

Diabetes and Audiological Monitoring of Ototoxic/Vestibulotoxic Medications

Robert M. DiSogra, AuD, FAAA

Audiology Consultant

Millstone, NJ

www.drbobdisogra.com

Webinar Outline – Part II

Types of HL with Diabetes

**Pathophysiological
Explanation of Diabetes-related
Hearing Loss**

Webinar Outline – Part II

Incidence of HL with Diabetes

Duration of Diabetes and HL

Webinar Outline – Part II

Effects of Age & Gender

Symptoms of HL

Webinar Outline – Part II

Tinnitus

Degrees of HL

Webinar Outline – Part II

Co-Morbidities

Drugs and Insulins for Diabetes Management

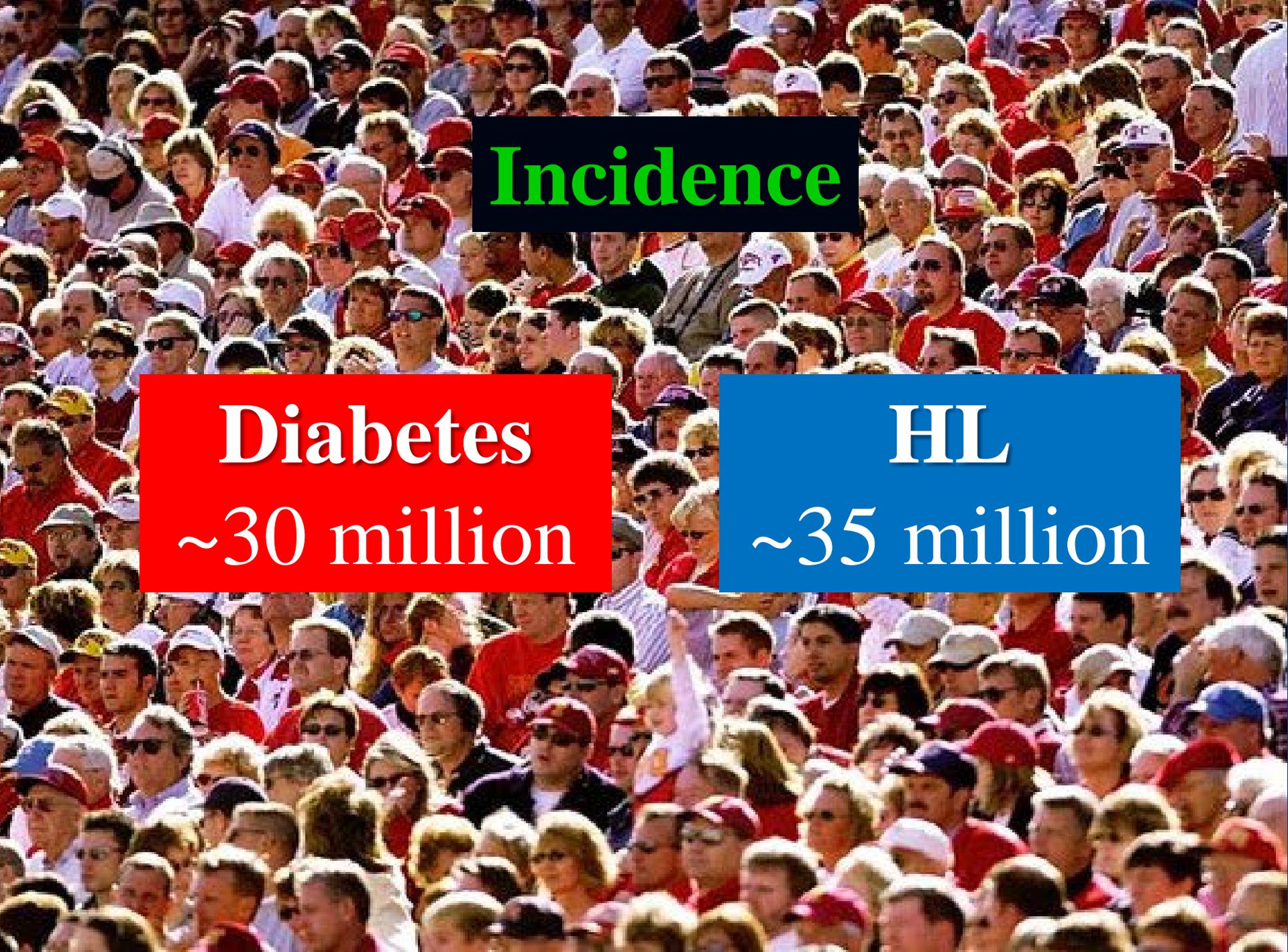
Webinar Outline – Part II

Audiological Monitoring

Vestibular Monitoring

Webinar Outline – Part II

Communication Strategies for Persons with Hearing Loss

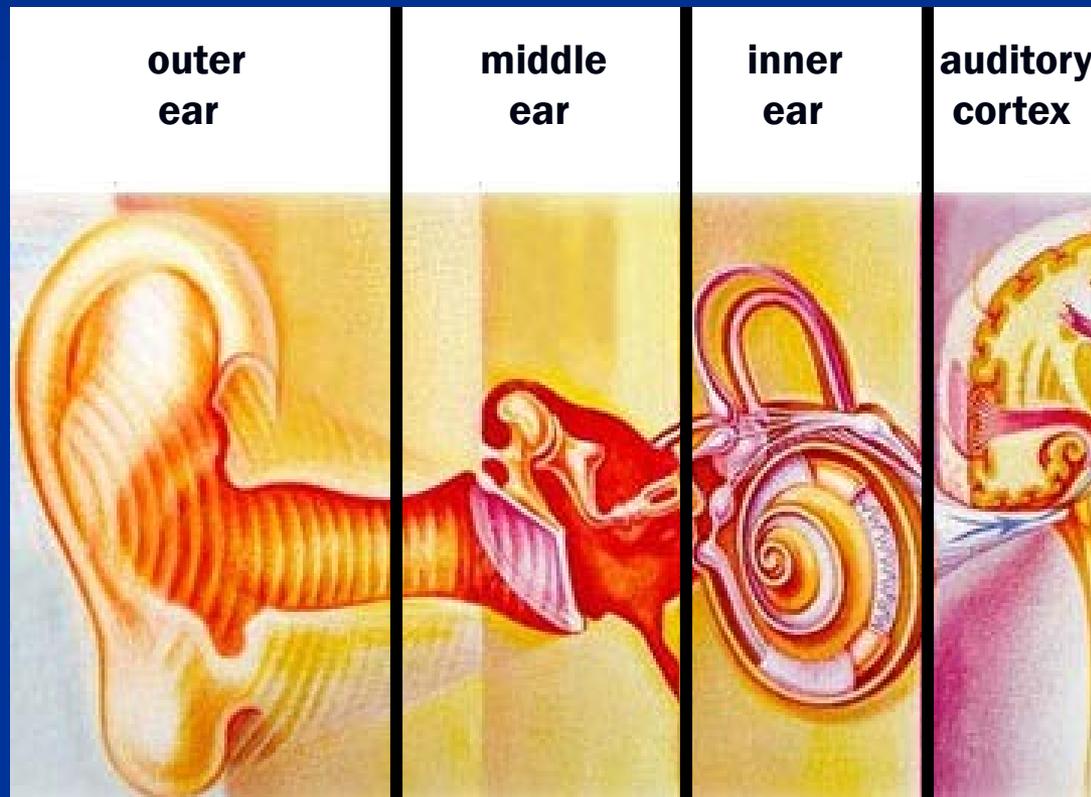


Incidence

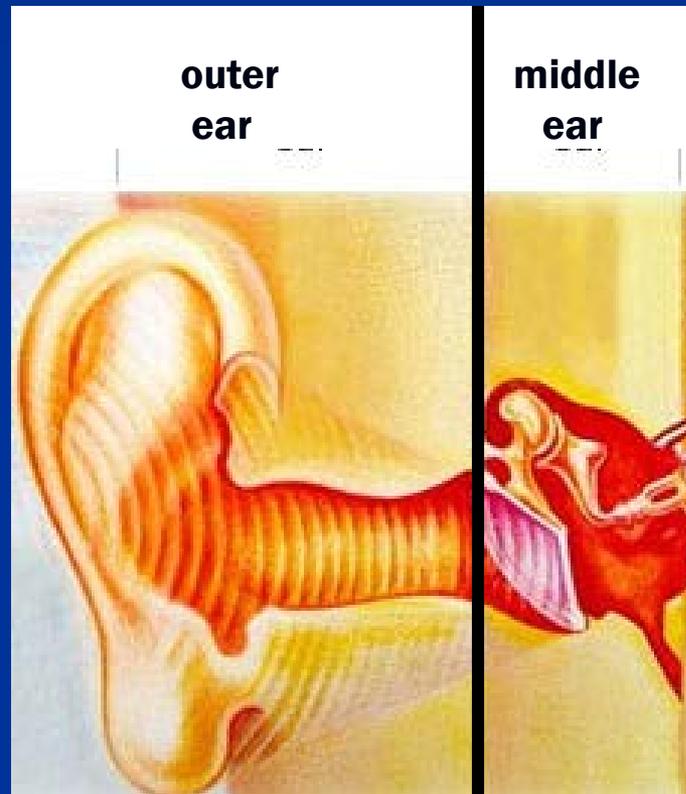
Diabetes
~30 million

HL
~35 million

Diabetes and the Auditory System



Diabetes and the Auditory System



