ACUTE EUSTACHIAN SALPINGITIS.*

BY FRANK H. KOYLE, M.D., HORNELLSVILLE, N. Y.

The aetiology of Acute Eustachian Salpingitis is to be considered under two heads: predisposing and exciting. The chief *predisposing* causes are: impaired general health, disordered gastric or intestinal digestion, pre-existing lesions of the nose and naso-pharynx, adenoids, middle ear catarrh, hypertrophy of the faucial tonsils, rickets, gout, lithaemia, hot and insufficiently ventilated rooms, improper dressing, and failure in the use of ordinary judgment in eating, drinking, bathing and exercise.

Among the more common *exciting* causes are to be found: acute coryza, acute naso-pharyngitis, acute pharyngitis, diphtheria, typhoid fever, hay fever (so-called), pertussis, the exanthemata, damp underwear, and chilling of the cutaneous surfaces.

Among the less common *exciting* causes are: acute articular rheumatism, syphilis, the accidental introduction into the Eustachian tube of either fluid or solid bodies, external injury or that due to the passage of bougies, nasal sepsis, and again adenoids.

In his work on Diseases of the Ear, Gruber makes the statement that "pathological changes peculiar to the organ of hearing have no existence; and that there can be, therefore, no justification at all for any *special* pathology of the ear." He further states that "As, however, the most diverse tissue-elements contribute towards its formation, and diseases of the neighboring structures exercise great influence upon its function, an accurate acquaintance with such diseases must be gained. The fact also that the ear is not rarely affected by diseases of organs standing in no direct anatomical connection with it, emphasizes the need for a familiar acquaintance with general pathology." While these statements are perfectly true as comprising a general enunciation, it is more the habit of the American mind to proceed from the general to the particular. Because of tubal continuity it would not be considered *quite* the right thing to give the pathology of proctitis if one should be asked for that of gastro-duodenitis. The gall-bladder and labyrinth both contain fluid, yet no one will contend that the most perfect knowledge of gall-stones will help in assigning a cause to a vertigo. If, then,

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we are to consider the Eustachian tube as an entity, even though it be a part of another organ, we must consider it as such and give to it the consideration which so important a structure deserves.

The mucous membrane of the normal tube is lined with cylindrical epithelium except in its cartilaginous portion where the epithelium becomes ciliated, the direction of the ciliary movement being towards the pharynx. Salpingitis in its mildest form may be a simple hyperaemia of the mucous membrane of the tube: or, a mild inflammation may follow the venous engorgement, attended by a slight swelling and diminution of the tubal lumen. With the involvement of the submucous layer the increased pressure results in a more or less complete stenosis and in a transudation of the fluid elements of the blood, the viscid exudate containing quantities of ciliated epithelial cells and leucocytes. Plugs of mucus of varying consistency sometimes occupy the lumen of the entire tube, although the occlusion caused by these masses is more often found in the cartilaginous tube. The gland-follicles are engorged and enlarged, giving a granular appearance to the tubal lips. Other pathological conditions to be considered are those of the middle ear resulting from the tubal stenosis. Here the rapid absorption of the contained air results in a diminished atmospheric pressure, while the same force acting from without drives the drum inwards and with it the ossicular chain. Should this condition remain unrelieved, adhesions form between the promontory and the membrana tympani at its point of least resistance.

The symptoms of Acute Eustachian Salpingitis vary in degree with the intensity of the attack. If mild, the affected ear becomes suddenly stuffy and stopped-up. To relieve the sensation of occlusion, the patient resorts to various devices such as exhausting the air in the auditory canal with his finger, swallowing, yawning, and a lateral movement of the jaw. Not infrequently there will be experienced a stiff, numb sensation involving the whole side of the head. Should the tubal stenosis last more than a few hours deafness and tinnitus aurium, varying in intensity according to the severity and duration of the attack, will almost invariably be present. The subjective sounds may be out of all proportion to the deafness, no complaint of which may be made by the patient, and consist of high-pitched, singing or squeaking noises. Sensations of pain are usually complained of, referred to the upper part of the pharynx, the larynx, the root of the tongue, to the tonsil and radiating to the ear, and to the side of the neck over the course of the tube. Instead of pain there may exist a sensation of a foreign body in the pharynx or

larynx or at the root of the tongue. Another symptom nearly always complained of is autophony. In those cases where the inward displacement of the membrana tympani and ossicles is very pronounced vertigo is quite apt to obtain, and in cases which have resisted treatment for some time aprosexia is not uncommon.

