Recent Trends in Esophageal Surgery*

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In the past decade surgery of the esophagus has made tremendous strides, not only in the field of carcinoma but also in the numerous other conditions to which this organ is heir. Diseases of the esophagus fall not only into the realm of the surgeon but into that of the general practitioner, the internist, the pediatrician, the anesthetist, the roentgenologist and the otorhinolaryngologist as well. It is for this reason that a presentation dealing with this subject is timely.

Anatomy

Some points in the surgical anatomy of the esophagus bear emphasis. It is well to remember that the esophagus per se is 10 inches (25 cm.) in length, extending from the sixth cervical vertebra (cricoid cartilage level) to the 10th dorsal vertebra (esophageal hiatus level). The esophagologist, however, does not measure from the sixth cervical vertebra but rather from the alveolar margin, which adds an additional six inches (15 cm.) to its actual length; thus he bases his report upon a 16-inch (40 cm.) structure.

The esophagus has three normal curves and three physiologic constrictions. Its three curves or flexures are placed in the following manner: in the neck it curves to the left, as it descends in the thorax it curves to the right, and as it approaches the esophageal hiatus it curves again to the left. These flexures are of practical importance, since they may determine the proper side of approach. The three physiologic constrictions are located (1) at the level of the cricoid cartilage (sixth cervical level), (2) at the arch of the aorta and (3) at the esophageal hiatus. It is at these constrictions that the greatest amount of irritation takes place and the greater number of pathologic lesions are observed. Most foreign bodies are impeded in their path downward at the first physiologic constriction and are therefore found on a level with the sixth cervical vertebra. In locating a swallowed foreign body it is all-important, therefore, to order not only a roentgenogram of the chest but one of the neck as well.

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The relation of the vagus nerves to the esophagus should be stressed, since these nerves may be involved or must be sacrificed in some esophageal procedures. Although much has been written recently regarding the anatomy of the vagi and although numerous patterns have been described, in the main it may be stated that the left vagus nerve passes along the anterior aspect of the esophagus, intimately hugs the food pipe and is the smaller of the two vagi. The right vagus passes posteriorly, does not hug the esophagus and is larger.

To know the boundaries of the so-called "esophageal triangle" is to make identification and isolation of the supradiaphragmatic portion of the esophagus a simple and rapid maneuver. This anatomic triangle is bounded in front by the heart, behind by the descending aorta and below by the diaphragm.

Almost every text, monograph or recent article calls attention to the poor blood supply of the esophagus. I cannot agree with this teaching. To emphasize this point one needs only to divide

![CONGENITAL ANOMALIES](http://journal.publications.chestnet.org/pdfaccess.ashx?url=data/journals/chest/21221/)  

**FIGURE 1:** The esophageal atresia involves the proximal segment of esophagus and the tracheo-esophageal fistula involves the distal end of the esophagus. The gas in the stomach and small bowel is derived from the trachea.
the esophagus into upper (cervical), middle (thoracic) and lower (abdominal) parts. The upper part of the organ is supplied voluminously by the inferior thyroid artery; the middle or thoracic part is supplied by aortic, bronchial and intercostal branches; the lower part is well supplied by the left gastric and the inferior phrenic arteries. In my work I have demonstrated, and also presented in a recent motion picture of the actual procedure, the removal of the entire thoracic esophagus, both supra-aortic and infra-aortic portions, from its mediastinal bed. After this the esophagus was transected at its entrance into the stomach, and brisk, bright red arterial oozing was noted. I feel, therefore, that much more can be expected of the esophagus in its ability to heal, particularly if careful sutures are placed and if tension is avoided.

Atresias and Tracheo-Esophageal Fistulas

Various combinations and degrees of these anomalies are possible. The most common such defect is one in which the proximal end of the esophagus terminates as a blind pouch and the distal end joins the trachea to form a tracheo-esophageal fistula (Fig. 1).

Such a defect is to be suspected if the newborn baby presents a symptom complex revealing the three “C’s,” namely, coughing, choking and cyanosis. Especially is this true if there is an abnormal amount of drooling and rhinorrhea. These symptoms should suggest an impending surgical emergency. The roentgenologist is of inestimable value in determining the type and site of such lesions by merely noting the presence or absence of gas in the stomach and bowel, and by injecting a small amount of lipiodol through a nasal catheter into the proximal portion of the esophagus (barium should never be used).