Types of Hearing Loss with Diabetes

Conductive Hearing Loss

15 - 16% CHL

(Genevey Hlayisi, V. et al 2018, Thimmasettaiah,
et al, 2012)

Types of Hearing Loss



Types of Hearing Loss with Diabetes

Sensorineural Hearing Loss

**More common with diabetes pts
than with non-diabetes patients**

(Kakarlapudi, V., et al., 2003; Genevey Hlayisi, V.
et al, 2018)

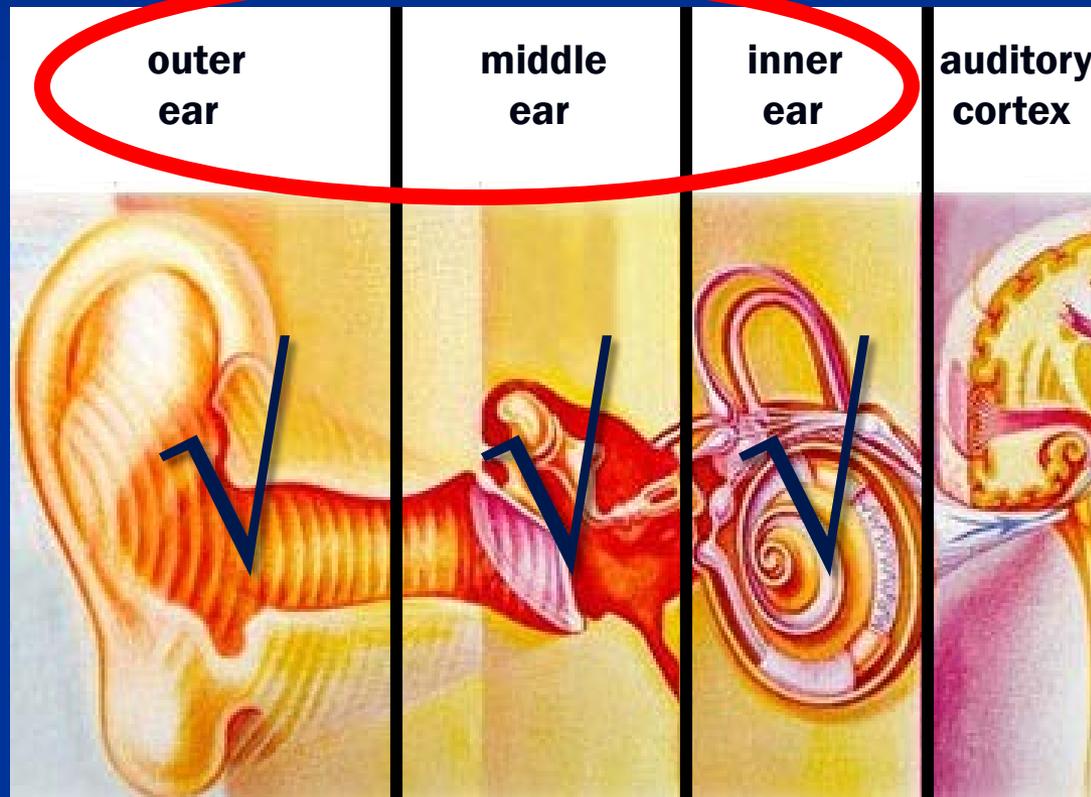
Types of Hearing Loss with Diabetes

Sensorineural Hearing Loss

Fluctuating Hearing Loss

(altered sodium/potassium gradients
and
reduced endocochlear potentials)

Diabetes and the Auditory System



Types of Hearing Loss with Diabetes

Mixed Hearing Loss
(combo. of CHL & SNHL)

26% Mixed HL

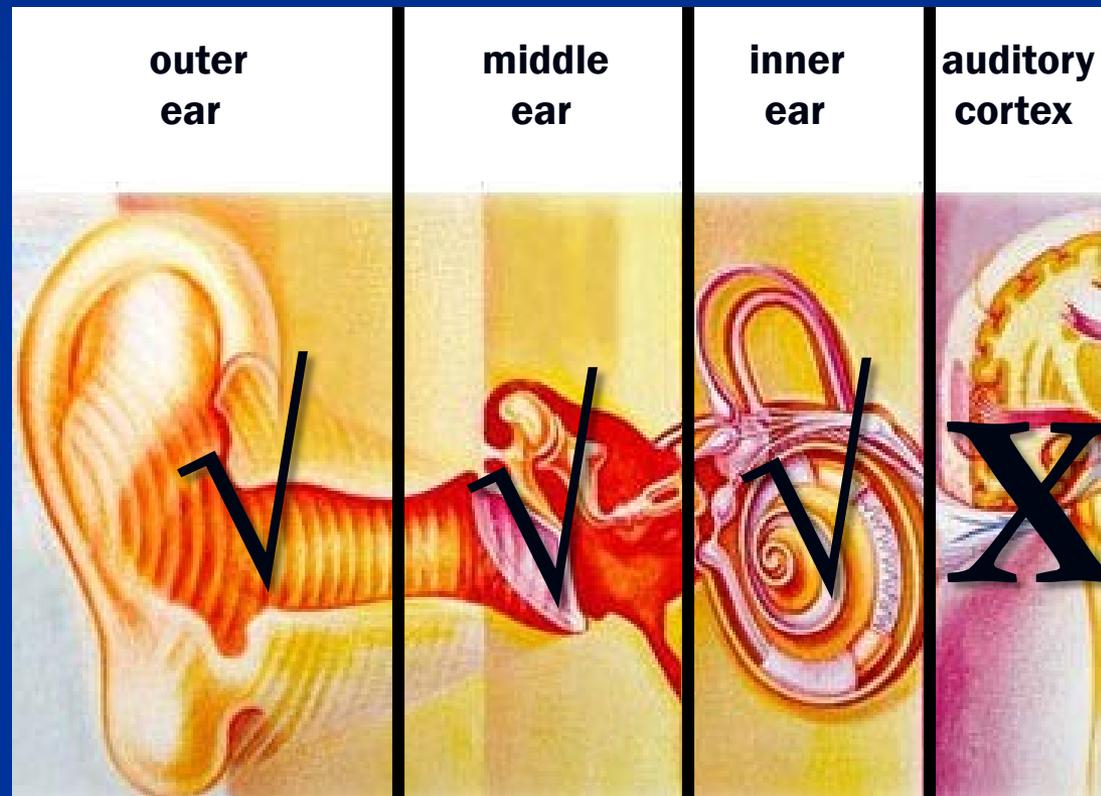
(Genevey Hlayisi, V. et al, 2018)

Types of Hearing Loss with Diabetes

Central Hearing Loss (cortical HL)

**No research identifying central
HL with insulin dependent or
non-insulin dependant patients**

The Tour Continues...



