

APPENDIX.

LARYNGOSCOPY.

THE larynx is explored by bringing its different parts into view by means of mirrors. Its interior is illuminated with natural or artificial light reflected downwards from the pharynx, the image of the vocal cords and the adjacent structures being received on a plane mirror (the laryngeal mirror) placed against the uvula.

The real originators of the practice of laryngoscopy are Türck and Czermak (1857—1858); the former invented the laryngeal mirror, while to the latter we owe the publication of the first experiments made with it and the introduction of artificial light as a means of illumination.*

The larynx may be illuminated in one of three ways: by the rays of the sun, by the diffuse light of day, or by lamp-light.

1. The full *light of the sun* is the most intense; if therefore one has at disposal a chamber into which it shines strongly its rays, either direct or reflected, may be employed. The direct solar rays are available only when they do not enter the room too obliquely. If the examination is protracted the apparent alteration which takes place in the position of the sun renders it necessary to be continually shifting the patient about. These difficulties, which at most are but trifling, may easily be got over by placing a plane mirror fitted with a universal joint (like that of the ordinary toilette mirror) in the window of the apartment, in such a position that the beams of the sun fall upon it and are thrown either directly into the patient's mouth or on a

* The discovery that the interior of the larynx may be seen reflected in a mirror laid on the uvula belongs really to the early part of the present century, but the observations then made were very imperfect;—even the views of Garcia, the singing-master, on the movements of the vocal cords in phonation, published in 1855, did not materially advance the practice of laryngoscopy.

concave mirror and thence into the pharynx. The mirror must naturally be turned from time to time, to follow the apparent movements of the sun.

2. *The diffuse light of day* is strong enough to be used for the illumination of the larynx in a well-lighted room and on a clear day. It has this advantage, that it shows the interior of the larynx in its natural colouring. The best method of employing it is to reflect it into the mouth of the patient from a concave mirror of 26—29 ctm. focal distance placed so as to receive the light entering by the window. The glare may be lessened by allowing the light to pass through only a portion of the window or through a small chink in the closed shutters, but this is seldom necessary, nor is it practicable without great inconvenience. The illumination so obtained is not, of course, so bright as that produced by the rays of the sun, but it is generally sufficient to permit the several parts of the larynx to be distinctly seen. The position of the reflecting mirror for diffuse daylight and for sunlight is the same as that specified below as requisite for artificial illumination and the same apparatus is necessary.

3. *Artificial Illumination.* Sunlight and daylight being naturally available only at certain times, some method of illuminating the larynx artificially must often be resorted to, and since the introduction of laryngoscopy the efforts of inventors have been persistently directed to the perfecting of the apparatus by which this may be most efficiently accomplished.

Artificial light is used in two ways.

a. A concave mirror of about 16 ctm. focal distance, fixed on a stand, is placed on a table in front of a common lamp (either a gas, petroleum, or oil lamp), the light from which is thus reflected into the patient's mouth. By this means a very bright light is obtained; the area illuminated is indeed small, but is sufficiently large for the purpose, as only the laryngeal mirror, which projects the beam downwards into the larynx, needs to be lighted up, and not the whole of the pharynx. If it is desired to explore the mouth and pharynx, it is necessary merely to turn the concave mirror slightly from side to side in order to throw the light on the different parts one after the other.

The form of the lamp is perfectly immaterial. The concave mirror should be mounted on a stand (Türck) which is fastened to the table (Waldenburg, Bose, &c.); this is a more convenient arrangement than

that in which the mirror is tied on the head of the observer by a band passing round the forehead, or is fixed in a spectacle-frame.—The concave reflector is provided with a central opening, through which the image is seen in the laryngeal mirror.

b. The *second* method of employing artificial light consists in the introduction of *lenses* between the flame of the lamp and the concave mirror which reflects it; some use only one simple biconvex lens (Levin, B. Fränkel), others two lenses (v. Bruns), or even three (Tobold).

The light obtained by this apparatus is no brighter than that given by simple reflectors without lenses, but it appears clearer, as it is distributed over a larger surface and falls on the parts in the form of a clearly-defined circle.

The manner in which the lenses are arranged and the construction of the different apparatuses, cannot be described here in detail. Tobold's apparatus is made in two forms, a larger and a smaller, both of which are fitted in a case and are easily carried about; the smaller model is in very extensive use.

The lamp should always stand to the left of the examiner, a little to the patient's right. The lamp and reflector,—and the lenses, if they are used,—must be so placed that the flame is on a level with the patient's mouth; particular care must be exercised in adjusting the various parts of the apparatus if lenses are interposed between the lamp and the mirror.