The side of approach to atretic lesions and tracheo-esophageal fistulas is open to controversy. It is true that if only a small narrow atretic portion in the esophagus exists the right-sided approach is preferable. The reasons for this are that the arch of the aorta does not interfere with exposure, only the azygos vein need be ligated and severed to visualize the esophagus thoroughly, and an end-to-end anastomosis may be accomplished readily. However, if the atresia or the fistula involves a longer segment of esophagus, an end-to-end esophageal anastomosis cannot be accomplished. Thus if one has utilized a left-sided approach it is an easy matter to open the diaphragm, mobilize the stomach, and perform an intrathoracic esophagogastrostomy. It should be remembered also that in the newborn and in the young the aorta is not the barricading impediment that it is in older persons, since in the young it can readily be retracted out of the way.
HELLER'S OPERATION

Liver
Gall bladder
Mucosa

Triangular lig. (cut)
Hiatus
Esophagus
Stomach

FIGURE 2. The left lobe of the liver has been reflected to the left after cutting the left triangular ligament. An extramucous esophagocardiomyotomy is performed.
If a few of these pertinent facts are kept in mind, not every “blue baby” will be thought to present the tetralogy of Fallot, and an immediate and proper work-up will be instituted, thus saving many such children from unnecessary deaths.

*Diverticula of the Esophagus*

Esophageal diverticula are classified into pulsion and traction types. Surgically we are interested in the pulsion type of diverticulum, which occurs either in the neck (cervical) or immediately above the diaphragm (epiphrenic). The so-called traction type is usually located in the region of the tracheal bifurcation where the chronically inflamed tracheal lymph nodes are found. These rarely produce symptoms, since they usually have a wide ostium which forms their neck. However, more important than the classification is appreciation of the pathologic physiology which underlies the formation of this condition. It is believed that one of the prerequisites for the pulsion type is a weakness in the muscular wall, which permits herniation of the mucosa through the weak part and results in a diverticulum. No symptoms are produced as long as the opening into the diverticulum is large. However, as food slowly packs into the diverticulum the latter increases in size and drops downward. This process continues until the weighted sac hangs downward and produces pressure upon the esophagus, obstructing it. It should be noted that in such far-advanced stage food has easier access to the diverticulum than to the esophageal lumen proper. Dysphagia is the outstanding complaint, and diverticulitis, perforation and mediastinitis are the more common complications.

In this day of chemotherapy, improved surgical technique, modern anesthesia and proper postoperative care, the one-stage diverticulectomy is preferred over the two-stage procedure. Although removal of the diverticulum is preferred, diverticulopexy still has its place. The latter procedure, in which the diverticulum is dissected free and stitched upward to the surrounding structures, is deserved for the poor risk patient with marked symptoms. When this has been done, food does not have access to the downward-hanging diverticulum and thus the symptoms are relieved.

*Cardiospasm (Achalasia) of the Esophagus*

Cardiospasm is neither cardiac nor spastic. It is a condition in which there is dilatation, hypertrophy and tortuosity of the esophagus unassociated with an obstructed esophageal hiatus. Theories as to its production are numerous and will not be discussed here. This condition is twice as common in females as in males, and in
a rather large percentage of cases a history of emotional strain or psychic trauma can be elicited.

The outstanding symptoms are dysphagia, regurgitation and pain. Complete esophageal obstruction for varying periods has been noted, even to a point where the patient cannot swallow his own saliva. The pain is usually retrosternal and varies from mild to severe. Morphine addiction has resulted from this condition.

The roentgen film is of particular help in diagnosing cardiospasm. Recently Kramer and Ingelfinger described the mecholyl test as an aid to the diagnosis of cardiospasm. When mecholyl, a parasympathomimetic drug, is injected into a normal person there is only a slight increase in tone and magnitude of esophageal contractions. However, in patients with cardiospasm, marked esophageal spasm and contractions follow administration of the drug. Complications that may be associated with the condition are bronchitis, bronchiectasis and pulmonary abscess. All of these may result from aspirated material regurgitated from the esophagus.