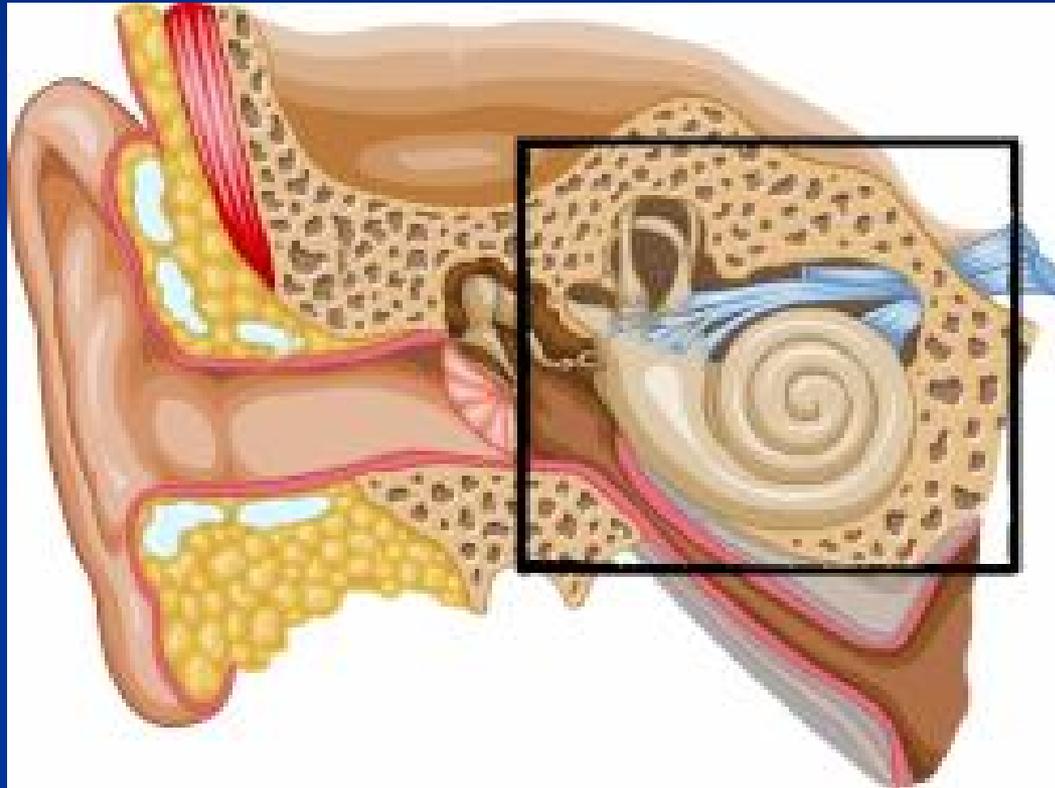
Types of Hearing Loss with Diabetes

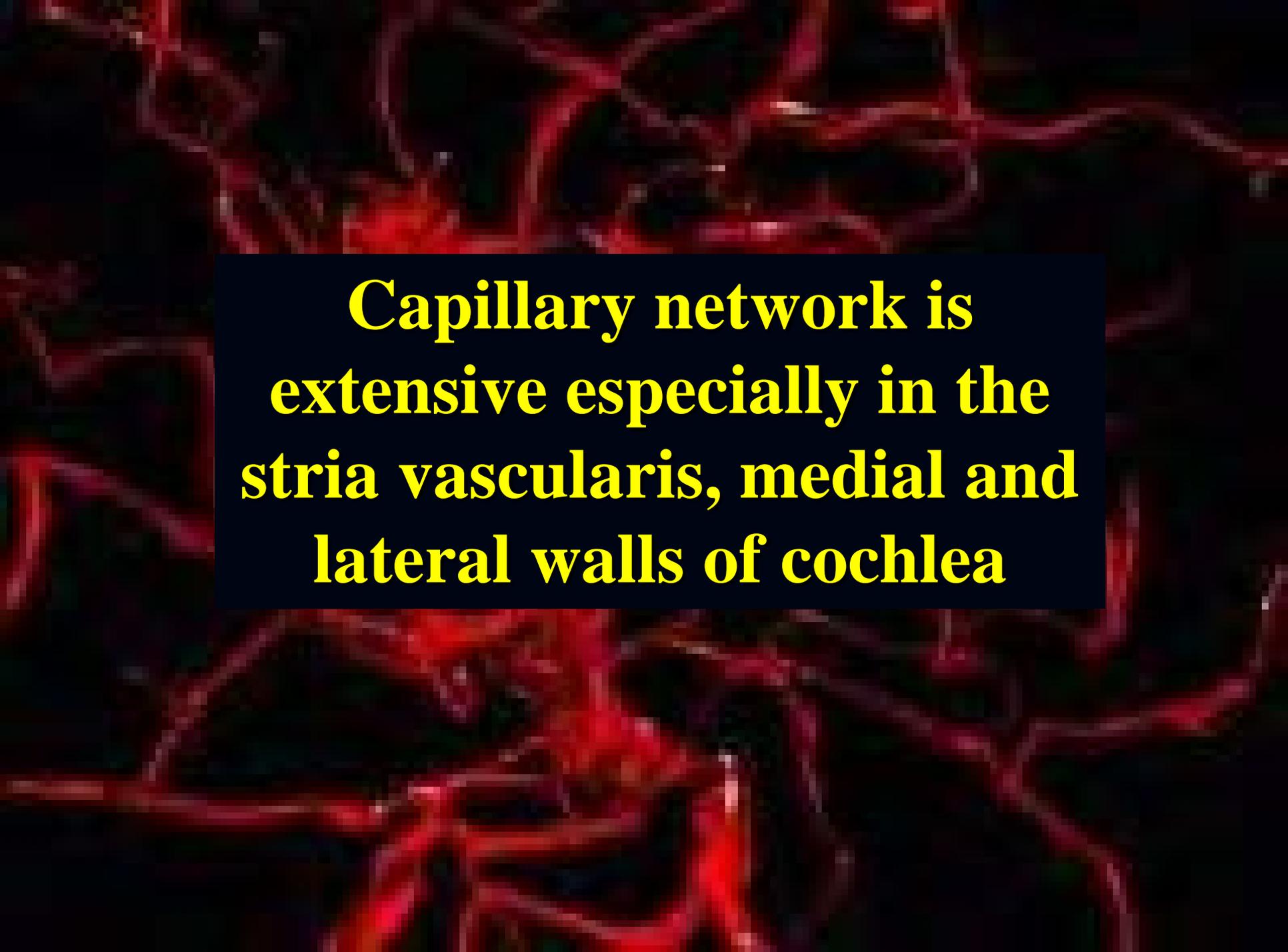
Sudden S/N Hearing Loss

Cases of sudden HL
have been reported

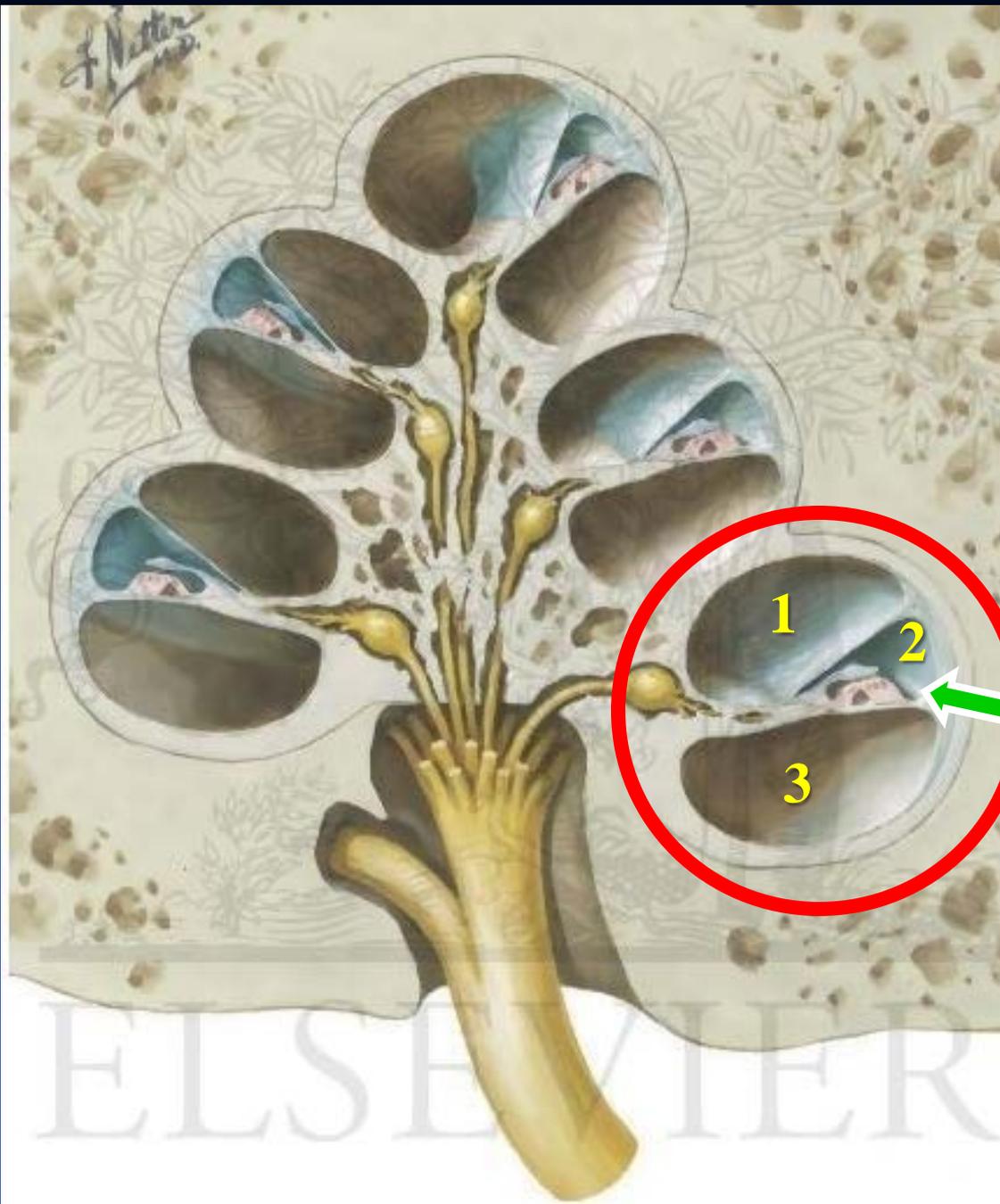
(Jung, et al. 2018, Weng, et al 2005)

The Cochlea

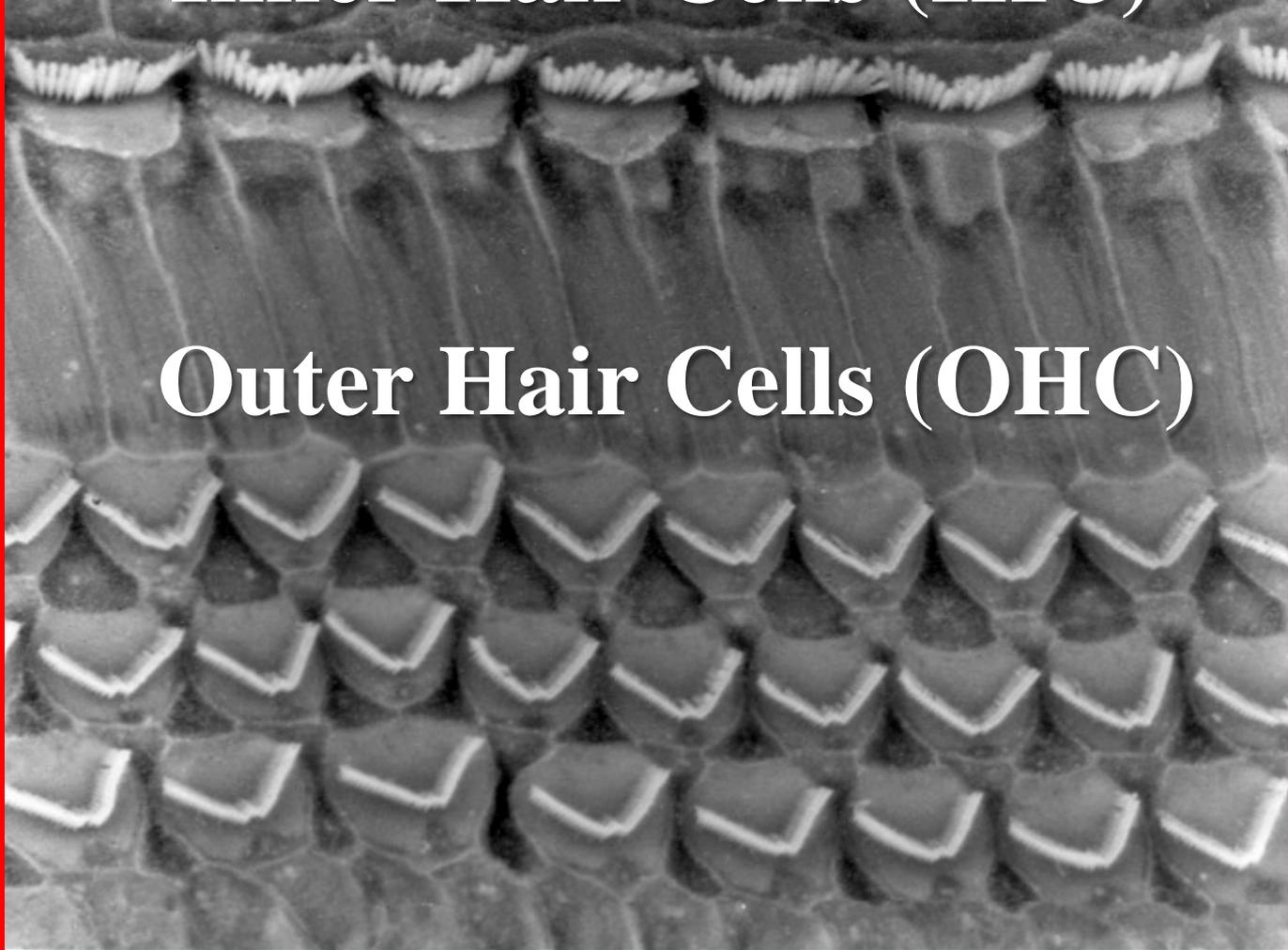




**Capillary network is
extensive especially in the
stria vascularis, medial and
lateral walls of cochlea**



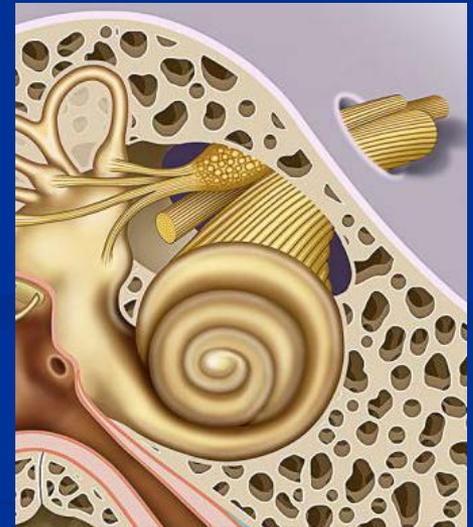
Inner Hair Cells (IHC)



Outer Hair Cells (OHC)

Pathophysiological Explanation of Hearing Loss

For Type II, the cochlea
is the main structure
affected



Fukushima, et al. Cochlear changes in patients with Type 1 diabetes mellitus. *Otol. Head Neck Surg.* Vol 133, No. 1 July 2005, pp. 100-106.