The only other instrument which is required in examining the larynx is the *laryngeal mirror*. This is a plane mirror, round, oval, or square in shape, the circular form being the most generally useful; its diameter varies from $1\frac{1}{3}$ to $2\frac{1}{3}$ ctm. The larger size, which has the advantage of showing a larger portion of the larynx, may be introduced when the fauces are wide, and in individuals in whom its frequent application has rendered the parts tolerant of its presence.—The mirror is made of highly polished glass, and is fastened to a stem of German silver at an angle of about 45 degrees; this stem fits into a wooden handle, in which it is firmly fixed by means of a screw.

LARYNGOSCOPIC EXAMINATION.

The patient, with his head slightly thrown back, should be seated facing the observer and as close to him as convenient. The fauces are then to be illuminated, in the manner described above, and carefully examined to determine in the first place

whether they are the seat of such affections as pharyngeal catarrh, enlargement of the tonsils, ulcerations, &c., which often give rise to symptoms referred by the patient to the larynx. The examination of the larynx is then proceeded with.

To introduce the laryngeal mirror the mouth must be opened widely and the tongue thrust forward. By the latter action the cavity of the mouth is enlarged, especially posteriorly, and as it also raises the larynx somewhat the latter is more readily illuminated. The patient should put out his tongue and grasp its tip with the forefinger and thumb of his right hand, protected by a napkin, and keep it fixed in that position; if frequently examined he soon learns to keep out the tongue without the aid of the hand. In the case of patients who are still unaccustomed to the process the observer may, with the thumb and index finger of the left hand, have to catch hold of the tongue and at the same time steady the chin, in order to keep the head erect.

Many patients bear laryngoscopic examination exceedingly well; others with extreme difficulty, and only after long practice. The principal obstacles to be overcome are the disposition to elevate the tongue (and so obstruct the view) and the sensibility of the uvula to the touch of the laryngeal mirror. In most people there exists the inclination, when the tongue is thrust forward, to raise its base and press it against the hard palate, an action which renders laryngoscopy difficult or even impossible. If the patient is unable to control this movement he should be directed not to put out the tongue; if, notwithstanding this, the root of the tongue still rises, the examination may be facilitated by causing the patient to take several deep inspirations, the effect of which is usually to depress the tongue; or the base of the tongue may be kept down by means of a spatula. Occasionally these proceedings cannot be borne by the patient, on account of the choking sensations and retching they are apt to excite; repeated manipulation, however, generally lessens the sensibility of the parts.

The difficulties arising from a faulty position of the tongue having been overcome, others appear on attempting to use the laryngeal mirror, as simply touching the uvula is often enough to cause spasmodic contraction of the muscles of deglutition and severe retching. These accidents are often due to the unskilful introduction of the mirror, and patients who have frequently

submitted to examination soon come to know, by the occurrence of retching, when the mirror is not properly laid against the base of the uvula, as they can bear its presence even for several minutes without discomfort if it be held so as to lie in contact only with the uvula and with none of the neighbouring parts. Some patients never get accustomed to the irritation of the mirror even though treated carefully and perseveringly, or at most they learn to endure it for a short time only. It is frequently observed also that whilst in the first few trials the mirror is borne easily and for a moderately long time, it on subsequent occasions produces an increasing amount of annoyance and at last ceases to be tolerated, particularly if the examinations be too protracted or repeated too often; then, of course, all attempts to get a view of the larynx must be given up for a time.

Besides these choking sensations and the retching just mentioned certain other difficulties, due to local morbid conditions which seriously interfere with the proper adjustment of the laryngeal mirror, are encountered. *Hypertrophied tonsils* and an *abnormally long uvula* present obstacles of this kind, the point of the latter being always apt to come in front of the mirror; in the first case the introduction of a long narrow mirror, in the second the employment of one of larger size than usual, will enable the observer to see the larynx. Mucus, when accumulated in quantity in the pharynx, may also prove troublesome; it may be removed by gargling or coughing.

Before introducing the laryngeal mirror it should be warmed, face downwards, over the globe of the lamp or, when examining by sunlight or the diffuse light of day, over the flame of a spirit lamp; to make sure that it is not too hot, and in order to avoid burning the patient, its metallic surface should then be applied to the skin of the back of the hand. The warming prevents the condensation of the moisture of the breath on the face of the mirror, and the consequent obscuration of the image it reflects, as well as the irritation which a cold body in the mouth would certainly produce. The mirror must be cleaned and warmed anew after each application.

