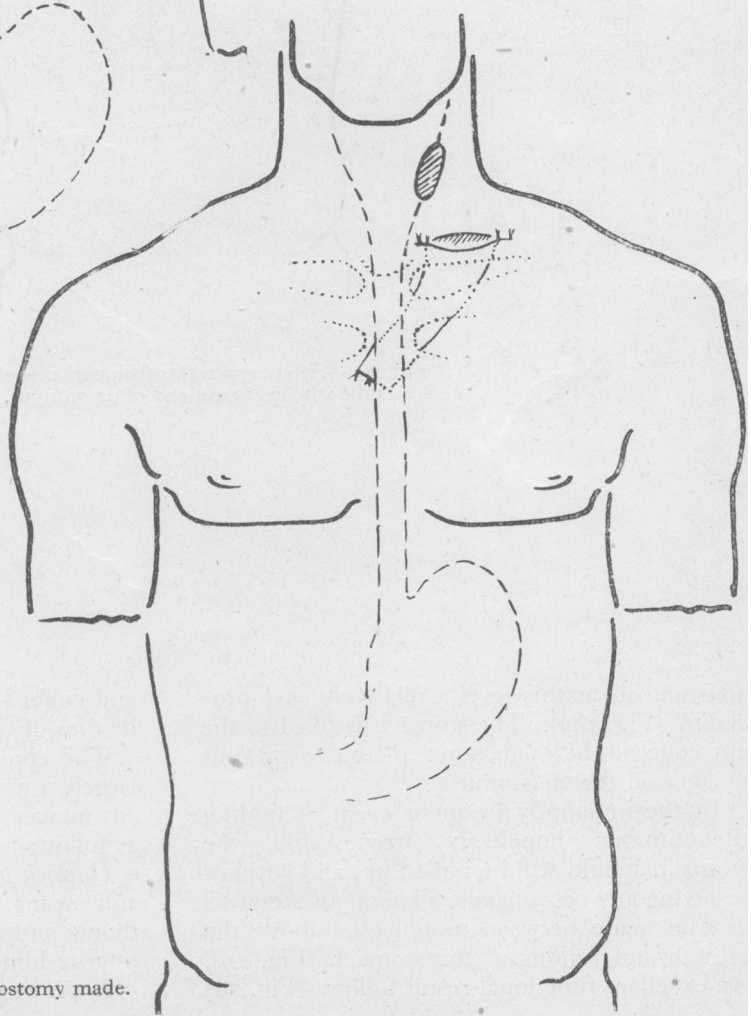


FIG. 24.—Left pharyngostomy made.

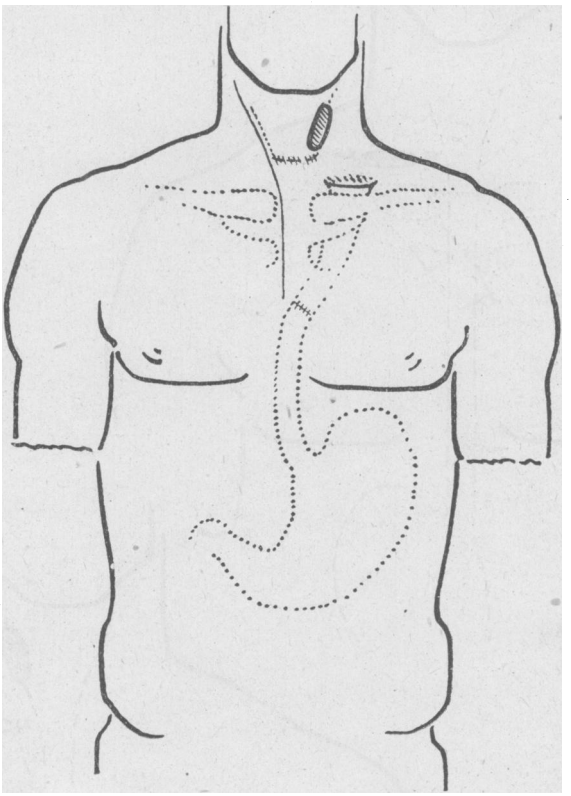


FIG. 25.—After removal of upper oesophagus, skin tube stitched to cut end of oesophagus.

anastomosis at this level a relatively easy procedure (Fig. 18a). The stomach is fixed to the cut edge of the mediastinal pleura to prevent tension on the anastomosis.

