葉大偉 醫師

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進修	美國哈佛醫學院耳鼻內視鏡手術、顳骨解剖及側顱底手術進修 澳洲雪梨大學耳內視鏡學會耳內視鏡及側顱底手術進修 香港中文大學微創耳鼻喉內視鏡手術進修 新加坡總醫院鼻內視鏡及前顱底手術進修
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HARVARD MEDICAL SCHOOL | Department of Otolaryngology Head and Neck Surgery

MASSACHUSETTS EYE AND EAR

2025. 02. 22 頭暈讀書會 @ Tainan

Clinical Features and Associated Comorbidities: Comprehensive Evaluations to *Vestibular Migraine* & *Migraine-associated Tinnitus*

高雄榮民總醫院耳鼻喉頭頸部

國立中山大學醫學院生物醫學研究所

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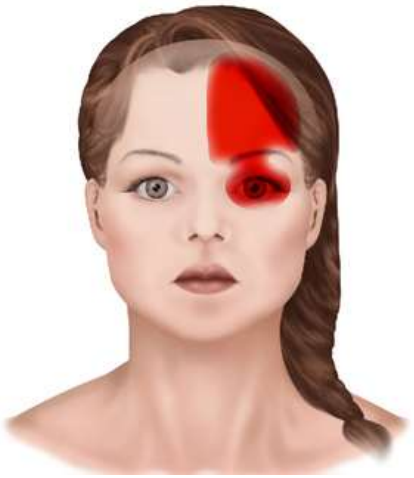
Declare of Interest

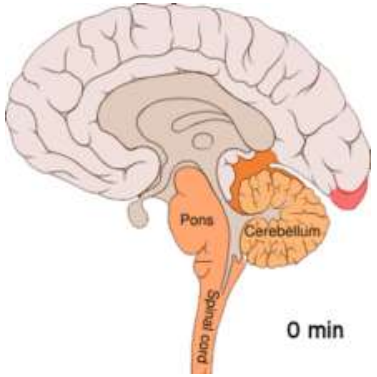
- **None.**

Migraine: More Than a Headache

- Migraine: believed to be a genetic and trigger related neurovascular disorder
  - → Cortical spreading depression of Leão
  - → A trigeminovascular system disorder
  - → Associated with lower levels of Serotonin
  - → More released Calcitonin gene-related peptide (CGRP)



- Cause aura
- Activate CN V afferents
- Vasoconstriction of brain and alter BBB permeability



Gilmore, B; Michael, M. *American Family Physician*. 2011; **83** (3): 271–80

Aura / Prodrome of Migraine / VM

- Presented episodes of **“central neuronal hyperexcitability ”** or **“sensory hyperreflexia”**

- **“Visual aura”** waving, shadow, lightning; “Alice in Wonderland syndrome”…
- **Photophobia**
- **Phonophobia**; hyperacusis
- **Osmophobia**
- **Vertigo/dizziness/desequilibrium**
- Acute onset of **generalized fatigue**
- **“Brain fog”:** Rapid onset of cognitive deficit
- **Allodynia**
- **Irritable bowel; “Abdominal migraine”**

Diagnostic Criteria of Vestibular migraine (VM)

1. Vestibular migraine

A. At least 5 episodes with vestibular symptoms[1] of moderate or severe intensity[2], lasting 5 min to 72 hours[3]

B. Current or previous history of migraine with or without aura according to the International Classification of Headache Disorders (ICHD)[4]

C. One or more migraine features with at least 50% of the vestibular episodes[5]:
- headache with at least two of the following characteristics: one sided location, pulsating quality, moderate or severe pain intensity, aggravation by routine physical activity
- photophobia and phonophobia[6],
- visual aura[7]

D. Not better accounted for by another vestibular or ICHD diagnosis[8]

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2. Probable vestibular migraine

A. At least 5 episodes with vestibular symptoms[1] of moderate or severe intensity[2], lasting 5 min to 72 hours[3]

B. Only one of the criteria B and C for vestibular migraine is fulfilled (migraine history *or* migraine features during the episode)

C. Not better accounted for by another vestibular or ICHD diagnosis[8]

＊ Barany Society & IHS Criteria, 2012:

A. 至少發生過五次以上，中等至嚴重程度的暈眩，每次都持續**5分鐘至72小時**之間。

B. 被醫師診斷過或疑似有符合定義的**偏頭痛病史**。

C. 暈眩發作時至少有一半的時候會合併下列症狀**至少一種**：

1. 有至少符合下列兩種特色的頭痛 –
   - ■ **偏單側**
   - ■ **中等至嚴重**的痛
   - ■ **有搏動感**
   - ■ **日常活動反而加劇**
2. **畏光**，或覺得對**聲音敏感**
3. 眼睛看到一些**閃光或波紋**