Medical management includes psychotherapy, antispasmodics and dilatation. Surgically many types of procedures have been advised, which include cardioplasties, cardiomyotomies, resections and anastomoses. The procedure of choice is Heller's operation, which is a transabdominal extramucous esophagocardiomyotomy. This is simple to do with a negligible morbidity and mortality. The postoperative results are excellent (Fig. 2).

**Hiatus Hernia**

The following three types of esophageal hiatal hernias have been described: (1) the para-esophageal type, in which the stomach herniates through the esophageal hiatus and lies parallel with an esophagus of normal length; (2) the sliding type, in which the stomach is herniated through the hiatus but has pushed an esophagus or normal length upward, thus rendering it tortuous, and (3) the hiatal hernia with a congenitally short esophagus, in which the upper part of the stomach is herniated through the hiatus because the esophagus has never attained its normal length.

The last-mentioned type can be diagnosed by the esophagologist when he records the appearance of gastric mucosa at an unusually high level, indicating a short esophagus. Hiatal hernias may be observed as a coincidental finding in taking gastro-intestinal roentgen films. Such hernias rarely if ever produce symptoms. Although many advocate leaving them alone, the danger of strangulation of such a herniated segment of stomach, with resulting putrid empyema and rapid death, must be kept in mind.
Many patients with hiatal hernias complain of epigastric distress, bloating, belching, anorexia, loss of weight and retrosternal pain. Such cases have been diagnosed erroneously as disease of the gallbladder, peptic ulcer, gastritis or coronary disease. These errors can be avoided if the possibility of hiatal hernia is kept in mind and if roentgen films are taken with the patient in the Trendelenburg position, which would readily demonstrate herniation that might otherwise be overlooked.

The surgical repair of a para-esophageal hernia or a sliding type of hernia is simple, since all that is necessary is reduction of the herniated stomach and tightening of the esophageal hiatus. It is the hernia associated with a congenitally short esophagus that presents a problem. For such a lesion I have devised a procedure by which the hiatus is incised and enlarged and the defect increased. This is accomplished by herniating more stomach into the thoracic cavity, thus removing the pull on the congenitally foreshortened esophagus. The esophageal hiatus is then loosely sutured around the stomach. In the poor risk patient phrenicotomy might produce gratifying results.

**Portal Hypertension**

This condition results from increased pressure in the portal system and is almost always observed at the lower end of the esophagus (recent studies reveal, however, that varices may occur in any part of the esophagus). Portal hypertension may be due to intrahepatic or extrahepatic causes. The usual condition causing intrahepatic block is cirrhosis of the liver. Extrahepatic block may be due to phlebitis, thrombosis, fibrous stenosis or cavernomatous transformation of the portal vein; it may be congenital or acquired.

One does not refer to Banti's disease in these modern times, but rather to Banti's syndrome. This is characterized by splenomegaly, anemia, esophageal varices, ascites and leukopenia. The syndrome has been produced experimentally by Whipple, who blocked the portal vein. If the block is due to an intrahepatic lesion the liver function tests will give positive results, whereas if the portal block is extrahepatic the results of these tests are usually negative. If the condition is in a quiescent stage it may be safe to take an esophagram, which will reveal the pathognomonic "beaded" appearance at the lower end of the esophagus.

Since hemorrhage from a ruptured esophageal varix may be fatal, definite measures must be taken to prevent recurrence. Some of the therapeutic procedures advocated are injection of the varix with sclerosing agents, tamponade with oxycel or gel-fonam through the esophagoscope, ligation of the coronary vein,
esophagogastric resection to remove the "pile-bearing" area, and various forms of portacaval shunts. More recently splenic artery ligation, splenectomy, and hepatic artery ligation have been advocated. The author has performed three of the latter procedures following the suggestion of Rienhoff.

