Aural Health in Diabetes

Donella Chisari
Audiologist
chisarid@unimelb.edu.au
How do we hear?

The ability to hear sound involves a number of important structures of the ear.

Peripheral and central auditory pathways

• Outer Ear
• Middle Ear
• Inner Ear
• Auditory nerve
How do we hear?

Outer Ear  Middle Ear  Inner Ear
Hearing loss types

Conductive hearing loss

Auditory Neuropathy

Sensory (sensorineural) hearing loss

Mixed hearing loss
What can diabetes do to the ear?

Metabolic changes and microvascular complications have been commonly reported \(^1, \^3, \^11\)

- Localised microangiopathy \(^11\)
- Subsequent disruption of blood supply to the inner ear and the auditory nerve.
- Changes in vessel wall thickness of components of the Organ of Corti (basilar membrane and stria vascularis) \(^11\)
- Interference of nutrient transportation across thickened capillary walls, narrowed blood vessels \(^1, \^2\)
Degenerative changes in the organ of Corti, including a decrease in concentration of outer hair cells \(^5,11\)

Neuronal degeneration, and slowing of neural conduction in the auditory nerve and auditory brainstem\(^3\)
Hearing loss and diabetes

Research has demonstrated that the presence of diabetes can affect hearing across the lifespan.

• Difficulties in functional hearing ability for both adults and children with type 1 diabetes\textsuperscript{1,3,4}

• Adults with diabetes are twice more likely to experience cochlear hearing loss (as measured by pure tone audiometry) than those without diabetes\textsuperscript{8}

• Large variability in prevalence of cochlear hearing loss in people with diabetes; ranging from no occurrence, to up to 80%\textsuperscript{2,7,10}
Hearing loss and diabetes

• Typical hearing loss in people with diabetes is described as a progressive, high frequency sensorineural hearing loss\(^6,12\) however other configurations are possible\(^13\)

• Some suggestion that degree of hearing loss is correlated with progression of diabetes disease\(^7\)

• Hearing loss can be cochlear, retrocochlear or a combination of both\(^1,13\)
Auditory function and functional hearing abilities in two groups

- adults with type 1 diabetes (Rance et al, 2014)
- children with type 1 diabetes (Rance et al 2016)

Assessment of a range of listening measures: sound detection, speech in noise perception, temporal processing ability

Objective measures of auditory nerve integrity (Auditory Brainstem Responses) and clinical features of T1DM.
Significantly delayed neural conduction times of ABR responses when compared to controls

Abnormal ABR responses to faster stimulus rates

Impaired perception of timing cues, a typical feature of auditory neuropathy.

Significant correlations between ABR, speech perception scores and degree of DSPN (large fibre).

Adults with T1DM (Rance et al 2014)

For children with type 1 diabetes, this study showed evidence of cochlear and neural dysfunctions affecting the central auditory pathways.

Significant correlation between perceptual deficits on speech reception measures and degree of neural disruption.

Self perceived deficits in noise were also noted.
Research in Type 2 Diabetes

Systematic review and meta-analysis of hearing in Type 2 diabetes (Akinpelu, Mujica-Mota & Daniel, 2014)

• Higher incidence of at least a mild degree of hearing loss in type 2 diabetes compared with controls

• Greater degree of hearing loss (across all frequencies, greater difference in high frequency hearing thresholds) when compared to controls

• Prolonged ABR wave V latencies, suggesting retro-cochlear involvement

• Occurrence of hearing loss in type 2 diabetes can be influenced by age and duration of diabetes
Questions to ask

• Are there any hearing concerns?
• If so, are there any situations where hearing is more difficult?
• Over what timeframe has the hearing deterioration occurred?

A baseline measurement of hearing is recommended to determine hearing acuity and functional hearing.

People with hearing difficulties may not realise or may not think they need assistance.
Optimal auditory assessments

• Pure tone **audiometry** is a routine clinical assessment used to establish hearing acuity over a range of frequencies.

• **Tympanometry (immittance testing)** is an objective assessment of the middle ear.

• **Speech perception testing** can be completed in quiet or noise
  • in noise is more representative measure of daily communication abilities.

• **ABR (Auditory Brainstem Response)** assesses the integrity of the auditory pathway by presenting sounds to the ear and measuring the time it takes for the sound to travel from the cochlea to the auditory centres in the brain, via the auditory nerve and auditory brainstem.
How often to monitor

Diabetes management should include a hearing assessment to establish baseline measures of hearing acuity and functional hearing ability.

Regular reviews (annually) ensure that hearing is monitored and appropriate audiological management is advised.


Thank you

chisarid@unimelb.edu.au