D. 排除其他已知造成眩暈或頭痛之原因

Characteristics of Vestibular migraine (VM)

- Peak: 30 – 50 y/o; the most cause of “young vertigo”
- M : F = 1 : 5
- 1/3-2/3 patients had a family history of migraine/VM.
- > 40% migraine patients have vestibular symptoms.
- 50% patients got vertigo/dizziness episodes without headache.
- While getting older, headache↓, but vertigo↑
- 20% true vertigo, 80% dizziness or imbalance
- Duration of vestibular symptoms: minutes to hours
- The most diagnosis of vertigo by otoneurology specialists in US

JOHNS HOPKINS
MEDICINE

Teixido M, Carey J. Migraine - More than a headache. Otolaryngol Head Neck Surg 2014;14:1-14.

Sinus	Tension	Migraine	Cluster
			
Sinogenic	**Tension**	**Migraine**	**Cluster**
Only with sinogenic lesion	最多, F>M, Prev. 80% in age 20-40	M:F = 1:3~5	Prev. < 1%, mostly in smoking young males
Localization to sinuses	Bi-frontal最多, gradually onset	Usually **sudden, unilateral, pulsatile**	Short lasting, sharp retroorbital pain
Sinus infection, tumor or MTS	Multifactoral, **less painful**	Associated with prodromes or aura(15~30%)	Anxious, dramatic extremity
Purulent rhinorrhea Nasal congestion	**No N/V Neck/shoulder pain**	**N/V Photo/phonophobia**	**No N/V**
Nasal Mx or Surgery	Analgesic, Physical Tx	Analgesic, **Triptans**	100% O2, Triptans

VM in Taiwan: Similar Presentations as Westerners?

Patients Diagnosed with VM

OPD Patient
2020/05-2023/03

History, PE Audiometry DHI / MSQ

Retrospective Analysis

Statistical Data Analysis

SPSS
Ver. 22

Kaohsiung Veterans General Hospital
ORL-HNS
耳鼻喉頭頸外科部

眩暈障礙量表 Dizziness Handicap Inventory

眩暈障礙量表（Dizziness Handicap Inventory, DHI）

您的姓名：　　填寫日期：

	您過去一段時間是否因眩暈造成以下問題？	完全沒有	有些時候	幾乎都有
P1	向上看會增加您的不舒服嗎？	0	2	4
E2	因為您的暈眩，您覺得沮喪嗎？	0	2	4
F3	因為您的暈眩，是否限制了您的外出，例如商務及旅遊？	0	2	4
P4	在超級市場的走道間購物是否會增加您的症狀？	0	2	4
F5	您的暈眩是否讓您在上床或下床時感到困難？	0	2	4
F6	您的暈眩是否嚴重限制了社交活動，像出門晚餐、宴會等？	0	2	4
F7	您的暈眩是否造成閱讀障礙？	0	2	4
F8	增加日常活動的程度，像是運動、跳舞、打掃家務或擺放碗盤等等，是否會增加您的症狀？	0	2	4
E9	因為您的暈眩症狀，您是否不敢在無人陪伴的狀況下離家？	0	2	4
E10	您是否曾因暈眩症狀，在其他人面前覺得很尷尬？	0	2	4
P11	迅速的頭部移動會增加您的症狀嗎？	0	2	4
F12	您會因為您的暈眩症狀而避免去高處嗎？	0	2	4
P13	當您躺在床上時，轉頭向一側會增加您的症狀嗎？	0	2	4
F14	您覺得暈眩的症狀讓您對較複雜的家務和農務感到困難嗎？	0	2	4
E15	因為您的暈眩，您是否會擔心別人誤會您中毒了？	0	2	4
F16	因為您的暈眩，您是否連獨自出門散個步都有困難？	0	2	4
P17	行走在人行道上會增加您的症狀嗎？	0	2	4
E18	您會因為暈眩症狀而很難專心做事嗎？	0	2	4
F19	因為您的暈眩，在家中陰暗的地方走動是否有困難？	0	2	4
E20	因為您的暈眩，您是否會害怕獨自一人在家？	0	2	4
E21	因為您的暈眩，您是否覺得生活中有相當多障礙？	0	2	4
E22	您會因為暈眩症狀造成和親朋好友之間的關係變得緊張嗎？	0	2	4
E23	因為您的暈眩，您是否覺得憂鬱？	0	2	4
F24	您的暈眩是否干擾了您的工作或家務責任？	0	2	4
P25	彎腰會增加您的症狀嗎？	0	2	4

此量表僅作為資訊收集用途，並非健康照護專家的診察和評估。

- Jacobson GP, Newman GW, 1990.