Pathophysiological Explanation of Hearing Loss

MICROANGIOPATHY

A disease of the
blood vessels
(arteries, veins, and
capillaries)



wiseGEEK

Pathophysiological Explanation of Hearing Loss

MICROANGIOPATHY

CAUSE: build-up of sugar-based substances
on vessel walls

RESULT: reduces blood flow throughout the
body

Pathophysiological Explanation of Hearing Loss

STRIA VASCULARIS

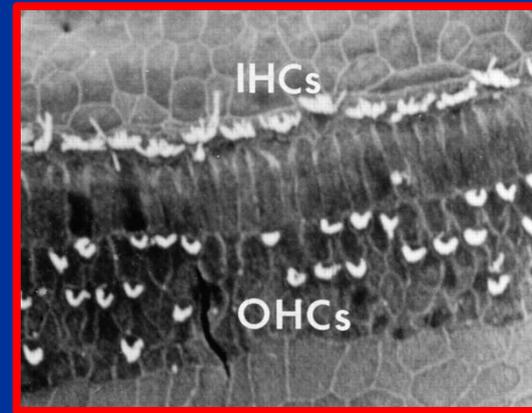
**Stria vascularis was 10-20 times
thicker than usual in diabetes patients**

Jorgensen MB, Buch NH. Studies on inner-ear and cranial nerves in diabetes. *Acta Otolaryngol.* 1961;107:179-82.

Pathophysiological Explanation of Hearing Loss

HISTOPATHOLOGICAL STUDIES

Loss of outer
hair cells (OHC)

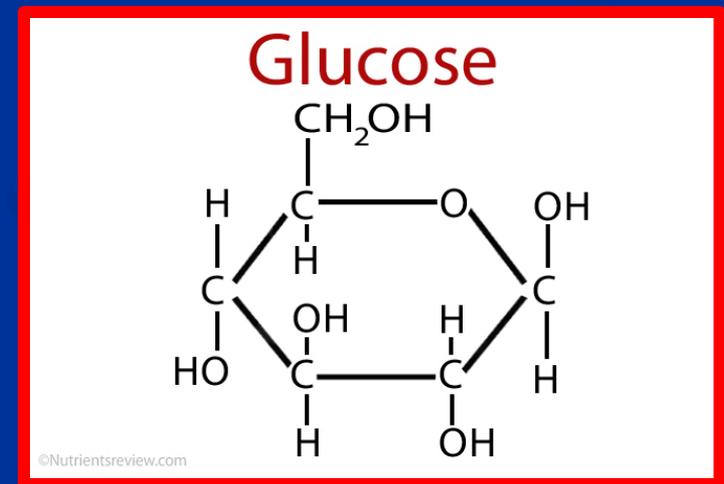


Fukushima, et al. Cochlear changes in patients with Type 1 diabetes mellitus. *Otol. Head Neck Surg.* Vol 133, No. 1 July 2005, pp. 100-106.

Pathophysiological Explanation of Hearing Loss

GLUCOSE

Cochlear function is
affected
by hyperglycemia



Incidence of HL and Diabetes

HL is *twice as common*
in diabetic pts
with proliferative
retinopathy

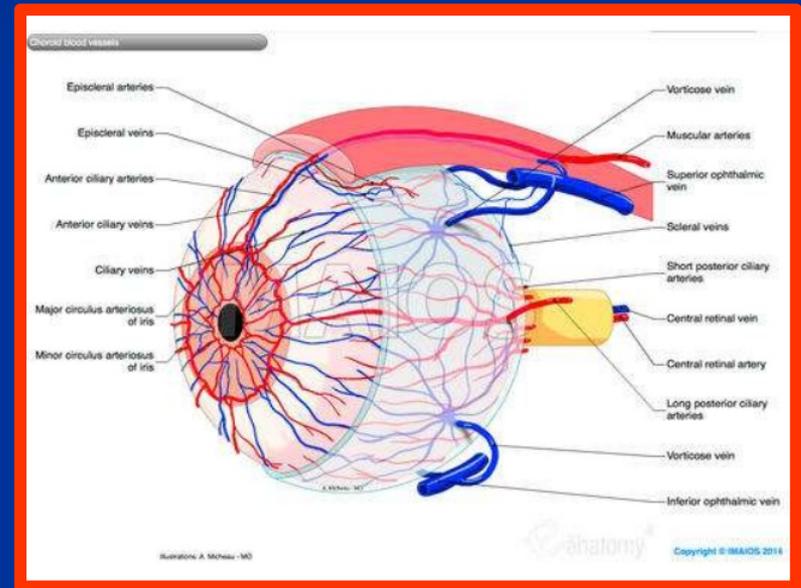


Jorgensen MB, Buch NH. Studies on inner-ear function and cranial nerves in diabetes. *Acta Otolaryngol.* 1961;53:350-64.

Incidence of HL and Diabetes

Microvascular blood supply of the **EAR** is similar to that of the **EYE**

**Retinopathy =
Hearing Loss**



Incidence of HL and Diabetes

Type I: 32%

Botelho CT, e al. Increased prevalence of early cochlear damage in young patients with type 1 diabetes detected by distortion product otoacoustic emissions. *Int J Auidiol.* 2014 Jun;53(6):402-8.

Incidence of HL and Diabetes

Type I: Significant HF SNHL (n=63)

Elamin A, et al. Hearing loss in children with type 1 diabetes. *Indian Pediatr.* 2005 Jan;42(1):15-21.

Incidence of HL and Diabetes

Type II: 44% - 69%

Mais CA, Campos, CA. Diabetes mellitus as etiological factor of hearing loss. *Braz J Otolaryngol.* 2005 Mar-Apr;71(2):208-14.

Duration of Diabetes and HL

**Neuronal and
vascular function**
of the auditory pathways
change in addition to changes
from presbycusis

Age

Under 60



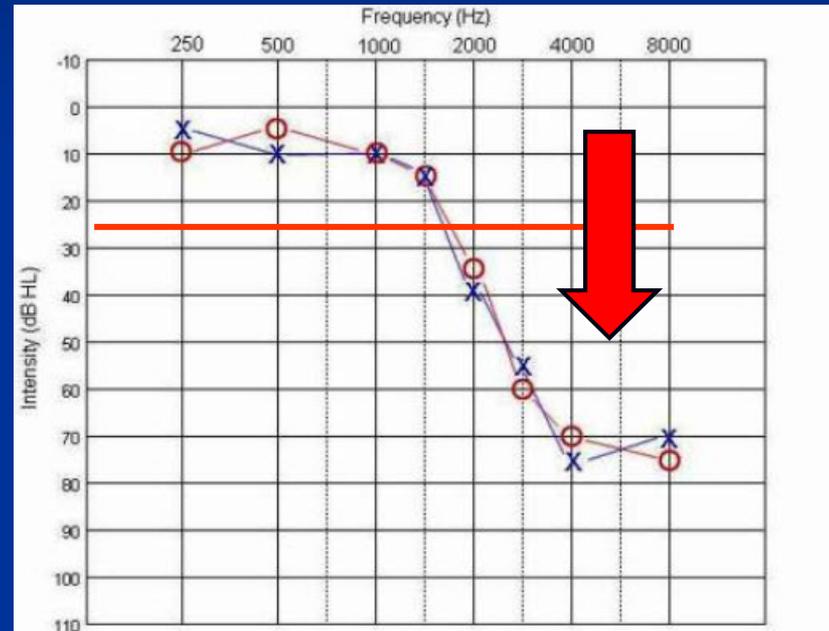
Unexplained HF HL might lead to a diabetes diagnosis (after lab tests)

Age

Under 60

**55% with diabetes
have HF SNHL**

**9% have HL
w/o diabetes**



Vera-Genevey Hlayisi, et al. High prevalence of disabling hearing loss in young to middle – aged adults with diabetes. *Int J Diabetes in Devel Countries*. Published online, June, 2018.

