



Tinnitus in Children

A Medical Perspective

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Why assess children with tinnitus?

- To address the **child's questions or worries** about the tinnitus
- To try and answer **common parental questions** e.g. “Why has my child got tinnitus? What is causing it? Is there any treatment/management?”
- To **identify any associated audiovestibular symptoms** or associated medical conditions and perform audiological and medical investigations where appropriate.
- Where possible to **treat** any detected medical or surgical condition(s)
- To **contribute to multidisciplinary team management plans** for children who have with tinnitus.
- To give the child and family **advice on coping strategies** for dealing with the tinnitus

- Common features of tinnitus in adults and children
 - Troublesome or ‘just there’
 - Tinnitus must be considered in the context of hearing loss and other audiological or neurological symptoms
- BUT children are not little adults
 - Different mindsets and experiences
 - holistic approach (child, family and school) is required to meet the needs of children who present with troublesome tinnitus.

Prevalence

- **COMMON**
- **Reported prevalence**
 - 12% - 36% in children with normal hearing thresholds
 - up to 66% in children with hearing loss
- **Sleep:** affected in 38- 79%
- 50% had difficulty **listening** to teachers and difficulties with **attention** and **concentration**
- 33% of the children had a possible or probable **emotional/anxiety disorder.**

Prevalence

- Variable (3% - 76%)
 - Reported prevalence may be setting and question dependant
- Savastano 2006: 33.4% of 1100 children with tinnitus
 - 76.4% in children with normal hearing,
 - 24.6% Hearing Impaired
- Aust 2002: 7.2% of 1420 children
 - 26.4% normal hearing
 - 75.3% hearing impaired

- More common in children with middle ear disease (43.9%) than children with sensorineural hearing loss (29.5%) (Mills 1984)
- More common in children with moderate than profound hearing loss (Graham 1984)
- 18% of children (n = 88) presenting with tinnitus were classified as severe (Baguley et al 2012) ie audible in all acoustic environments, can disturb sleep

Recent studies

United States: Cross-sectional analyses of U.S. representative demographic and audiometric data 2005 to 2008.

- **7.5%** of 3,520 aged 12 to 19 years reported tinnitus
- prevalence of chronic tinnitus was **4.7%**,
- History of ≥ 3 ear infections and history of tympanostomy tube placement were associated with overall tinnitus.

Korea: A cross-sectional study using data from the Korea National Health and Nutrition Examination Survey 2008 through 2011,

- **17.7%** of 3047 participants aged 12 to 19y reported tinnitus
- **0.3%** of subjects reported severe discomfort
- tinnitus prevalence increased with age, female gender, sleeping less than 9 hours, noise exposure, maternal history of tinnitus

More recent.....

Sweden 2006: 756 children attending for hearing assessment

- Tinnitus reported in 41% of the 706 children with normal hearing and 58% of the 50 children with hearing impairment.
- The probability of noise-induced tinnitus was 59% in children who experienced TTS and 17% in those who did not experience TTS. TTS did not correlate with hearing impairment.

Poland 2011: 143 children attending Tinnitus Clinic

- 41.3% of the children suffered from bothersome tinnitus.
- 44.1% of the patients demonstrated normal hearing.

- Age: increases with age
 - Progressive increase around age 13-14y (Aksoy 2007)
- Gender: increased prevalence in girls

Impact of Tinnitus

- Difficulties in listening and attention skills
- Difficulties in concentration
- Behavioural problems
 - Irritation
 - Nervousness
- Learning and writing difficulties

Impact of Tinnitus cont.

- Associated dizziness 46%
- Accompanying headaches 23%
- In a few children ?tinnitus a manifestation of transient, sub-clinical convulsive episode

Impact of Tinnitus cont.