E	F	P	總分	

Dizziness Handicap Inventory

Instructions: The purpose of this scale is to identify difficulties that you may be experiencing because of your dizziness. Please check "always", or "no" or "sometimes" to each question. Answer each question only as it pertains to your dizziness problem.

	Questions	Always	Sometimes	No
P1	Does looking up increase your problem?	☐	☐	☐
E2	Because of your problem, do you feel frustrated?	☐	☐	☐
F3	Because of your problem, do you restrict your travel for business or pleasure?	☐	☐	☐
P4	Does walking down the aisle of a supermarket increase your problem?	☐	☐	☐
F5	Because of your problem, do you have difficulty getting into or out of bed?	☐	☐	☐
F6	Does your problem significantly restrict your participation in social activities, such as going out to dinner, going to movies, dancing or to parties?	☐	☐	☐
F7	Because of your problem, do you have difficulty reading?	☐	☐	☐
F8	Does performing more ambitious activities like sports, dancing, and household chores, such as sweeping or putting dishes away, increase your problem?	☐	☐	☐
E9	Because of your problem, are you afraid to leave your home without having someone accompany you?	☐	☐	☐
E10	Because of your problem, have you been embarrassed in front of others?	☐	☐	☐
P11	Do quick movements of your head increase your problem?	☐	☐	☐
F12	Because of your problem, do you avoid heights?	☐	☐	☐
P13	Does turning over in bed increase your problem?	☐	☐	☐
F14	Because of your problem, is it difficult for you to do strenuous housework or yard work?	☐	☐	☐
E15	Because of your problem, are you afraid people may think that you are intoxicated?	☐	☐	☐
F16	Because of your problem, is it difficult for you to go for a walk by yourself?	☐	☐	☐
P17	Does walking down a sidewalk increase your problem?	☐	☐	☐
E18	Because of your problem, is it difficult for you to concentrate?	☐	☐	☐
F19	Because of your problem, is it difficult for you to walk around your house in the dark?	☐	☐	☐
E20	Because of your problem, are you afraid to stay home alone?	☐	☐	☐
E21	Because of your problem, do you feel handicapped?	☐	☐	☐
E22	Has your problem placed stress on your relationship with members of your family or friends?	☐	☐	☐
E23	Because of your problem, are you depressed?	☐	☐	☐
F24	Does your problem interfere with your job or household responsibilities?	☐	☐	☐
P25	Does bending over increase your problem?	☐	☐	☐

偏頭痛生活品質評量 MSQ ver 2.1

偏頭痛生活品質評量(Migraine-Specific Quality of Life Questionnaire, MSQ, ver. 2.1)

您的姓名： **填寫日期：**

此量表僅作為資訊收集用途，並非健康照護專家的診察和評估。

請依照您過去一個月以來的生活經驗，仔細閱讀後於每個選項圈選最適合的選項。		從未發生	少數時候	有時候會	時常發生	大部分會	總是發生
RR1	偏頭痛是否干擾您和身旁關係密切的人之間的來往，像是親朋好友等等？	1	2	3	4	5	6
RR2	偏頭痛是否影響您的休閒活動，例如運動、閱讀等等？	1	2	3	4	5	6
RR3	是否因為偏頭動的症狀，您的工作及日常活動進行變得困難？	1	2	3	4	5	6
RR4	是否因為偏頭痛，您很難像以前一樣有效率的處理工作和生活上的事務？	1	2	3	4	5	6
RR5	偏頭痛是否讓您工作或處理日常生活雜務時無法專心？	1	2	3	4	5	6
RR6	偏頭痛是否讓您覺得面對工作及日常活動時太過勞累？	1	2	3	4	5	6
RR7	是否因為偏頭痛，讓您覺得精神飽滿的日子越來越少？	1	2	3	4	5	6
RP8	是否曾因為偏頭痛發作，讓您必須取消工作或日常活動的安排？	1	2	3	4	5	6
RP9	在您偏頭痛發作時，是否需要他人的幫忙才能進行一些日常工作，像是家務、採買等？	1	2	3	4	5	6
RP10	您是否需要停下正在進行的工作或日常活動，來處理偏頭痛的症狀？	1	2	3	4	5	6
RP11	是否曾因為偏頭痛發作，讓您無法參加社交場合，像是朋友聚餐、宴會等等？	1	2	3	4	5	6
EF12	對於您的偏頭痛症狀，您是否覺得忍無可忍或是非常沮喪？	1	2	3	4	5	6
EF13	因為有偏頭痛症狀，您是否覺得您像是他人的負擔？	1	2	3	4	5	6
EF14	您是否害怕因為您有偏頭痛症狀而造成別人不開心？	1	2	3	4	5	6

