

## EDITORIAL

# TINNITOLOGY

It is a symptom not a disease which is a perception of sound at cerebral cortex level without acoustic stimuli. The tinnitus is derived from latin word tinnire meaning to ring. It is distinct from auditory hallucination which is perception of voices or music and not affected by environment while tinnitus is usually aggravated in quiet surrounding and diminishes or subside with external sound stimuli. Sensation of tinnitus may be explained as ringing, buzzing, whistling, roaring, hissing, steam escape or clicking sound. The sound is usually heard in head and frequently associated with cochlear deafness difficult to localise the side. If localised usually, lesion is in the ipsilateral temporal bone.

The incidence of tinnitus varies from 5 to 30% world wide. At our centre patients attending OPD is less than one percent. In northern India most of elderly presume that it is an aging symptom after the age of forty years. In our setup both sex are equally affected.

### CLASSIFICATION

Tinnitus may be classified as:

Vibratory/ Non vibratory

Pulsatile / Non-pulsatile

Continous / Interrupted

Subjective / Objective

Low Pitch/ High Pitch

Single / Multiple Sound

Loud and distracting / Soft

Maskable/Non-maskable Tinnitus

### ETIOLOGY

Various theories has been proposed -

1. Central Nervous system responds to disorganized activity of hair cells, importing signals without external stimuli.
2. Chemical changes in cochlea and auditory nerve hence spontaneous nerve activity in auditory nerve may be responsible.
3. Study by positron emission tomography in tinnitus suggests that a different area of brain is triggered and stimulated in generating tinnitus.
4. Any occlusion of external or internal side of blood vessel leading to turbulent blood flow specifically of carotid artery or jugular vein may generate pulsatile objective tinnitus.
5. Clonic movement of palato pharyngeal region may lead to myoclonic tinnitus including of temporo mandibular joint.

Eustachian tube dysfunction, ossicular chain abnormalities including otosclerosis, middle ear pathologies, perilymph fistula, Meniere's disease, schwannoma may generate the tinnitus.

### LOCATION

It is believed that problem lies from hair cells (cochlea) and auditory neural pathways.

### PREDISPOSING FACTOR

Apart from loud noises, blast trauma, emotional trauma, ototoxic drugs.

### SUBJECTIVE TINNITUS

Tinnitus may arise from lesion in any part of auditory pathways from Pinna through cochlea to temporal lobe and hippocampus.

When sound is perceived only by patient and investigator has to rely on the subject, wax,

infection, allergy, inflammation, tumours, metabolic disorders like diabetes, thyroid disorders severe anaemia, over medication, emotional trauma, acoustic trauma and fatigue may precipitate or aggravate the symptoms. The center for emotion is closely associated with the site of tinnitus centre hence emotional disturbances aggravate the tinnitus and vice versa. Tinnitus may lead to depression, irritability and other behavioral changes leading to problems in job profile too. Autonomic nervous system is also closely associated to sound and tinnitus centre hence tinnitus and loud sound may lead to sleep disturbances and in acute stage dilatation of pupil, tachypnoea, pallor of face and syncope. Though literature report an incidence of more than 20% are disrupted from their work or socio familial life but in Indian scenario the incidences is negligible. Dysfunction of ear, specifically of inner ear contributes to the arousal of tinnitus but generation and interpretation depends upon cortical process of brain because perceived only when awake.

### OTOLOGIC FACTORS

#### External Ear

- o Wax
- o Foreign Body
- o Hairs touching the tympanic membrane
- o Tympanosclerosis
- o Cholesteatoma of Canal
- o Perforation of Drum.

#### Middle Ear

- o Negative pressure
- o Fluid (OME) - bubbling sound can be heard even as objective Tinnitus.
- o Otosclerosis
- o Ossicular pathologies
- o CSOM

#### Inner Ear

- o Labyrinthitis
- o Labyrinthine Hydrop
- o Hair cell disorder

### OBJECTIVE TINNITUS

The sound of tinnitus can be heard by investigator. In majority of the cases we can reach to final diagnosis hence can be cured.

### CLASSIFICATION

Majority produces bruits based upon effects from abnormal curling of blood within the arteries.

#### A. VASCULAR DISORDER OR ABNORMALITIES

- o Arteriovenous malformation
- o Glomous tumour/Tympanicus.
- o Stenosis, carotid or vertebral artery
- o Vascular loop of anterior inferior cerebellar artery over the auditory nerve

#### VENOUS HUMS

- o Benign intracranial hypertension (pseudomotor cerebri)
- o Hypertension - tinnitus is more common in extremely high difference between systolic and diastolic blood pressure.
- o Dehiscent jugular bulb
- o Dissection of carotid or vertebral artery
- o Increased hemo dynamics
- o Severe anaemia
- o Pregnancy
- o Diabetes
- o Thyro toxicosis

#### MECHANICAL CAUSES

- o Tensor tympani or stapedius muscle myoclonus
- o Palatal myoclonus
- o Eustachian tube abnormalities
- o Temporo mandibular joint disorder - Crackling sound can be heard.
- o Shifting foreign body or wax
- o Sound can be transferred from cervical spine and its joints.

