

abductor muscles to local irritation and also to the normal blood stimulus.

The abductors of the larynx, situated on the outer portion of the laryngeal framework, are not so much subject to local irritation; their motor centre in the brain is less excited and less susceptible to normal stimulus, and thus, spasm of the abductor muscles is less frequent than spasm of the adductor muscles, and less persistent when it occurs.

THE TECHNIC OF CATHETERISM OF THE EUSTACHIAN TUBE, AND THE INDICATIONS FOR ITS USE.

A Clinical Lecture delivered at the Chicago Polyclinic, August 2, 1892

BY JOHN F. OAKS, M.D.

INSTRUCTOR IN LARYNGOLOGY, RHINOLOGY AND OTOTOLOGY, CHICAGO POLYCLINIC.

By catheterism of the Eustachian tube we understand the introduction of a properly curved tube into the tubal orifice, from 5 to 15 mm. according to the depth of the trumpet shaped opening of the pharyngeal orifice of the Eustachian tube.

Since our time is limited and you can readily find in your text books the historical details of this procedure, I will at once enter *in medias res*.

The necessary instruments for the proper performance of eustachian catheterization are, 1, the catheter; 2, the auscultation tube sometimes improperly called the otoscope and 3, the air bag.

Eustachian catheters are made of hard and soft rubber and of silver. Hard rubber catheters have the advantage of cheapness and lightness; they are not easily corroded. The aurist can supply himself with a number of all sizes and curves, so that each patient may have one to himself and thus escape the danger of possible infection. On the other hand the silver catheter if made of virgin silver, is much thinner than those made of hard rubber giving the important advantage of a larger calibre. Silver catheters are flexible, and any need to change the curve of the distal end is thus easily obtained in one instrument. It has the further advantage of being easily cleansed and sterilized by immersion in boiling hot water, or by holding in the flame of a gas burner (*ausglühen*.)

Again, they are not fragile like the hard rubber ones. It is very important to bear this in mind since it may happen that by a sudden motion or flinching or even the forcible grasping and extracting of the h.r. catheter by the patient the distal end may break off and remain imbedded in the tubal orifice, or serious traumatism to the naso-pharyngeal or nasal mucosa may be entailed. Not so with the silver catheter, on account of its great flexibility.

The soft rubber catheter I will dismiss in a few words. They are difficult of introduction on account of their being too flexible, unless they are made so thick as to be clumsy and too large in diameter for the average nasal fossa, and the small size of their calibre.

The silver catheter, see Fig. 1, is usually made in three sizes being respectively 2, 2.5 and 3, mm. in diameter. The whole length of the catheter should be about 16 cm. and the length of curve at distal end is from 2 to 3 cm. and varies from 140° to 150°. The beak, (see Fig. 1) is olive-shaped and has the advantage over the usual square end, of being less liable to produce a traumatism and the possible con-

sequent emphysema. The indicator ring at the proximal end serves the purpose of indicating the direction of the beak and is usually placed in the axis of the curve of the catheter.

The silver catheter as described is made by Sharp & Smith after the German model.

The air bag I here show you and which has been used in this clinic for several years is known as the Lucae double balloon (see Fig. I). It is composed of a heavy rubber bulb with an automatic valve at b.; the second bulb is called the balloon, and is supplied with a similar valve at a. It is covered with webbing so as to prevent rupture by over filling. By means of this balloon, we not only get a continuous supply, but also an increased pressure of atmospheric air by compression of the balloon, which can be nicely graduated and regulated at will. The continuous atmospheric pressure obviates the necessity of disconnecting or removing the air bag from the catheter as must be done after each compression when using the Politzer bag. It also has the advantage over the Politzer in permitting of a more accurate observation of the auscultatory sounds, in consequence of the absence of the supplementary noises made during the acts of swallowing or phonation which are unavoidable in Politzerization.

Another advantage of the Lucae air bag is its simplicity and convenience. A short distance above the second bulb or balloon is a hook by which the air bag can be suspended from a button hole in the lapel of the coat (see Fig. 1 d.). At the distal end of the rubber tubing is a tip (see Fig. 1. "c.") which should be made to fit accurately into the funnel shaped end of the catheter.

