found in the wall itself. In cases of compression, moreover, a softer, easily flexible instrument will frequently accomplish more than a rigid one.

On repeated examination of a stricture one can determine in what direction, by what manipulations (turning, advancing and withdrawing, gliding along a certain part of the wall, etc.) the bougie can be passed along the right path through the stricture. Free lateral motion of the bougie before entering the constriction would point to dilatation above the stricture.

It is seldom possible to determine positively the length of the stricture with the bougie. It may be accomplished by measuring or reading off the distance passed from the moment the instrument enters the stricture till it has passed the latter. For the purpose of determining the length and form of a stricture various moulded sounds have been constructed. B. Holmes armed a sound with wax. This is also employed in a sound recently introduced by Kelling, which is intended to take an impression of the stricture. The sounds of Schrieber and Reichmann are also intended for this purpose, besides being used for the purpose of dilatation.

After it has been ascertained by means of a bougie whether and at what level stricture is present, œsophagoscopy may be employed for the purpose of obtaining information in regard to the details of the parts above the stricture, as well as the position of the entrance into the latter (eccentric displacement of the lumen), the appearance of the passage of the stricture, particularly, however, in regard to whether it is caused by a cicatrix or by carcinoma.

In well-developed strictures caused by caustics the œsophagoscopic findings are, as a rule, very characteristic. (v. Hacker.) In the cervical portion and the portion below the bifurcation there are frequently linear, longitudinal, and macular white scars, sharply raised above the red mucous membrane. Close to the stricture the mucous membrane is even more traversed by scars. An annular stricture or a commencing tubular stricture appears as a cicatricial funnel or like the vaginal portion of the cervix. It is only in case of very superficial scar formation that the constricted portion, which is often eccentrically displaced and frequently appears like a diaphragm turned in, shows respiratory motions and radiating folds. The deeper the action of the caustic, the more immovable does the constricted portion become. In the strictured portion one will find a canal partially or completely lined with white cicatricial tissue. While in carcinoma proliferation and infiltration are characteristic features, in cicatricial stenosis there are contraction and scar formation.

Differential Diagnosis.—The differential diagnosis between carcinomatous and cicatricial stricture is comparatively easy. In the great majority of cases of carcinoma a positive diagnosis can be made even in the early stages by means of œsophagoscopy, and frequently also by extraction of portions of tissue by means of the latter method and their microscopical examination. Without œsophagoscopy the diagnosis can frequently be only a probable one unless possibly portions of carcinomatous tissue remain adherent to the bougie. In case of stricture caused by injury the history will be a guide; subsequently œsophagoscopy will be an aid to diagnosis.

In rare cases in which a stricture is not carcinomatous nor caused by caustics, one must consider cicatricial stricture following injury caused by a foreign body, or one of the inflammatory processes previously mentioned. As the strictures caused by the latter are more circumscribed and do not involve the deeper tissues to such a degree as to distort the neighboring mucous membrane, there is as a rule in these cases simply a superficial or valve-like stricture. These strictures are generally single. In cicatricial strictures the history is characteristic; also the above-mentioned temporary variation in the degree of constriction and the subsequent progressive increase. In the latter there is also the firm resistance offered to the sound by the cicatricial tissue; also the rapid response to treatment. In certain respects the site may be a guide in so far as in the lower part of the œsophagus one may think of stricture caused by peptic ulcer in the region of the bifurcation of the trachea, of cicatrization associated with cheesy degeneration and suppuration of the bronchial lymph-glands.

Stenosis of the œsophagus resulting from adhesion of the latter with cheesy, slaty, indurated lymph-glands situated at the bifurcation of the trachea, or from the formation of a traction diverticulum through cicatricial contraction, also permanent or temporary compression of the œsophagus, caused by enlarged glands, and finally also cicatricial strictures of the œsophagus resulting from abscess and rupture of lymph-glands, with cicatricial formation in the œsophagus, have been repeatedly observed. As a result of using too much force in passing bougies perforations may be produced in the spaces between the lattice-like cicatricial bands present in such strictures. As a result of suppuration of the wall there may be rupture into a bronchus. The erosion of vessels may lead to severe and fatal hemorrhage. (Krauss, Körner.)