Gender

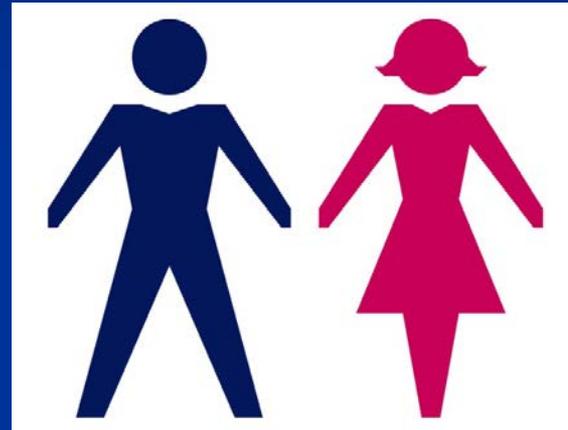
Females > males



Sharashennidz N, et al. Age related hearing loss: gender differences. *Georgian Med News*. 2007;144:14-8.

Gender

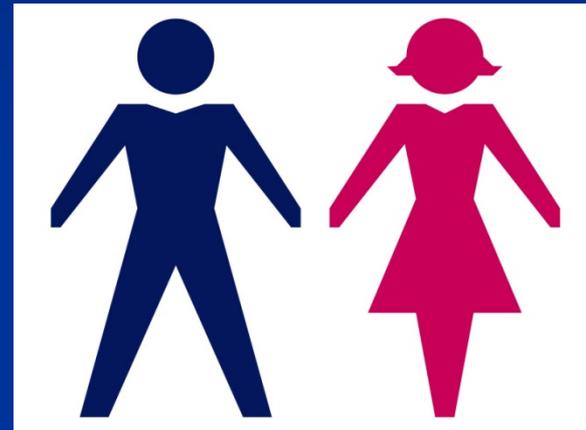
“No difference
between the
sexes”



Liu. B. et al. Investigation and analysis of tinnitus in diabetic patients. *Lin Chung Er Bi Yan Hou Tou Jing Wai Ke Za Zhi*, 2018 Apr;32(8):566-569.

Gender

Males >females



Vera-Genevey Hlayisi, et al. High prevalence of disabling hearing loss in young to middle – aged adults with diabetes. *Int J Diabetes in Devel Countries*. Published online, June, 2018.

Symptoms of Hearing Loss with Diabetes

**“I hear but can’t understand
the words”**

Tinnitus “Aural fullness”

Bilateral

Progressive



Tinnitus

Descriptors



Ringing

Humming

Buzzing

Whooshing

Roaring

Hissing

Chirping

Crickets

Clicks



Tinnitus

Causes



Age **Hearing Loss** **Rx Side Effects**

Head Trauma **Caffeine** **>Sodium**

TMJ problems **Circulatory Disorders**

NOISE ESPOSURE!

Tinnitus with Diabetic Patients

**Greater incidence of tinnitus which may
be related to the age**

(n = 112)

51-60 year: 43%

>60 year: 55%

**Liu B. et al. Investigation and analysis of tinnitus in
diabetic patients. *Lin Chung Er Bi Yan Hou Tou Jing Wai
Ke Za Zhi*, 2018 Apr;32(8):566-569**

Thorough Case History



Get to know your pharmacist



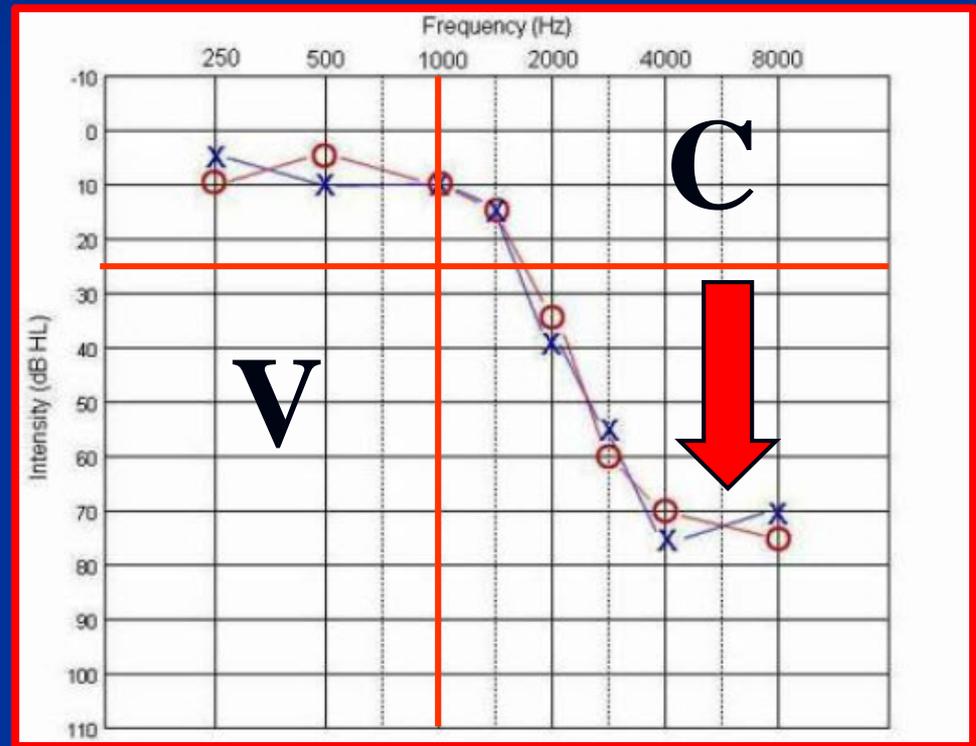
Refer to Audiologist for Testing



Degree of Hearing Loss

>25dB in the poorer ear

Usually mild to moderate



Frequency Range

Low to Mid Frequency (Type I & II)

Peripheral neuropathy (foot)
associated with
low/mid frequency SNHL
(but not high frequency SNHL)

Frequency Range

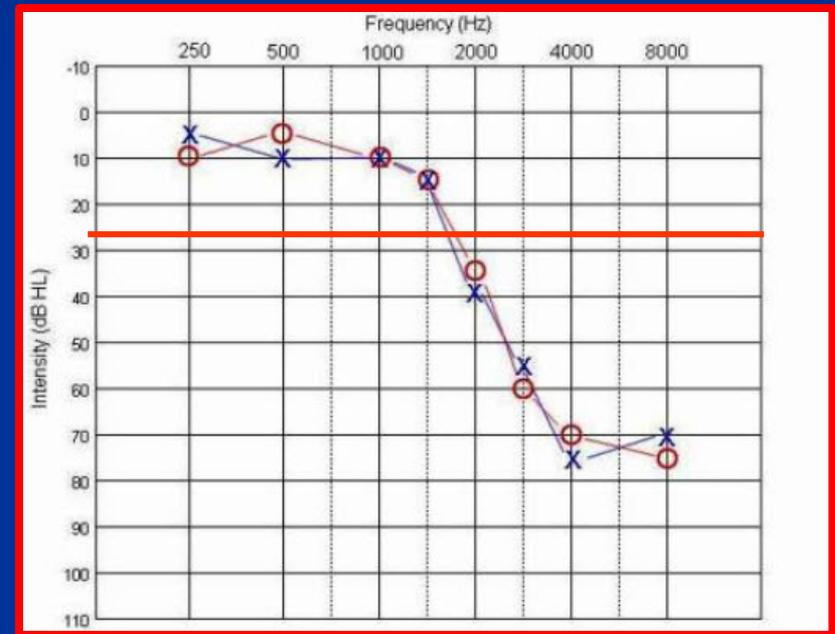
**Before 1981 the literature showed
that diabetes-related HL was:**