The most common cause of pulsatile or objective tinnitus is pseudomotor cerebri or benign intracranial hypertension, followed by carotid artery disease and glomus tumour. Though enlarged

vertebral artery, aberrant stapedia artery, intra cranial tumour may also lead into pulsatile tinnitus.

#### **BENIGN INTRA CRANIAL HYPERTENSION**

Common in young, obese female patients, there is elevated intracranial hypertension with headache, visual changes, dizziness without hydrocephalus but cranial nerves (IV, V, VII) may be affected. The disease is self limiting. Tinnitus is due to pulsation of cerebro spinal fluid.

#### **GLOMUS JUGULARE**

Glomus jugular (paraganglioma) as the name suggests it arises from Paraganglia within the adventitia of the jugular bulb. While glomus tympanicus arises from the area of Jacobson's nerve at promontory in middle ear. Tinnitus is unilateral, more in females and in right side, between the age of 30-50 years.

These can be visualized as pinkish mass on otoscopy, along with conductive hearing loss. Diagnosis can be confirmed by magnetic resonance angiography.

#### **ATHEROSCLEROTIC DISEASE**

Atherosclerosis of internal, external carotid and subclavian artery is a common cause of pulsatile tinnitus along with dizziness, loss of memory (forgetfulness), generalized feeling of weakness. Carotid bruit can be heard usually over orbit or on the ear.

Dissection of carotid or vertebral artery or persistent stapedia artery may lead to tinnitus. In cases of persistent stapedia artery, middle meningeal artery and foramen spinosum do not develop.

Iatrogenic arterio venous malformation following myringoplasty and mastoid surgery leading to pulsatile tinnitus has been reported in literature.

#### **MECHANICAL NON VASCULAR CAUSES**

Rhythmic contraction of tensor veli palatine, levator veli palatine, stapedia or tensor tympani muscle may lead to tinnitus which is usually clicking sound can be heard by investigator. Frequency ranges from 10 to 240 /

mts. The rate does not correspond to arterial pulse or heart beat. The Clicking Caused by tensor veli palatine due to Eustachian tube opening while stapedia and tensor tympani result in ossicular chain motion hence movements of palate or tympanic membrane may be seen as the case may be.

The myoclonus is generated due to neuro muscular disorder in multiple sclerosis, cerebro vascular disorder (brain stem infarct) intra cranial neoplasm and in psychogenic problem.

In a patulous Eustachian tube tinnitus may be the result of perception of respiratory sounds from nasopharyngeal end due to air turbulence hence cessation of respiration clinches the diagnosis. Patients usually complain of abnormal awareness of his own voice with statements I hear myself in ears termed as autophony. Oestrogen or gross reduction of weight without exercise contribute to this condition, movement of tympanic membrane is rhythmic but cessation of respiration stops the movement which persists in tensor tympani myoclonus. Engorging the Eustachian tube area by shifting the patient in Tendelburg position may stop the tinnitus.

#### **ENDOGENOUS TINNITUS**

This type of tinnitus is maskable.

Masking the tinnitus is a more optimizing procedure, and can be divided in low, middle and high frequency tinnitus.

##### **Low Frequency Tinnitus**

- o Meniere's Disease
- o Apicocochlear disorder

##### **Middle Frequency Tinnitus**

- o Otosclerosis

##### **High Frequency Tinnitus**

More Common.

Usually result of noise trauma, whiplash, head & skull trauma, cardiovascular lesion, stress, nicotine or drug abuse, acoustic neuroma.

QEEG (Quantitative electro encephalography) exhibits overshoot of electric power in tinnitus which is typical for epilepsy demonstrated at posterior part of upper gyrus of temporal lobe from there it extends to vertex and opposite side and frontal part of brain. It has been also observed there is remarkably elevated metabolic activity in these areas.

SPECT in central tinnitus may localise neurodegenerative disease.

### **Exogenous Tinnitus**

This type of tinnitus can not be masked and patient prefer a quit surrounding and avoids noise or outside sounds.

On Pure tone audiotometry usually there is no airborne gap.

Low loudness discomfort is seen which is usually below 85db and may lead to sudden loss of word understanding, subjective Pain along with vegetative reactions and of course tinnitus.

The discrimination score is poor and loud sounds generate pain in the ears.

### **Mixed Tinnitus**

This is due to multilocal etiology in hearing pathways having high cortical electrical activity presenting as various type of sound perceived along with extreme aggravation by noise. Acoustic masking do not reduce this suffering.