In rare cases of stricture following peptic ulcer, or following ulcer of the cardia extending into the œsophagus (Eversmann), the diagnosis may be based on the location, the occurrence of hemorrhage if the ulcer is still open, and the severe pain felt at the moment of swallowing or a short time after, without actual interference with swallowing; also the protracted time required for the development of the stricture, as well as its occurrence in anæmic or alcoholic individuals.

Syphilitic strictures are more frequently met with in the upper portions of the œsophagus, and may be very extensive. Usually there are other symptoms of constitutional syphilis; also the response to antisyphilitic treatment. Diphtheritic stricture may be suspected following a previous diphtheria. In case of extensive strictures the scars of phlegmonous œsophagitis must be considered. Pure spastic stricture would be indicated by variable situation and varying intensity of the symptoms in nervous, hysterical individuals. Resistance to

sounds may apparently be as insurmountable as in cicatricial stricture. By means of œsophagoscopy it may be possible to determine the absence of any anatomical change in the wall. By the same method of examination it is possible to determine the principal causes of obstructive stenosis, namely, the constriction of the lumen by intra-œsophageal polyps, deposits of thrush, and foreign bodies.

Another form of obstruction which is important from the point of view of differential diagnosis is compression stenosis.

In the neck, thickening and ossification of the plate of the cricoid cartilage occurring without symptoms in old age may cause marked manifestations of constriction of the œsophagus. (Travers, Wernher.) In a similar manner marked compression stenosis in the neck can be caused by lordosis of the cervical portion of the vertebral column (Sommerbrodt), particularly where the lordosis of the cervical vertebræ compensates senile kyphosis of the dorsal vertebræ. (v. Hacker.) In the neck the œsophagus may also be compressed by struma encircling it in the form of a ring, or unilateral retrovisceral struma. This form of compression may also be confirmed by œsophagoscopic examination. Dysphagia is more severe in case of stenosis, which, according to Rose, is almost always present in malignant new growths of the thyroid gland, and which is caused by compression or direct invasion of the tumor. Carcinoma originating in the larynx, enlarged lymph-glands, and tumors of the cervical vertebræ may also cause constriction of the œsophagus.

In the thorax, as in the neck, neighboring tumors will produce stenosis of the œsophagus only where they completely surround or invade the latter, owing to the fact that the œsophagus is freely movable. Mediastinal tumors, carcinoma of the vertebræ, of the lungs or pleura, bronchial and mediastinal lymphomata (particularly tuberculosis and carcinoma) may be considered. Aneurism causes pressure stenosis only when there are adhesions with the œsophagus. Only in exceptional cases will marked hypertrophy of the heart, or marked pericardial or pleuritic exudate, cause dysphagia. On the other hand, dysphagia frequently results from large peri-œsophageal abscesses, also in cases of a pulsating diverticulum when the latter is filled.

Prognosis.—In regard to carcinomatous strictures see page 111. The chances of recovery in cicatricial stricture vary according to the extent and depth of the scar; for this reason strictures due to the action of caustics are usually more difficult to treat than those occurring after other inflammatory and ulcerative processes. On account of the tendency of cicatricial tissue to contract, strictures almost always recur, even after they have been successfully dilated, unless dilatation is regularly carried out afterward, for this treatment can never restore the normal elasticity. For this reason the number of complete recoveries is small. In children the prognosis is generally more favorable, as artificial dilatation is aided by the gradual growth of the œsophagus. (Keller.) This applies particularly to cases in which scar formation does not completely encircle the œsophagus. Following the

action of caustics the mortality is so great that those cases which do recover are generally those suffering from the milder forms. In general, of those patients which survive the immediate effects of the injury caused by caustics, one-third die from the consequences of the stricture. The prognosis is least favorable in cases in which the stricture involves larger areas.

As patients suffering from strictures are always liable to have a recurrence unless the stricture is regularly dilated afterward, and as frequently foreign bodies remain impacted in the beginning or in the course of the stricture, they are always exposed to the consequences of stricture or of the treatment necessitated by the latter. Many die of inanition or of tuberculosis. The most frequent cause of death in those treated by dilatation is perforation of the œsophagus, which may take place spontaneously as a result of ulceration, or, as is occasionally the case, rupture is predisposed by the presence of a foreign body and indirectly caused by the use of bougies. It may also be directly due to too much force in passing a sound or to the formation of a false passage, etc. It is important to note that in single instances even superficial epithelial abrasions and ulcerations without true perforation may be followed by peri-œsophageal suppuration and lead to death. According to its location, perforation is followed by pleuritis, pericarditis, mediastinitis or purulent bronchitis, gangrene of the lungs, etc. In those cases dying after operations perforation is not infrequently found to be the cause of death. Perforation is rarely caused by the operation as such (internal œsophagotomy), but generally by a previously existing ulceration.

