others, have shown. Complete primary union without drainage, as obtained elsewhere, is impossible under any condition after œsophagotomy.

As far as the feeding of the patient is concerned, it is necessary in exceptionally weak individuals to pass a drain through the nose into the stomach and allow this to remain in place for the first few days. Fairly well nourished patients can be fed by the rectum for a few days, after which the patients are allowed to swallow nourishment. In some cases this can be done a few hours after operation. Where the open method of treatment is employed, nourishment for the first eight days is provided through the tube inserted into the wound. After this the tube is removed and the patient allowed to swallow. In the beginning the wound in the œsophagus can be held closed by using two fingers.

It is only recently that this operation has been more frequently employed. The relatively high mortality, about 24 per cent. (Fischer's statistics, with the addition of the cases compiled by Egloff, Fedoroff, and Bull-Walker, show 184 cases with 45 deaths), cannot be referred to the operation itself, but to the ulceration, perforation, and gangrene of the œsophagus, erosion of bloodvessels, exhaustion, etc., produced by the foreign bodies. In other words, the high mortality is due to the fact that œsophagotomy was performed too late. The operation itself is not very dangerous; thus all of the 9 cases operated upon in Billroth's and Gussenbauer's clinic from the year 1880 to 1897 recovered.

Gastrotomy and Gastrostomy.—Removal through the stomach is indicated in all cases of foreign bodies situated too low in the thoracic portion to be reached by œsophagotomy, which cannot be removed by the latter operation or by other means. It is adapted therefore to cases in which foreign bodies are situated 26 cm. or more from the teeth, as well as those situated near the cardial end of the œsophagus, particularly in case of large, angular, irregular-shaped bodies.

For the surgeon who is skilled in the use of the œsophagoscope the indications for gastrotomy will be as infrequent as for œsophagotomy, particularly in case of rounded hard bodies which do not produce injury. Artificial teeth, bones, apricot-stones, etc., situated below the bifurcation and at the level of the diaphragm, can usually be extracted without difficulty or danger. Occasionally where the tube is passed far down, dilatation of the œsophagus will result in the body passing into the stomach or in allowing it to be easily pushed down. In case foreign bodies are lodged immediately above the cardia, even where they are liable to produce injury, the latter procedure is justifiable. Even if gastrotomy should be subsequently indicated, the latter operation is much simpler and less dangerous where a foreign body is located in the stomach than where it is firmly impacted in the œsophagus. It might be possible in difficult cases to extract a foreign body situated low down in the œsophagus through the gastrotomy-wound by loosening the foreign body during anæsthesia with forceps by the aid of the



œsophagoscope, so as to place it within reach of the finger passed through the stomach.

In the removal of foreign bodies situated low down in the thoracic portion there is always the disadvantage that this portion of the œsophagus cannot, like the cervical portion, be exposed, and that therefore operation must be carried out in the dark. Gastrotomy and gastrostomy must now be considered.

Gastrotomy is particularly applicable in cases in which foreign bodies are situated near the cardia and the œsophagus is normal. Various methods may be employed:

1. The index finger may be introduced into the stomach through a small opening high in the fundus. (Wilms.) The finger is surrounded by a purse-string suture which holds the stomach-wall in close contact with it, and the anterior wall of the stomach is pushed in sufficiently to allow the finger to pass through the cardia to the foreign body.

2. Method of passing instruments (forceps, etc.) through an opening in the stomach, the latter being held well beyond the edges of the abdominal wound. By this method Trendelenburg was able to remove artificial teeth through a small opening in the stomach with forceps.

3. Method of passing the hand into the stomach after the latter has been opened and retracted with ligatures. (The incision in the stomach should be about 13 cm. long.)

4. Method of passing the hand into the stomach after the latter has been temporarily sutured to the abdominal wall and only subsequently opened. (Trendelenburg, Quadflieg.)