Portacaval shunts have attained a certain degree of popularity in the past few years, and various types of anastomoses have been attempted in order to shunt the blood from the portal to the caval system. It is my opinion that, rather than the time-honored end-to-side portacaval shunt (Eck fistula), a lateral anastomosis between the portal vein and the inferior vena cava will prove to be the method of choice. This is accomplished best through a right thoracoabdominal incision in which the costal arch is divided, making it possible to dislocate the right lobe of the liver into the right thoracic cavity. When this approach is used, the portal vein and the inferior vena cava practically approximate themselves, thus avoiding the necessity of dissecting out the common duct and the hepatic artery. It seems preferable also to permit some portal blood to continue through the liver rather than make a complete division of the portal vein. Only time will tell the efficacy of these measures.

Carcinoma of the Esophagus

What was considered a hopeless and inoperable condition only a decade ago presents at least a worthwhile challenge to the doctor of today. If present impressions are correct, the overall outlook and prognosis for the patient with carcinoma of the esophagus is better than the 5 per cent, five-year "cure" for carcinoma of the stomach.

It is of practical value to divide the esophagus into zones. Many such divisions have been described. One that has served me well divides the organ into three zones, namely, an upper (Zone 1), which extends from the beginning of the cervical esophagus to the manubrium sterni; a middle (Zone 2), which extends from the manubrium sterni to the inferior pulmonary ligament, and a lower (Zone 3), from the inferior pulmonary ligament to the esophagogastric junction.

Early diagnosis is of paramount importance in cases of this type of carcinoma, since it is by this means that the survival rate can be increased. One often hears mention of a "change in stool habit" as a probable symptom of carcinoma in the lower intestinal tract; in like manner it may be stated that "any persistent change in the swallowing habit is an indication of carcinoma of the esophagus until proved otherwise." Were this dictum to be heeded and such cases further investigated by means of esophagoscopy and
roentgen study, then many esophageal neoplasms would be operated upon earlier.

Treatment

Needless to say, preoperative and postoperative therapy for these patients is of the utmost importance, and much has already been written concerning these phases.

For lesions located in Zone 1 the Wookey procedure has been used, especially for a tumor situated in the cervical portion of the esophagus. Recently, however, lesions involving the superior mediastinal segment of the esophagus as well as the cervical part have been approached by a more radical procedure, which removes the thoracic portion of the esophagus and most of the cervical portion. This is accomplished through a thoracic phase of the operation and a cervical phase. The operation is completed by an intracervical end-to-side esophagogastricostomy. In placing the mobilized stomach in the neck the surgeon may find that the thoracic inlet impinges upon the stomach. If this is the case it may be necessary to remove the inner half of the clavicle and the first rib. Whether the mobilized stomach should be placed behind or in front of the arch of the aorta is a moot question and must be decided by the surgeon at the time of operation.

Lesions of Zone 2, or those which involve most of the thoracic portion of the esophagus, are removed by a rather standardized procedure in which a wide esophageal resection is accomplished, followed by an end-to-side supra-aortic esophagogastricostomy or esophagojejunostomy (Fig. 3). When the jejunum is used it may be necessary to do a Roux “Y” anastomosis or some modification thereof.

Lesions of Zone 3 include not only the lower end of the esophagus but the gastric cardia as well. I prefer a thoracolaparotomy incision in which a left rectus incision extends across the left costal arch, dividing it and then continuing into the eighth intercostal interspace. The diaphragm is divided to and through the esophageal hiatus, and the esophagus is mobilized from the aortic arch to its entrance into the stomach; the latter is then mobilized to the pylorus. The right gastric and gastro-epiploic arteries should be left intact. An esophagogastric resection is then accomplished and is followed by an end-to-side esophagogastricostomy. If necessary the spleen and part of the pancreas are removed.

In most of my esophageal operations water seal drainage is preferred, and a Levine intragastric tube is permitted to remain in place for the first three postoperative days. I cannot subscribe to the teaching that these tubes may be harmful. Routine portable
roentgenograms are taken 24 hours after operation to determine the pulmonary status.

**Palliative Procedures**

Although the primary lesion may be extensive or may even show distant metastases, it is always worthwhile to attempt a palliative resection, thereby improving the patient's general condition and sense of well being. This is explained by the fact that infection is reduced and anemia is corrected. In the event that it is impossible to remove the primary growth, some short-circuiting procedure, such as an esophagostomy or an esophagojejunostomy may make the patient's remaining days more comfortable.