The earlier treatment is instituted, the more favorable will be the results.

Occasionally dilatation permanently and completely removes the disturbance, even in apparently severe cases. In recent times the prognosis of apparently impermeable strictures has been materially improved by the treatment of the latter with sounds passed through the mouth or through an œsophageal fistula to the stomach fistula by methods in which the dangers of producing injury with the tip of the sound are obviated.

Treatment.—Except in those rare cases of stricture of the cervical portion in which attempts are made to divide the stricture longitudinally and to stretch the wound transversely, or in those cases in which the constricted portion is resected, strictures of the œsophagus are always treated by dilatation. According to the manner of carrying out the treatment and according to the route employed for this purpose, two methods may be distinguished:

1. Dilatation with sounds and similar instruments, which are passed through the mouth.

2. Operative treatment.

DILATATION TREATMENT.—As examination with bougies is necessary for the determination of the site, character, and degree of stricture, it would naturally suggest itself to leave in place for some time

the first sound that will enter or pass the stricture, in order to produce dilatation. Gradual dilatation, by passing bougies and similar instruments through the mouth, is therefore the method most frequently applied. Besides being employed in cases of actual stricture, it may also be successfully applied in many cases of stenosis caused by compression. In cases in which the stricture is not too tight, woven flexible bougies or woven flexible stomach-tubes are the most useful. These bougies, if softened or hardened by placing in hot or cold water, and lubricated with oil, vaselin, glycerin, or egg-albumin, will readily glide down if passed and advanced according to the rules given in describing the method of examination with bougies. These bougies may also be used by the patients themselves, provided they have been properly instructed as to the method of introducing them. The stomach-tube may be employed where, in cases of exhaustion, it is intended to feed the patient as soon as the stricture has been passed. Usually, however, the solid flexible woven bougies are employed, either with cylindrical or conical tips. In children flexible urethral bougies, particularly those with conical tips, are frequently employed. In case of moderate stricture the cylindrical bougies will answer the purpose. In tighter strictures the conical tipped bougies are employed. They more readily enter the stricture, but at the same time are more liable to produce injury. The cylindrical bougies are not employed until the stricture has been dilated to the size of a lead-pencil.

During the first attempt at passing a bougie it is impossible, as a rule, to leave the latter in place for more than a short time, as the patient usually gags and stops breathing. As soon as the patients have become accustomed to breathe regularly while the bougie is in place and allow the saliva to flow out of the mouth at the side of the bougie, the latter may be left in place for from five to ten minutes, or even one-quarter or one-half hour. Experience has shown that in the comparatively mild cases of stricture in which this method of dilatation is indicated it is sufficient to pass the bougie once or twice a day and allow it to remain in place a short time. Under normal conditions a bougie 13–14 mm. in diameter ought to pass the narrow entrance of the œsophagus without appreciable stretching of the walls. It is sufficient therefore in case of stricture to dilate till a sound of this size can easily be passed. In order to prevent the part of the bougie projecting from the mouth of the patient from being chewed, particularly in children, a piece of cork or a wooden wedge should be placed between the teeth.

In addition to woven flexible bougies there are woven bougies with a lead core (Rontier) or a core of mercury. The latter act partly by their weight, and have been recommended in certain cases by Billroth.