In making a diagnosis it may be well to suggest the importance of avoiding the error into which a young aurist will sometimes fall, viz.: the immediate reduction of the inflamed nasal tissues, a condition obtaining in most cases of acute Eustachian salpingitis. Such reduction should never be made until the rhinoscopic mirror has been used and the M. T. inspected.

The nasal mucous membrane will be found more or less acutely congested, boggy with a watery infiltration, turgescent, and the passage more or less occluded. In most cases there will be marked fullness, perhaps redness, of the faucial tissues, and occasionally a mild oedema of the soft palate and uvula. The rhinoscopic mirror will show a pronounced congestion of the tubo-pharyngeal eminence with more or less closure of the tubal entrance. An exudate of varying consistency will frequently occupy the tubal orifice in severe cases which have remained untreated for several days. If adenoids are present they will be swollen and congested, with stringy mucus occupying the interstices between the masses. If lymphoid tissue is not present the naso-pharyngeal vault will be congested and dry, or moist, according to the stage of the disease.

On inspecting the M. T. it will be noticed that the whole lower two-thirds of the membrane is greatly sunken and the cone of light displaced. This displacement will vary according to the degree to which the drum is indrawn. If the retraction be absolute the cone of light may be absent altogether; if only partial, the light reflex will be seen occupying a position somewhat higher than the normal. The malleus handle will be seen foreshortened, its tip being in more or less close apposition to the internal tympanic wall. In severe cases the neck of the malleus will be outlined by the closely clinging drum membrane, the short process being projected outward as a well-defined white knob. The anterior fold of the M. T. will usually look stretched and wrinkled, the posterior fold exaggerated, and the whole membrana vibrans so thin that through it may be seen the lining membrane of the uncongested inner tympanic wall, together with parts of the incus and stapes. As Dench so tersely puts it, "the physical appearances are due entirely to the diminution of atmospheric pressure within the tympanic cavity, this region itself being unaffected."

If the surgeon desires to be thorough in his diagnosis he will now proceed to make a functional examination of the aural conditions obtaining in his patient. After finding that hearing is reduced for the watch, acoumeter, and residual whisper, a condition which he naturally expects to encounter, he is now confronted by such positive evidence of labyrinthine disease (a marked reduction of the upper tone limit), that, engrossed by this new turn of affairs, he is apt to lose sight, for the moment, of the physical conditions which have already enabled him, probably, to determine the character of the disease under investigation. Should he ask himself at this juncture whether this is an "error of the mind" or an actual labyrinthine lesion, he will see, after a moment's consideration, that the lesion is not only real but the only condition that could be expected, from a mechanical point of view, as a result of the profound displacement of the ossicular chain. He now understands that the tinnitus, and perhaps vertigo, of which the patient has complained is due to the inward excursion of the stapedial footplate which has pressed upon the endolymph and violated the sanctity and integrity of the delicate structures guarded and bathed by the labyrinthine fluid. If the labyrinthine disturbance is, however, of less degree, it will usually be found, in a well-defined case under 40 or 45 years of age, that there is a raising of the lower and a lowering of the upper tone limits, the degree of each depending upon the acuteness and severity of the attack, as well as upon the length of time the disease has existed and the extent of the stapedial incursion. Rinné will be found negative for the lower notes, usually up to C natural, and then a reduced positive, varying to positive according to the degree of pressure. If the disease is unilateral Weber will be found positive.