The examiner should take the mirror in his right hand, as one holds a pen, grasping it at the point where the stem joins the wooden handle; he then passes it into the mouth, with the reflecting surface directed downwards and forwards. If he has

to use his right hand, either in operating in the larynx or in manipulating a brush dipped in some astringent solution, the mirror may be introduced with the left hand. The mirror is now carried steadily backward, without touching the back of the tongue or the hard palate, and is gently laid with its metallic surface upwards against the base of the uvula, the patient being at the same time directed to say "eh" or "a" (as in *tell* or *tale*); the image of the interior of the larynx will then be seen in the mirror. The whole of the interior of the larynx does not become visible at once; to obtain a view of all its parts in succession the mirror must be turned a little to the right or left, upwards or downwards, as required. The precise direction in which it must be turned when it is desired to examine any particular part of the larynx, will be indicated on a subsequent page; but it is not always possible to follow set rules,—the method of procedure must to a great extent be determined by the special local conditions in each case, the skill of the observer being shown in the readiness with which he adapts himself to these. During all these manipulations, however, the mirror must not be moved from its position against the uvula.

The parts seen reflected in the mirror, in the order in which they appear, are: the *back of the tongue*, with its circumvallate papillæ, the anterior surface of the *epiglottis* with its three glosso-epiglottidean ligaments (l. medium and lig. lateralia), then the *arytenoid cartilages*, the *posterior part of the rima glottidis*, the *vocal cords*, and the *posterior wall of the larynx*. If the mirror be slightly lowered and pointed more nearly vertically downwards, the *anterior* wall of the larynx comes into view, the *anterior* part of the vocal cords and their angle of union anteriorly, the *false vocal cords*, the *ventricles of the larynx*, a small portion of the *posterior* surface of the epiglottis, and, if the illumination be good and the glottis widely dilated, the *trachea*, sometimes as far down even as its bifurcation. As soon as the mirror has been placed in position the first thing that should be done, particularly if the examination has to be made somewhat hurriedly, is to look for the true vocal cords; the other parts may then be inspected in succession by slightly turning the mirror as before described.

The parts of the larynx seen to the right and left in the mirror correspond with the patient's, and not with the examiner's, right

and left; thus, those which appear to the observer's left in the mirror represent parts situated on the patient's right, and *vice versâ*. It is more difficult at first, however, to realise that according as the mirror is held the position of the different parts of the larynx will seem to vary. As it is usually placed, pointing obliquely downwards and backwards, the structures at the back of the larynx are seen at the bottom of the mirror (the arytenoid cartilages, for instance), and those at the front of the larynx (the anterior angle of the glottis, for example), in the upper portion of the image. A little practice soon enables one to recognise the various structures in the mirror and to refer them to their real position in the body.

EXAMINATION OF THE DIFFERENT PARTS OF THE LARYNX.

When the mirror is laid against the base of the uvula the first object seen is the *epiglottis*; on raising the mirror a little and placing it at the junction of the hard and the soft palate, the *back of the tongue* also becomes visible. The ligaments which pass from the base of the tongue to the epiglottis, the median ligament and the two lateral frænula, next catch the eye, and between these folds the two glosso-epiglottidean *sinuses* or *vallecule*.

The *epiglottis* is the first structure which comes into view on getting the laryngeal mirror into position, only its anterior surface, however, being then seen. On the configuration of the epiglottis depends to a great extent the ease or difficulty experienced in examining the larynx. There may thus, apart from the great differences it shows with regard to size, be considerable irregularity of its anterior surface and in the outline of its anterior margin. Very frequently it is found to be inclined too far backwards; while occasionally it is markedly contracted in the middle. In both cases a large part of the larynx is shut off from inspection, and it becomes difficult, sometimes impossible, to obtain even a glimpse of the parts in the front of the laryngeal cavity (the anterior portion of the vocal cords and their angle of junction). The mirror must in such cases be thrust as deeply as possible into the pharynx, being held no longer obliquely but pointing almost vertically downwards.

When the mirror is placed in its ordinary position only the

anterior surface of the epiglottis is exposed; to bring into view its *posterior* surface the mirror must be directed very obliquely downwards and backwards, though even then only a *portion* of this side can be seen. While the mirror is so held also the anterior part of the glottis is generally at the same time visible.

After having sufficiently investigated the parts at the base of the tongue and the epiglottis, attention should be directed to those within the larynx. On depressing the mirror and turning it somewhat more obliquely backwards the *arytenoid cartilages* next come into view. These bodies appear as two cartilaginous prominences, about as large as small peas, pale reddish in colour, and converging towards each other. In inspiration they fall widely apart, in expiration they approach each other, while in pronouncing the vowel-sound "eh" or "a" (as in *tell* or *tale*), they come into close apposition with each other. On their apices are situated the *cartilages of Santorini*, two cartilaginous nodules which are visible only when the illumination is exceptionally good.

During respiration there remains between the arytenoid cartilages a fissure of greater or less size, occupying the long diameter of the larynx, the *rima glottidis*, through which the posterior laryngeal wall is discovered. This triangular aperture is dilated in inspiration and contracts in expiration. The wider it is the more fully not only the posterior but also the anterior wall of the larynx is opened to the view; the patient should therefore always be asked to make several deep inspirations, but to do so as quietly as possible.