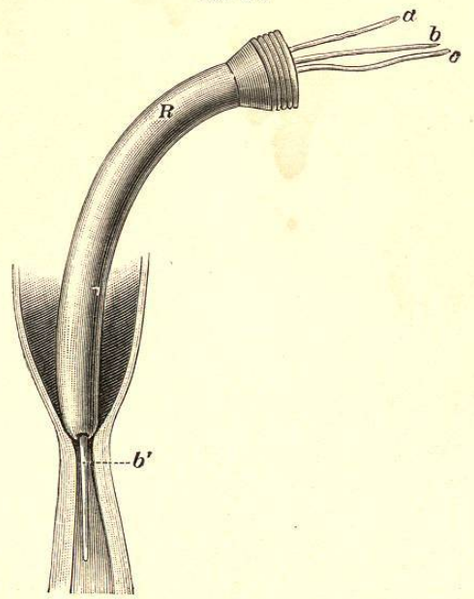
In very tight strictures the small-calibre woven flexible bougies, even if placed in very cold water, are not sufficiently stiff to pass through narrow constrictions. They bend when they reach the latter or are too large to pass through them. In such cases catgut strings are employed; they should be well rounded at the tip (but not frayed

out from frequent use). After having been passed into the constriction the gut swells, thus dilating the stricture. They may remain in place from ten to thirty minutes. Frequently it is possible to dilate very narrow strictures, particularly in cases in which the entrance is eccentrically placed, by passing a number of gut strings into a short hollow bougie which has been passed as far as the stricture (v. Hacker, Fig. 28), carefully advancing first one string and then another. This method was successfully employed by Eiselsberg.

As soon as a stricture has been sufficiently dilated with gut strings or small bougies further dilatation can be most rapidly and safely accomplished by introducing a drainage-tube drawn over a sound as a guide. (v. Hacker.)

The bougie, which should be well rounded at both ends, but particularly at its tip, is armed with a rubber drainage-tube in the following

FIG. 28.

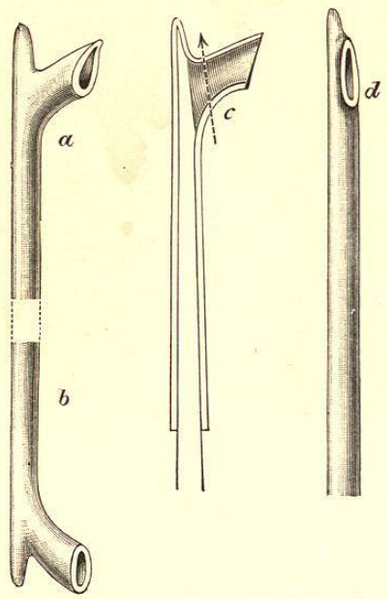


Passing thin gut strings (*a*, *b*, *c*) through a hollow bougie (*R*) into the stricture (*b'*).

manner: The bougie is well lubricated with vaselin, glyceriu, etc., the drainage-tube is then grasped at both ends and stretched sufficiently to project beyond both ends of the bougie, and by bending the tube over the tip of the sound and relaxing the tension on the tube the former will cause the walls of the tube to bulge. (Fig. 29, *a* and *b*.) Only that part of the tube projecting beyond the tip of the bougie need be cut off (Fig. 29, *c*) so as to enable it to be readily passed (Fig. 29, *d*). At the other end of the bougie the tube may project farther, or it may be tied off, to be clamped to the bougie by some special contriv-

ance. For a guide the author usually employs a new gut string covered with shellac to prevent it from swelling, or the smallest size flexible woven bougie stiffened by a core of copper wire. More rarely he employs a whalebone staff. The latter is less flexible, but for the same reason more liable to produce injury. If in passing the above instrument any obstruction is met, it is usually due to the fact that the tip is too sharp. As soon as the stricture has been passed, the drainage-tube is allowed to glide slowly along over the guide and the latter withdrawn from the tube. The drainage-tube contracts, assumes its former greater diameter, and in this way dilates the stricture. This method is so effective that strictures which hardly admit a bougie 4–5 mm. in diameter can be passed by a bougie 15 mm. in diameter after from two to three weeks. Care must be taken that the size of the tubes is increased gradually, as too large a drainage-tube

FIG. 29.



Dilating the œsophagus by means of a drainage-tube drawn over a guide.

may cause laceration of the œsophageal wall. If the tube is to be left in place for some time, it is easier to carry it out through the nose by means of a Bellocq tube than if a rigid bougie is used. It is also possible to feed the patient through the tube. The latter can be thoroughly sterilized by boiling.

The method described has been found useful in cicatricial as well as in carcinomatous stricture. In a series of cases in which, as a result of carcinomatous proliferation, the lumen had become so contracted that the patient could hardly swallow fluids, and they only in

insufficient quantity, the author found that after such a thin drainage-tube had remained in place during several hours on one or two successive days, or for one night, the patients could again swallow for weeks or months.