5. Method of employing a string.[1]

Where the foreign body was situated high up, a small sound was passed either from above or through the stomach. To this was attached a piece of string armed with a sponge or piece of drainage-tube, the purpose of the latter being to pull the foreign body upward into the mouth or down into the stomach (Bull, Finney, peach-stone). This procedure and attempts at removal in general are rendered easier by previously performing œsophagotomy, although rarely except in children is it possible to make the fingers touch when passed into the stomach and the wound in the neck, respectively.[2]

Only by the method of Wilms (folding in the anterior wall) or by passing the hand into the stomach is it possible to enter the cardia with the finger, and even then it may be very difficult. If the stomach is drawn forward and retracted and only one finger inserted, it is impossible to reach the cardia, which is situated at about 20 cm. from the anterior abdominal wall. In more difficult cases, particularly those in which foreign bodies are impacted above the cardia, and in which various procedures are necessary in order to loosen and bring down

[1] It is assumed that the methods described under 2, 3, and 4 have previously been performed.

[2] This was repeatedly attempted on the cadaver at Trendelenburg's clinic by Wilms and by the author, and always failed.

the former, passing in the whole hand will be the most practicable method, experience having shown that a smaller incision of the stomach is not adequate in complicated cases. (Richardson, Wallace, and others.)

The entrance of stomach contents into the abdominal cavity should be carefully avoided by retracting and packing around the stomach. The method described under 4 should only be employed when the stomach is well drawn forward and retracted.

The opening of the cardia is frequently obstructed by folds. Entrance into the latter may be facilitated both when using the index finger alone according to Wilms, or when the whole hand is passed into the stomach by pushing the finger along the lesser curvature, by stretching the stomach in this direction, or by lifting up the right wall. (v. Hacker.) Where the incision into the stomach is larger, the walls can be held apart and the cardial opening exposed to view.

The abdominal incisions employed are either Fenger's parallel with the left costal arch, or a longitudinal incision at the outer border of the left rectus muscle; more recently a median incision has been employed. The fold of the stomach is drawn forward and retracted and opened by an incision parallel with the greater curvature, or, better, parallel with and between the bloodvessels. The edges of the stomach are grasped with clamps or held by ligatures and drawn over the edges of the abdominal wound, and then held sufficiently far apart to allow the operator to pass in one hand. After removal has been completed the wound in the stomach should be carefully sutured.

Gastrotomy for the removal of foreign bodies from the lower portion of the œsophagus has produced excellent results in selected cases. In 15 cases (Richardson, Bull, Trendelenburg, Finney, White, Wallace, Morton, Lejars, Stunbo (Romm), Fl. Edmunds, Thiriar, Quadflieg, Wilms, Hansy) extraction was successful; 2 of these died and 13 recovered. Gastrotomy was unsuccessful in 4 cases. (Stelzner, Henle, Enderlen, Jacobson.)

Gastrostomy combined with the string method discussed under gastrotomy, is particularly serviceable in cases in which foreign bodies are situated at a distance, and in which there is tight stricture of the œsophagus, the object being to dilate the latter at the same time. It may also be successful in cases in which the œsophagus is normal, in the presence of soft or rounded bodies that are not liable to produce injury.

Dorsal or Thoracic Œsophagotomy.—Œsophagotomy through the posterior mediastinum is the method of last resort in the case of foreign bodies lodged in the intrathoracic portions of the œsophagus (particularly below the bifurcation) when—and only under such conditions—these bodies cannot be removed by other more conservative method and purulent mediastinitis is apprehended.

The dangers of dorsal mediastinotomy (see page 56) are increased by opening the œsophagus through the wound of the former. Gastrotomy should be previously performed for the purpose of supplying



nourishment to the patient. If the pleura has remained intact, the œsophagus should be opened at once. Where there is extensive injury of the former this should be postponed till there is firm adhesion of the layers of the pleura, the wound having been packed with iodoform gauze for several days.

This operation has been performed twice to remove artificial teeth (Henle, Enderlen; Forgue opened only the mediastinum). Enderlen's patient was the only one to recover, but in consequence of abscess of the liver and subphrenic abscess (preliminary gastrotomy had not been performed) convalescence was protracted; the œsophageal fistula closed only after nine months.