### **MANAGEMENT**

General conditions like severe anemia, pregnancy, thyrotoxicosis, diabetes and hypertension should specifically be looked for. In general examination, wax, infection of external and middle ear may lead to tinnitus which can be managed well, stethoscope should be put over ear, eye and Carotid region for a pulsation or bruit. An audiogram and tinnitus matching masking should be performed.

- o counseling
- o avoid loud sounds
- o elimination of alcohol and tobacco
- o avoid Caffeine and nicotine (constricts blood vessels).

o avoid quit environment, listen soft music of choice.

o Distract your attention - avoid focus on tinnitus

o regularize life style and 8 hour of night uninterrupted sleep.

o change life pattern, avoid stress

o regular exercise and relaxation techniques

o treatment of associated allergy

### **Surgical treatment**

Intratympanic drug administration - steroids (Methyl Prednisolone gives promising results more in Chchlear lesions.

### **NOISE GENERATORS**

Water fountains, fan, pillow speaker in the ear, sound generator all these acts as tinnitus maskers. Those who have got associated hearing loss hearing aid provides amplification hence even outside noises mask the tinnitus and provide relief. Remember hearing aid do not amplify tinnitus and improve speech perception, so are more effective in low pitch. In Patients tinnitus with sensoneural hearing loss Cochlear implantation and surgery for otosclerosis may provide dramatic relief in tinnitus apart from hearing improvement.

Hearing aids or tinnitus masker either / alone or in combination act as masker and/or amplification, bedside masker may be good substitute if tinnitus perception is aggravated in quit surrounding.

### **TINNITUS RETRAINING THERAPY**

The tinnitus patient treated with wide band low level noise generators by habituation which can be defined as reduced response to stimulus after repeated exposure and no activity can be recorded at cortical level which is brought out by reprogramming of neural network at cortical level. Patient has to wear binaural low level noise generators for six to eight hours for 18 to 24 months .

**High Frequency/Ultrasonic**

High frequency hearing sound from 10,000 to 20,000 Hz and ultrasonic frequencies has been used in habituation therapy as well as to stimulate the residual hearing cells involved at apical segment of basillar membrane.

Commercial instruments are available.

**Electrical Stimulation**

Electrical stimulation of promontary round window through positive D.C. current has been observed to provide relief, specifically in cases of severe degree of senso neural hearing loss but disadvantage is technique is not patient friendly and needs expert handling.

Effective in Central Type of tinnitus.

**Receptor Targeted Therapy**

These drugs acts by reducing excessive excitability at cerebral cortex as well as increasing the inhibitory action of GABA receptor.

Gabapentin doses has to be titrated from 100 to 300 mg/day on individual basis.

**Diet, Vitamin and Nutritional Supplements**

Food allergies may cause tinnitus in some people. For some individuals, caffeine or other stimulants, excess salt, or the quinine in tonic water can trigger an episode of ear noise.

**Vitamin B :** Supplementing B vitamins, especially B12, B6 and B5 (pantothenic acid), often improves ear ringing.

Taking an additional 50 milligrams of B6 two or three times a day may help stabilize inner-ear fluids. It is found in whole grain products, bananas, most fruits and vegetables, eggs, and dairy products.

Vitamin B12 deficiency has been reported to be common in people exposed to loud noise on the job who developed tinnitus and hearing loss. Intramuscular injections of vitamin B12 reduced the severity of tinnitus. Vitamin B-12 can be

found in yeast, oysters, eggs, milk and milk products, fish, poultry and lamb.

**Vitamin A :** Vitamin A deficiency can cause inner-ear problems including tinnitus important for the membranes in the inner ear. Good sources of vitamin A are oily fish, dark green leafy vegetables, blueberries, yellow vegetables, and fruits (such as carrots, yams, oranges, apricots and cantaloupe). Vitamin A supplementation (5,000 to 10,000 IU a day) may be at least partially effective against tinnitus.

**Vitamin E :** Vitamin E improves oxygen supply to the cells. Vitamin E is found in whole grain products, dried beans, green leafy vegetables, fish, and eggs.

**Choline:** Choline (provided by two lecithin capsules at each meal or 2 tablespoons of brewer's yeast daily) effective in tinnitus of high blood pressure.

**Zinc :** Studies show that high doses of zinc sulfate can reduce or eliminate the tinnitus. Zinc supplements have been used to treat individuals who had both tinnitus and hearing loss (usually age-related). Do not take more than 80 milligrams daily without medical supervision. Foods rich in zinc are: oysters, whole-grain cereals, beans, nuts, eggs, and fish.

**Nutritional Supplements**

Daily Dosages:

- \* Vitamin B12, 1 mg
- \* Zinc, 30 mg, with 3 mg copper
- \* Vitamin B complex, 50 mg twice per day
- \* Vitamin E, with mixed tocopherols, 400 IU
- \* Vitamin A, 10,000 IU (avoid during pregnancy)
- \* Noise exposure causes magnesium to be excreted from body hence addition of 500 to 1000 mg/day in diet is recommended