Besides the instruments mentioned above, various other sounds are employed in the treatment of strictures; thus, for example, whalebone sounds to the tip of which variously sized hard-rubber or ivory buttons can be screwed (Trousseau's sounds), also metal sounds with spherical tips (Rosenheim), block-tin bougies, etc.

For the purpose of gradual dilatation the passage of elastic tubes or bougies or gut strings (in certain cases olivary bougies), later dilating drains, and later still larger bougies, are most to be recommended. They accomplish all that can be hoped for in cases that are adapted to dilatation. Whatever method of dilatation is employed, it should be carried out with great care and gentleness, continued gradually, and immediately discontinued if it is followed by severe pain, stitch in the side, or fever, in order to avoid the occurrence of peri-œsophageal suppuration, perforation, etc.

Dilatation with dilatable instruments operated by springs intended to tear the stricture (dilators of Fletscher, Collin and Lefort, Vidal and Leube), also those which dilate more slowly (Jameson, v. Bruns, and Switzer), has been almost entirely discarded. More recently there have been employed dilating sounds of Senator (inserting a tent attached to a string by means of a bougie), dilatation by means of rubber tubes filled with water (Schreiber), and the sounds of Reichmann and Russel constructed on similar principles.

On account of the simplicity of the method and on account of the possibility of watching the amount of dilatation the author prefers the employment of a rubber drain drawn over a bougie to all the mentioned dilating instruments.

Dilatation through the mouth may be accomplished with the aid of the œsophagoscope.

The author first employed this method in 1888, and having used it a number of times since that time he has found that occasionally it is possible by the aid of œsophagoscopy to find the lumen with gut strings or thin, small-size bougies, and to pass a stricture that had hitherto seemed impermeable. In addition, it is possible to employ successfully his method of drawing a rubber drainage-tube over a guide, or by means of a guide to insert tents (solid, not hollow, owing to the uncertain amount of swelling of the latter). (Ebstein, Rosenheim, Pariser, Guttentag.)

According to the author's experience, there are not many cases in which the stricture can be more easily dilated through the œsophagoscope than by the usual method through the mouth. In his own cases of this kind he was able to pass the stricture after he had dilated once or twice through the œsophagoscope, and had ascertained the character of the obstruction. Cases in which this cannot be accomplished should be treated by operation.

For the purpose of aiding the dilatation treatment it has recently been recommended to employ thiosinamin internally on account of its power of softening scars. A 15 per cent. alcoholic solution was employed. Adults are to be injected with 5–10 lines of a Pravaz syringe, children with 2–3 lines, every second or third day. (A. Fränkel, E. Teleky.)

Operative Treatment.—As a transition from dilatation to operative treatment may be mentioned the use of caustics as well as electrolysis, for the purpose of dilating strictures.

At the present day the employment of caustics in the œsophagus is only admissible if carried out with the aid of the œsophagoscope. Caustics were first employed by the author for this purpose in case of fissures after injury, in case of superficial ulcerations, and in case of carcinoma. In addition to a brush or caustic-holder, a specially adapted galvanocautery may be employed. In cicatricial strictures this method could only be used for the purpose of dividing a bridge or trabeculum, or a cutaneous annular or valve-like constriction. Recently the author successfully incised a portion of an annular stricture projecting into the lumen by means of a hook-shaped cautery, and subsequently dilated it with drainage-tubes drawn over a guide.

Electrolysis is occasionally employed in fibrous or carcinomatous strictures. A spherical or conical metal sound attached to a stomach-tube, connected with the negative pole, is applied to the stricture, while the positive pole is applied to the thorax by means of a plate electrode. Lefort allows the current to act on different portions of the stricture alternately (Electr. linéaire), using in cicatricial strictures a current of 15 milliampères, each sitting lasting from fifty to sixty seconds; in carcinoma, 32 to 36 milliampères, each sitting lasting from ten to fifteen seconds. Böckel and others, using a correspondingly strong current, gently advance the instrument, which has previously been passed as far as the stricture. Many claim that this method is free from danger and successful in removing strictures. Others (Newmann) have not found it beneficial. Electrolysis has been employed, not only through the mouth (Lefort, Sletow, Postnikow, and others), but also through a gastric fistula (Hjort), or through an incision in the œsophagus, or through an œsophageal fistula (Pretorius).