Kentish et al 2000 'Children's experience of tinnitus'

- Health: Sleep:79%, Physical problems: 46%
- Listening/Attention
 - Listening/Attention N:50% HI:8%
- Psychological Effects
 - Worries re Ti: N:29% HI:25%
 - Behavioural problems N:8.3% HI:16.7%
 - Anxiety symptoms N:50% HI:12.5%
 - Also - annoyance, fed-up, frightened

Bolton Snapshot

- ❖ 18 children
- ❖ Age range 5 – 13 years (Mean: 8.6)
- ❖ Hearing: N -7; CHL-8; SNHL - 3
- ❖ Non-troublesome in 12; troublesome in 6
- ❖ Troublesome aspects:
 - ❖ 4 - When trying to concentrate or go to sleep
 - ❖ 1 – Becomes upset / impatient when hears noise
 - ❖ 1 - Drive him mad
 - ❖ 1 - Annoying

Descriptions

Whistling

banging

Tee, tee

Lady singing in my ear

Buzzing

Bleep

Bumping

beep

'like the wind'

Screeching

Deeeeee

'eek eek' like a mouse

'oo oo' like an owl

ringing

'Someone blowing in my ear'

Breathing sound in ear

Buzzing

'Train chugging'

Assessment Approach

- **Overlap of clinician roles**
 - First point of contact
 - Relevant skills
 - Red flags
- **Routine** - ask all children attending for audiological assessment whether they hear noises in their ears or head.

Red flags supporting a referral for medical assessment



- Ear discharge
- Persistent ear pain or headache
- Dizziness/vertigo
- Unilateral or pulsatile tinnitus
- Head injury
- Middle ear myoclonus
- Abnormal findings on otoscopy
- Progression of known hearing loss
- Identification of any unmanaged hearing loss, conductive or sensorineural

History and Exam

- Consider the main history to be a conversation with the child about tinnitus
- The required examination depends on the history details
- The following is not a complete approach. Each child is different so there is not a one size fits all approach

Finding out about the tinnitus...

- Just ask!
 - “do you get any sounds in your ears or in your head?”
 - “tell me about them”, “what are they like?”
 - Ask older children about their own concerns eg “What do you think about them?”
- Listen to the language used
 - ?emotive
- Include open-ended follow-ups that invite the child to keep talking:
 - “Really, tell me more about that”
 - “that’s interesting. Let’s talk more about that”
- Remember children like to please so avoid leading questions eg “that doesn’t bother you, does it?” or conveying a negative or dismissive attitude towards the tinnitus

Aim is to get

- Description of the tinnitus:
 - sounds (site, onset, duration, frequency and severity/loudness of the sounds).
 - Any trigger, aggravating / relieving factors (*bump in the night*)
 - Child's beliefs about tinnitus
 - Provoking factors
- Description of annoyance and distress:
 - Impact on life at home, at school
 - Effect on activities eg sleep
 - Emotional effects re understanding as to how the tinnitus makes the child feel.

Prevalence

Martin and Snashall (1994)

Frequency

- 18 (43%) constant
- 8 (19%) most of the time
- 14 (33%) some of the time

Site

- 29 (69%) Bilateral
- 13 (31%) Unilateral

Duration

- 12-144 months

Swedish study (Wiberg et al)
70% of 20 localised tinnitus to
head/bilateral

Possible indicators of distress

(Kentish + Munro)



- Reluctance to talk about tinnitus
 - Seems scared, poor eye contact
- Description of tinnitus
 - Personified, alive, have to fight it
- Unable to describe any coping strategies
 - Seems helpless re ability to manage tinnitus
- Onset linked to significant life event

Possible indicators of distress

(Kentish + Munro)

- Complaints about an uncomfortable 'something' in ear
- Strong dislike of sounds near one ear
- Distrusts sounds heard near one ear
- Perception that hearing in one ear worse

Tinnitus Details

- Other audiovestibular symptoms
 - Auditory symptoms (Hearing difficulties/loss, hyperacusis)
 - Associated otological problems (Ear infections, pain/blockage, head injury, noise exposure, rhinitis, cleft palate)
 - Imbalance / dizziness
- Family history of tinnitus and hearing difficulties
- Child's and family's strategies for managing tinnitus
 - successful and unsuccessful

History cont

- **Paediatric history**
 - pregnancy, delivery and postnatal period
 - developmental milestones including speech, language, motor milestones
- **Medical history / co-morbidities** eg migraine, meningitis
- **Psychological/psychiatric** co-morbidities or Mental health history
- **Medication/treatment** history eg ototoxic medication, radiation

History cont.