The tuning-fork tests will be of less value, however, in patients over 45 years of age owing to the altered conditions of bone-conduction which then obtain. Another exception to be noted is that due to hyperaesthesia of the auditory nerve, which, according to Dench, may be produced by a sudden increase of labyrinthine pressure in sudden and complete closure of the tube. This author claims that "when the auditory nerve is in a condition of hyperaesthesia the perception of low tones is well preserved, and it may happen that the lower tone limit is not elevated to the degree which we should expect to find in sudden and complete closure of the Eustachian tube."

Acute Eustachian Salpingitis is to be differentiated from (a) Acute Tubo-Tympanic Congestion, and (b) Acute Otitis Media, the

history of the case and the physical conditions obtaining in the nose, naso-pharynx and tube, together with the appearance of the M. T. precluding any possibility of mistaking the affection for acute labyrinthine disease.

In Acute Tubo-Tympanic Congestion the patient complains of pain rather than the stuffy feeling experienced in acute salpingitis. There is impairment of audition but it is not so pronounced nor so sudden in its onset as in salpingitis. Again, there is usually a small amount of fluid in the middle ear cavity, air-bubbles being seen through the drum membrane on auto or other inflation, the air producing a crackling sound as it passes through the fluid. The M. T. is either a dull white or a pinkish white, the inferior segment showing a yellowish tinge if serum is present in the middle ear, and is only slightly retracted. The malleus handle is only moderately foreshortened and is somewhat rendened.

The findings of the functional examination are practically those of acute salpingitis and are thus of no value from a differential point of view.

In Acute Catarrhal Otitis Media there is at first a sensation of fullness and stuffiness in the ear, but this rapidly changes to a steadily increasing pain which ultimately becomes so severe that the patient complains of practically nothing else, even of the subjective noises which may be present. The diffused, pronounced redness of the M. T., together with the pain referred to, makes the diagnosis of this disease easily differentiated from that of Acute Eustachian Salpingitis.

Some authorities are prone to consider an attack of acute Eustachian salpingitis as of slight importance; others do not even mention it. It is true that a properly handled initial attack is devoid of special danger to the integrity of the ear, but it cannot be too forcibly impressed upon the patient that one attack predisposes him to another, a second to a third, a recurrence being certain if the disease is allowed to run its course and ultimately resulting in a permanent impairment of audition. It will not suffice that the patient may not be conscious, at the expiration of a few days of treatment, that he has any impairment of hearing. He must nevertheless be told, and in no compromising terms, that it will take several weeks to permanently restore the function of the ear. The constant dropping of water will wear away a stone. Likewise the stretching process to which the M. T. is subjected during each attack of acute Eustachian Salpingitis will deprive it of its elasticity to such an extent that it will stay stretched. The tensor tympani muscle, deprived of its

normal function as a result of its drifted anchorage, will become shortened, while the apposition of the tip of the malleus to the intra-tympanic wall will result in adhesive inflammation, the irritation thus produced involving the whole middle ear cavity in a chronic inflammation.