Actual surgical operative treatment of stricture is employed when treatment with bougies is unsuccessful in spite of all the recent improvements in its technic. This is the case where a stricture is impassable or cannot be dilated sufficiently and without danger. The principle governing surgical treatment of stricture elsewhere, exposure of the site of the stricture, and division of the stricture, or complete excision of the latter, can only be applied to certain cases of stricture of the cervical portion of the œsophagus, owing to the great danger involved in exposing the thoracic portion (Rehn), or the cardial portion (Levy's, Biondi's, and Bozzi's experiments on animals). In all other cases an attempt must be made to approach as near to the stricture as possible in order to dilate the latter, if not under guidance of inspection,

at least under guidance of the finger, or by having the lumen marked by a string passed through it and in such a way as to prevent perforation of the wall of the œsophagus.

The methods employed are: internal œsophagotomy, external œsophagotomy, combined œsophagotomy, excision of the stricture, and gastrotomy or gastrostomy.

Internal Œsophagotomy.—The original method of incising from above downward with instruments constructed like urethrotomes has been abandoned, owing to the danger of causing injury of important neighboring organs, entering a false passage, or dividing the entire thickness of the wall, particularly near the entrance of the stricture. Instruments were devised later which divide the stricture after the latter has been passed and while the instrument is being withdrawn through the constricted portion. Several small incisions, in different directions, are preferable to one single deep incision.

According to the anatomical relations of cicatricial strictures, internal œsophagotomy ought to accomplish more in superficial strictures, as, for example, annular strictures. If œsophagoscopic examination shows the presence of such a stricture, the author would deem it safer to make a number of small incisions with a long, narrow knife or galvanocautery, guided by inspection through the œsophagoscope.

While in other countries this operation has even recently been frequently performed (Demons, Bottini, and others), only a few cases have been reported from Germany (Bergmann, Kölliker). German and Austrian surgeons are generally opposed to this operation, and maintain that although it may have produced good results in a number of cases, it is an operation which cannot be controlled, and which is therefore uncertain and not in accord with modern surgical principles. Besides the danger of hemorrhage, which was severe in a number of cases, and the possibility of cutting through the wall of the œsophagus, it is not a safe plan, according to König, to make a wound on the inner surface of an organ from which phlegmonous processes are so liable to spread.

External Œsophagotomy and Œsophagostomy.—Opening the œsophagus in the neck is applicable, in the first place, in cases of stricture of the cervical portion; but this operation may be also considered in cases of stricture situated lower down, in order to provide easier access to the latter. In cases of stricture of the cervical portion the operation is performed (1) preliminary to excision of the stricture. The latter operation is rarely indicated either in carcinoma or cicatricial stricture. (2) It is employed also in dividing strictures. The latter operation is usually an external one, but may be combined with an internal incision. (3) Finally, the operation is employed for the purpose of establishing a fistula below the stricture in order to feed the patient (œsophagostomy) or for the purpose of dilating the stricture through the fistula. The fistula may be established independently, or after external excision or division of the stricture.

In cases of stricture located below the superior aperture of the

thorax, which in adults is situated more than 20 cm. from the teeth, the above operation (external œsophagotomy) is employed in establishing a temporary œsophageal fistula (1) either for the purpose of dilating a stricture situated lower down, or (2) for the purpose of performing so-called combined œsophagotomy. At present the operation is more frequently performed after complete gastrostomy, where it is desired to carry out more readily dilatation of the stricture.

The technic of external œsophagotomy in case of stricture is the same as in case of foreign bodies. Whenever possible the œsophagus is opened over a bougie passed through the mouth. The latter should be as large as possible (stomach-tube, flexible woven or metal catheter), therefore above the stricture as a rule. The operation is more difficult when the stricture is situated high up and the œsophagus must be opened below the stricture, as under these conditions if the stricture is impermeable, it is impossible to use the bougie as a guide, and it will be necessary to depend upon the anatomical relations, the longitudinal direction of the fibres in a smooth round cord, and to incise the latter free-hand between forceps, with which the muscular coat should first be grasped, and then the mucosa. Frequently it is impossible to recognize the longitudinal and transverse muscular layers on account of cicatricial alteration.