- **Social** (Need to address this very carefully and delicately address any external stresses e.g. family issues (new baby), divorce, bereavement, or problems at school/bullying.)
- **School placement:** Information about academic progress and social integration in school

Possible indicators of distress

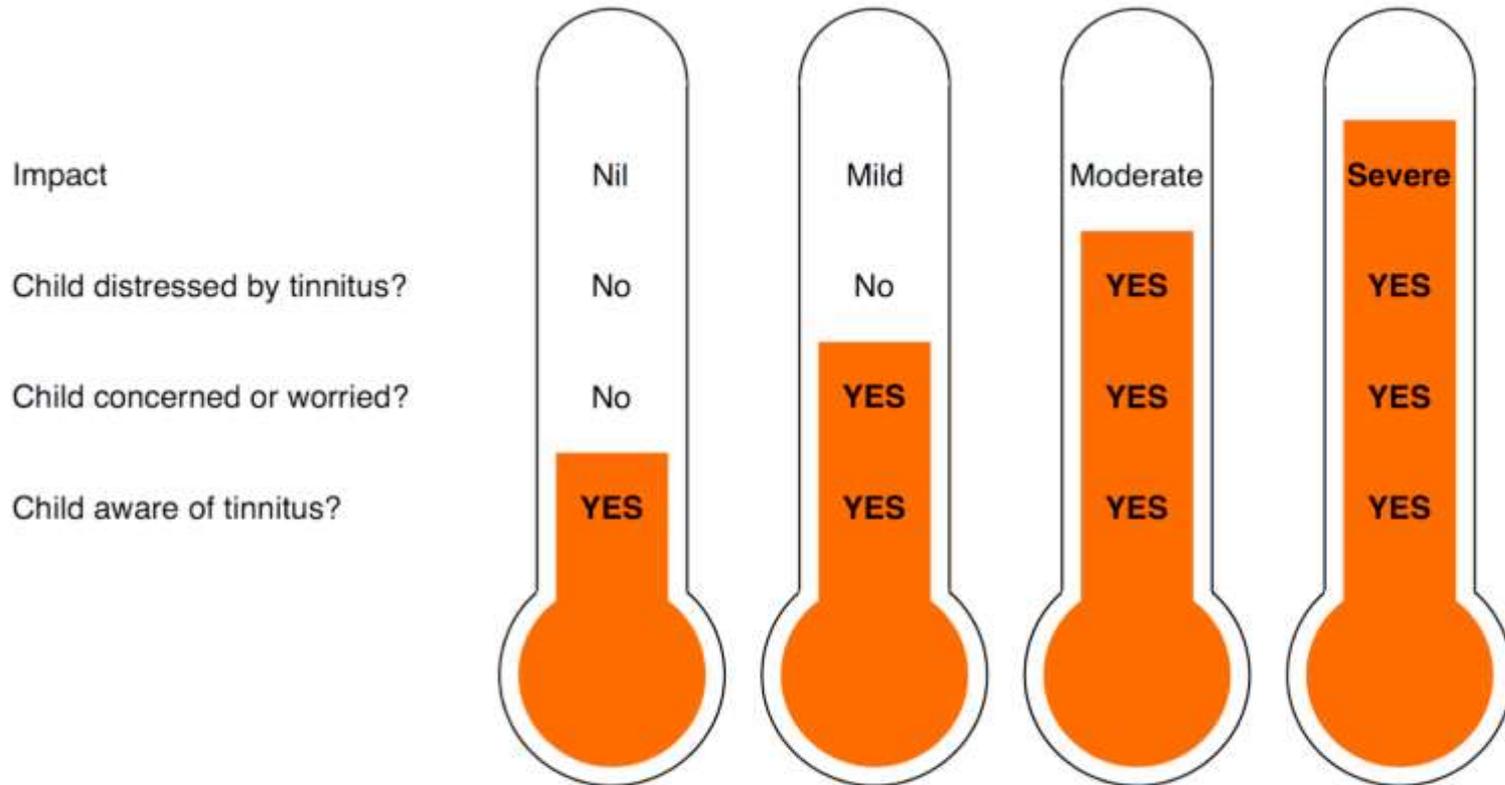
(Kentish + Munro)

- Tinnitus occurs in specific circumstances
 - School vs home,
 - Triggers eg shouting, quiet
 - Tiredness, stressed
- Behaviours
 - Speech perception difficulties in noise and in quiet
 - Concentration difficulties at school
 - Moody, difficulty sleeping

TWO patients

- Child and Parent
- Parental concerns that noises a sign of
 - Hearing loss
 - Causing hearing loss
 - Mental health problems
 - Brain tumours
 - Other neurological conditions

Possible levels of tinnitus



The above figure illustrates the levels of distress and the impact that tinnitus may have on a child. Four distinct levels are depicted, however, in reality distress and the impact of tinnitus manifest as a continuum.

