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THE MOUTH OF THE ESOPHAGUS.*

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The title of my paper may be received with some surprise. Has the esophagus a mouth? It will give me pleasure to present some data as the results of my recent careful research in the details of this question.

When the finger is introduced into the mouth of an adult, we reach at best the entrance of the larynx; and it is hardly possible to come to satisfactory conclusions concerning this matter. It is always difficult even for the experienced practitioner to introduce instruments into the esophagus back of the larynx. Practice is required to pass this point with ease.

Those who base their information on anatomical illustrations or on observations made on the cadaver cannot understand why it is so difficult to pass beyond the larynx into the esophagus, for in the cadaver no obstructions are apparent, and anatomists delineate this passage as they have studied it in the cadaver,—wide open.

More positive information may be gleaned by examination with the laryngoscope. To the inexperienced observer, the image presented in the laryngoscopic mirror does not indicate the position of the passage of the esophagus. This is corroborated by the queer answers given sometimes by students to questions concerning this point. Perhaps much of this confusion is due to the inversion of the picture of the larynx in the mirror, as the epiglottis is seen superiorly when in reality it is located anteriorly, and the arytenoid

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area is seen below when in reality it marks the posterior boundary of the glottis. According to this, it cannot be difficult to find the passage into the depth of the esophagus; as viewed in a laryngoscopic picture it must be situated below the posterior wall of the larynx, and may be diagrammatically represented by a single line. From this we may conclude that in the living subject the larynx lies close to the anterior surface of the spinal column, and that the passage to the esophagus is closed while at rest, that is, when not in the act of deglutition.

If we direct the patient to sustain a tone during examination with the laryngoscope, the course of the passage into the esophagus can be traced a little farther. During phonation the arytenoid cartilages are set in motion in a slightly forward direction, and are raised somewhat from the posterior wall of the pharynx. The movements of these cartilages are increased with the pitch of the tone. Thus an additional view of the depth of the trachea may be obtained, even to the upper border of the cricoid cartilage and laterally deep into the sinus pyriformis. This varies in different patients.

From the upper border of the cricoid cartilage, the passage appears tightly closed. It has been my impression, and possibly yours likewise, that this condition is due to the manner of suspension and fixation of the larynx by muscles and ligaments, while the muscles are completely inactive and in a state of rest, as in the cadaver. There is, however, a marked difference which first occurred to us when we attempted to pull the larynx forward from the vertebral column. In the cadaver this can be done easily when no muscle-rigidity exists. In the living subject, however, there is a marked resistance when the attempt is made. This can be easily proved on a lean neck by taking hold of the larynx in front and pulling it forward, or by pushing it forward with both hands from behind, or by grasping it with a forceps, taking hold in front, back of the cricoid cartilage. The resistance is enormous. The entire musculature in which the larynx is involved offers energetic though involuntary resistance. There exists, then, a tonicity of the muscles which maintains the larynx in its definite position and is only influenced by central impulses, as for example during deglutition, emesis, singing, etc., when changes in the position of the larynx take place.

I have observed in a number of cases that under special conditions a still deeper inspection may be made during phonation. If, during laryngoscopic examination, the patient is directed to bend the head well forward, and if the examiner views the larynx from below up-

wards, an additional stretch of the mucosa of the esophagus can sometimes be seen, corresponding to the upper of the cricoid cartilage. Now and then, I have even succeeded in obtaining a fleeting view down to the middle or even to the lower third of the cricoid cartilage.

This can be done very effectively by practicing the hypo-pharyngoscopy as suggested by von Eicken. In this technique the larynx is cocaineized, and a strong laryngeal probe introduced into it, and the entire organ drawn firmly forward. Another way is to pass a suitable instrument back of the larynx and to pull it directly forward.

These investigations teach us that the pharynx in its whole width extends downward posteriorly to the larynx, and narrows rapidly to a small medial zone, situated in the region of the lower third of the cricoid cartilage. It can be plainly seen that the side walls converge to this point and that the anterior wall, represented by the posterior wall of the larynx, is also directed to it in a straight line. Another noticeable fact: The more traction brought to bear on the larynx, the more does the posterior wall of the pharynx bend in a gentle forward curve to the above mentioned area. This, then, presents a well-marked point of juncture.

The question is, in what manner does the esophagus extend downward from this area which we have described as its beginning? To attain better facilities for inspecting the depth of the esophagus, I made the attempt to pull the larynx away from the vertebral column more energetically than could be done from above. I availed myself of the opportunity to experiment on three tracheatomized patients in the following manner. The sub-glottic area was thoroughly cocaineized around the tracheal wound. I then introduced a hook in an upward direction, and took firm hold of the cricoid cartilage itself. At the same time I made an inspection of the hypo-pharynx with the laryngoscope, directing the patient to bend the head well forward in order to relax the muscles of the neck. It was definitely determined by this technique that even with such intense traction the entrance to the esophagus (for as such we must evidently regard the above described area) cannot be made to gap. This orifice of the esophagus remains closed, and is pulled forward with the larynx. The posterior wall of the pharynx is tensely stretched, and well removed from the vertebral column above the entrance. So firmly is the orifice of the esophagus attached to the larynx that it is more readily drawn forward with the latter than that it is opened.

