THE TREATMENT OF TINNITUS AURIUM.*

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The treatment of tinnitus can be divided into local, general, psychic or mind cure, and empirical.

LOCAL TREATMENT.

Local treatment in tinnitus includes treatment for deafness, and should be directed to the removal of the slightest perceptible possible cause. The condition of the mucous membrane is most important and calls for restoration to normal. The more energetic therapeutic or surgical procedures can be reserved until their necessity has been demonstrated by the failure of the milder measures. Too energetic treatment may increase tinnitus or cause it in cases where it did not previously exist.

In a very large proportion of cases of tinnitus the sound conducting mechanism or middle ear is at fault, and in the majority it is wholly to blame. Errors in conduction require treatment more than any other defect in the often complex condition which gives rise to tinnitus. The treatment of this defect is identical with that for deafness due to the same cause and consists in removing the impediment, whatever it may be. (See *conduction tinnitus*.)

I. OBJECTIVE TINNITUS. The local treatment is chiefly directed to lessening the objective sounds and secondarily to lessening the ear's perception of them. (1) In *external tinnitus* the local treatment is less important than in most of the other forms of tinnitus. When any is required it is chiefly directed to the impaired action of the sound conduction apparatus. (a) In *vascular tinnitus*, small aneurisms or local chronic hyperæmias require ligation of the offending arteries. Any tumors giving rise to tinnitus by compression of the vessels should be removed. Compression of the carotids or vertebrals sometimes affects the tinnitus favorably. (b) In *pharyngeal tinnitus* the local treatment is chiefly alkaline, antiseptic or stimulant applications, and the removal of hypertrophies or new growths. (c) In *respiratory tinnitus* the local treatment consists in removing the causes of the altered respiratory sounds. Morphological impediments in the respiratory tract, such as hypertrophies and new growths, should be removed by surgical means

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and dislocations and deformities reduced. (d) *Muscular tinnitus* is not amenable to local treatment except for the relief of local irritation. The treatment is chiefly psychic because the offending muscles are under control of the will. Electricity, hydropathy and general tonic remedies are indicated, and sometimes bromides help.

(2) In *internal tinnitus* local treatment is more important, and is directed to (a) *salpingeal tinnitus*. The tube should be kept free from secretions, etc., the consistency of which should be improved by appropriate local applications. The ordinary treatment of the coexisting nasopharyngitis is indicated, together with applications of adrenal products, nitrate of silver, tannin, and iodine, as the case may require. When the tube is hyperpneumatic stimulants applied to its mouth may aid its physiological closure. If its nutrition can be improved, try electricity or nitrate of silver. (b) In *tympanic tinnitus*, if fluid is present it should be drained by improving the patency of the Eustachian tube. (See *conduction tinnitus*.)

II. SUBJECTIVE TINNITUS. The local treatment is chiefly directed to lessening the perception of the sounds by the ear and the improvement of sound conduction; secondarily to lessening the sounds themselves. (a) In *vital tinnitus* the local treatment is directed to the improvement of sound conduction only (See *conduction tinnitus*.) (b) In *diplacusis tinnitus* local treatment of the sound conduction mechanism is indicated, together with treatment of the sound perception mechanism if that is also defective. (See (3) *sensory tinnitus*.)

In (2) *endotic tinnitus* the treatment is directed to (a) *circulatory tinnitus* in which local treatment is used for the improvement of sound conduction and for lessening local congestion, which requires special attention to the mucous membrane. (See IV. *mucous tinnitus*.) (b) In *myotilitic tinnitus* the local treatment consists in removing any local cause for irritation of the tympanic muscles, such as granulations, foreign bodies or any irritation of the mucous membrane in the tympanum. Electricity or sedatives are indicated. (See V. *contraction tinnitus*.) Counter-irritation of the tube and pharynx, and adjacent skin, should be tried. (c) In *movement tinnitus* the local treatment consists in the removal of the bodies which cause the tinnitus by their motion. When muscular action is at fault attempt to control this is indicated. (See V. *contraction tinnitus*.) (d) *Somatic tinnitus* requires local treatment only for the impaired sound conduction apparatus.