In the unhappily frequent event of finding the tumour hopelessly irremovable, the stomach should still be pulled up, and without resecting any oesophagus, a lateral anastomosis can be made between oesophagus above the growth and fundus of the stomach (Fig. 19). An excellent functional result follows (Fig. 20) and enables the patient to eat in comfort until he dies of the disease.

The choice of procedure to be followed is largely a matter of individual preference. The advantages and disadvantages I would place as follows :—

Garlock procedure. Requires great dexterity and means working at both upper limit of the thorax and also under the diaphragm. It may require blind mobilization of the tumour.

Lewis procedure. Requires dexterity in the

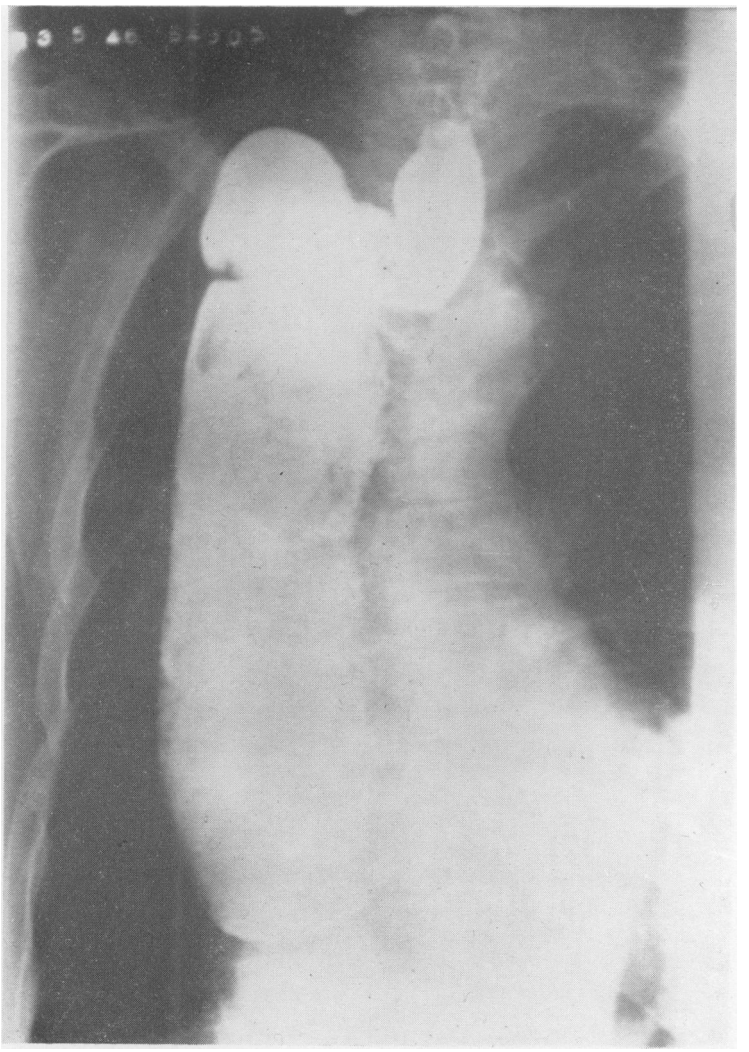


FIG. 18.—X-ray of barium swallow, after author's method of oesophagectomy showing anastomosis at level of sternoclavicular joint.