Tinnitus Triggers

- Noise (~50%)
- Quiet (25%)
- Emotional responses (37.5%)
- Concentrating (8.3%)
- Physical (8.3%)
- Removing hearing aid (8.3%)
- Other (eg travelling, warmth) (25%)

Aetiology

Martin and Snashall (1994)

- 13 (19%) migraine
- 5 (7%) features of Meniere's disease
- Others
 - 3 endolymphatic hydrops
 - 3 CSOM
 - 2 trauma
 - 1 palatal myoclonus
 - 1 tumour affecting central auditory tract

Aetiology cont

Other conditions reported

- Perilymph fistula (Parnes & McCabe 1987)
- Vestibular schwannoma/NF2 (Evans 2009)
- Increased intracranial hypertension secondary to cerebral venous thrombosis (Sogawa et al 2005)
- Essential palatal tremor (MacDonald 2007)

Noise exposure

Holgers & Peterson (2007)

- odds ratio 1.4 of noise induced tinnitus in adolescents attending concerts/discos
- OR 4.4 for individual attending concerts 6-12 times/year compare with no concerts
- Children attending discos have OR of 3.8

Coelho (2007)

- Noise exposure Hx: OR 1.8 re tinnitus sensation, 2.8 re suffering (firecracker)

Examination

- Led by the clinical history
- Inspection of craniofacial region
- Examination of the ears, oral cavity including soft palate, neck, ?nose and throat
 - ?external or middle **ear disease, wax**
 - If history of pulsatile or objective tinnitus in the absence of observed middle ear pathology, use **stethoscope** re auscultation of heart, neck, mastoid, cranium and orbits.
 - If mouthbreathing, consider **nasal examination**
 - If symptoms of dizziness, consider **neurotological examination**
 - May need general **paediatric** assessment

Audiological Assessment

- Change in subjective loudness eg occlude ear canal
- Age-appropriate audiometry, ear-specific where possible
- Tympanometry
- Otoacoustic emissions
- Electrophysiological testing