**Treatment of Complications of Foreign Body in the Œsophagus.**—The most important complications which follow the swallowing of foreign bodies are hemorrhage and phlegmonous processes resulting from injuries of the œsophagus. There may be severe hemorrhage where the foreign body is situated partially or entirely within the œsophagus, or where in case of perforation it is situated outside and adjacent to the latter. Hemorrhage may also take place after removal of the foreign body through the mouth or through the œsophagotomy-wound. Where œsophagotomy has been performed there is hemorrhage from the wound, otherwise it occurs from the mouth. There may or may not be vomiting of swallowed blood.

Hemorrhage from the mouth is caused by injury of the vessels of the neck, less frequently by injury of one of the œsophageal vessels. Its occurrence will necessitate exposure and ligation of the respective vessels. As soon as the seat of the foreign body has been determined œsophagotomy should be performed. In the course of the latter operation the injured vessel should if possible be ligated before the œsophagus is opened. The presence of hemorrhage into the tissues surrounding the œsophagus before the latter has been opened would point to perforation of the latter and render it advisable to search carefully for the injured vessel in the tissues surrounding the wound of the œsophagus in order to tie it, at a time when the parts are not displaced and the contents of the œsophagus have not escaped. Not till then should the œsophagus be opened and the foreign body removed. If there is no perforation of the œsophagus, hemorrhage must arise from one of the vessels in the wall of the œsophagus. This may be the case also where the œsophagus has been perforated by a foreign body, but the accident is rare.

If during the operation there are no signs of perforation in the surrounding tissues, and if upon opening the œsophagus it is seen that the foreign body has penetrated the wall of the œsophagus in another direction, and if this site is surrounded by blood-clots, it is advisable to look for an injured vessel in the wall of this portion, or even to dissect out the tissues surrounding the œsophagus at this site in order to find the injured vessel.

In nearly every instance of hemorrhage in case of foreign body the former is due to erosion of one of the vessels of the neck, whether

it takes place before or after removal of the foreign body or after œsophagotomy. Of the smaller vessels, the inferior thyroid artery or its branches is most frequently injured. For this reason it has been proposed to tie this vessel in those cases in which it is impossible to find the injured vessel in the wound. This is an uncertain procedure, as among the cases published hemorrhage has resulted also from injury of the ascending cervical artery (Rose), common carotid artery (Billroth), internal jugular vein (Gerster, Weinlechner), and the œsophageal veins (Hochenegg).

If hemorrhage is serious and the injured vessel cannot be found, it will be necessary to tie the common carotid artery in its lower third. If it is uncertain whether the ligated vessel is the actual source of hemorrhage, or if during the operation the carotid artery is found lying close to the foreign body or to the focal abscess caused by the latter, and if it is uncertain whether the walls of the vessels are injured or not (Ardle), a provisional ligature may be passed about the carotid without being tied, according to Annandale's suggestion. If secondary hemorrhage does not take place, the ligature can subsequently be removed.

Where there is severe secondary hemorrhage from the wound after œsophagotomy the same procedure may be employed. Whether hemorrhage is caused by injury of a large vessel during operation or, as has more frequently been the case, is caused by pressure-necrosis from an œsophageal tube inserted for the purpose of supplying nourishment, the above method should be employed. It is advisable not to choose too large a tube. The latter should preferably be left in place for a few days only. (See Decubital Ulcers.)

Where hemorrhage occurs after removal of the foreign bodies by œsophagotomy death generally takes place instantly, as in the cases of Bose, Krönlein (inferior thyroid artery), Gerster, and Weinlechner. Ligation of the injured vessel is rarely followed by recovery (inferior thyroid artery, Frew; inferior thyroid vein, Krönlein). Even where, after severe hemorrhage, the opening in the vessel is temporarily closed by a blood-clot and the vessel can be quickly tied (Billroth, carotid) the patients soon die from loss of blood.