(B) *Neurotic tinnitus* requires under (1) *peripheral tinnitus* treatment of (a) *reflex tinnitus*. This admits of no local treatment other than counter-irritation to pharynx, skin and other parts of the body,

such as sinapisms to back of the neck, hot foot baths, etc., etc. Galvanism can be tried on the offending nerves.

(2) In *optic tinnitus* the treatment is directed locally to (a) *conduction tinnitus*. Here the treatment is for the most part local and similar to treatment for deafness due to impaired function of the sound conducting mechanism. In the atrophic and sclerotic processes of the tympanum and its contents, stimulants and irritants are indicated, carried to a point just short of suppuration. The hot air douche in the external canal is good in some cases, and occasionally electricity is used as a stimulant with good results.

(1) In MYRINGEAL TINNITUS the treatment is directed (1) to allaying congestion and acute inflammation by removing any irritating substances, by improving the ventilation through the tube, by counter-irritation of the nasopharynx, external meatus and the region anterior to the tragus. (2) Sclerosis of the drum membrane should be stimulated by inflation, instillation of irritants through the Eustachian tube and massage to improve nutrition. Talking into the ear through a cone of paper gives good vibratory massage. The malleus may be removed, the malleus and incus or the incus alone in cases when the stapes is free to act except for the hindrance from the other ossicles. (3) Repair of the drum membrane is indicated when there is destruction of tissue. This is done by stimulating the growth of a cicatrix. The periphera of the perforation is stimulated by irritating it with caustic, by scarification and by massage. If repair remains defective, substitution of an artificial membrane is indicated, such as cotton pledget, paper discs, collodion dressings, or variously constructed artificial drums. (4) Cicatrices are to be stretched when they are too tight. This is done by manipulation, massage or inflation. When cicatrices are too loose, they should be contracted by rest and collodion. (5) Adhesions of the drum membrane should be stretched with massage and inflation, or cut. Their absorption can be stimulated by intratympanic injections of irritating substances. (6) Relaxations of the drum membrane like loose cicatrices are contracted by rest and collodion or paper splints. Avoid all inflation. (7) Atrophy requires stimulation by irritants, electricity, and by pneumatic or sound vibration applied at the meatus, also Lucae's pressure probe or Hommol or other forms of massage. Means that might stimulate nutrition must be tried. (8) Calcifications can be excised, and stimulation used to prevent their recurrence. (9) Inward displacements of the drum membrane due to faulty ventilation require for their treatment correction of the tubal conditions. When the displacement is due to muscular action or other contractions, Polit-

zer plugs are indicated, following inflation. If these are insufficient, tenotomy may be tried. When the function of the Eustachian tube cannot be re-established, paracentesis of the drum should be tried and if good results follow the opening can be made permanent. (10) Outward displacement of the drum is to be rectified by proper regulation of the ventilation and drainage of the tympanum, but especially by keeping the meatus free.

II. TUBAL TINNITUS is the most common variety of all. This is the case on account of the influence which nasopharyngeal conditions have on the Eustachian tube, owing to the continuation of the mucous membrane from one to the other and the intimate relations of their nerves and blood supplies. Local treatment of the nasopharynx is indicated in all pathological conditions of the tube, and where the changes in the naso-pharynx are marked their correction is of first importance. The tinnitus is apt to be increased in bed, especially in the morning, which is due to the increased swelling of the mucous membrane, and because stasis and engorgement of the turbinates are common at that time; therefore sleeping with the head high is indicated in these cases. In the chronic conditions massage behind the angle of the jaw applied with the finger or vibrator is very useful. Tubal tinnitus depends on pathological conditions in the nose, most of which are due to the gouty conditions. Second only to these in importance are nasal obstructions which are amenable to local treatment. Tinnitus can sometimes be cured by stopping mouth-breathing alone.