Treatment of Acute Eustachian Salpingitis includes the management of the present attack, attention to the exciting causes of the present attack, predisposing causes, and the prevention of recurrence of the disease. Since the opening of the Eustachian tube is to be accomplished before hearing can be restored, we must, if we are to use the catheter, not only reduce the engorged tissues but anaesthetize them sufficiently to make the operation painless. For this purpose a spray or swab of cocaine or eucaine must be used to open the nasal passages and the mouth of the tube. If the swelling is persistent adrenalin solution, applied either alone or added to the anaesthetic, will produce immediate ischaemia and shrinking of the parts. The nose is now sprayed gently but thoroughly with a warm alkaline antiseptic, *e. g.* a 20% solution of Glyco-Thymoline. The naso-pharynx should then be thoroughly cleared of its viscid secretions. This is accomplished, first by means of a single-tube DeVilbiss atomizer introduced through the inferior meatus; then by a post-nasal spray, using the double-tube DeVilbiss atomizer with reversible tip, the soft palate being gently retracted to facilitate the cleansing. This method is preferable to the use of the post-nasal syringe and will not, if care is used, produce the traumatism of the palate and pharyngeal walls which is more than apt to follow the use of the syringe. At this stage of the treatment it is frequently difficult, sometimes impossible, to use the rhinoscopic mirror for the purpose of further inspecting the condition of the tubal orifice. Should it be possible, and the tubal orifice is found occluded by a plug of mucus, it is best to remove it thoroughly before attempting inflation. The mouth of the tube being anaesthetized, a cotton-tipped applicator suitably bent and moistened with a 10% solution of alumnol may be used to detach and wipe away the mucus. Should inspection be impossible, the catheter, gently introduced, will prove to be the best means of ascertaining the presence of mucus. Using the Dench apparatus, a gentle pressure of the bulb will produce coarse, rasping, bubbling sounds if thin or stringy mucus occupies the meatus or the canal itself. If the mucus be inspissated the impinging of the end of the catheter against it will prevent egress of air and no sound will be heard. To be sure that an oedema is not the cause of the obstruction, the tip

should be moved about gently while slight pressure is being applied to the bulb. If it is determined that the obstruction is due to a plug of inspissated mucus it may be removed in the manner already mentioned. If, on the other hand, fluid mucus is found, the catheter is left in position, the inflating apparatus detached from it and *gentle suction* used. Almost invariably it will be found that the mucus can be easily sucked into the catheter from which it can be forced, after withdrawal from the nose, by a blast of compressed air and received upon a bit of cotton or paper for preservation and future examination. So long as fluid mucus is found in the tube this procedure should be kept up, the introduction of the catheter, its withdrawal, and the management of its tip being conducted with the greatest care. Even a plug of gelatinous mucus lodged in the isthmus can thus be removed, the suction engaging it in the distal end of the catheter where the mass will be found on withdrawal. It has frequently been the writer's good fortune to so completely remove in this way the viscid mucous and muco-purulent secretions of the tube that the subsequent catheterization was a dream, a mild inflation serving to restore normal tympanic relations without producing, or increasing an existing, tinnitus or vertigo. It might be added that he has employed the same method with equal success in withdrawing comparatively large quantities of fluid from the cavity of the middle ear in tubo-tympanic congestion. Having now cleared the tube by means of the catheter it would be folly to substitute for it the Politzer bag to complete the inflation.

From the first the object has been to relieve the patient's deafness. This can be accomplished by only two methods, viz.: the Eustachian catheter, and Politzerization (or one of its equivalents). The great value of the former in the preliminary clearing of the tube having been so clearly demonstrated, the writer believes that the latter should be condemned except in the treatment of young children. True, it gives quick results, if, indeed, inflation is possible at all, but it is nevertheless true that the operation is always fraught with danger. During its performance the contents of the tube must necessarily be driven into the cavity of the middle ear. It is difficult, nay, impossible to accurately regulate the force required to open the tube, and hence a possibly infective mass is distributed broadcast within the tympanic cavity, while the impact of the blast of air cannot but produce a traumatism of the inflamed and contracted tubal walls and of the delicate middle ear structures. It is in this way, too, as instanced by increased tinnitus and vertigo, that more or less damage is done to the labyrinthine contents as the result of sudden

shock and pressure. It does not seem fair to subject a patient to the possible untoward results of such a forcible inflation by Politzerization. Enumerated, these are found to include: acute suppurative otitis media with its possible sequelae; chronic adhesive catarrhal otitis media; impaired integrity of the stapedius and tensor tympani muscles; stretching of an already weakened drum membrane, thus producing unequal vibrating areas should it have become adherent to the promontory; damage to the opposite ear either from trauma or infection or both; and last but not least, a permanent injury to Corti's rods or the membrana basilaris.