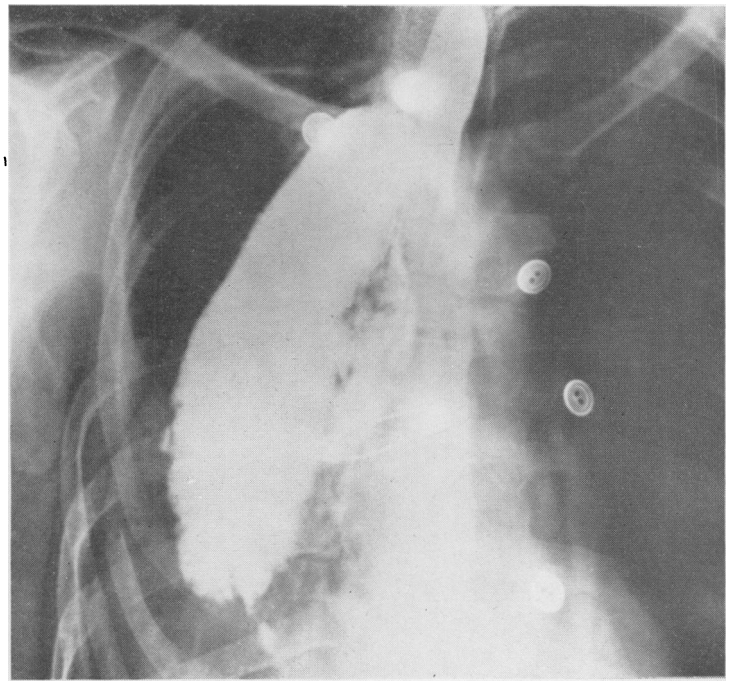


FIG. 20.—X-ray of palliative oesophago-gastrostomy for carcinoma shown in Fig. 1.

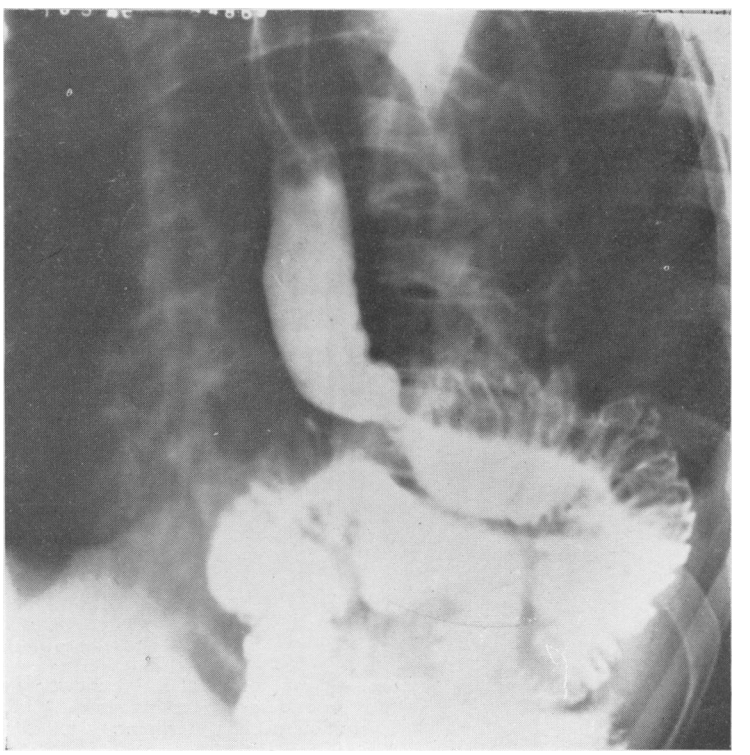


FIG. 26.—Transthoracic oesophagojejunostomy after total gastrectomy and oesophagectomy for carcinoma of cardia. Patient working and taking normal meals.

thoracic part of the operation, as it means working on the highest part of the pleural cavity, and also at the oesophageal hiatus in the diaphragm. Adhesions may add to the difficulties. The two stages and the jejunostomy mean less tax on the patient. The interval between the two procedures probably enables the fundus of the stomach to recover from its vascular deprivation, making it more safe for anastomosis (Ochsner, 1941).