**Mild-Moderate
and
High Frequency**

Frequency Range

High Frequencies

Type II patients
(Tay, et al, 1995)



Frequency Range

High Frequencies

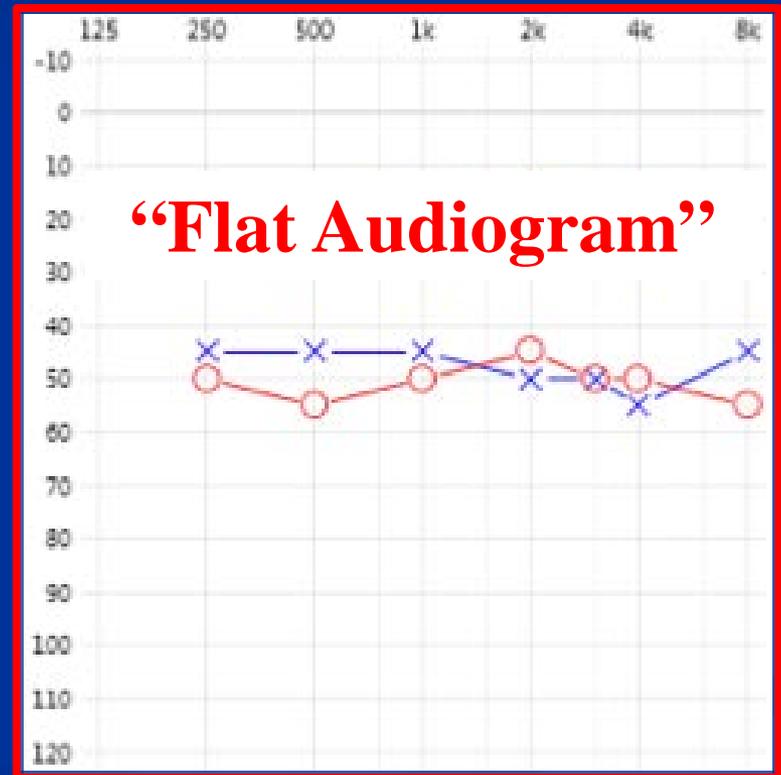
Follows a similar pattern that of age-related HL (presbycusis)



Frequency Range

All Frequencies

Celik (1996)
showed elevated
thresholds at *all*
test frequencies
with **Type I**
diabetic patients



Frequency Range

All Frequencies

Celik (1996)
showed elevated
thresholds at *all*
test frequencies
with **Type I**
diabetic patients

Microangiopathy



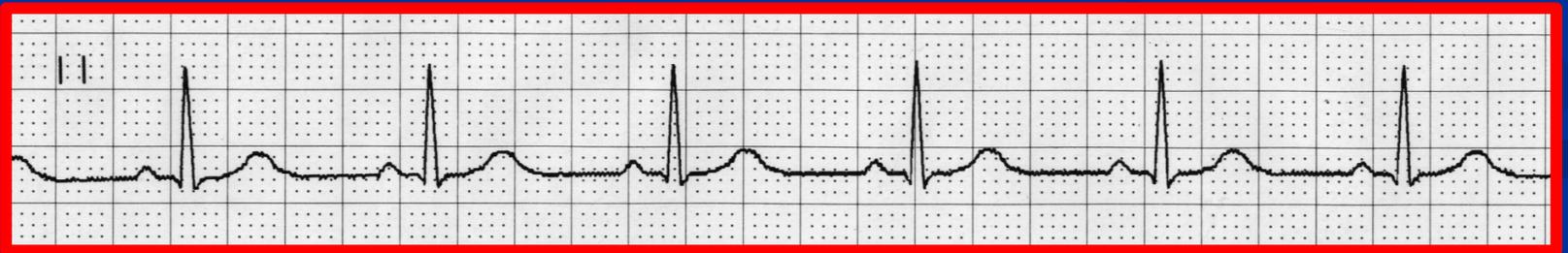
wiseGEEK

Co-Morbidities

Hx of cardiovascular disease

Hypertension

Duration of the diabetes



Co-Morbidities

Blood sugar control

Presence of pre-existing HL

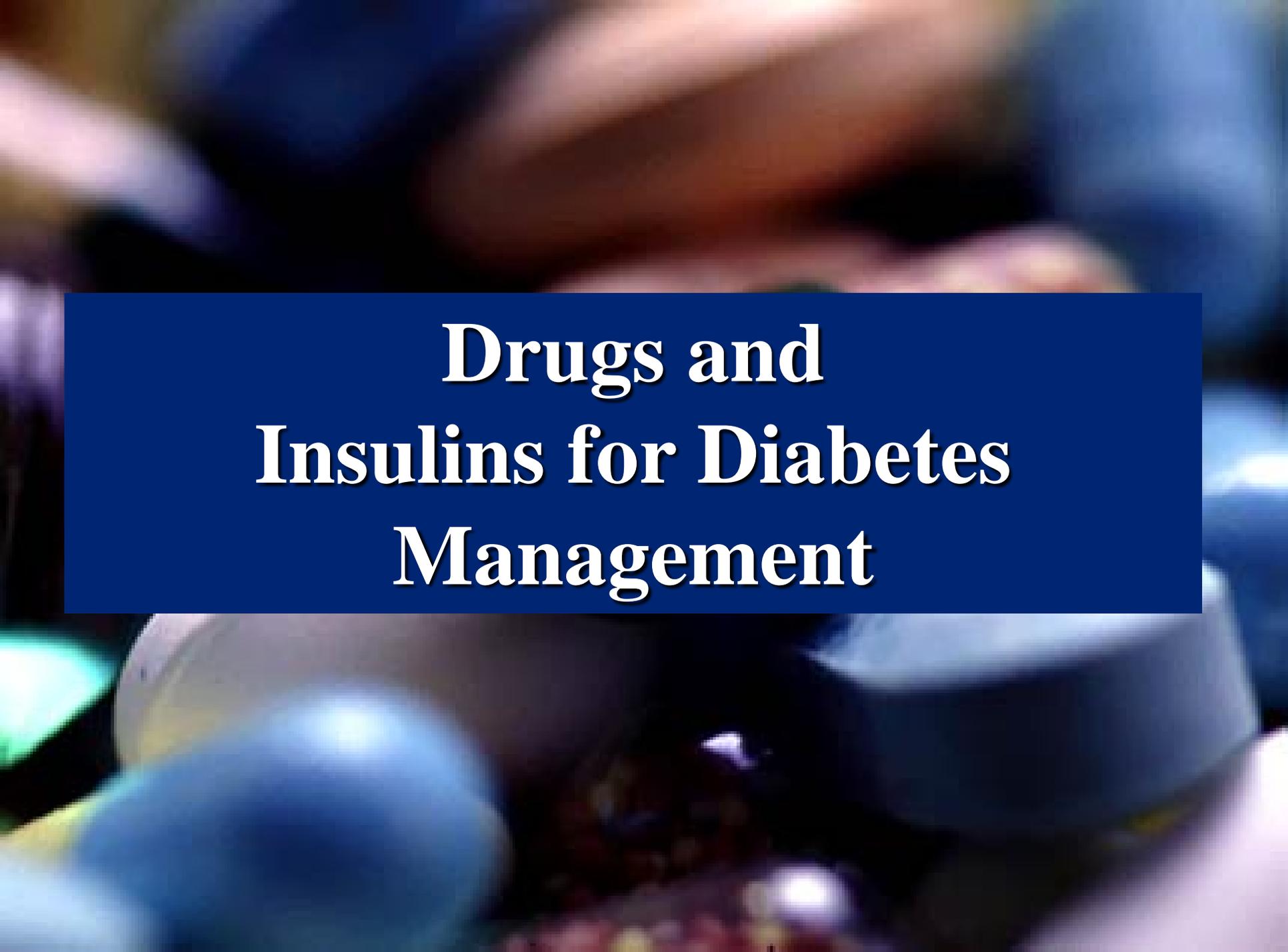
Severe peripheral neuropathy

Co-Morbidities

Retinopathy

Increased body mass index (BMI)

Noise exposure

The background of the slide is a blurred image of a person's face and hands, possibly a healthcare professional, in a clinical setting. The colors are muted, with blues, greys, and skin tones. A dark blue rectangular box is centered over the image, containing the title text in white.