The nasopharyngeal conditions requiring local treatment are: (1) Inflammations, which are treated by cleansing and antiseptic alkaline solutions, etc. (2) Abnormal secretions of the mucous membrane are removed with alkaline and antiseptic sprays. If the secretions are viscid, appropriate treatment is required for their improvement, stimulant and revulsant. (3) Sthenic congestion with red mucous membrane and secretion abundant or nearly wanting and the pharynx dry, are indications for adrenalin. (4) Acute congestive coryzas require soothing alkaline and aromatic sprays. Avoid use of cocaine and adrenal products. Acute conditions of the tube respond with remarkable rapidity to improvement in the like conditions of the nasopharynx. (5) Venous or passive congestions. (6) Asthenic conditions, with pale mucous membrane, sometimes red and dry, occasionally oedematous, require locally, astringent and stimulating applications, such as silver nitrate, Monsel's solution of the persulphate of iron. Adrenalin occasionally does good. (7) Acute secretive catarrhs like summer colds may require essential oils and oily sprays. (8) Atrophic conditions

require stimulating and antiseptic treatment with various applications, such as nitrate of silver, ichthyol, iodine, glycerine, etc., general treatment and electricity, Roentgen rays, or radium. (9) Destruction of tissue. (10) Obstruction due to functional derangement of the erectile tissues of the nose can be treated with suprarenal products, cautery, astringent of the obstruction can be removed by surgical means. Cold applications on the back of the neck are often efficacious in reducing congestion of the turbinates and mucous membrane. (11) When there is loss of tissue the defect should be remedied if possible, and cicatrization encouraged. The mucous membrane can be helped to regain its normal activity by alkaline antiseptic or stimulating applications. (12) Mucous hypertrophies can be removed by surgical means and cauteries. (13) Morphological obstruction should be removed or rectified by surgical means. (14) Adhesions ought to be broken down, especially in the fossæ of Rosenmüller. When the fossæ are closed by adhesions, they require to be broken down with the finger, or bent probe, and afterwards kept free with the probe. Applications of silver nitrate should be used until the surfaces no longer bleed easily. (15) Cicatrizations may require operative interference. (16) New growths and (17) foreign bodies should be removed. (18) Defective muscular action of the tubo-pharyngeal muscles requires faradism and stimulation. (19) Hypertrophies of normal tissue, lymphoid and turbinal, can be removed by surgical means. Avoid use of cocaine, as the irritation it often causes is not desirable.

The good effects of irritating the mouth of the tube are shown by the effects on the structures within the tympanum.

Local Treatment of the Eustachian Tube. The Eustachian tube must perform its normal function of ventilating the drum, and must not cause any reflex or circulatory disturbance. To insure this, use the largest sized catheter possible, in order to produce complete distension of the tube, and to give an air pressure in the tympanum up to 5 lbs. per sq. inch. The Eustachian catheter acts by equalizing the pneumatic tension on the drum membrane, but chiefly by pneumatic massage of the tube and tympanum and by direct massage and stimulation of the mouth of the tube.

(1) Congestion is to be relieved with adrenal preparations. (2) Oedema is to be lessened by adrenal preparations and stimulation, massage, etc. (3) In congestion, inflammation and swelling with more or less obstruction use the Politzer air douche and catheter. The best topical application is adrenalin followed by nitrate of silver applied on a bent cotton carrier and pushed into the tube until

the patient feels it in the neighborhood of the ear. Applications can be made further up in the tube with bougies, but are not usually necessary as the obstruction is generally near the pharyngeal end of the tube. Sometimes milder applications are sufficient. Abnormal secretions of the mucous membrane are to be removed with the air douche, catheter or suction, and the tube can be washed out with mild alkaline and antiseptic solutions when the drum head is perforated. (4) Products of inflammation and (5) foreign fluids are removed in the same way. (6) Hypertrophies require the cautery or astringents and escharotic treatment and adrenal extract, Monsel's solution, nitrate of silver, or electricity. (7) Organic cicatrices require incision and dilatation, or paracentesis of the drum with a permanent opening. Cicatrization and stricture are usually at the tympanic orifice connected with similar processes in the tympanum.

