

## Acoustic Shock

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## Acoustic shock

- What is it?
- Fact or fiction?
- Is it really a new phenomenon?
- What do we do about it?

## Acoustic shock

A “new” syndrome: pain, tinnitus, balance disturbance and phobic symptoms following exposure to sudden, unexpected noise.

## Overview

- Definitions
- Causative sounds
- Clinical features
- Epidemiology
- Management

## Definition

“Any temporary or permanent disturbance of the functioning of the ear, or of the nervous system, which may be caused to the user of a telephone earphone by a sudden sharp rise in the acoustic pressure produced by it.”

(International Telecommunications Union  
European Transmission Standards Institute)

## Definition

“An Acoustic Incident is a sudden, unexpected, noise event which is perceived as loud, transmitted through a telephone or headset”  
“Acoustic Shock is an adverse response to an acoustic incident resulting in alteration of auditory function”

(Acoustic Safety Programme, United Kingdom)

## Definition

“Acoustic shock refers to the combination of exposure to a brief, sudden, unexpected, high frequency, high intensity sound emitted (the stimulus) and the subsequent symptoms (the response) which can develop.”

(The Health Services Australia Group)

## Causative sounds

- Many!
- Includes:
  - Faulty telephone or headset equipment
  - Transmission faults within the network
  - Lightning
  - Positive feedback with some cordless and mobile phones.
  - Tones from facsimile machines or modems
  - Maliciously generated sounds: shouting or blowing a whistle into their telephone.

## Causative sounds

Sound characteristics

- 56 to 108 dB at 100 Hz to 3.8 kHz
  - (Hinke & Brask)
- 82 to 110 dB at 2.3 to 3.4 kHz
  - (Milhinch)
- Rise time 0 to 20 ms
- Duration ?
  - Short
  - As long as it takes to move handpiece from ear or remove headset

## Causative sounds

NOT the characteristic sounds causing NIHL or Acute Noise Trauma.

## Clinical features

- Immediate / soon onset
  - Ear pain 81%
  - Tinnitus 50%
  - Balance problems 48%
  - Hearing loss 18.4%

(mostly temporary and may involve low and mid frequencies in contrast to the high frequency loss of noise induced hearing loss)

(Milhinch)

## Clinical features

- Immediate / soon onset cont'd
  - Pain in the neck or jaw 11%
  - Pain in the face 7%
  - Sensation of blockage or aural fullness
  - Numbness
  - Collapse

(Milhinch)

## Clinical features

- Delayed onset
  - Anxiety, depression
  - Headache
  - Sensitivity to previously tolerated sounds (hyperacusis)
  - Sleep disturbance
  - Hyper-vigilance
  - Anger

(Milhinch)

## Clinical features

- Examination
  - Mostly normal
- Tests
  - Mostly normal
  - May have sensorineural hearing loss but may be low / mid frequency rather than 4-6 kHz loss of NIHL

## Clinical features

NOT the symptoms, signs, test results of NIHL or Acute Noise Trauma.

## Clinical features

- Exposure to an acoustic incident does not automatically result in the development of acoustic shock symptoms.
  - 11% of those who experienced an acoustic incident reported some symptoms
  - 1.5% persistent symptoms

(Telstra: internal report)

## Epidemiology

- Call centre workers at increased risk
- Increased prevalence in those with stress, smoking, neck and shoulder pain
- However, no evidence of pre-existing psychological or psychiatric morbidity
- More women than men even allowing for skewed sex distribution within call centre workplaces
- True figures unknown as often unrecognised

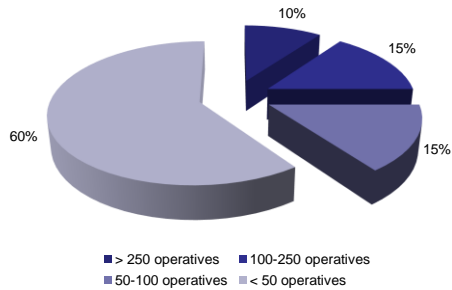
## Epidemiology

### UK Call centres

- More than 5700 in UK
- Workforce between 650,000 and 1,000,000
- 2 to 3% of working population
- High staff turnover: between 20% and 400% per annum