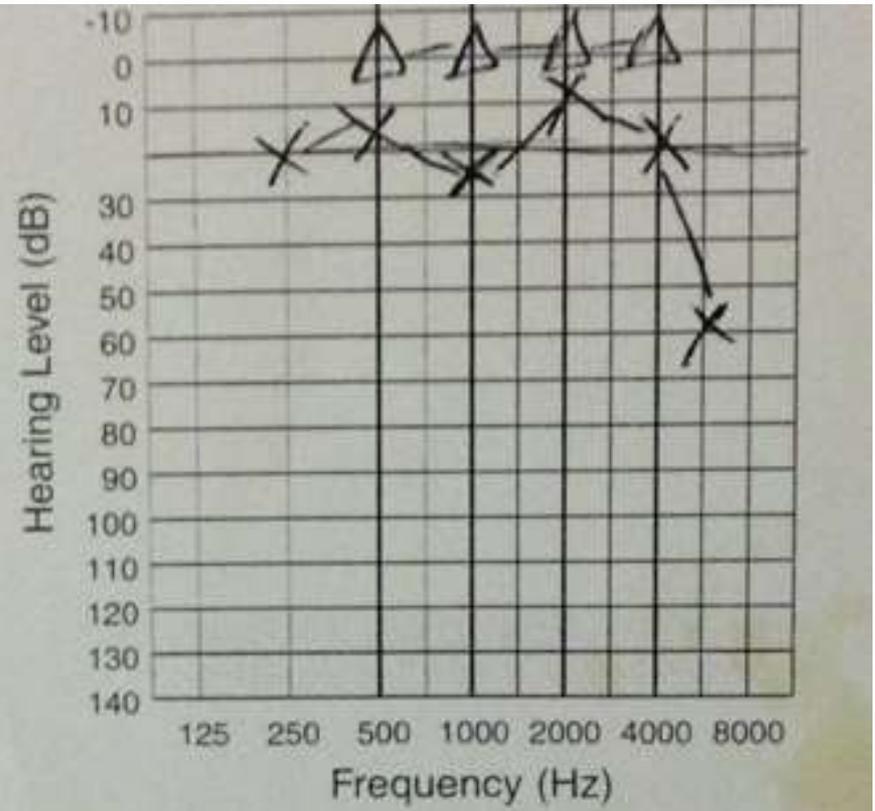
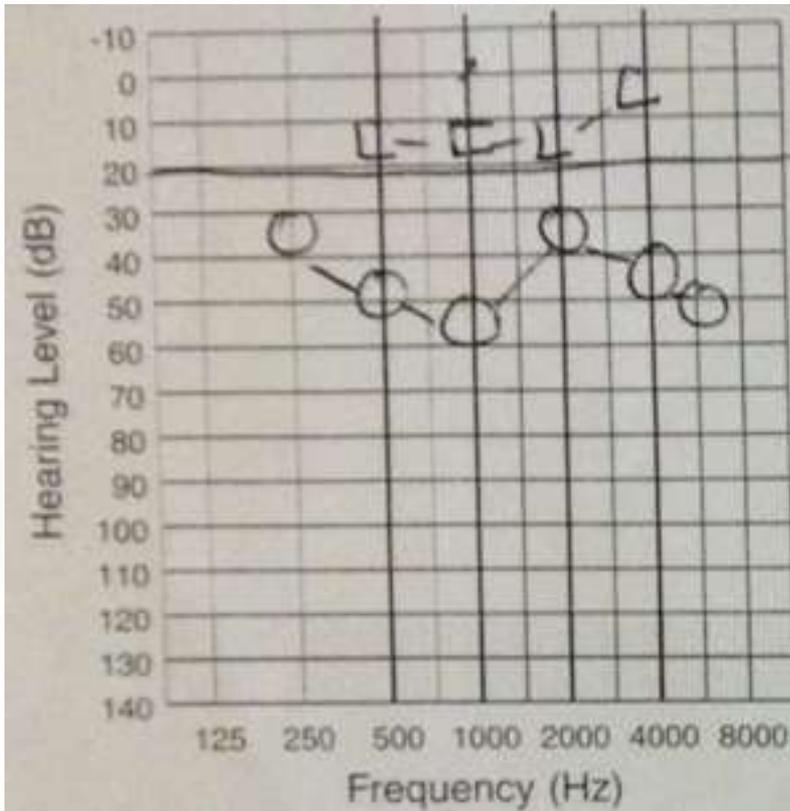