Electric treatment gives excellent results in tubal tinnitus and is useful in cases that have proven refractory to other methods. The negative pole can be applied to the tube, preferably through the nose. It is best made in the form of a Eustachian catheter conical at the tip and in three sizes. It should be insulated to within three-quarters of an inch of the end of the electrode. This bougie will enter the tube probably as far as there is necessity for it to pass, because the obstruction is usually in the cartilaginous tube not far from its pharyngeal end. Duell's electric bougie is very satisfactory in the most refractory cases. (8) Atrophy needs stimulation and electricity. When, in atrophic conditions, the tube remains continuously open and every breath goes through to the drum head, stimulants, local and general, are indicated.

III. In OSSICULAR TINNITUS (1) rigidity of the ossicular ligaments requires stimulation by hot air or hot water, gentle exercise, or massage. (2) Ankylosis requires the removal of the larger ossicles if the stapes is free. Atrophic conditions and resulting ankyloses and ankyloses from cicatrization require stimulation by applications, electricity and massage locally or to the neighboring parts, such as the pharynx, external meatus, irritating tubal injections, etc. The treatment is nearly the same as for adhesive processes. Much can sometimes be accomplished by weighting the membrana tympani, either by cotton pledgets, collodion films or vaseline. (3) Relaxation of the articulations requires rest and splints, made of collodion or paper, and stimulation to improve nutrition. Above all avoid inflation. (4) Adhesions are to be stretched by inflation, or destroyed by section, or absorbed by low grade inflammation. Treatment by sound vibrations and massage is very good. (5) Caries requires removal of the diseased bone.

IV. MUCOUS TINNITUS, first of all, requires proper ventilation and drainage through the Eustachian tube. Abnormal secretions or exudates should be removed by the air douche or catheter, with inflation or suction. If attention to the tubal function is not sufficient, the drum head can be punctured, followed by inflation to expel the exudate. Alkaline tubo-tympanic injections to soften and remove the exudate are good. The conditions of the tympanic mucous membrane are directly dependent on the conditions of the mucous membrane of the Eustachian tube, and this is again dependent on the condition of the mucous membrane of the pharynx, and therefore the treatment is not complete unless the pathological conditions in all these localities are taken care of. (1) Disturbances in the tension of the reduplications of the mucous membrane are important. (A) They may be swollen by congestion and require soothing and depleting measures. (B) They may have lost their elasticity and impede the action of the ossicular chain, and require stimulation, irritation, and massage to improve the nutrition, with the hope of inducing them to resume their normal condition. Or stretching and section are indicated. (C) They may be shortened and hold the ossicular chain out of position and interfere with the acoustic balance, in which case section is required, if stimulation, massage and stretching fail to relax them. (2) In congestion of the mucous membrane, lessen the local cause if possible, and facilitate the return flow of the blood. Ventilation of the tympanum is important. Insufflation of adrenalin and cooling vapors is indicated. (3) In œdema improve the circulation, especially with massage, and insure proper ventilation through the tube. (4) In inflammations, proper ventilation through the tube is of first importance. Remove the cause if possible, treat by anti-phlogistic procedures, and apply adrenalin to the tube. Inflate with caution when the drum is perforate; use antiseptic applications and douching when the drum head is perforated. Products of inflammation, such as pus or blood, better be evacuated by puncture of the drum membrane. Mucous rarely requires this; serum, never. Evacuate exudation and secretions retained under pressure. Use neutral salt solution for local application for cleansing purposes except when some stronger agent is definitely indicated. In resultant hypertrophic conditions, intra-tubo tympanic injections of ether and water have been found a good stimulant to hasten absorption. (5) Polypi and new growths should be removed. Polypi can be cauterized with nitrate of silver. (6) In sclerosis, stimulation, massage, and irritation to the utmost limit are required. Sometimes it can be helped by stimulation with electricity through an internal electrode, or by tubal injection of

spirits of nitric ether. (7) Atrophy should be treated in much the same way as sclerosis with vapor of sulphuric ether, acetic ether, or chloroform, with iodine, also carbo-iodide. Mixture of sulphuric ether and liq. anæstheticus Hollandi, 6:4; warm albolene and menthol; iodide of ethyl, spirits of nitric ether, Stapler's solution for vaporizer (camphor menthol, turpentine and albolene, equal parts of each), are all useful. (8) After hæmorrhage proper ventilation or paracentesis of the drum is needed to promote absorption.