Tanner procedure. Perhaps bias makes me consider this the easiest procedure to perform, in fact it is an easy operation in most cases. It has the disadvantage of being a major abdominal and thoracic operation on an often rather enfeebled patient, but there is only one convalescence to be guided through. The sudden deprivation of blood supply to the fundus may diminish its healing powers (in one case a patch of necrosis occurred where the stomach was closed near the cardia).

Upper third of the oesophagus

Very small neoplasms in this area have occasionally been treated by local excision, leaving part of the circumference of the oesophagus intact. The narrowed gullet which results is later dilated by bouginage (Hoover, 1938). Excision and reconstruction by Trotter's lateral skin flap is satisfactory only if the excised part is small and entirely cervical, and not many suitable cases will be found for it. Churchill complains that his patients had poor function after this operation. In the more extensive growths two other procedures have been reported. One is to excise the tumour, perform a cervical oesophagostomy with the upper end and close the lower end of the oesophagus and drop it back into the superior mediastinum. Quite a radical excision is possible by this method but a permanent gastrostomy is, of course, necessary. If the growth has involved the larynx or trachea, which is not infrequent, the second procedure, Gluck's combined cervical oesophagectomy and laryngectomy, may be used. Evans had a case alive and well thirty-two years after he had performed this operation.

It is possible that restoration of continuity might be obtained by an extension of the operation used in the middle third, but in this case the stomach would have to be pulled through the superior mediastinum into the neck, and anastomosed to the oesophageal stump through a separate cervical incision. In fact, in 1922 Kummell recorded two cases where the stomach and oesophagus were mobilized by an abdominocervical approach, the stomach was pulled through the posterior mediastinum to the neck, the growth was excised, and an oesophagogastrostomy done. Unhappily both cases died.

There is room for much research and ingenuity here. It seems strange that the part of the oesophagus where the earliest attempts were made and the earliest successes were obtained, is now surgically one of the most unsatisfactory areas. No doubt this is in part due to the fact that lesions here are often advanced when diagnosed and that radiotherapy has its greatest success here.

A method of dealing with growths in this area originated by the author may be of interest, being applicable to extensive and lower cervical growths, and aiming at restoration of continuity.

The stages are as follows :—

1. Gastrostomy, then an interval to improve nutrition.

2. Formation of a superior mediastinal skin tube. A wide flap of skin is raised from below the left clavicle with its base uppermost (Fig. 21). It is dissected up over the clavicle and the left sterno mastoid origin is entirely freed from sternum and clavicle, and by further dissection into the posterior mediastinum the growth can be examined. The flap of skin is formed into a tube with skin surface *innermost* (Fig. 22), and this tube of skin is thrust behind the clavicle into the posterior mediastinum behind the oesophagus (Fig. 23). The bare area on the chest wall is covered with Thiersch graft. A time interval for the graft to take follows.

3. A low left lateral pharyngostomy is made, pharyngeal mucosa being stitched to skin to make a really wide opening (Fig. 24).

4. After the previous wounds are healed, a long incision along the anterior border of the *right* sternomastoid muscle on to the sternum is made. The sterno clavicular joint and inner

part of the first rib and adjacent sternum are removed to give a good view of the superior mediastinum. Damage to the pleura is the major risk here, and must be avoided. The growth is mobilized and excised up as high as the upper oesophageal opening, where the pharynx is firmly closed with two layers of interrupted silk. After dividing below the growth and removing it, the skin tube from the opposite side is found and its open end is stitched to the oesophagus with one good layer of interrupted silk sutures (Fig. 25). A small catheter is passed through the skin tube and then through the anastomosis. The wound is closed with a small pack and drain below the closed pharynx.