The auscultation tube (also called the diagnostic tube) consists of rubber tubing made of pure gum. It should be about 120 cm. long and from 8 to 9 mm. outside diameter, that being the size that will fit into the average external meatus. The end pieces of different color usually recommended in the text-books are a disadvantage unless the calibre of these end pieces is nearly equal to that of the rubber tubing. Schwartz and other eminent aurists dispense entirely with the end pieces and prefer to mark the ends of the tubing for patient and operator by making the cut ends respectively oblique and straight.

One end of the auscultation tube is held snugly in the external meatus of the ear to be catheterized, while the other end is brought around and behind the neck, and over the shoulder into the corresponding ear of the examiner. This disposition of the latter end makes it less liable to slip out or being dragged out by gravitation and therefore makes it more secure.

Although Roosa (*loc. cit.* page 76) does not consider the auscultation tube a necessary adjunct to successful catheterism of the Eustachian tube, yet its importance will be conceded when we consider the following facts which our extensive clinical material has established beyond peradventure viz:

1. By means of the auscultation tube we are enabled to determine absolutely, whether the distal end of the catheter is properly engaged in the t. o.¹

2. To diagnosticate the perviousness or patency of the E. t.² which can be quite accurately determined by the pitch of the auscultatory sound or a stenosis

¹ t. o. stands for tubal orifice.

² E. t. stands for Eustachian tube.

of the E. t. by the amount of atmospheric pressure required to overcome the resistance.

3. Condition of the mucosa of the E. t. and middle ear cavity; whether moist or dry, or whether there is present much or little fluid. Moist râles indicate an excess of fluid caused by the admixture of air and fluid contents of c. t.³ If contents are serous, the râles are fine, if mucous they are more like vesicular breathing ("bruit de pluie," "Regensgerausch" from its resemblance to the falling of rain through the leaves of a tree). These râles must not be confounded with those produced at the t.o., when the beak of catheter is not properly engaged but lies near or in the lumen of the ostium.

4. When the sound is intermittent, with explosive noises during the act of swallowing it may indicate stenosis from swelling of the mucosa in cartilaginous portion of the E.t. or near the ostium tympanicum. Explosive sounds may also be due to sudden tension of m.t.⁴ or when there are adhesions between it and the inner wall of the c.t.

5. A whistling or hissing sound will indicate a perforation when it is small. Where the perforation involves all or a greater portion of the m.t. without any appreciable moisture in c.t. the auscultatory sound may simulate that of a normal and patent E.t.

6. If in the presence of a pervious E.t. (which can be determined by a bougie) there is an obscuration of the usual auscultatory bruit we may assume that the c.t. is occupied by some inflammatory product or the space compromised by swelling or proliferative thickening of the mucosa.

So much for the diagnostic use of catheterism. It also aids us in our prognosis in so far as we can determine absolutely or approximately the pathological conditions which obtain.

Let us now consider briefly the therapeutic indications for Eustachian catheterization.

1. One of the principle indications for its use and in the patient before us is a sense of fullness and pressure with tinnitus and deafness. These symptoms are usually due to disturbance of the equilibrium of atmospheric pressure in the middle and external ear from defective ventilation of the c.t. by way of the E.t., giving rise to diminished air tension and consequent hyperæmia *in vacuo* with more or less collapse of the m.t., and consequent involvement of the apparatus of hearing made manifest by impairment of the aerial conduction of sound.

2. In acute otitis of the middle ear, as soon as the acute pain has been relieved by the usual treatment, the air douche is indicated. Where the otitis is unilateral, catheterization is to be preferred to Politzerization. Catheterization secures perviousness of the E.t., establishes the equilibrium of atmospheric pressure, thereby relieving tension of the m.t., the tendon of the tensor tympani muscle, also chain of ossicles and undue pressure on the labyrinthine windows; it disperses and displaces intra-tympanic exudations *via* the E.t. into the pharynx, or in the presence of a spontaneous or artificial solution of continuity of the m.t., into the external meatus; it establishes normal intra-tympanic pressure with consequent reduction of hyperæmia *in vacuo*, absorption of exudation and by virtue of what might be appropriately called aural massage, viscid mucous

and plastic exudates are displaced and removed from the immediate vicinity of the oval and round windows and foot plate of the stapes which tend to more or less compromise the function of the apparatus of hearing. Plastic exudations are prevented from becoming organized and forming bands of adhesions between the m.t. and inner wall of the c.t. or immobilizing the maleo-incudal incudo-stapedial joints.