V. In *contraction tinnitus*, massage, and especially electricity for the offending muscles, in indicated. Tenotomy may aid in relieving the contraction. (1) Spasmodic contractions are most helped by general treatment. Tinnitus when due to irregular muscular action can best be treated by counter-irritation of the pharynx or outer surface of the neck, and by the use of electricity good results are obtained. (2) Contractures and shortenings require local treatment to relieve the source of irritation, or section of the tendon can be tried. (3) Deficient muscular action and paralyses are often improved by faradism applied with an internal electrode, and massage, together with stimulants and general tonics.

VI. In *ADHESION TINNITUS*, inflation and massage are useful in cases of deficient nutrition, or impaired action due to adhesion and contractions. Massage can be applied behind the angle of the jaw, in the meatus by pneumatic massage, to the malleus by probe pressure, or by the finger on the tragus (Hornmel massage). The absorption of the adhesions and bands may be stimulated with electricity (galvanism). The negative pole is placed on the external meatus or in the mouth of the Eustachian tube, which is the best way. Hot air or hot water douche to the meatus and intra-tympanic injections of irritating substances (gases or fluids) are useful. The best procedure is to excite a non-infectious inflammation of the tympanum by inflating the tympanum with a vapor of albolene and chloroform, 15 to 20%; or of carbolic acid, 10 to 15%. The operative treatment consists of exploratory incisions of the drum membrane, freeing all adhesions which can be reached (whether of the malleus, drum membrane, stapes, or incus), perhaps even the removal of the incus, malleus, drum membrane, or all together, followed by mobilization of the stapes. I have known good results to follow the removal of the stapes also.

VII. *FENESTRAL TINNITUS* requires inflation, paracentesis, or cutting of adhesions and removal of superabundant tissue. (1) In cases of impaired motion of the stapes and membrana rotunda. (2) In clogging of the fenestræ by products of inflammation, electri-

city against and through the windows has seemed to hasten improvement.

VIII. TRAUMATIC TINNITUS requires rest, removal of the foreign bodies, exudate and blood, and the repair of the wound helped by keeping it as aseptic as possible without irritating it.

IX. MEATAL TINNITUS is treated by remedies appropriate to the kind of dermatitis present. Collections of pus are evacuated with a knife and antiseptic treatment applied. (1) Eczemas and irritation from scaly skin require treatment to lessen the irritation. In the dry form, use applications of lanoline, or lanoline and creoline—2 to 3 minims to the ounce. The following prescriptions are said to be good where the external meatus is dry and has no normal secretion. Their use relieves the condition and produces a reflex amelioration of the tinnitus:

R	Tinc. Ambrae	2.0
	Aether, sulph.....	1.00
	Glycerini (pure)	12.00
or R	Tinc. Valerian	2.0
	Aether acet	1.0
	Glycerini (pure)	10.00
S.	Paint in meatus.	

(2) Accumulations of secretion and exudate must be removed by syringe, cotton sticks, or forceps, and the skin treated to prevent their recurrence. (3) Proper ventilation of the outer surface of the drum membrane requires keeping the meatus patent. (4) New growths and hypertrophies are removed with knife, snare, forceps, chisel, or cauteries. Roentgen rays and radium have proven very useful in superficial rodent epithelioma and tubercular alterations, and are also of use in various infections. Morphological obstruction is obviated by operation or dilatation. (5) Foreign bodies are removed by forceps or syringe.

(b) *Reaction tinnitus* requires lessening the irritation of the tympanum caused by conditions or substances not necessarily enough, or so located as to cause defects in sound conduction. These may be fluid, localized swelling, a polyp, or foreign bodies. Intra-tympanic injections of hydrochlorate of cocaine, 5—8 gtt. of 2—5% solution, are sometimes good; and the counter-irritation of the tube, pharynx, or the skin may be useful.