The writer feels warranted in making the statement that the first-mentioned of these results is only too common, an acute salpingitis being converted into an acute suppurative otitis media through the injudicious means taken to rapidly give the patient relief. Children too young to be amenable to catheterization must, of course, be Politzerized; but even in them we must realize that many a case of acute or chronic suppurative otitis media was primarly one of acute Eustachian salpingitis. As to the second of these results, viz.: chronic adhesive catarrhal otitis media, it may be said that non-infective viscid secretions or exudates thus driven into the cavity of the tympanum are not completely absorbable. The aqueous element having been absorbed, what becomes of the sticky residuum? Assuming its inocuousness, it is nevertheless a mechanical menace to the normal transmission and reception of external vibrations. Surrounding the ossicles and their articulations, reducing the mobilization of the stapedial foot-plate by its very adhesiveness, diminishing by its contracting force and by its weight the outward excursion of the membrane of the round window, an excursion so necessary to labyrinthine equilibrium, this residuum ultimately becomes organized into a low grade tissue and a pathological condition now obtains in which an insistent, insidious process of inflammation adds new material to the recently organized exudate. Thus the foregoing physical conditions are exaggerated and the transmission of sound more and more impeded by subsequent repeated accretions and contractions incidental to the now chronic hyperplasia. The writer's objection to Politzerization as a routine primary procedure is so pronounced that it has seemed necessary to establish his position by thus reviewing its probable consequences. In so doing he is entirely cognizant of the fact that several authorities advise Politzerization in the treatment of this disease. In fact one of them, Bishop, goes so far as to emphatically advise against the use of the catheter, claiming that "it increases the irritation of the inflamed tube." If

it were always possible to see and treat these cases at their very inception and with the tube perfectly dry, it is quite probable that no material harm would result from the "gentle and gradual Politzerization" which he advises, but in the writer's experience these cases have never presented themselves until the process was well established. Having decided, then, upon the use of the silver catheter, it is only necessary to say that the actual induction of the restoration of the tympanic membrane to its normal position should be proceeded with in a manner so cautious and gentle as not to produce the slightest traumatism of the tube, the drum membrane, the intra-tympanic structures or the labyrinth. Thus tinnitus and vertigo are relieved by the gradual release from pressure of the labyrinthine fluid, the intra-tympanic muscles allowed to functionate normally, the drum membrane and ossicles restored to their proper relations to one another and to adjacent structures, and more or less normal hearing ensues. It occasionally happens that with no inspissated plug of mucus occluding the tube the constriction due to oedema or engorgement is so great as to make it impossible to perform inflation by *any* method. Should this condition be present it will be found that a Dench bougie of No. 5 piano wire, tipped with a small pledget of cotton, will serve a useful purpose if moistened with a 1-1000 adrenalin solution, introduced through the catheter and gently pressed against the engorged tissues. In about a minute inflation can be performed, especially if the patient be directed to swallow at the same moment the bulb is compressed. It is in these cases of total obstruction that the greatest caution should be used in inflation, since the introduction of even the smallest stream of air under moderate compression of the bulb will not infrequently increase the existing labyrinthine pressure and produce a severe vertigo, great nausea and vomiting, and a collapse from which it takes hours to recover. For this reason it is advisable to so regulate the force of the entering stream of air that it will merely *trickle* in, thus providing for the gradual restoration of labyrinthine equilibrium while abolishing the intra-tympanic vacuum. Inflation having been satisfactorily performed, an astringent is to be applied to the mouth of the tube with a cotton-tipped carrier. Argyrol in a solution varying in strength according to the severity of the inflammation (*i. e.* from 20% to 50%) will furnish an ideal medicament. The act of swallowing will now aid in the distribution of the argyrol throughout the tube in so thin a stratum as not to materially lessen its lumen and will exert its astringent action for some hours. If the naso-pharyngeal process has been an acute one a 50% solution of the same

medicine is then painted over the entire naso-pharynx as well as over the oro-pharynx and tonsillar regions should they present evidence of inflammation. A 5% solution may even be sprayed into the nose if the surgeon will remember to caution his patient to use a 1-1000 solution of bichloride to decolorize the stains on subsequently used handkerchiefs.