*Treatment of Retro-œsophageal Abscess, Empyema, and Pyopneumothorax.*—Contrasted with those cases mentioned above, in which the foreign body produces an ulcer or circumscribed abscess, there are other cases in which abscesses of the neck or rapidly advancing inflammation of the submucous and peri-œsophageal tissues as a result of infection of the site of injury by the decomposing body or by the entrance of decomposed food occur. This is particularly liable to happen where perforation is caused by the stomach-tube.

It is of practical importance that these phlegmonous processes following ulceration, perforation, or gangrene of the œsophagus, which may lead to suppuration of the pleura, to pneumonia, and gangrene of the lungs, as a rule first involve the loose connective tissue between the vertebral column and the œsophagus, and then extend from the



latter. Accordingly one can hope to check the progress of the disease by opening this space early. Unfortunately, however, these processes show a septic tendency from the outset, more frequently causing diffuse seropurulent infiltration of tissues than the formation of pus.

The onset of abscess is characterized by fever not necessarily high, occasionally ushered in by chills, accompanied at times by marked swelling of the pharyngeal mucous membrane (at times there is distinct swelling of the posterior pharyngeal wall), also pain on swallowing or moving the neck, frequently also difficulty in breathing, which may develop into asphyxia if œdema of the glottis should occur. These symptoms may rapidly lead to the formation of a fluctuating retropharyngeal abscess. If the abscess extends lower down or is situated lower down from the outset, there will be tenderness of the neck and a doughy swelling at one or both sides of the trachea and larynx, with or without crepitating emphysema. The neck has been found inflamed and swollen, and the cellular tissue at the side of the œsophagus infiltrated with pus as early as two or three days after injury of the œsophagus. In a number of cases in which a bone had been swallowed there was gangrene of the wall of the œsophagus, as well as abscess of the mediastinum and pleuritis, on the fourth day after the accident. Subcutaneous emphysema of the neck is an extremely important and ominous symptom. In case of foreign bodies perforation of the œsophagus will first be thought of. In abscesses which rapidly undergo ichorous decomposition emphysema may be due to the formation of gas.

In all cases of abscess caused by foreign bodies, as well as in many cases of abscess of the neck, an external incision like that employed for œsophagotomy should be made. By means of the latter the site of perforation should be exposed, the foreign body removed, and all purulent or ichorous tissue opened up. If the abscess extends behind the viscus, or even to the opposite side, or if the body has perforated in that direction, a similar incision should be made on the other side also and carried well into the retro-œsophageal tissue, so that this space may be packed with iodoform gauze from both sides; at the same time treatment should be directed toward suppuration proceeding in other directions (trachea, retropharyngeal space, etc.).

The *prognosis* of existing abscess of the neck is usually unfavorable. Even when it is possible by means of operation to prevent its progress, aspiration of septic material may have already caused fetid bronchitis, pneumonia with subsequent abscess or gangrene of the lungs, and ichorous pleuritis. The conditions become still more unfavorable when abscesses extend into the thorax, or if the foreign body has produced an injury and abscess in the latter region. In these cases abscesses develop in various directions (pleura, pericardium, stomach, with secondary affections of the lungs, empyema, pyopneumothorax); also hemorrhage from the thoracic vessels (aorta), etc., besides direct perforation of neighboring organs by foreign bodies.

Very rarely injury or perforation of the œsophagus by a foreign body is followed by empyema or pyopneumothorax. Empyema may

originate in the neighborhood of the perforation if the latter is situated in the thoracic portion, cases being known where, corresponding to the anatomical situation, perforation took place directly into the pleural cavity, the foreign body escaping into the latter, or where the perforation was situated higher and at a distance, in which empyema was caused by secondary rupture of the retro-œsophageal abscess into the pleural cavity. Finally, purulent ichorous pleuritis may occur as in Fischer's case, following perforation of the pharynx, through the medium of a putrid bronchitis, pneumonia, and gangrene, caused by septic infection of the respiratory organs.