Signs of tinnitus in clinic

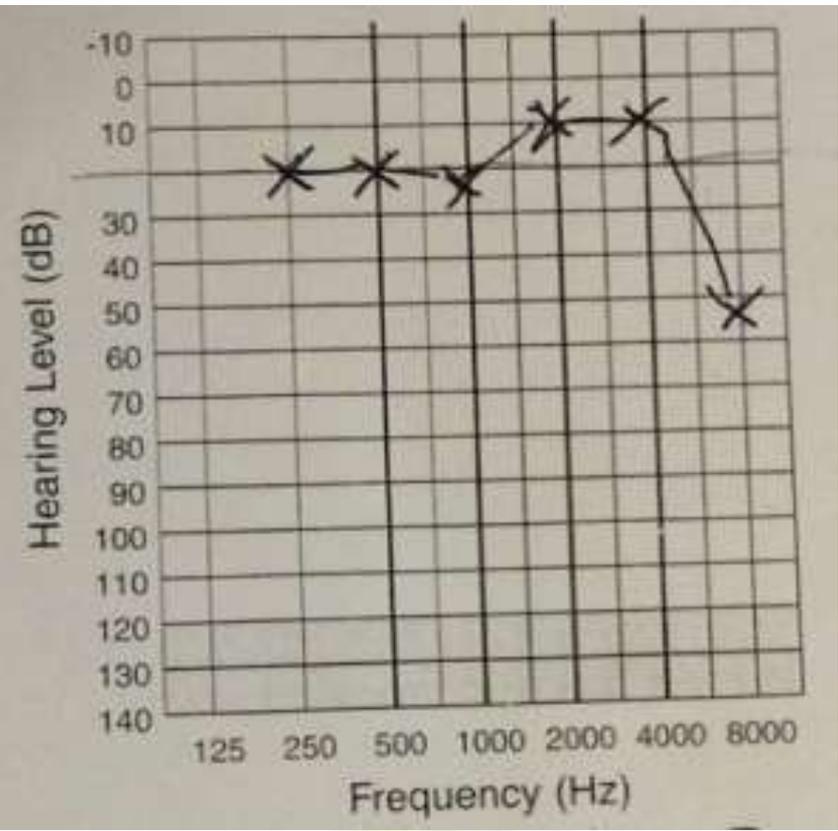
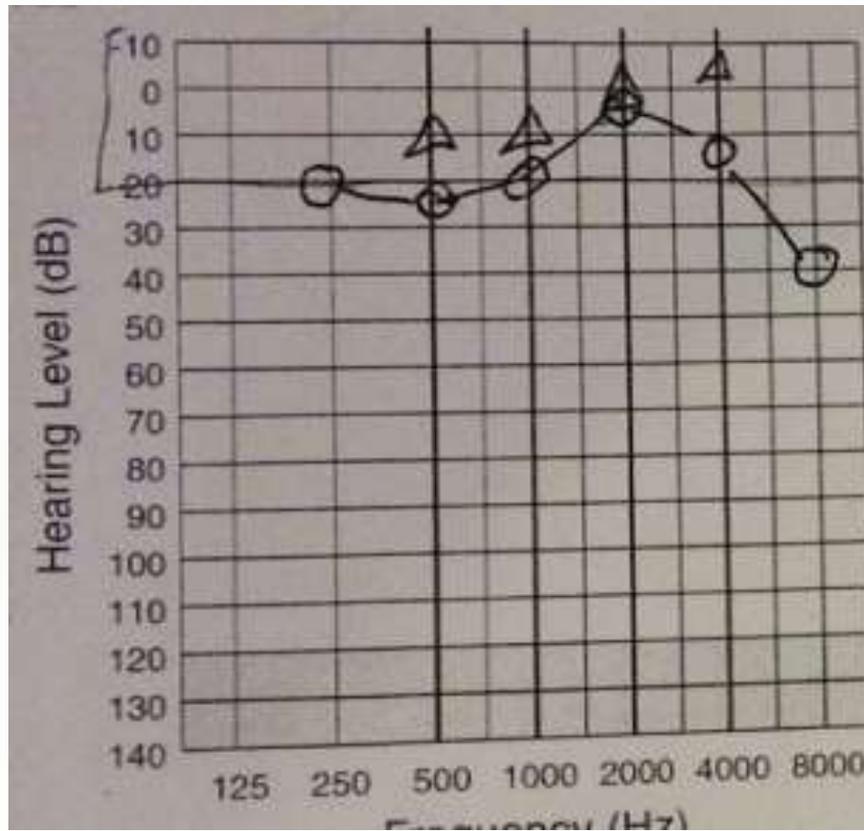


- Avoidance or distress
 - in anticipation of being tested
 - on entering soundproofed room
- Unreliable PTA, suggestion of non-organic
- Dislike of one ear
- Unexplained difficulties with h/aid
- Difficulties in listening in noise AND quiet with normal thresholds