**Benign Tumors**

Lipomas and myomas are the most common of benign tumors which have been found in the esophagus. Owing to the constant effect of swallowing, such tumors have a tendency to become tremendously elongated and pedunculated. They have been known to be coughed up and to appear in the patient's mouth. If this occurs it may be possible to remove the lesion by means of a snare passed orally. If the tumor, however, is lower down, esophagotomy with removal of the tumor and primary closure of the esophagus is the treatment of choice.

**Perforations of the Esophagus**

Both spontaneous and traumatic rupture of the esophagus have been described in the literature. A spontaneous rupture is an interesting lesion and is not so extremely rare as it was formerly thought to be. If one has the condition in mind it should be possible to diagnose it preoperatively. It is found most frequently in male patients who are victims of alcoholism, and is associated with a preliminary severe bout of vomiting; this is followed by agonizing pain, which may be either thoracic or abdominal. The patient usually goes into rapid and profound shock. This condition cannot be confused with a ruptured peptic (gastric or duodenal) ulcer, since with the ruptured ulcer the pain appears first and is followed by vomiting, whereas with the spontaneous rupture vomiting comes first and is followed by pain.

The ruptured esophagus is associated frequently with surgical emphysema, which can be felt in the neck. Whenever such emphysema is noted one should think immediately of spontaneous esophageal perforation and verify this with a flat roentgen film, which will reveal a spontaneous hydropneumothorax. Aspiration of the chest has been done in some cases, resulting in the discovery of food particles or vomitus. Formerly the mortality was
thought to be 100 per cent; however, with early diagnosis and modern surgical therapy the outlook is much better today, and some patients are definitely being saved.

Mediastinitis

Perforation of the esophagus may result in a serious condition, mediastinitis. Malignant tumors or foreign bodies are the two main causes of perforation. Since carcinoma develops gradually, it does not give rise to as extensive an infection of the mediastinum as do other lesions.

Perforations caused by foreign bodies are of more practical importance. At present it is felt that mediastinal infections which extend deeper than the fourth or the fifth thoracic vertebra cannot be adequately drained by means of cervical mediastinotomy and must be treated by posterior mediastinotomy. Chemotherapy is an all-important adjunct for this type of infection.

In a presentation of this type it is impossible to mention every aspect of esophageal pathology. Only the more common and frequent conditions have been stressed. The esophagus has been just as much of a “hermit” as the pancreas; however, recently it has been brought within reach of the well equipped and well trained surgical team. That this organ is accessible to modern diagnostic and therapeutic procedures is due to the efforts of such men as Franz Torek, Sauerbruch, Garlock, Sweet, Nissen and others too numerous to mention. Their contributions have enabled the modern surgeon to save many lives that were doomed a decade ago. Today the future for esophageal surgery is most promising.

SUMMARY

The more common pathologic conditions which affect the esophagus have been discussed, and their treatments have been evaluated. The importance of physiopathology as an aid to early diagnosis has been stressed.

Since the advent of improved diagnostic methods, modern anesthesiology, chemotherapy, skillful surgical technic, and proper preoperative and postoperative care the esophagus has been brought into the realm of surgical safety.

RESUMEN

Se discuten las condiciones patológicas más comunes del esófago y se evalúa su tratamiento. La importancia de la fisiopatología como auxiliar para el diagnóstico temprano se hace notar.

Desde el advenimiento de métodos mejorados de diagnóstico, la anestesiología moderna, la quimioterapia, el desarrollo de mejor
técnica quirúrgica y los cuidados pre y postoperatorios, el tratamiento de las afecciones del esófago ha entrado en una fase de seguridad quirúrgica.

RESUME

L'auteur discute les aspects anatomiques les plus communs des affections oesophagiennes et leur traitement. Il insiste sur l'importance de la physio-pathologie, pour permettre un diagnostic précoce.

Depuis que les méthodes de diagnostic ont fait de grands progrès, que l'anesthésie s'est modernisée, que la chimiothérapie est apparue, et que les techniques chirurgicales sont plus sûres, ainsi que les soins pré et post-opératoires, on peut entreprendre avec sécurité des opérations sur l'oesophage.