Noise Induced Hearing Loss

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Noise Induced Hearing Loss

- Definitions
- Acoustic Trauma vs. Chronic NIHL
- Physiology/Pathophysiology/Histopathology
- Susceptibility and Interactions
- Hearing Impairment vs. Hearing Handicap vs. Disability
- Legislation and Worker’s Compensation
Noise

- An unwanted or unpleasant sound.
- An intense sound capable of damaging the inner ear.
- Temporal patterns
- Measurement of noise
- A-scale
Acoustic Trauma

- Sudden, permanent SNHL caused by single exposure to an intense sound.
- Impulse sound, 130-140dB
- Presentation
- Examination
- Audiogram
- Management
Chronic NIHL

- Gradual hearing loss occurring over years of exposure to noise.
- Prevalence
- Industrial vs. Non-industrial
- Temporary Threshold Shift
- Permanent Threshold Shift
Chronic NIHL

- **Damage Risk Criteria**
  - Total sound energy
  - Every 3dB increase in sound intensity leads to a doubling of sound pressure.

- **OSHA Regulations**
  - 5dB rule
  - Allowable levels
    - 90dBA for 8 hours
    - 95dBA for 4 hours
    - 100dBA for 2 hours
    - 105dBA for 1 hour
    - 110dBA for 30 minutes
    - 115dBA for 15 minutes
Chronic NIHL

Defining Characteristics

- Always sensorineural
- Nearly always bilateral and symmetric
- Does not produce a profound hearing loss
- Will not progress once noise exposure discontinued
- Rate of loss decreases as threshold increases
- Most severe loss at the 4kHz frequency
  - 3-6kHz losses are greater than 500Hz-2kHz
- Maximum loss seen after 10-15 years of exposure
- Continuous noise is more damaging than intermittent noise

American College of Occupational Medicine
Noise and Hearing Conservation Committee
Chronic NIHL

- Defining Characteristics
Chronic NIHL

- Presentation
- Examination
- Audiogram
- Management
Chronic NIHL

- Hearing Conservation Programs
  - Assessment of Noise Levels
  - Engineering Controls
  - Administrative Controls
  - Personal Hearing Protectors
  - Serial Audiograms
Chronic NIHL

- Personal Hearing Protectors
  - Earplugs
  - Earmuffs
  - Canal Caps
Chronic NIHL

- Personal Hearing Protectors—Attenuation

Earplugs

Earmuffs

Both
Physiology/Pathophysiology

- External Ear
  - Resonant frequency = speed of sound/4 x EAC length

- Middle Ear
  - Acoustic Reflex

- Inner Ear
  - IHC vs. OHC
  - Supporting cells
  - Nervous structures
  - Blood vessels
Histopathology
Histopathology
Histopathology
Histopathology

- Acoustic Trauma
Histopathology

- Acoustic Trauma
Histopathology

- Industrial Noise
Histopathology

- Industrial Noise
Susceptibility

- 5% of individuals exposed to 80dBA noise levels develop a significant hearing loss.
- 5-15% for 85dBA exposure
- 15-25% for 90dBA exposure

Why?
Interactions

- AIHL vs. NIHL

- Total HL = NIHL + AIHL − \((\text{NIHL})(\text{AIHL})\) / 120
Interactions

- Presbycusis
- Ototoxic drugs
  - Aminoglycosides
  - Cisplatin
  - Lasix
  - Aspirin
- Chemicals
  - Toluene
  - Carbon monoxide
  - Carbon disulphide
- Vibration
Impairment/Handicap/Disability

- Hearing Impairment
  - “a change for the worse in either structure or function, outside the range of normal”

- Hearing Handicap
  - “the disadvantage imposed by an impairment sufficient to affect a person’s efficiency in the activities of daily living”

- Disability
  - “an actual or presumed inability to remain employed at full wages”
Hearing Handicap

AAO-1979 Rule

- Establish thresholds at 500Hz and 1-3kHz
- Calculate average monaural thresholds
- Assume handicap begins when thresholds exceed 25dB and increases by 1.5% for each additional decibel loss
- Apply 5:1 weight favoring the better hearing ear

\[ HH = \frac{5(MI_b) + (Mi_w)}{6} \]
Legislation

- Walsh-Healy Public Contracts Act, 1969
- Occupational Safety and Health Act, 1970
- Clean Air Act, 1970
- Bulletin #334, 1971
- Noise Control Act, 1972
- Hearing Conservation Amendment, Final Rule, 1983
Worker’s Compensation

- Provides payment to cover lost wages and medical expenses accrued by a worker as a result of an injury sustained on the job.
- Based on hearing handicap, most often as calculated by the AAO-1979 rule.
- Otolaryngologist’s role:
  - Complete history and physical
  - Audiogram
  - Diagnostic conclusions