(3) *Sensory tinnitus*. Local treatment is in the line of major surgery, and is directed to the removal of local causes of irritation which usually act by pressure. These may be: (a) Inflammatory. (b) Hæmorrhage. (c) New growth. (d) Pressure from without. (e) Pressure from within. Other forms of local treatment are of little avail. But counter-irritation may have some effect. In tinni-

tus from anæmia of the head the patient should sleep with the head low. When the tinnitus is from too much blood supply, sleep with head high.

(a) *Nerve tinnitus* gives slightly more opportunity for local treatment than psychopathic tinnitus. It can sometimes be aided by electricity, preferably galvanism. Electrolysis against and through the labyrinthine windows and via the membranes has been thought to do good. Vibrating tuning forks, used from one to ten minutes, may relieve severe attacks of tinnitus. Use low tones for high pitched tinnitus, and vice versa.

(I.) In PERIPHERAL TINNITUS, if caused by drugs, they should be stopped. Local treatment is sometimes required for the following conditions, when present, which is in the form of operative interference: Hæmorrhagic accumulation. Exudates. Inflammations. Pressure from without is treated by alleviation to the sound transmitting apparatus. Pressure from within is best treated by general remedies. Cases of impaired nerve action are stimulated with electricity (galvanic), quinine, strychnine, etc.

Lumbar puncture in labyrinthine cases has given good results (Babinski). This is much more rational than pilocarpin, but blood-letting would probably do as well and not be so unpleasant.

(II.) TRUNK TINNITUS can sometimes be improved by removal of tumors pressing on the nerves, or by the improvement of other pathological conditions at the base of the skull. (III.) PROXIMAL TINNITUS and (IV.) ASSOCIATION TINNITUS can sometimes be helped by local treatment when the tinnitus is dependent on operable conditions.

In (b) *psychopathic tinnitus*, when dependent on operable pathological changes, an improvement may follow local treatment of these intercranial conditions. (a) Inflammations should be treated locally with antiphlogistic remedies, and the products of inflammation removed by drainage. (b) New growths are removed by surgical means. (c) Pressure from within or from without is relieved by surgical means, as in a depressed fracture of abscess.

When, in cases of grave tinnitus, all treatment has been tried and failed, section of the auditory nerve is indicated for the purpose of producing absolute deafness for all sounds objective and subjective; and when the source of the tinnitus can be located peripherally to the proposed point of section and when hearing by bone conduction is unimpaired, which is proof positive that the function of the auditory nerve and root is not much impaired and therefore not the seat of the tinnitus.

The operations done on the auditory nerve for the relief of tinnitus have been a failure in the past partly because the cases selected

were not suitable and partly on account of the methods followed. Cases with much diminished bone conduction are not suitable for operation because the seat of the tinnitus can not be definitely located in any special part of the course of the auditory nerve, its roots or centers. Three routes have been tried: (1) Via the ordinary cerebellar route, (2) via the mastoid process, and (3) via the cochlea. There is another route more safe and sure which I hope to describe on some subsequent occasion.

SUMMARY OF CLASSIFICATION.

TINNITUS.

I. OBJECTIVE.

(A) VIBRATORY.

1. *External*: (a) Vascular.
 (b) Pharyngeal.
 (c) Respiratory.
 (d) Muscular.
2. *Internal*: (a) Tubal.
 (b) Tympanic.

II. SUBJECTIVE.

(A) PHONETIC.

1. *Exaural*: (a) Vital.
 (b) Diapycusic.
2. *Endotic*: (a) Circulatory.
 (b) Myotolitic.
 (c) Movement.
 (d) Somatic.

(B) NEUROTIC.

1. *Peripheral*: (a) Reflex.
2. *Otic*: (a) Conduction:
 - I. Myringal.
 - II. Tubal.
 - III. Ossicular.
 - IV. Mucous.
 - V. Contraction.
 - VI. Adhesion.
 - VII. Fenestral.
 - VIII. Traumatic.
 - IX. Meatal.
- (b) Reaction.
3. *Sensory*: (a) Nerve Tinnitus:
 - I. Peripheral.
 - II. Trunk.
 - III. Proximal.
 - IV. Associated.
- (b) Psychopathic:
 - I. Central.
 - II. Illusional.
 - III. Hallucinational.
 - IV. Delusional.