Regina R, et al. The psychometric properties of the Migraine-Specific Quality of Life Questionnaire version 2.1 (MSQ) in chronic migraine patients. Qual Life Res. 2013 Jun; 22(5): 1123–33.

RR	RP	EF	總分

Role function-restrictive (RR)

1 […] have migraines interfered with how well you dealt with family, friends, and others who are close to you?

2 […] have migraines interfered with your leisure time activities, such as reading or exercising?

3 […] have you had difficulty in performing work or daily activities because of migraine symptoms?

4 […] did migraines keep you from getting as much done at work or at home?

5 […] did migraines limit your ability to concentrate on work or daily activities?

6 […] have migraines left you too tired to do work or daily activities?

7 […] have migraines limited the number of days you have felt energetic?

Role function-preventive (RP)

8 […] have you had to cancel work or daily activities because you had a migraine?

9 […] did you need help in handling routine tasks such as every day household chores, doing necessary business, shopping, or caring for others, when you had a migraine?

10 […] did you have to stop work or daily activities to deal with migraine symptoms?

11 […] were you not able to go to social activities such as parties, dinner with friends, because you had a migraine?

Emotional function (EF)

12 […] have you felt fed up or frustrated because of your migraines?

13 […] have you felt like you were a burden on others because of your migraines?

14 […] have you been afraid of letting others down because of your migraines?

Demographics & Typical Presentations of VM

- Cases fulfilled with the diagnostic criteria of VM (N=393)
  - ➔ Gender: M : F = 21.6% : 78.4% (mostly 1:5)
  - ➔ Age: Mean 47.28 ± 15.51 y/o (Range: 11.0 – 83.0, median 47.41)
  - ➔ BMI: 23.35 ± 3.86 kg/m^2

- Typical symptoms within the diagnostic criteria:

Symptoms in the Criteria	N	%	%*	%, Other References	
Recurrent migraine headache	**360**	**91.6**	91.8	94	Neuhauser H, et al. 2009
Photophobia	**230**	**58.5**	57.7	70	Neuhauser H, et al. 2009
Phonophobia	**237**	**60.3**	37.1	64	Neuhauser H, et al. 2009
Visual aura	**181**	**46.1**	35.4	36	Neuhauser H, et al. 2009
Definite VM	**292**	**74.3**	64.9	68.5	Divya C, et al. 2020
Probable VM	**101**	**25.7**	35.1	31.5	Divya C, et al. 2020

* Liu, Rauch, unpublished (US data)

Associated Symptoms of VM

項目	N	%	%*	%, Other References	
Subjective hearing loss	144	36.6	37.9	25	Goshtasbi K, et al. 2021
Bothersome Tinnitus	214	54.5	49.2	34	Goshtasbi K, et al. 2021
Aural fullness	169	43.0	31.4	54	Moshtaghi O, et al. 2019
Otalgia	47	12.0	14.5	65	Teixido M, et al. 2011
Sensation of true vertigo	153	38.9	67.0	20	Teixido M, et al. 2014
Osmophobia	80	20.4	13.8	10.7	Bah SC, et al. 2019
Gastroesophageal reflux	97	24.7	16.2	22	Bozena J, et al. 2008
Irritable bowel syndrome	143	36.4	7.5	42	Wongtrakul W, et al. 2022
Emotional / mental symptoms	133	33.8	28.0	>50	Bah SC, et al. 2019
Sleep disorder / chronic fatigue	115	29.3	10.5	25.9	Tiseo C, et al. 2020
Cervicalgia	228	58.0	18.3	76.2	Ashina S, et al. 2015
Allodynia	153	38.9	10.5	61.1	Baykan B, et al. 2016
Brain fog	175	44.5	19.2	20.8	Divya C, et al. 2020

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* Liu, Rauch, unpublished (US data)

