

# Tinnitus

## Central Causes of Tinnitus

Associate Professor Somsak Tiamkao

Division of Neurology

Department of Medicine

Faculty of Medicine

Khon Kaen University

Khon Kaen, Thailand

## Tinnitus

- Auditory phantom sensation
- Ringing of the ear when no external sound is present



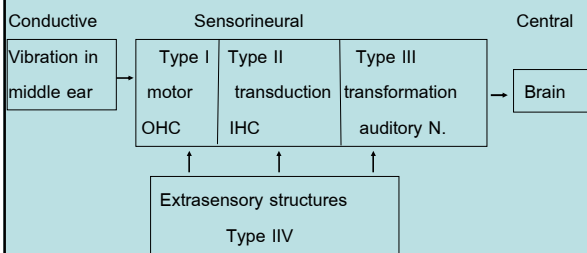
## Classification of Tinnitus

- Pathology : normal, pathological
- Severity : acceptable, unacceptable
- Duration : temporary, permanent
- Site : middle ear, peripheral neural, **central neural**
- Etiology : tumour, stroke, etc

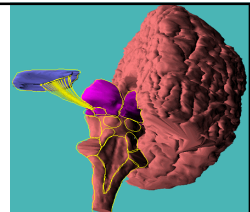
## Central tinnitus

- Primary central
- Secondary central
  - peripheral → brain
  - phantom tinnitus

## Secondary tinnitus



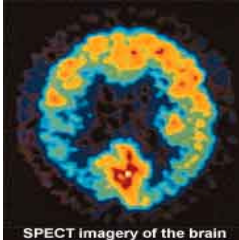
## Anatomy



- Auditory brain stem
- Auditory midbrain
- Auditory thalamus and cortex

**Single Photon Emission Computerized Tomography: SPECT**

- Perfusion abnormality
- Mesial temporal lobe
  - Hippocampal
  - Amygdala
- Frontal
- Temporal
- Parietal cortex



SPECT imagery of the brain

**Positron Emission Tomography**

- Aberrant neural links between the somatosensory and motor system and auditory system
- Abnormal neural link between limbic system and emotional centre and auditory system

**Central Tinnitus:causes**

- Cerebellopontien angle lesion
- Vertebral artery: dissection, aneurysm
- Brains stem/cerebellar lesion
- Benign intracranial hypertension

**Central Tinnitus:causes**

- Dural AVM
- Dural AVF
- Inferior olivary hypertrophy

**Physical examination**

- General examination
- Head and neck
- Neuro-otologic examination
  - Brain stem
  - Cerebellar
  - Palatal myoclonus

**Dural AVM**

- 10-15% of intracranial AVM
- AVM at dura
- Male: Female = 1:3
- Noise in head (bruit)
- Pulsatile tinnitus
- Stroke-like symptoms
- Headache
- Seizure

### Cause of Dural AVM

- Congenital
- Secondary
  - trauma
  - infection : syphilis
  - intracranial surgery
  - pregnancy

### Dural AVF

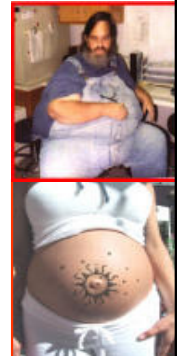
- Most common at transverse and sigmoid sinus
- Tinnitus
- Cause is the same AVM
- Risk of bleeding

### Benign intracranial Hypertension

- Pseudotumor cerebri
- Increased ICP without neurological deficit
- CN VI palsy or papilledema
- Pulsatile tinnitus headache, visual disturbance

### Cause

- Pregnancy
- Obesity
- Thyroid
- Anemia
- Cushing
- Drug



### Hydrocephalus

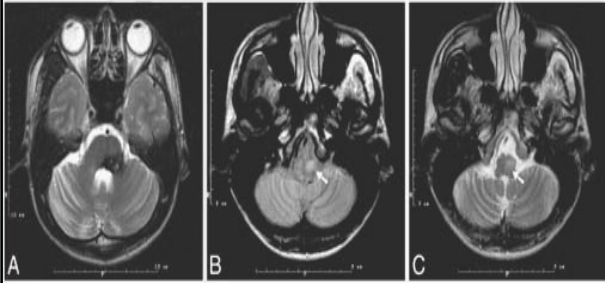
- Pulsatile tinnitus can be first sign of increased ICP
- Pulse synchronous tinnitus is through to be due to vascular pulsations in CSF transiently compressing the dural venous sinus resulting in turbulent blood

### Palatal myoclonus

- Rhythmic involuntary jerking movement of soft palate
- Clicking sound
- 1-2 Hz
- Lesion in triangle of Gullain Molleret which composed of Inferior olivary nucleus in brain stem
- Central tegmental tract
  - Connects olive to red nucleus in midbrain
- Superior olivary peduncle to contralateral dentate nucleus of cerebellum

- Inferior olive is provided with a massive inhibitory (GABA)

- Stroke 40%



### GABA-Benzodiazepine-Chloride Receptor-Targeted Therapy for Tinnitus Control

- Central pathway in medial temporal system
- SPECT
- Irregular and reduced chemical binding GABA receptor
- Deficiency of GABA receptor is direct related to worsening of tinnitus
- Impairment of GABA function has been considered to lead convulsion
- Tinnitus is an epileptic-like auditory phenomenon
- Gabapentin

### Vertigo, dizziness, and tinnitus after otobasal fracture

L Heid and et al. Int Tinnitus J 2004;10:94-100.

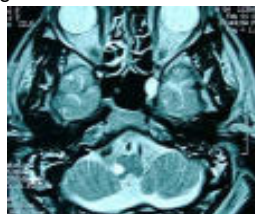
- 41% complained of tinnitus
- 53% complained of hearing loss

### Unusual Cause of Tinnitus

- Central giant cell granuloma of skull base
- Leber's optic atrophy which involved brain stem
- Superficial siderosis of CNS
- Spontaneous intracranial hypotension syndrome

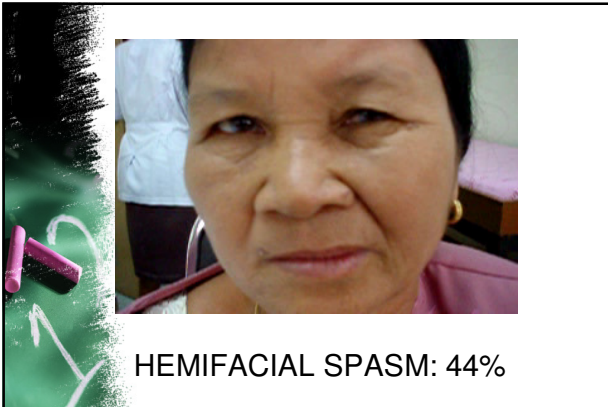
### Anterior Inferior Cerebellar Artery Infarction

- AICA ischemic stroke
- Vertigo, hearing loss, facial palsy, ataxia, nystagmus
- Tinnitus, hearing loss
  - Cochlea
  - Auditory nerve
  - Cochlear nuclei
- Hearing loss
  - non → severe



### Complex partial seizure

- Female 21 yr
- Episodic of vertigo and click in the brain
- No palatal myoclonus
- MRI-brain : normal
- EEG : epileptic discharge



HEMIFACIAL SPASM: 44%