Inconsistent Audiometry



Audiometry: Warble vs Pure Tone

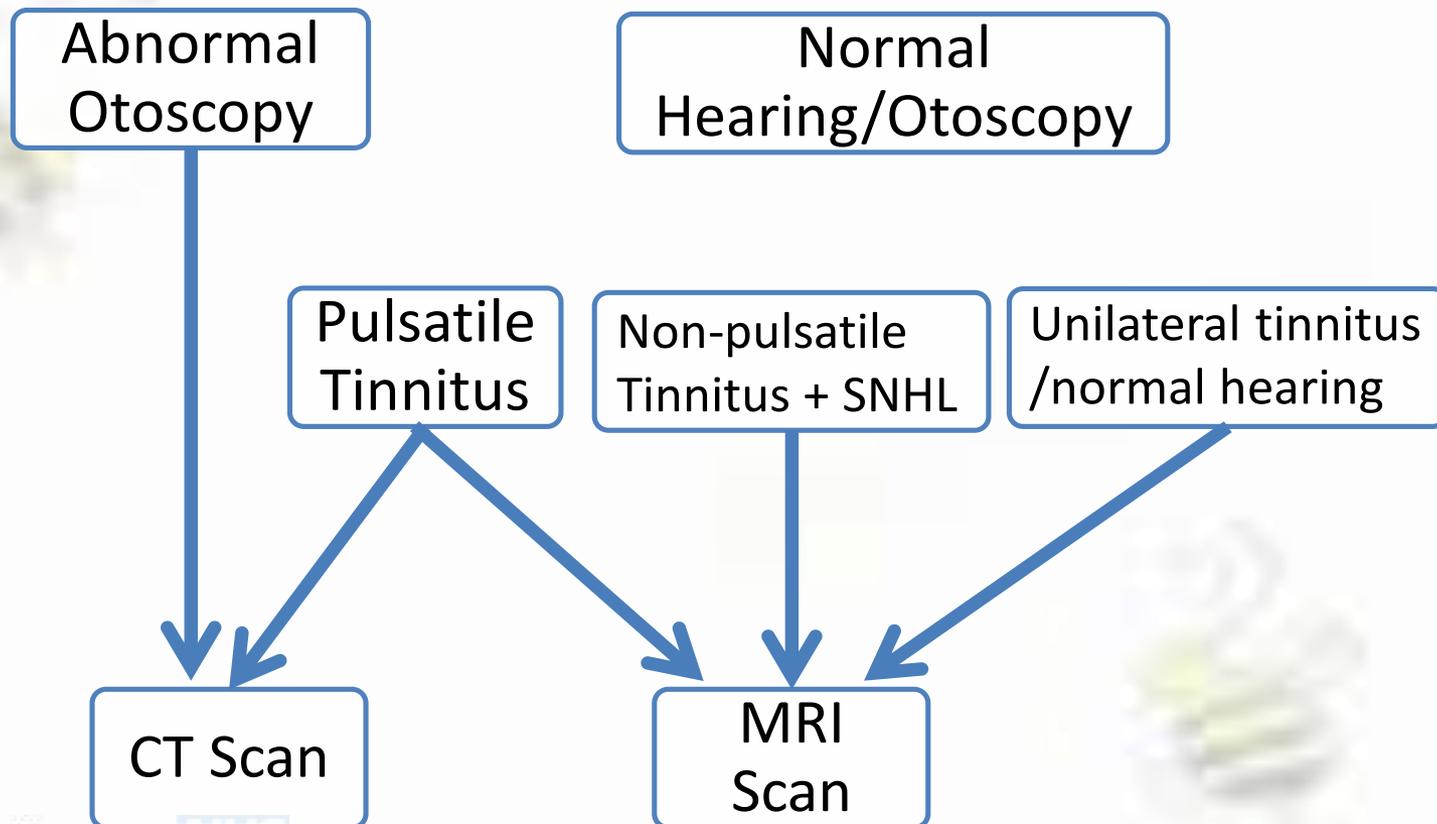


Medical Investigation

- Led by history and examination

Radiological Investigation of Tinnitus

- Consider **imaging** if pulsatile tinnitus, unilateral tinnitus, or asymmetrical bone conduction, neurological symptoms/signs.
 - Pathology eg vestibular schwannomas can present in children but very rare that tinnitus is only finding



Review of clinical presentation of vestibular schwannomas in 39 children

Clinical presentation	No. of patients	%
Deafness and tinnitus	23	58.9
Cerebellar symptoms	7	17.9
Facial palsy	10	25.6
Symptoms of raised intracranial pressure	14	35.8

Vestibular Schwannomas In Children V. B. POTHULA et al Otology & Neurotology, Vol. 22, No. 6, 2001

Tinnitus management

- Managing tinnitus *distress*
 - Tinnitus symptoms often decrease when other presenting/co-existing symptoms addressed
 - Reassurance re non-sinister nature of tinnitus
 - High levels of distress can sometimes simply need good information counselling
- Explore if any associated problems provoking or caused by tinnitus
- Address underlying educational/psychological concerns

Management

- Identify effective coping strategies
 - can help a child to develop a sense of control.
- The strategies must be tailored to the needs of the children and their families
 - and be appropriate to the age and level of cognitive and linguistic understanding of the child.