3. In chronic catarrhal otitis of the middle ear it forms the most important factor in the treatment. The rationale is the same as that mentioned in acute otitis. Perhaps the element of mechanical pressure (aural massage) is of greater moment in the treatment of the chronic forms of otitis media, especially where there is much swelling or proliferative thickening of the tympanæ mucosa. It prevents the fixation of the chain of ossicles and secondary tympanic membrane (the membrane covering the round window) by connective tissue proliferation; it also prevents stenosis of the ostium pharyngeum and ostium tympanicum of the E.t. as well as in its continuity.

4. In deafness and tinnitus caused by the above mentioned pathological conditions, it is the only treatment that will prove of any avail. If it does not cure the deafness and tinnitus it will most certainly in the majority of cases relieve them, and prevent rapid progressive impairment or entire loss of hearing.

5. In acute-suppurative otitis of the middle ear catheterization and careful inflation may induce dispersion and absorption of sero-purulent exudate without perforation. Where, however, there is a perforation, the purulent secretion is displaced into the external meatus from whence it is removed by irrigation with a $\frac{3}{4}$ per cent. solution of sodium chloride or a 2 to 3 per cent. solution of boric acid, or by pledgets of borated cotton, *secundum artem*. It furthermore establishes the desirable intratympanic conditions which favor subsidence of hyperæmia and stimulates absorption of abnormal exudations.

6. In chronic suppurative otitis the same indications obtain as in the acute form, the rationale being the same. In addition, catheterism also furnishes the means for irrigating the c.t. by way of the E.t., as recommended by Schwartze, *loc. cit.* 194.

You ask, how soon should inflation be repeated?

As a result of clinical experience we find that the improvement after the first few catheterizations (that is in otitis media chronica) usually lasts from a few to 24 hours and recedes again. It is therefore advisable to repeat the inflation, indeed before the benefits of the preceding one have entirely disappeared, otherwise your patient would remain in a condition of *statu quo* or the improvement would be at least very slow. It is advisable to inflate daily for five or six days, or until such time as the improvement is more or less permanent, when the interval can be prolonged according to the progress or exigencies of the case. Therefore, in the chronic forms of Otitis media catarrhalis and suppurativa you must continue in this line of treatment for a long time, or as long as the pathological conditions that obtain compromise the sense of hearing or the integrity of the temporal bone.

In this connection I wish to call your attention for a few moments, to the contra-indications of

³ C. t. stands for cavum tympani.

⁴ M. t. stands for membrana tympani.

Eustachian catheterizations, and will divide them for more convenient study, into absolute and relative.

Absolute.—1. When there is ulceration in the nose or naso-pharyngeal cavity with or without tendency to hemorrhage, on account of the danger of septic infection. 2. hyperpyrexia. 3. Acute otitis complicated by acute pharyngitis and severe otalgia. 4. Emphysema of pharynx or larynx.

Relative.—1. Early childhood. 2. Senility. 3. Neurotic conditions. 4. During convalescence where there is great nervous prostration.

As to the technic of the procedure you know, gentlemen, that the pharyngeal orifice of the E.t. is located on the lateral wall of the naso-pharynx, nearly on a line with the inferior meatus of the nose, and that between the posterior lip of the ostium (also called the salpingo-pharyngeal fold) and the posterior wall of the naso-pharynx is a depression called the fossa of Rosenmüller. If the distance from the anterior nares or the posterior wall of the pharynx to the t.o. was uniformly a fixed one (which, however, is not the case) there would be no difficulty in finding it by means of a fixed scale on the catheter. Therefore, we proceed after a method (of which there are a number) that establishes a fixed point or landmark as a point of departure for the *maitre de tour*.

The method that is taught in this clinic is known as the modified Kramer or Gruber method. The patient should be seated well back in a chair with body erect. It is desirable to have the patient blow the nose so as to cleanse nasal passage and to moisten the same.