From this we must conclude that the mucosal surfaces in the orifice of the esophagus do not lie simply in contact with each other as in other similar mucous tracts, but that they are held tightly together by means of a tonic muscle contractility, a kind of sphincter. *A circularly arranged musculature distinctly guards the entrance to the esophagus.*

But furthermore, this musculature is evidently closely connected with the cricoid cartilage, or else it would not be possible to pull the orifice of the esophagus forward with the larynx when traction on the latter is made. Anatomical investigations prove that the portion of the constrictor inferior known as the crico-pharyngeus is thus closely connected. It begins on the side of the cricoid cartilage behind the crico-thyroideus, loops around the entrance of the esophagus, and reaches the other side of the cricoid cartilage. The element of tonic contractility of this muscle explains this phenomenon.

Additional data may be gathered by the employment of esophagoscopy. It is a simple matter to pass beyond the cricoid cartilage to the orifice of the esophagus with a properly selected esophageal tube, and then to push the tube into the depth of the esophagus while carefully inspecting this region. Here we find in an area of several centimeters a tightly closed passageway, the mouth part of the esophagus, the walls of which are made to open sluggishly by the pressure of the esophageal tube. From this point downward extends the open portion of the esophagus. A similar observation is made during the withdrawal of the tube, as has already been noted by von Mikulicz. In his treatise on esophagoscopy and gastroscopy, published in 1881, he observed that the entrance to the esophagus is kept closed by the constrictor inferior. As I have demonstrated, only the cricoid cartilage portion of this muscle is called into action, but evidently also the upper part of the orbicular muscle of the esophagus.

The fact that the esophagus from its beginning to its termination at the cardia consists of an open air-filled tube has been proven beyond a doubt by Mikulicz, who has also demonstrated this physiologically. The accuracy of this observation is proved in every esophagoscopy. Mikulicz has also demonstrated that the air in the esophagus is subjected to negative pressure. I thought for a time that this negative pressure might, perhaps, explain the closure of the orifice of the esophagus, and have attempted, while performing deep hypo-pharyngoscopy, to introduce a catheter into the air-space of

the esophagus. The orifice of this organ closed spasmodically around the catheter, but showed no tendency to gap.

This assumed sphincter closure of the orifice of the esophagus may well be compared with the similar function of the cardia of the stomach. The cardia is also closed by tonic muscle-contractility. This contraction is released reflexly during deglutition or emesis. What is the conduct of the mouth of the esophagus in this respect? I can present a series of most interesting observations regarding this. One case which especially directed my attention to these conditions has been reported by Karl von Eicken in his essay on hypo-pharyngoscopy. The irritation produced by the laryngoscopic mirror produced sensations of choking in a female patient. Von Eicken observed that a deep inspection of the hypo-pharynx orifice was wide open. In a favorable moment I had the opportunity to observe a most unusual phenomenon. *In the area of the lower third of the cricoid cartilage a thick, crescent-shaped fold protruded bilaterally from the posterior wall of the hypo-pharynx forward to the cricoid cartilage.* When we desired to make a further inspection of this condition, the patient unfortunately failed us, and would not open her esophagus again. This phenomenon impressed me greatly. I recognized the importance of this observation, and it occurred to me at once as similar to that known as Passavant's fold, which is formed, as we remember, in the region of the upper end of the constrictor superior opposite to the velum platinum, when the epi-pharynx is closed during speech or deglutition. Much to my regret, the patient would not submit to further examinations, and I was unable to get more specific data concerning this occurrence. The question was lost sight of until early this year, when the same patient presented herself again at the clinic. On this occasion, it was easy to produce the reflex choking sensations by tickling with the laryngoscopic mirror, resulting in dilation of the mouth part of the esophagus, and to expose to view convincingly and clearly this crescent-shaped fold, the lip of the mouth of the esophagus.

It was now to be determined whether this lip was an accidental anatomical peculiarity of our patient, or whether it was a usual occurrence. To this end I employed hypo-pharyngoscopy on a number of patients and attempted to produce symptoms of retching. While I was not always successful, I was able to produce the same results as in the above mentioned patient in a sufficiently large number of cases. The mouth of the esophagus gapped wide during the time of retching, and the crescent-shaped fold came plainly into

view. It was evident that it could not be simply a fold in the mucous membrane, but undoubtedly partly composed of muscle tissue. My experiments were unsuccessful when the retching was of so violent a character that no systematic observations were possible. By co-cainizing the parts well, the entire process could be so modified that another positive result was obtained. The regular occurrence, then, of this crescent-shaped lip of the mouth of the esophagus during retching can hardly be doubted. But, furthermore, we learn that the mouth of the esophagus acts like the cardia at the time of retching, which forms only a part of the process of vomiting, and during this process the cardia gaps at the same time with the mouth of the esophagus.

