Tinnitus; diagnosis and imaging
Rutger Hofman, MD, PhD

NVA, Nijmegen
September 30th, 2011
Contents

- Introduction
- Diagnosis
- Imaging
- Pathology; diagnosis and imaging
- Conclusion; algorithm
Joseph Toynbee (1815-1866)
Tinnitus

Definition: ‘a sound perceived for more than five minutes at a time, in absence of any external acoustical or electrical stimulation of the ear and not occurring immediately after exposure to loud noise’.
Tinnitus

- Objective
- Subjective
- Auditory hallucinations
Diagnosis

- Medical history
  - Subjective description of tinnitus (uni-, bilateral)
  - Annoyance daily life/sleep
  - Synchrony of tinnitus with pulse
  - Effect of neck movement
  - Effect of neck compression
  - Effect of respiration
  - Associated auditory or vestibular symptoms
  - Otological/general medical conditions
  - Medication/Drugs
  - Noise exposure, family history
  - Stress conditions, psychological/psychiatrical disorders
Medication

1. Salicylate, NSAID’s: aspirin (reversible)
2. Mycin-antibiotics
3. Antimalaria medication: quinine (reversible)
4. Diuretics: furosemide
5. Cytotoxic medication: cisplatin, methotrexate
6. Tricyclic antidepressant, benzodiazepine
Diagnosis

● Physical examination
  ■ Otoscopy
  ■ Palpation
  ■ Auscultation

● Audiometry
  ■ Pure tone audiometry
  ■ Speech audiometry
  ■ Tympanometry
  ■ Stapedial reflexes
  ■ (BERA, OAE’s)
Otoscopy

- External meatus acusticus
- Tympanic membrane, middle ear cavity
  - Tympanic sclerosis
  - Glue
  - Schwartze’s sign
  - Myoclonus middle ear muscles
  - Vascular tumours anomalies
Physical examination

- Palpation neck
  - Thyroid gland

- Auscultation
  - Peri-auricular
  - Neck (carotid souffle)
  - Cor (transmittid souffle)

- Oropharyngeal inspection
  - Palatal myoclonus
Diagnosis

- (Vestibular assessment)
- (Neurological assessment)
Imaging

- Ultrasound neck (echo duplex)
  - Superficial vascular structures

- Computed Tomography (CT/CTA)
  - Bony structures

- Magnetic Resonance Imaging (MRI/ MRA)
  - Soft tissue structures

- Digital Subtraction Angiography
  - Profound vascular structures
Tinnitus

- Objective
- Subjective
Objective tinnitus

- Vascular (pulsatile)
  - Vascular malformations
    - Arteriovenous malformations
      - Aneurysms
      - Fistulæ
    - Carotid artery stenosis
  - Vascular tumours
    - Paragangliomas
      - Glomus tympanicum
      - Glomus jugulare
    - Haemangioma
Arteriovenous malformations
Arteriovenous malformations
Stenosis carotid artery
Paraganglioma

The rest of the eardrum is normal

Pulsating red mass behind the eardrum
Paraganglioma
Paraganglioma

= glomus tympanicum
Haemangioma
Haemangioma
Objective tinnitus

- Vascular (pulsatile)
  - Increased intracranial pressure
  - Transmitted cardiac murmurs
  - Different hyperdynamic vascular states (‘veneus hum’)
    - Pregnancy
    - Hyperthyreoidism
    - Anaemia
Benign intracranial hypertension (‘pseudo-tumour cerebri’)

- Unusual
- Raised intracranial pressure
  - headaches,
  - dizziness,
  - visual disturbance,
  - pulsatile tinnitus
- Associated with obesity
- Lumbar puncture, MRI
Objective tinnitus

- Myogenic
  - Palatal
  - Middle ear muscles
    - m. tensor tympani
    - m. stapedius
    - m. levator palatini
Objective tinnitus

- Patulous Eustachian tube; ‘Tuba aperta’
  - Nasal respiration
  - Tympanic membrane movements
    - Otocopy
    - Tympanometry
Objective tinnitus

- Temporomandibular joint abnormality
- Spontaneous otoacoustic emissions
Subjective tinnitus

- Conductive hearing loss
- Sensorineural hearing loss
Conductive hearing loss

1. Otitis externa
2. (chronic) Otitis media
3. Otosclerosis
Otitis externa
Otitis media
Otitis media
Otosclerosis

Toonaudiogram (Rechts)

Toonaudiogram (Links)

Lu42

Lu10

LuH42

LuH23

dB (ISO 1975)

Hz

125 250 500 1000 2000 4000 8000

R

L
Otosclerosis
Otosclerosis
Otosclerosis
Sensorineural hearing loss

1. Noise-induced
2. Ménière’s disease
3. Congenital/hereditary
4. Vestibular schwannoma
5. Presbyacusis
6. Paget’s disease (osteodystrophia deformans)
Vestibular schwannoma
Vestibular schwannoma
Vestibular schwannoma
Paget’s disease
osteodystrophia deformans
Paget’s disease
osteodystrophia deformans
Anterior inferior carotid artery

- Vascular loop with suggested compression or irritation of the auditory nerve equally present in symptomatic and non-symptomatic ears. Makins et al., 1998

- Vascular loops significantly more common (p<0.0001) in patients with unilateral pulsatile tinnitus than non-pulsatile tinnitus. De Ridder et al., 2005
AICA
Typewriters tinnitus

- Levine RA, 2006
- n = 6
- ‘...a staccato quality of their intermittent tinnitus ('like a typewriter in the background, popcorn, Morse code‘)’.
- 5 patients symmetric and consistent with their ages audiograms.
- 4 patients vascular compression of the auditory nerve on MR imaging.
Typewriters tinnitus
Conclusion

- Extensive medical history
- Extensive physical examination
- Imaging
- Pulsatile tinnitus!
Pulsatile Tinnitus

Normal tympanic membrane

Duplicates ultrasound

- Positive
  - Atherosclerotic carotid artery disease in neck
  - Fibromuscular dysplasia

- Negative

Retro tympanic mass

MRI/MRA

- Positive
  - Glomus tumour
  - Other vascular tumour
  - High jugular bulb
  - Abberant internal carotid artery

- Negative
  - Re-evaluate otoscopic findings
  - Consider CT scan

MRI/MRA

- Positive
  - Glomus tumours
  - Angiography for glomus tumours

- Negative

- Suggestion of raised intracranial pressure
  - Lumbar puncture
  - Benign intracranial hypertension

Consider angiography
Acknowledgements

dr. R.H. Free
drs. J.A. Wachters
References