The catheter having been scrupulously cleansed and sterilized, make sure that it is pervious by forcing air through it from the air bag (not by the mouth for that would not be aseptic) then adjust the auscultation tube as noted; place your left hand on the patient's forehead and with the thumb raise the tip of the nose; grasp the catheter delicately at its proximal end between thumb and index finger of the right hand holding it nearly perpendicularly, with the beak resting at the outer side of the floor of the vestibule, make an upward and forward motion carrying beak over the muco-cutaneous fold (the junction of the vestibule and nasal floor proper) at the same moment bringing the catheter to a horizontal, on a plane with the floor of the inferior meatus and continue the forward motion *with beak hugging the floor* until it reaches the naso-pharynx and you feel the resistance of the posterior pharyngeal wall; the catheter, with the indicator ring pointing directly downward and on a horizontal plane, is then drawn forward until the resistance of the soft palate is felt, when without hesitation it is turned outward and upward through the arc of a circle of about 135°, so that the indicator ring is on a line with the outer angle of the eye, or at an angle of 45°, when the beak of the catheter will usually glide into the t.o. The latter movement is aided somewhat by the contraction of the palatal muscles which, so to speak, lifts and rides the distal end of the catheter toward the t.o.; then, sliding left hand downward over forehead (not raising the hand from its support) grasp the catheter firmly between the thumb and index finger to prevent motion or rotation on its axis while making connection with the tip (see Fig. 1, c) on the Lucae air bag, at the same time keeping the tips of the remaining fingers fixed against the glabella as a

fulcrum. On compressing the bulb and filling the second balloon moderately with air the auscultation tube will at once determine the success or failure of the manœuvre.

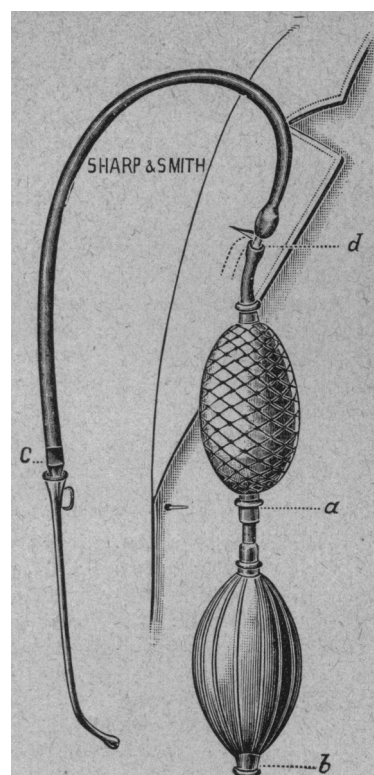


Fig. 1.

I will in this connection, without comment, mention in brief some of the other methods of procedure.

In the Lowenburg method you proceed as in the one before mentioned, until the beak of the catheter meets the resistance of the posterior pharyngeal wall, when it is rotated inward through the arc of a circle of 90° and brought forward until the concavity of the curved distal end meets the resistance of the posterior margin of the septum nasi (which in this method is the landmark), it is then rotated downward, outward and a little upward, describing a little more than a semi-circle, with indicator ring at same angle as in the previous method.

In Kuh's method, the beak, after meeting with the resistance of the posterior pharyngeal wall, is turned outward into the fossa of Rosenmüller; it is then brought forward until the resistance of the posterior lip of the t.o. is felt, when it is drawn gently over the lip or fold into the t.o. By this manœuvre there is more or less danger of injury to the mucous membrane sufficient sometimes, to entail the serious consequence of emphysema, especially where this landmark is unusually developed. The following method of Bing is an improvement on the latter. You will proceed as in the previous method until the posterior lip is plainly felt, which can be more easily discerned, by carrying the proximal extremity of the catheter toward the septum, when it will be noticed that on slight traction, the beak being directed slightly downward, that it can be made to glide easily downward and around the posterior lip, and circumducted, so to speak, into the t.o. The greater the development of this land-

mark (the posterior lip) the easier and more certain is catheterization by the Bing method.

Gentlemen, you must not forget that familiarity with, and dexterity in these methods of procedure are absolutely essential to success; that that method is the most desirable, that accomplishes catheterism with ease and without pain, "tuto, cito et jucunde."

As you become expert in the manœuvre you will not confine yourself to any particular method, but will proceed more or less unconsciously and independent of any special landmarks, as after the method of Boyer or Gairal, in which the catheter is passed along the floor, being held somewhat obliquely so that the convexity of its distal extremity is upward and inward and the concavity downward and outward, until the distal end reaches the nasopharynx when it is turned outward and upward into the tubal orifice.

A knowledge therefore of the topography of the nose and naso-pharynx and a practical experience in the procedure are the only means that will insure success.