Observations of the conditions during deglutition were still wanting. The movement of retching is a retrogressive one, while that of deglutition is progressive. The technique of hypo-pharyngoscopy by means of von Eicken's modification of H. P. Mosher's long straight spatula gave me the opportunity to see this muco-muscular ledge during deglutition and also to observe the opening of the mouth of the esophagus. All the patients whom I examined in this manner could swallow with ease during the insertion of this narrow spatula. The lip of the mouth of the esophagus was thus exposed to view, and the mouth itself dilated.

It cannot be doubted, therefore, that a contraction-mechanism is located in the orifice of the esophagus similar to that in the entrance to the stomach. The observation explains a whole series of phenomena which, until now, were more or less obscure.

It is known that some persons are able to pass large quantities of fluid into the stomach without visible signs of deglutition after one or two efforts at swallowing have been made. The heroes of the "Kneipe" are a striking example. Evidently, the tonic contraction of the sphincters at the orifice and at the end of the esophagus is temporarily suspended by will-force in these cases.

We are probably correct in the assumption that the sensation of contraction and of the presence of a globus in the throat may be associated with marked contraction of the mouth of the esophagus. I recall to you the sensation during the act of rapidly swallowing highly carbonated waters.

Strictures following corrosion of the mucosa of the esophagus are frequently localized in the region of the mouth of the esophagus, because the acids have come more intensely in contact with this area. It is possible that the mouth of the esophagus presents a hind-

rance to the free passage of such acids notwithstanding the effort at deglutition because of this special contractility.

The mouth of the esophagus is also a favorite site for the lodging of foreign bodies. These coming in contact with the mucous membranes produce a contraction of the sphincters. I recall two cases, when coins had been swallowed which stuck in the mouth of the esophagus, where I could see distinctly a ring of contraction around the coin which offered considerable resistance during extraction.

Improperly masticated food containing coarse particles produces a similar irritation to that of foreign bodies. Only a soft food-bolus passes easily beyond the constricted portion of the esophagus. This accounts for the well-known spasms of the esophagus in cases where rapid deglutition of improperly masticated food-masses has been practiced for years. I have seen a large number of cases of this kind. The patients locate distinctly a feeling of constriction in the region of the mouth of the esophagus and complain that food passes this point with difficulty. Spasms of the esophagus may be correlated with spasms of the cardia, and both are frequently due to secondary neurosis in chronic diseases of the stomach. In explaining the dilation of the esophagus following spasms of the cardia, the possible relation of the mouth of the esophagus must now always be considered. This dilatation is more easily comprehended when we consider that the bolus is compressed between two sphincters.

These observations may throw some light on the question of the origin of pulsating diverticula of the esophagus. We now know that these diverticula should not be considered as belonging to the esophagus, but rather to the hypo-pharynx, because in all instances they are located above the crescent-shaped lip of the mouth of the esophagus. This lip is identical with the ledge of the diverticulum, as I have previously designated it. Dissections of the musculature of this area when such diverticula exist substantiate my theory. The hypertrophied fibres of the crico-pharyngeus pass through the ledge of the diverticulum, which extends backwards, and must be included in the posterior wall of the hypo-pharynx. It is easily comprehended that this wall must distend with increased pressure during deglutition, for the anterior wall of the hypo-pharynx is formed by the posterior surface of the cricoid cartilage. A small pocket located above the lip of the orifice of the esophagus may gradually widen, and develop to a sack of considerable size. As a rule, this condition is observed in patients of advanced years, who have been in the habit of masticating poorly and swallowing rapidly.

These pulsating diverticula are analogous to dilations of the esophagus following spasms of the cardia. We may safely assume that spastic irritations in the mouth of the esophagus may contribute somewhat to the formation of such diverticula.

I do not wish to claim that this theory concerning the formation of diverticula in the region of the hypo-pharynx is sufficient. It is not to be concluded that this mechanical theory concerning the formation of diverticula in the region of the hypo-pharynx, which has been inaugurated by Zenker, is sufficient to explain it. It is well known that von Bergmann has always claimed that heredity is the cause of such diverticula. In my opinion both theories are probably well founded. It appears to me that diverticula with narrow orifices occurring in young subjects can scarcely be considered as of distinctly mechanical origin. We have lately had such a case under observation, and have studied it with all the means at our disposal. Here the impression prevailed that there must have been a predisposition to the formation of such a diverticulum, which developed mechanically into a sack. I remember from my investigations concerning the bursa pharyngea that in certain mammals pharynx diverticula in this region are a common occurrence. Why should not this be the case in man, though, of course, in very rare cases? Perhaps chance will answer this interesting question for us some day.

39 Friedrichstr.