Strategies

- Coping strategies for everyday living and managing anxiety
 - Sleep advice and management
 - School environment
 - Managing quiet / noise control
- Sound enrichment / appropriate amplification where hearing loss

Use of coping strategies

71% presenting with tinnitus had developed strategies (Kentish 2000)

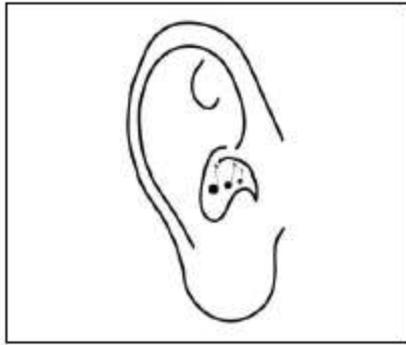
- TV/music/radio 54%
- Ignoring/Distraction 37%
- Reading 21%
- Wearing Hearing aids 12.5%
- Other 42%
(covering/fingers in ears, cats/cuddly toys to bed)

Management of Tinnitus cont.

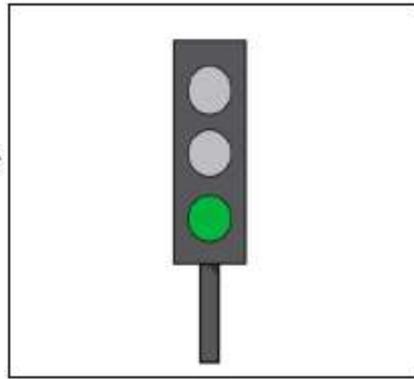
- Relaxation (Relax Kids website)
- Child centred counselling
- Formal therapy - Psychology
 - Narrative therapy
 - Mindfulness techniques
 - Cognitive behavioural therapy techniques
(Child Friendly Tinnitus Model)

Narrative Therapy

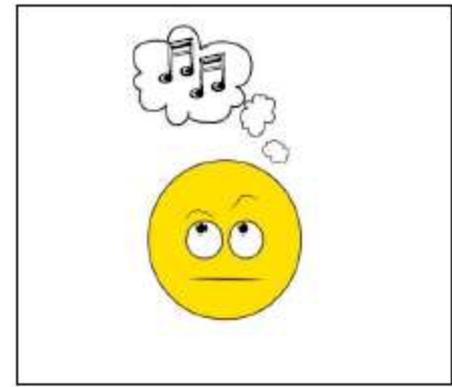
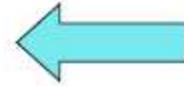
- Involves child drawing how perceive tinnitus (monster, insect, dangerous animal)
- Develop a story describing how tinnitus behaves – angry, demanding attention
- Once character of tinnitus exposed, progress story in which tinnitus is beaten or becomes a friend



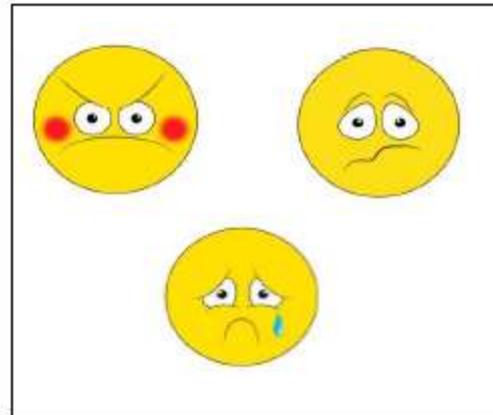
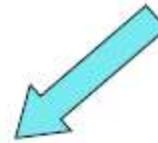
Ear noises



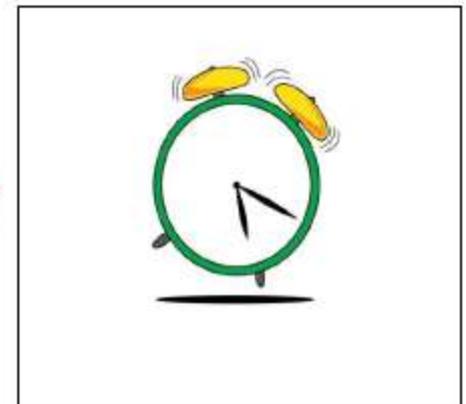
Noise traffic light



I hear my ear noises



Emotions



Body Alarm

Red flags supporting a referral to child mental health services



- Depression and significant anxiety
- Reports of self-harm or suicidal thoughts
- Reluctance to attend school or socialize with peers
- Reluctance to engage in normal activities
- Significant family emotional issues e.g. bereavement

Take Home Message

- Routinely ask children
- Address child's fears and anxieties
- Reassure, tailoring to child's level of understanding, language skills
- Build on coping skills, imagination of child, confidence levels
- Involve family, school
- Most need little further intervention

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KNOWLEDGE | LEARNING | PRACTICE | IMPACT

