Noise induced hearing loss

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Noise induced hearing loss

- What is it?
- What sounds cause it?
- What are the effects?
- What are the symptoms?
- Who is affected?
- What research is being done?
- How we can prevent it?
What is it?

- Everyday we experience sound, normally at a safe level that does not affect our hearing.

- However some sounds can be harmful if they are too loud or loud and lasting a long time.

- Sensitive structures in our ears can be damaged: hair cells. These are sensory structures which convert sound energy into electrical energy. Once damaged these cells cannot grow back.
Hair cells
Damaged Hair cells
Definition

- The term Noise induced hearing loss (NIHL) refers to a reduction in auditory acuity associated with noise exposure.

- It can be classified into 3 categories
Classification of NIHL

- 1. Noise induced temporary threshold shift
- 2. Noise induced permanent threshold shift
- 3. Acoustic trauma: a single exposure to an intense sound leads to an immediate hearing loss (National institutes of health consensus)
History

- From the first use of metals hearing has been at risk. Gunpowder discovered about 1300AD added to the problem. As far back as 1713 Ramazzini reported workers who hammered copper for a living had their ears injured and recommended the use of hearing protectors.

- Admiral Lord Rooney apparently became deaf for 14 days following the firing of 80 broadsides from his ship HMS formidable 1782.

- Fosbroke in 1831 gave an accurate description of NIHL in blacksmiths, coining it ‘blacksmith’s deafness’.

Taken from Scott -Browns Otorlaryngology Adult audiology Vol 2 6th ed
What sounds Cause NIHL

- Continuous or Intermittent
- Explosive or Impulsive
- Above 85dB long or repeated exposure may cause NIHL
- Source of sound - Industry, military, Leisure
How loud is it?

- Humming of a fridge is 45dB,
- Normal conversation is approx 60dB,
- Heavy city traffic can reach 85dB,
- Motorcycles, firecrackers and small arms can emit sound of between 120-150dB
What are the effects?

- Damage to the sensitive hair cells in the inner ear
- Hearing loss which may be accompanied by tinnitus
- May be a temporary threshold shift
- Temporary threshold shift may go on to be permanent
What are the symptoms?

- Hearing loss

- Characteristic notched audiometric configuration maximal in the 3-6kHz region with recovery at 8kHz? Show eg of NIHL??

- Individuals with coincident hearing loss of other aetiology (e.g. age!) may not have a notch > the absence of a notch does not exclude NIHL (and vice versa) (Coles et al 2000)
Examples of audiograms

Normal Audiogram

Possible NIHL

High frequency HL

Tinnitus support group
Who is affected?

- There is a wide variation in individual susceptibility (Henderson et al 1999).
- A potential genetic basis has been considered and experimental evidence from studies with mice has implicated the Ahl gene (Davis et al 2001).
- Possible other factors like include smoking (Wild et al 2005), diabetes and cardiovascular disease (Lonsbury-Martin et al 1998).
- The combination of exposure to ototoxic agents and noise has been shown to be synergistic in animal models (Makite et al 2003). A similar situation has been proposed in humans with regard to industrial solvents (Prasher et al 2002).
What research is being done

- Gene therapy in the regrowth of hair cells
- Research in Oregon shows a key gene Atoh1 can not only cause cells to develop into hair cells but they also function as normal hair cells
- Possibility of using antioxidants to help prevent production of free radicals which can go on to cause hair cell death
- Programmed cell death inhibitors
How can we prevent it?

- Hearing conservation programmes
  - Noise hazard identification
  - Engineering controls
  - Personal hearing protection
  - Monitoring audiometry
  - Record keeping
  - Health education
  - Enforcement
  - Programme evaluation
References