5. After a course of bouginage has shown no contraction of the dermato-oesophageal anastomosis and the pharyngostomy shows no signs of stenosing, the pharyngosty and upper opening of the skin tube are united by raising a skin flap on either side. The proximity of the two openings should make this easier than most such operations.

Unhappily I have never reached stage five. Two cases have been so treated, but in both cases the recurrent nerves were involved in growth and were resected with it and this combined with excessive bronchial secretion caused death after the fourth stage. If I have an opportunity of making a third attempt, I shall seriously consider the advisability of performing a tracheotomy at the fourth stage, and also using this for repeated bronchial aspirations.

The question of hair growth obstructing skin tubes has given rise to much trouble in the past. If a hairy part were used I would also give an occasional epilatory dose of deep X-rays to the tube.

Pre- and Post-Operative Treatment

The pre-operative preparation of a patient for oesophageal resection is mainly designed to improve nutrition, indeed the success of the operation rests on the satisfactory replacement of depleted reserves of protein and carbohydrates.

Many patients, particularly those with neoplasms of the upper thoracic oesophagus, are able to swallow fluids, and if not a gentle oesophagoscopic cleansing may enable them to do so. In such cases fluid protein must be given to the limit, the patient having frequent feeds of milk, coddled egg and fine minced meat if it is swallowed easily, and sugar. One should aim at about 5-6 eggs daily. Fortified mixtures if the patient can tolerate them may also be given.

D. Barlow has tried ox blood plasma and casein hydrolysates by mouth, but their unpalatability caused nausea. He has found that frequent almost continuous feeding, even night feeding gives good results. Iron should be added, also full doses of vitamin C and the B complex. If unable to swallow these quantities intravenous medication with saline, glucose and blood plasma or amino acid should be given for at least a week prior to operation. If satisfactory feeding by these means is unattainable, then a feeding jejunostomy must be made.

Blood transfusions must be given at regular intervals if the haemoglobin is under 80 per cent.

Dental cleansing is important, but a conservative attitude must be taken towards extractions in a patient who has difficulty in swallowing.

Breathing exercises and gentle exercise of the whole body must be started before operation, and continued into the convalescence.

Pre- and post-operative chemotherapy with sulphonamide or penicillin is usually regarded as essential.

A drip blood transfusion during the operation does much to counter the effects of haemorrhage and is useful in the event of a sudden accidental blood loss.

Post operatively in the more extensive resections some degree of surgical shock may require treatment. The use of an oxygen tent for at least the first day or two is favoured by most surgeons, but the author discards it early as it may mask the collection of excessive bronchial secretions.

The treatment of excessive bronchial secretions, which may prevent adequate pulmonary ventilation, or produce atelactasis and which favour infection, is usually the first problem after operation. The patient is nervous of coughing but should be encouraged to do so.

A 'fruity' cough (Brock) is a sign that tenacious bronchial secretions are present. Clearing the bronchi is often assisted by making the patient cough after his routine post operative morphine injections—this dulls the wound pains sufficiently to make an effectual cough possible. The moister secretions are assisted by postural coughing, that is coughing while lying on one side or the other with the foot of the bed raised and the head low without pillows. Strong doses of ammon. carb. and Coramine are also helpful (Barlow, personal communication).

Some lethargic or ill patients do not expel their secretions well, and in such cases, Haight's method (1938) of passing a No. 16 French rubber catheter blindly through the nose into the trachea and bronchi, and aspirating the secretions is very valuable, not only in the amount aspirated, but in its stimulus to adequate coughing.

The third and most certain method of treatment is by bronchoscopic aspiration. Ivor Lewis (personal communication) considers a careful bronchoscopic cleansing of both main and secondary bronchi essential if massive collapse has supervened. If there is merely excessive bronchial secretion purulent or otherwise, and the patient is a reasonably easy subject for bronchoscopy he performs a bronchoscopic aspiration the first time, and passes a catheter subsequently. If the patient's condition is precarious from excessive secretion he leaves the catheter down to facilitate repeated aspiration.