705 Venetian Building.

EYE TROUBLES WHICH CONSTITUTE A FREQUENT SOURCE OF HEADACHE, VERTIGO AND NAUSEA, AND OTHER NERVOUS DISORDERS.

Series of four lectures delivered at the Fourth Special Course of the Chicago Polyclinic.

BY F. C. HOTZ, M.D.,
PROFESSOR OF OPHTHALMOLOGY.

LECTURE II.—STRAIN OF THE OCULAR MUSCLES IN BINOCULAR VISION.

Second Group.—The ocular affections to which I wish to invite your attention to-day, create disturbances in the nervous system also by strained muscular action. But while a person with abnormal refraction may suffer from nervous symptoms whether he sees with one eye or with both, the group of affections now before us can trouble the person only when he uses both eyes together. *The nervous symptoms caused by this second group are due to unusual demands upon the ocular muscles to maintain binocular vision.*

Binocular vision is only possible if the visual line of each eye (i. e. the straight line drawn from the macula through the center of rotation of the eye) connects the macula with the object, or as it is usually expressed, both eyes must be turned directly towards the object. The slightest deviation of the one visual line from the object disturbs binocular vision by causing diplopia, as you may easily prove to yourselves by a very simple experiment. Place one finger very lightly on the upper lid of your left (or right) eye, and then make with this finger the faintest pressure upon the eyelid while you are looking steadily at one object. You will at once see the object double, because the pressure upon the lid is transmitted to the eyeball, causing a slight displacement which faint though it be is sufficient to change the direction of its visual line and thus to cause double vision. When the object is far away from the eyes, the direction of these visual lines is so slightly convergent that it is customary to speak of them as being parallel. The nearer the object approaches the eyes, the more convergent must be the visual

lines; and hence in looking around from one object to another, we are constantly changing the position of our visual lines. The movements the eyeballs have to make for these adjustments of the visual lines, are effected by the actions of the four straight and two oblique muscles. Under normal physiological conditions, these muscular forces are so well balanced that when the muscles are in a state of physiological relaxation the visual lines are practically parallel; if, therefore, we look at distant objects, these muscles are pretty well at rest, and they become active in proportion as the object gets nearer to the eyes. And as we frequently change looking from near to distant objects, the ocular muscles undergo so frequent changes of tension and relaxation that they can easily meet the demands imposed upon them in the interest of binocular vision.

Now in the affections which interest us to-day, this physiological equilibrium of the ocular muscles is slightly disturbed; the visual lines are not parallel when the muscles are in a state of perfect relaxation, but the visual line of the one eye is slightly turned upwards or downwards, convergent or divergent. But these departures of the visual lines from parallelism are so slight that they do not cause any manifest deviation (as in strabismus) and for the sake of binocular vision can be and are corrected, and the parallelism of the visual lines is restored by persistent special efforts of one or the other of the ocular muscles. For instance, if in the state of muscular rest my right eye was just a little convergent, my sight would be confused in a peculiar way in looking at a distant object, because its image would not be received exactly on identical points of the two retinae; in the left eye the image would be on the macula, but in my right eye it would be on the nasal side of the macula. And while the left eye would see the object in its true position, my right eye would see it slightly shifted to the right, according to the laws of projection; but the shifting would probably not be great enough to produce distinct double images; the two images would neither be distinctly separated nor exactly blended, they would overlap each other and make the object appear to me in very uncertain contours, like blotted type. To get rid of this very distressing state of vision I must bring the visual line of my right eye to bear directly on the object, and I should accomplish this by inducing the external rectus of my right eye to make a special effort to turn this eye just so much that the image of the object is thrown upon the macula. The visual lines of both eyes then connect the object with the macula, and binocular single vision is restored. But it is restored at the expense of the external rectus of my right eye which is obliged to keep up a certain degree of tension to oppose the natural tendency of the eye to turn in. And as this extra tension had to be kept up all day, it would not be surprising if sooner or later this strain upon the external rectus muscle would lead to similar nervous symptoms which, as you have learned in our first lecture, are so often caused by the strained efforts of the ciliary muscle. And so we find it in reality: headaches, neuralgia, vertigo, and the whole train of neuroses indicative of an unusual and excessive consumption of nerve force are frequent complaints of persons whose eyes show these peculiar disturbances of the muscular equilibrium.