In external division of the stricture the latter is cut longitudinally, similarly to urethrotomy, so that when union takes place the wound is stretched transversely and the constriction is removed. Whether located above or below the stricture, the latter should be divided through the incision in the œsophagus, guided by inspection and after having previously ascertained the path through the stricture by passing a bougie. The question of operation will be considered more frequently in cases of short stricture, particularly superficial, valve-like, crescentic or annular stricture of the cervical portion, than in cases of more extensive, callous strictures. It is not always possible, however, to make an exact diagnosis by examining through the mouth with bougies. Where the stricture is annular and short, and provided the œsophagus has not become adherent to the neighboring structures as a result of cicatrization, it might be possible to suture the longitudinal incision transversely through the wall of the œsophagus.

Experience has shown that external division of strictures is principally adapted to valve-like and sacculated strictures of the cervical portion. v. Bergmann and Billroth each successfully operated in such a case. The permanent result was confirmed in the latter case after two years. In both cases the œsophagus was not sutured. After external œsophagotomy Willy-Meyer successfully performed internal division upon a superficial semicircular stricture situated exactly opposite the opening from above downward, and sutured the wound transversely.

When at the time of operation it is seen that the constriction in the cervical portion is longer than was expected, or that the lumen

cannot be found, as happened to Albert, after the œsophagus had been divided transversely, it is best to perform gastrostomy immediately. In the first case combined œsophagotomy might have been attempted, provided it were possible to open the œsophagus.

As after external œsophagotomy for stricture the wound in the œsophagus is not sutured, but purposely allowed to remain open for a time, the operation may under such circumstances, as well as after external division of the strictures, be employed to establish a temporary œsophageal fistula. For this purpose the wound in the œsophagus is allowed to remain open and a tube passed through it toward or into the stomach. The edges of the œsophageal wound may also be drawn toward the skin with several sutures without being actually united to it. Besides being employed in external œsophagotomy, temporary œsophageal fistula will aid in transversely closing the wound. The operation of temporary œsophageal fistula has also been employed in strictures of the cervical portion which were difficult to dilate, being applied below the stricture for supplying nourishment and for subsequently carrying out retrograde dilatation. In most cases, however, it has been performed for the purpose of dilating strictures situated lower down, beneath the sternal notch; occasionally also for the purpose of performing combined œsophagotomy. The dilatation of stricture situated below the œsophageal fistula, first carried out by Billroth in a series of cases, has recently been recommended by Graser on the strength of his results obtained in Heinecke's clinic.

In general the results obtained by œsophagotomy or œsophagostomy in cases of stricture are not satisfactory. In v. Bergmann's clinic from 1883 to 1893, of 9 cases operated on, 4 died (55.5 per cent. mortality, Pickenbach).

Compared with the favorable results of œsophagotomy in cases of foreign bodies, it is true that dilatation performed after the operation occasionally exerts an unfavorable influence on the course of ulcerative and inflammatory processes. Even in favorable cases the results can only be maintained by continued dilatation. Forcible dilatation is particularly dangerous in cases in which the stricture extends so high up that the œsophagotomy-wound involves the stricture. At this site of transition deep tears of the œsophagus may occur, into which bougies may find their way when employed for purpose of dilatation. The operation also produces a wound in close proximity to the large vessels, which may easily become infected, and as a result of mechanical injury hemorrhage is very liable to occur.

On account of these dangers external œsophagotomy and temporary œsophagostomy are seldom performed primarily in the treatment of intrathoracic strictures. More frequently they are employed secondarily, after establishment of a gastric fistula, where it is not possible to pass bougies from the mouth to the gastric fistula or in the reverse direction.

A permanent œsophageal fistula (actual œsophagostomy) is rarely

established. It might be considered in marked obstruction situated high up, where there is little or no hope of its removal. The obstruction might be caused by carcinoma of the œsophagus or by compression of the œsophagus from without (malignant new growths, struma). But even in these cases gastrostomy would be preferable, as the gastric fistula is less annoying to the patient and can more readily be concealed.