Intravenous saline and glucose, and blood plasma to prevent hypo proteinaemia is continued until adequate oral feeding is possible.

In most cases limited fluid by mouth can be given immediately after operation, but it is usual to depend mostly on intravenous nourishment for three days and then start gradually increasing feeds, which should contain fluid protein from the first.

The intercostal catheter is usually removed in 48-72 hours (Sweet) though some retain it much longer. Any subsequent fluid collection must be aspirated, and it is wise to have a radiograph of the chest, with the patient sitting up, two days after removal of the tube.

Late results

It is too early to be dogmatic as to the chances of permanent cure after oesophagectomy. Sweet had five cases of excision of carcinomata of the cardia, all done over two years, still alive and well, but 16 out of 35 done altogether had recurred or died. One thing is certain, and that is that these operations are excellent palliation. Resection is justifiable, once the tumour has been exposed, even if the presence of malignant glands beyond the limits of resection preclude cure.

The patients are comfortable with all these resections and can return to work. I have been particularly impressed by the comfort of those who have had an end to end oesophagojejunostomy (Fig. 26).

The years ahead are full of promise and hard work. Let us be grateful to the succession of workers, particularly the long line of surgeons, who have traced out every step for us and guided us to the present degree of fruition.

REFERENCES

1. TURNER, G. GREY (1946), 'Injuries and diseases of the oesophagus,' Cassell, London.
2. ALLISON, P. R. (1946), Carcinoma of the oesophagus and cardia, *Proc. Roy. Soc. Med.*, **39**, 415.
3. KIEFER, E. V. (1938), Carcinoma of the cardia end of the stomach, *Surg. Clin. N. America*, **18**, 661.
4. ABEL, A. L. (1929), Oesophageal obstruction, *Oxford Medical Publications.*
5. GARLOCK, JOHN (1940), Discussion, *Journ. Thor. Surg.*, **10**, 470.
6. CHURCHILL, E. D. (1942), Discussion, *Journ. Thor. Surg.*, **2**, 494.
7. FAIRCHILD, G. C., and SHORTER, A. (1945), *Lancet*, **2**, 552.
8. ZAAIJER, J. H. (1929), Surgery of the oesophagus and lungs, *Lancet*, **1**, 909.
9. CARTER, B. N., STEVENSON, J., and ABBOTT, O. A. (1940), Experimental oesophagogastrostomy, *Journ. Thorac. Surg.*, **10**, 446.
10. OHSAWA, T. (1933), The surgery of the oesophagus, *Archiv. f. Japanische chirurgie*, **10**, 605.
11. CHURCHILL, E. D., and SWEET, R. H. (1942), Transthoracic resection of tumours of the oesophagus and stomach, *Ann. Surg.*, **116**, 566.
12. WU, Y. K., and LOUCKS, H. H. (1942), *Journ. Thorac. Surg.*, **11**, 516.
13. BROCK, R. C. (1942), Cardio-oesophageal resection for tumour of the cardia, *Brit. Journ. Surg.*, **30**, 146.
14. LEWIS, IVOR (1946), The surgical treatment of carcinoma of the oesophagus, *Brit. Journ. Surg.*, **34**, 18.
15. JUDIN, S. S. (1944), *Surg. Gynec. and Obst.*, **6**, 561.
16. CHURCHILL, E. D. (1935), Oesophageal surgery, *Sur. Gynec. and Obst.*, **60**, 417.
17. OCHSNER, A., DE BAKEY M. (1941), Surgical aspects of carcinoma of the oesophagus, *Thor. Surg.*, **10**, 401.
18. HOOVER, WALTER B. (1938), Carcinoma of the oesophagus, *Surg. Clin. of N. America*, **18**, 633.
19. HAIGHT, CAMERON (1938), Intrabronchial suction in the management of post operative pulmonary complications, *Ann. Surg.*, **107**, 218-228.