The *rima glottidis* is bounded on each side by the vocal cords. The posterior part of the vocal cords is usually seen when the arytenoid cartilages appear in the mirror, or in uttering the vowel-sounds described above. To recognise readily the vocal cords and to examine them carefully in their whole length, from their posterior attachment to the arytenoid cartilages to the point at which they join anteriorly, are the principal objects of laryngoscopy. For prolonged and thorough examination of the vocal cords, such as that often made simply for practice, quiet respiration is most favourable, occasionally interrupted only by the production of the vowel-sound "eh" or "a."

The *vocal cords* attract the attention at once, their *tendinous lustre* and *whiteness* being quite distinctive; in quiet respiration only their inner margins, which bound the *rima glottidis*, are

observed, but in phonation, in producing the sounds mentioned above, they become visible in their whole breadth, as they are thus made to approach each other and close the glottis.

The *vibration* of the vocal cords, both of their whole breadth and of their edges alone, may be studied while the patient sings, the cords vibrating in their entire depth when the lower notes are sounded, and only their edges when the higher notes, particularly those which constitute the falsetto voice, are sung. In those who have become accustomed to examination the increase and decrease of these vibrations may be followed closely while the patient sings up and down a scale.

The appearance of the vocal cords is practically the same throughout their whole extent; at one point only do they present a yellowish spot, the *macula flava*, about as large as a pin's head and situated on their inner edge, close to the arytenoid cartilages; these spots are small nodules of fibro-cartilaginous tissue, seated on the posterior surface of the cords and shining through them.—Whilst the posterior part of the vocal cords is always easily enough seen it is generally difficult to get a good view of their anterior part, and particularly of their anterior angle of junction. If the epiglottis be markedly trough-shaped, or curved so as to resemble the Greek letter omega, a very small portion only of the larynx is open to inspection, and it is seldom possible to get a sight of the point of insertion of the cords. Even these disadvantages may sometimes be overcome, however, by securing good illumination and by varying the position of the head and of the mirror to meet the special local conditions which complicate each case. No precise set of rules can be formulated on this subject, but it will in general be found to be of service to tilt back the patient's head considerably and to push the mirror more deeply into the pharynx, pointing it at the same time more obliquely downwards. Throwing the head back raises the larynx and hyoid bone, the consequence of which is that the anterior angle of the glottis is also elevated and the mirror allowed to be still further depressed. If notwithstanding the adoption of these expedients the examiner is still unable to see the point of insertion of the vocal cords the patient should be asked to make a series of deep inspirations and rapid and complete expirations; this will raise the epiglottis against the base of the tongue and so expose the parts below, though each view lasts only for an instant.

The vocal cords are also sometimes covered by tough, clear mucus, which may prevent any proper survey of these and the neighbouring parts being made; a few slight coughs will usually expel this mucus.

Above and to the outside of the vocal cords, and running parallel with them, lie the *false* or *superior vocal cords*, distinguished from the true vocal cords by their *pale reddish colour*. Between the superior and inferior cords there is situated on each side an elongated fissure of variable breadth, the *ventricles of the larynx*, or *ventricles of Morgagni*.

It is usually a matter of considerably greater difficulty to bring clearly into view the *aryteno-epiglottidean folds*, two thin folds of mucous membrane of exactly the same colour as the rest of the mucous surface, passing from the sides of the epiglottis to the arytenoid cartilages; they are often hidden by the overhanging epiglottis. Towards their posterior ends small cartilaginous nodules are sometimes found, the *cartilages of Wrisberg*; frequently, however, these bodies are wanting.

To the outside of the cartilages of Wrisberg and Santorini are seen the *pyriform sinuses*, formed on each side by the arching outwards of the walls of the pharynx; in phonation these sinuses are dilated to some extent and are therefore then more readily made out.

When the illumination is good, and during deep inspiration, the parts below the glottis may become so distinctly visible that the cartilaginous rings of the *trachea* may be counted, particularly if the larynx be exceptionally wide. The *bifurcation* of the trachea is about the lowest point to which it is possible to see even under the most favourable local conditions; nevertheless in a few rare cases a view has been obtained of a portion of the principal bronchi.

When by repeated examination in the healthy subject a clear conception has been formed of the shape, mobility, and colour of the various parts within the larynx, one is in a position to recognise readily those deviations from the normal type which are so often met with in the diseases of the part, whether these diseases are uncomplicated and limited to the larynx or arise in connection with affections of other organs, especially of the organs of respiration. The laryngoscopic appearances presented by the most important of these affections will now be considered.