Combined Œsophagotomy.—Combined œsophagotomy was first performed by Gussenbauer in the year 1880, and is a combination of external and internal œsophagotomy. The former is the first step, which must be performed in order that the latter can be more safely and accurately carried out. After opening the œsophagus in the neck —that is, above the constriction—a small olivary bougie is passed into the latter through the wound, and over the olivary bougie is passed a small hollow bougie. Along the latter a fine herniotomy knife is passed and small incisions made in various directions; after this a tube (elastic catheter, etc.) is immediately passed and allowed to remain within the stricture for several days. As soon as possible bougies are passed through the mouth. In this operation it is a good plan to pass two strong silk ligatures through the edges of the wound in order to draw the œsophagus upward and render it tense, as was done by Billroth in passing bougies through strictures situated beneath the cutaneous wound. By this method Gussenbauer was able to enter the canal in spite of extensive stricture. It has been demonstrated that it is possible to perform internal division of strictures situated at the level of the bifurcation in children, and to divide strictures situated just above the cardia.

Gussenbauer's method has not been extensively employed. The operation produces a wound on the inner surface of the œsophagus, with the danger of infection of the latter and subsequent phlegmonous processes. The method can only be employed where it is possible to reach the interior of the œsophagus or the stricture, and to pass a fine bougie into the latter through the wound in the neck. It is most applicable to division of short, annular strictures situated high up (in adults not higher than the bifurcation). The operation might also be considered when, on making the external œsophagotomy incision, it is seen that the stricture extends downward into the thorax, or that in the latter region there is a second stricture which cannot be immediately dilated through the wound. This method does not insure against recurrence.

In most cases of severe stricture, even those situated in the cervical portion, and at best in those situated below the sternal notch, the establishment of a temporary gastric fistula is the most practical method. If dilatation through the mouth and gastric fistula is not successful, it should be attempted through an œsophageal fistula. In case of recurrence or of failure of dilatation internal division of the stricture through the œsophageal fistula, according to Gussenbauer's method, might be employed. After gastrostomy has been performed, the principal danger of the operation could be prevented by laying iodoform gauze in the wounded portion of the œsophagus for several days, inserting the gauze by means of a string passed from the œsophageal fistula to the gastric fistula, or in the reverse manner.

Lange employed an artificial gastric fistula in order to pass a knife into the stricture from below upward in performing internal incision. Strictures have also been divided by means of a silk string passed from the opening in the stomach to the mouth, or from the stomach to the œsophageal fistula, by drawing the string back and forth (Abbe's method).

Excision of Stricture of the Œsophagus.—The transition from œsophagotomy to simple incision of superficial crescentic or valvular folds of mucous membrane produced by cicatrization and the plastic suturing of the wound (Willy-Meyer) to actual resection of the œsophagus is represented by Kendal Frank's method, successfully employed in one case. Through an œsophagotomy-wound a constricted band of healthy mucous membrane, one and a half inches broad and probably of congenital origin, was excised and the edges of the wound sutured. This operation might be employed in a cicatricial ring involving only the mucous membrane.

Experience has shown that complete circular resection of the constricted portion of the œsophagus is to be considered in severe forms of circular, callous strictures, also in short tubular strictures limited to the cervical portion of the œsophagus. The ends of the œsophagus should be brought together and sutured, or, when this is impossible, the defect should be closed by means of a plastic operation. Preliminary gastrostomy would lessen the dangers of the operation (periœsophagitis, mediastinitis, sepsis). The question of resection would enter principally into cases of carcinoma, and will be discussed more fully on page 118.

Cases of cicatricial stricture to which this operation is adapted are rather rare, as after injuries caused by caustics even strictures involving the deeper tissues can still be treated by dilatation. Besides syphilitic and tuberculous strictures, to which Heinecke drew attention, those following diphtheria might offer indications. (The latter form of stricture is more frequently situated at the level of the bifurcation.) H. Braun recommends resection where there are folds or pockets of mucous membrane in addition to the stricture, and where the former are the principal cause of difficulty in swallowing.

Resection of the œsophagus has been performed 4 times for annular cicatricial stricture of the upper portion of the œsophagus (the stricture being from 1 to 2 cm. in extent), 3 times with complete success, first in 1891 by H. Braun, later by Sandelin (1899); in both the cases the stricture was caused by caustics; also by Escher (1900) for syphilitic stricture, once (1898) by Krogius, with death from sepsis (stricture caused by caustic)—mortality, 25 per eent.

Braun left the œsophagotomy-wound open over the site of suture (a feeding-tube was passed through the latter). In Escher's case there