Whenever in such cases there is exudation into the pleural cavity, the latter should be immediately opened by extensive incision. The same is true in case of exudation into the pericardium as soon as exploratory puncture shows pus.

In those cases in which abscesses of the neck extend into the superior mediastinum or in which abscesses originate in the latter and ascend to the neck, the easier or less dangerous operation should be performed, namely, opening the abscess in the neck, from which region the third dorsal vertebra can be reached (cervical mediastinotomy). If the operation is unsuccessful, or if the abscess is situated lower down in the mediastinum, it may be necessary to consider opening of the posterior mediastinum through the back (dorsal mediastinotomy).

For cervical mediastinotomy, Heidenhain recommends entering above the sternoclavicular articulation (particularly where transverse incision is employed), and between both heads of the sternocleidomastoid muscle, or better still by dividing the latter from the clavicle and advancing on the right side between the common carotid artery and the jugular vein, and on the left side to the outer side of both structures. In two cases the author was successful by making a longitudinal incision along the inner border of the sternomastoid muscle and advancing on the inner side of the large vessels. The localization of pus or subcutaneous emphysema will generally offer information as to the proper route to pursue. Of 6 cases in which the mediastinal cavity was thoroughly opened and drained through the neck, 4 recovered. (Heidenhain, Rasumowsky, v. Hacker, König, Dobbertin.) In the author's case there was perforation of the thoracic portion of the œsophagus by a bougie. Two cases died. (Ziembicki, v. Hacker.) In 2 cases (Ziembicki, König) perforation of the œsophagus by pieces of bone was positively determined.

Nasiloff was the first to suggest rules for opening the posterior mediastinum through the back (dorsal mediastinotomy). Further studies on the cadaver were conducted by Quénu and Hartmann, by Potarca and Bryant. According to the author's investigations on the cadaver, it is possible to expose the œsophagus on either side above the arch of the arota, but it is better to carry out the operation on the left side, as here the œsophagus lies nearer the incision. The same thing was pointed out by Bryant and Nasiloff. Below the arch of the aorta it is easier to gain access and separate the pleura on the right side.



(Bryant, Nasiloff, Potarca.) Quénu and Hartmann recommend proceeding on the left side in all cases, for the reason that on the right side the pleura extends farther behind the œsophagus in the form of a blind sac. Enderlen recommends proceeding on the left side above the bifurcation, on the right side at the level of the fifth and sixth dorsal vertebræ, either the right or left side below the latter as far as the diaphragm.

Incision is generally made longitudinally, midway between the median line and the border of the scapula, dividing and retracting the muscles, the patient being placed either on his back or the opposite side. Quadrilateral (Bryant) or circular flaps, including skin and muscle, extending outward to the inner border of the scapula with the base over the spinous processes (Rehn), have been recommended. After exposing the ribs one of the middle ones is carefully resected subperiosteally, then the others, as many as are necessary. If there is only abscess formation, sufficient room will usually be provided by the resection of 4–6 cm. of three or four ribs, taken from the region of the articulation between the rib and the transverse process. The author does not consider resection of one or two processes (Heidenhain) necessary or advantageous. The separation of the pleura should commence at the transverse process of the vertebræ. If it is intended to expose the œsophagus, etc., it will be necessary to resect greater portions of the ribs (about 10 cm. from as many ribs as necessary, usually about six). During the operation care must be taken that the pleura is not lacerated by the edges of the rib through violent respiratory movements, as happened in Rehn's first case.

Except in those cases in which it was performed on account of caries of the vertebræ (Treves, Schäffer, Aufrecht, Vincent, and others), this operation has been performed on the living subject in only a few cases. Rydygier operated on the right side in a case in which after removal of cervical lymph-glands an abscess developed into the posterior mediastinum. He was successful in separating the pleura (as was true when Obalinski and the author operated on the cadaver). Up to the present time there has not been a single case of acute abscess cured by posterior mediastinotomy (Cavazzani operated in a case of chronic abscess).