It has usually been considered necessary to instruct the patient to use various aqueous or oil sprays and medicated vapors containing a variety of drugs such as tinct. benzoin comp., carbolic acid, menthol, camphor, iodine, eucalyptus and other oils. While the inhalation of a warm, bland vapor from a sterilized petroleum product into which a *very small* quantity of one of these drugs has been incorporated may be ordered for home treatment, it is doubtful if any particular benefit, except moral, is derived from its use in *acute* cases. Practically all these drugs are too stimulating, even in weak solutions, to be used on an acutely inflamed membrane. Later on, if the disease has not succumbed to astringent and detergent or other treatment, it is good medicine to promote endosmosis by vascularizing the atonic submucous tissues with one or more of the above-mentioned stimulants. It is then, and only then, that the introduction of such a vapor into the nose and Eustachian tubes can be productive of any real good. Instead of a warm vapor the writer has found that the use of superheated air has been of benefit in certain cases which did not prove amenable to other treatment. The temperature required is that of the patient's toleration, care being used to avoid destruction of the nasal mucous membrane. A fibre catheter is the ideal instrument for this purpose, but a silver catheter wound with a strip of compressed cotton may be used. An air pressure of ten pounds through an appropriate heating apparatus will generally prove sufficient to take care of the moisture in the tube and will not force mucus into the middle ear cavity. It is not to be assumed that the degree of heat used is sufficiently great to actually destroy the bacteria present in the tube. On the contrary it is by its stimulation that a phagocytosis is set up and the microphages, assisted by the opsonins of the blood plasma, become the avengers of the outraged tissues.

Another method of stimulation of undoubted value is that of mechanical vibration of the superior cervical ganglion whose ascending branch gives off an external branch to form the carotid plexus. A branch of this plexus joins a branch of the tympanic which supplies the mucous membrane of the tympanum and the Eustachian tube. To vibrate this ganglion pressure should be ap-

plied at the upper part of the anterior border of the sterno-cleido-mastoid muscle. Indirectly the superior cervical may be stimulated through the spinal connection at the upper cervical and also through the middle or inferior ganglion by vibrating lower in the neck.

As to internal medication camphor, aconite, belladonna and quinine have some therapeutic merit; but better results may be obtained by the administration of minute repeated doses of gelsemium. In the initial stage the greatest benefit to be derived from treatment, aside from overcoming the deafness and subjective noises, will be obtained, however, not from dosing a symptom, but from a proper understanding of the underlying causes which have made these symptoms possible. Therein lies the crux of the whole matter and therefore our energies should be directed towards the elimination of pathogenic products and the restoration of normal resistance. Recognizing the fact that the special activity of the bacteria immediately responsible for the present state of affairs has not been brought about without adequate cause, it becomes necessary to institute a thorough search for those systemic conditions producing the lowered vitality responsible for the present bacteriacidal victory.

It is to be assumed that the treatment of obstructions of the nose and naso-pharynx, of lesions resulting from traumatism of the tube itself through douching, instrumentation, or the introduction of foreign bodies, together with the prophylaxis to be observed in the exanthemata, need not be here particularized since such treatment scarcely comes within the scope of this paper. Neither is it pertinent to refer to the treatment of the conditions obtaining as a result of lues, cancer, or sepsis. We will usually find, however, that the goal of our therapeutic effort lies in the correction of an auto-intoxication resulting from a faulty metabolism and defective elimination by the skin, kidneys and bowels. Prompt flushing of these sewers miraculously terminates the progress of a great many diseases and none more quickly than the one under consideration. When possible, it is advisable for the first few days to treat the patient at his home where special diet, equal temperature and toilet necessities are assured. During this time other functional disturbances may be detected and prescribed for and the patient instructed in dietetics, exercise and personal hygiene according to his requirements.

119 Main St.