## Epidemiology

UK call centres



## Epidemiology

- Noise in call centres
  - Principal source of noise is people
  - Call centre workers listen to speech through a headset: monaural vs binaural
  - Required signal to noise ratio for speech discrimination is at least 15 dB

## Epidemiology

- Noise in call centres

Background noise

– 57 to 70.6 dB(A)

Headset noise

– 65 to 88 dB(A)

## Epidemiology

- The control of Noise at Work Regulations 2005

– Lower exposure action value (LEAV)	80
– Upper exposure action value (UEAV)	85
– Exposure limit value (ELV)	87

## Epidemiology

- Conclusions

- Substantial risk that call centres with high background noise will exceed LEAV
- Moderate risk that call centres with high background noise will exceed UEAV
- Small risk that call centres will exceed ELV

## Epidemiology of RSI

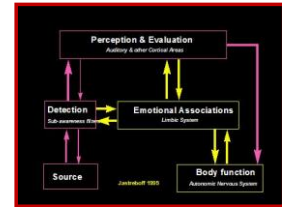
- Australia, Northern Europe / Scandinavia, UK, North America
- High perceived job stress and high workload
- Workers using visual display units over represented
- Women report more symptoms than men

## Pathophysiology

- Middle ear
  - Middle ear muscles (tensor tympani and stapedius). Link to startle reflex. 5HT linked to middle ear muscles and emotional state.
- Inner ear
  - Paucity of cochlear damage mitigates against cochlear mechanism
  - BUT; pain and imbalance symptoms argue for peripheral involvement

## Pathophysiology

- Central auditory system
  - Misophonia. Jastreboff / Hazell explanation
- Psychological
  - Phobic reaction
  - PTSD



## Management

- Prevention preferable to cure!

## Prevention

- Limit sound levels
  - But the sounds that trigger AS are not necessarily loud by the normal definitions of loudness.
  - Reducing level too much causes intelligibility problems – operative strains to hear and raises central auditory gain. Potentially counterproductive as if high central auditory gain may be more prone to AS.
- Selectively suppress troublesome sounds
  - How?

## Prevention

- Reduce ambient noise levels
  - Less background noise means less straining to hear and reduced central auditory gain
- Reduce workplace stress levels

## Management

- Investigate as any other tinnitus or hyperacusis
  - PTA. Tymp. Avoid reflexes. Avoid LDLs or do very carefully.
  - No clinical advantage doing OAE's, BSER etc.
  - MRI for usual reasons.

## Management

- Diagnosis
  - Rapid, interested, convinced
- Jastreboff / Hazell tinnitus and hyperacusis model
  - Explanation, counselling, desensitization using low level sound
- Psychological
  - Conventional psychological tools including cognitive behavioural therapy
- Job
  - May require change of duties

## Epilogue

- Unable to continue work at Walk In Centre
- Resigned
- Followed lifetime dream to become portrait photographer
- Now happier than before the acoustic shock

## Conundrums

- The condition seems genuine. But:
- Most current information is in company reports, non-peer reviewed journals, government websites
- Little published to date meets evidence based medicine criteria
- Many doctors are either ignorant of the condition or sceptical of its existence
- Telecommunication companies are also sceptical

## Conundrums

- Can other types of sound produce acoustic shock?
- My recent practice
  - 2 Intercom phones
  - 1 Skype phone
  - 1 Football whistle
  - 2 Demolition noise

## Summary

- A pattern of symptoms has emerged in people who are exposed to sudden, intense, unexpected noises.
- Appears to be a distinct subgroup of tinnitus / sound intolerance.
- Clinical picture is often not recognised. Therefore under-reported.
- Distinct from NIHL / acoustic trauma
- Tests often within normal range
- Information is difficult to find and nothing published to date meets evidence based medicine criteria.
- Pathophysiology / management uncertain

## Further reading

McFerran DJ and Baguley DM: Acoustic shock. Journal of Laryngology and Otology 2007; 13: 133-134.

Milinch: Acoustic Shock Injury: Real or imaginary? Audiology Online, 2002.  
[www.audiologyonline.com/articles/article\\_detail.asp?article\\_id=351](http://www.audiologyonline.com/articles/article_detail.asp?article_id=351)

Acoustic safety programme:  
[www.acousticshock.org](http://www.acousticshock.org)