In order to reach the œsophagus, Rehn, Forgue, Henle, and Enderlen operated upon the right side; Llobet, on the left side. Rehn and Forgue operated below the arch of the aorta, the former in a case of stricture due to swallowing sulphuric acid and of carcinoma, respectively; the latter, in a case in which a large copper coin had been swallowed. In all 3 cases the operation was interrupted by dangerous symptoms. Rehn was successful only in his second case; both patients died as a result of the operation. After unsuccessfully performing mediastinotomy Forgue finally removed the coin through the mouth with a Gräfe's coin-catcher. Llobet, after resecting part of the fourth to the eighth rib on the left side, divided a cicatricial stricture of the œsophagus (22–26 cm. from the teeth); death resulted from

mediastinitis and pleuritis. The cases operated upon for foreign bodies have already been discussed. Except in the case of Forgue, in which the operation was interrupted, the pleura was almost always injured, either during resection of the ribs, during its separation, or subsequently by the sharp edges of the ribs. Of the 5 cases operated upon with the object of sufficiently exposing the œsophagus (Rehn, 2; Henle, Llobet, and Enderlen, 1 each), all except the last died as a result of the operation.

Till further experience has been gained, this operation, which is in itself serious, and which is almost sure to be followed by pyopneumothorax, is principally justifiable in abscess of the posterior pleural cavity following perforation of the pharynx and œsophagus, as it may certainly be expected that in some cases this operation may prevent an otherwise certain fatal termination. In the presence of foreign bodies the latter could be removed from the œsophagus or from the peri-œsophageal tissues by incision, or in case of perforation into the pleura they could be removed from the latter. At the same time any existing purulent ichorous exudation into the pleural cavity could be removed at once by incision.

# CHAPTER IV.

## DISEASES OF THE ŒSOPHAGUS.

### INFLAMMATORY PROCESSES OF THE ŒSOPHAGUS.

**Acute catarrhal inflammation of the œsophagus,** which may be caused by irritation of the mucous membrane by foreign bodies, scalding, or irritating substances, is characterized by moderate mucoid secretion. Where inflammation is more severe there may be loss of epithelium, resulting in superficial erosions and ulcers, which usually heal without causing any complications.

**Chronic catarrhal inflammation of the œsophagus** occurs in alcoholics, also as a result of irritation caused by food accumulating in the dilated portions above the stenosis, in cases of diverticulum and carcinoma, also in the form of a congestive catarrh in chronic cardiac diseases. It is characterized occasionally by hyperæmia, leading to ectases, and marked thickening of epithelium. On œsophagoscopic examination there are seen a whitish cloudiness and a loosening of the mucous membrane, which secretes a mucoid, sticky substance; occasionally also there is slight dilatation of the œsophagus. In certain cases there occur circumscribed papillary proliferations as well as flat ulcerations; more rarely there are deeper ulcers. Where the inflammation continues for some time there may be thickening of the mucosa and the muscular coat (seldom leading to actual constriction); in other cases there are relaxation of the muscle and diffuse dilatation of the œsophagus. (Zenker-Ziemssen.)

**Catarrhal œsophagitis** may occasionally be followed by swelling of the follicles and result in a *follicular œsophagitis;* or if followed by dilatation of the follicles, small abscesses may occur, and by confluence of the latter *phlegmonous œsophagitis* may develop.

**Croupous, necrotic,** and **diphtheritic inflammation of the œsophagus** possesses surgical interest in so far as deposits of fibrinous pseudomembrane or dense infiltrations of the mucous membrane have been observed in the œsophagus; also in rare cases true diphtheritic ulcers, with subsequent cicatricial formation, occurring after extension from the pharynx or associated with acute infectious diseases (typhoid, measles, scarlatina, smallpox, sepsis, diphtheria, etc.). Such stricture formations have been recently observed, particularly after so-called diphtheria. (Leube-Panzaldt, v. Eiselsberg, Ehrlich, v. Hacker.) In the three last-named cases the stricture was always situated near the level of the bifurcation. In the author's case and that of Ehrlich it was particularly difficult to dilate the stricture.