Drugs and Insulins for Diabetes Management

59 Drugs for Diabetes

46



13



**DiSogra, RM. The audiology project.
*www.theaudiologyproject.com, 2018***

Auditory - Vestibular - Cognitive Side Effects



Drugs and Insulins for Diabetes Management

www.drbobdisogra.com

Click “More”

Click “Diabetes Rx Side Effects”

Rx Side Effects – Oral (incl. combination drugs) (n = 46)



Auditory 14 30.4%

Vestibular 43 93.5%

Cognitive 31 67.4%

Rx Side Effects – **Insulin**

(incl. Neutral Protamine Hagedorn – NPH)

(n = 13)



Auditory 1 8%

Vestibular 7 54%

Cognitive 5 38%

Rx Side Effects Summary

(n = 59)

Vestibular	50	85%
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Cognitive	36	61%
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Auditory	15	25%
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Rx Side Effects Summary (n = 59)

Vestibular	50	85%
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WEBINAR: May 22, 2018 - *Risk of falls with diabetes: screening, diagnosis and treatment; monitoring.* Dr. Richard Gans, American Institute of Balance.



**Audiometric
Monitoring for
Patients with
Diabetes**

Audiometric Monitoring for Patients with Diabetes

**No formal guidelines exist for
monitoring hearing loss and/or
tinnitus for patients with diabetes**

**DiSogra, RM. The audiology project,
www.theaudiologyproject.com, 2018.**

Audiometric Monitoring for Patients with Diabetes

Initial visit (baseline)

- **Review findings**
- **Review symptoms suggesting changes in hearing**

Audiometric Monitoring for Patients with Diabetes

Initial visit (baseline)

- Tinnitus Handicap Inventory (THI)
(if warranted)**

Audiometric Monitoring for Patients with Diabetes

3 months after baseline

- **to monitor any progression of the loss; THI if warranted**
- **review symptoms of changes in hearing**

Audiometric Monitoring for Patients with Diabetes

6 months after 1st follow-up

- to monitor any progression of
the loss**
- Repeat THI – if warranted**

Audiometric Monitoring for Patients with Diabetes

**Annually (or sooner if further
changes are suspected)**

- to monitor stability or any
progression of the loss**
- Repeat THI – if warranted**

Vestibular Monitoring for Patients with Diabetes

No formal guidelines exist for
monitoring vestibular function for
patients with diabetes

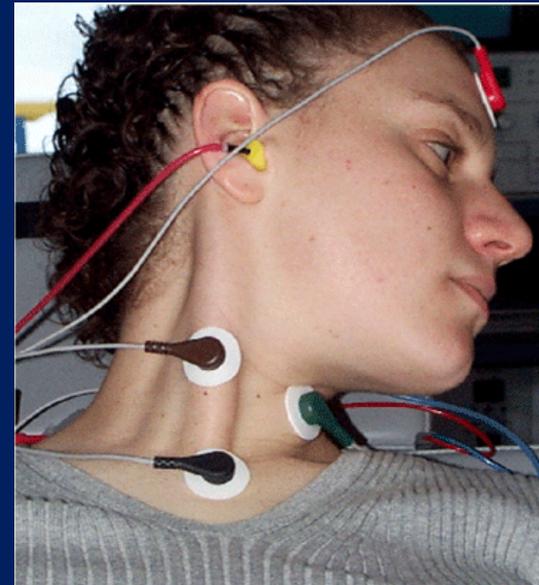
DiSogra, RM. The audiology project,
www.theaudiologyproject.com, 2018.

Balance Assessment

Video NystagmoGraphy (caloric)

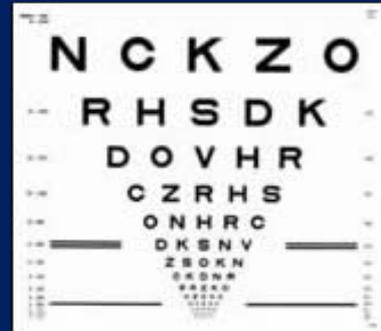


Vestibular Evoked Myogenic Potentials (VEMP)



Balance Assessment

Dynamic Visual
Acuity Test (DVAT)



Rotary Chair

Computerized
Dynamic
Posturography



Amplification or Hearing Assistance Technology Evaluation

At any time if the communication
problems increase





**Communication
Strategies for Persons
with Hearing Loss**

MARCH 2017

A PUBLICATION OF THE AMERICAN ASSOCIATION OF DIABETES EDUCATORS

diabeteseducator.org

AADE

IN PRACTICE

ISSN: 2325-1603

Can You Hear Me Now?
Communication
Strategies for the
Hearing Impaired

In this issue:

- ~ A back-up plan to prevent DKA
- ~ Same-day multidisciplinary team visits
- ~ Getting a grip on gastroparesis
- ~ Messages received from unlikely places

March 2017
pp. 32-37

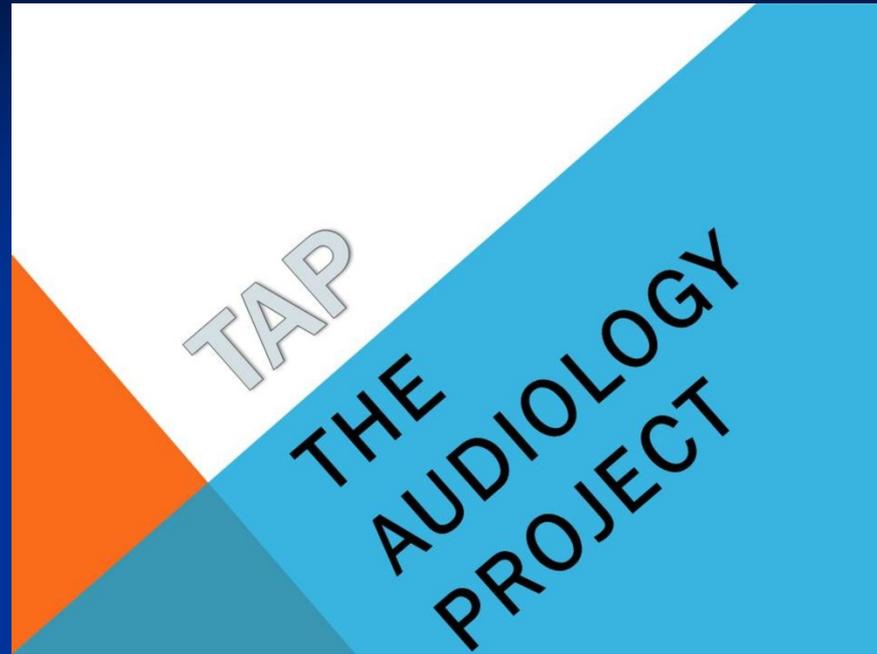
Includes
Hearing
Handicap
Inventory for
Adults
(HHIA)

Communication Strategies

www.drbobdisogra.com

Click “More”

Click “Communication Strategies”



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educational-materials](http://www.theaudiologyproject.com/educational-materials)



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