Co-morbid “Dizzy Diseases” with VM

“Mixed Diagnosis”	N	%	%, Other Study	Reference
Definite VM-MD (Meniere’s disease, 2015 AAOHNSF)	20	5.1	13 (dVMMD)	Neff BA, et al. 2012
Probable VM-MD (Meniere’s disease, 2015 AAOHNSF)	144	36.6	38 (pVMMD)	Neff BA, et al. 2012
PC-VM (Postconcussion syndrome)	27	6.9	38 (Migraine-mTBI)	Ishii R, et al. 2021
BPPV-VM (Benign paroxysmal postural vertigo)	59	15.0	41.7 (recurrent BPPV-VM)	Sfakianaki I, et al. 2021
VM-MS (Motion sickness)	28	7.1	61.1 (VM-MS)	Beh SC, et al. 2019
VM-CGD (Cervicogenic dizziness)	228	58.0	76.2 (M-cervicalgia)	Ashina S, et al. 2015
VM-PPPD (Persistent postural perceptual dizziness)	-	-	17 (PPPD-VM)	Sarna B, et al. 2021
VM-MDDS (Mal de Debarquement syndrome)	3	0.8	62.9 (MDDS-VM)	Beh SC, et al. 2021
VM-ISSNHL (Idiopathic sudden sensorineural HL)	-	-	0.9 (Migraine – ISSNHL)	Mohammadi M, et al. 2020

Definite VM v.s. Probable VM

	Definite VM		Probable VM		
Subjective symptoms	N	%	N	%	P value
Experience of true vertigo	98	40.5	21	36.2	0.549
Recurrent migraine headache	242	100.0	34	58.6	<0.001
Photophobia	173	71.5	16	27.6	<0.001*
Phonophobia	179	74.0	18	31.0	<0.001*
Osmophobia	63	26.0	7	12.1	0.024
Visual aura	140	57.9	17	29.3	<0.001*
Intolerance to visual change	37	15.3	6	10.3	0.334
Allodynia	119	49.2	19	32.8	0.024
Brain fog	137	56.6	19	32.8	0.001
Chronic fatigue/poor sleep	93	38.4	10	17.2	0.002
Chronic or fluctuated hearing loss	96	39.7	17	29.3	0.144
Chronic or fluctuated tinnitus	146	60.3	26	44.8	0.032
Chronic or fluctuated aural fullness	116	47.9	25	43.1	0.508
Chronic or fluctuated otalgia	32	13.2	7	12.1	0.814

Vestibular migraine (VM)

- Treatment:
  - Education: “suit up”!
  - Trigger management: drain the pool (triggers)
  - Medication: Elevate the height (threshold)

Vestibular migraine (VM)

- Trigger management: **50% patient effective in 6-8 weeks**

  ① Environmental

  Sudden light, odor, sound, weather change…

  ② (A tons of) Food

  Prepared, fermented, chemical added, gluten…

  ③ Physical

  Stress, hormone (menstrual period), H&N pain or inflammation, poor sleep, starvation…

Teixido M, Carey J. Migraine - More than a headache. Otolaryngol Head Neck Surg 2014;14:1-14.

類型	建議避免或減量的食物	能夠攝食的調整方式
咖啡因	每日咖啡攝取量盡量固定，且建議少於兩杯；濃茶、可樂、提神飲料、濃縮果汁	去咖啡因的咖啡、花草茶或綠茶、鮮果汁、無咖啡因汽水等
甜點	巧克力、堅果種子、花生或花生醬	不含前者的蛋糕、布丁果凍、冰淇淋、果醬、糖果、蜂蜜、餅乾都可以
酒精	盡量避免所有酒類接觸	無酒精飲料
奶蛋製品	大部分的起司、酸奶；蛋及優格一周盡量少於三次	新鮮牛奶
穀物類	各種現做的新鮮麵包建議避免食用；甜麵包、甜甜圈、發酵麵糰	吐司、穀物麵包、貝果、馬鈴薯片、一般米或麵、燕麥穀片
肉類	熟成牛排、各式香腸、火腿、肉乾、醃肉、罐頭	新鮮的肉類或魚類
調味料	各類食物都使用較為自然的烹調方式，避免味精、醬油、雞湯塊等人造添加物；甜食飲料避免使用代糖	一般的油、奶油、醋、砂糖、果糖、鹽、香料等，只要適量都可以添加
蔬菜	各種豆類種子、酸菜、洋蔥、橄欖	新鮮的葉菜類或瓜果類都可以
水果	酪梨、無花果、木瓜、百香果、紅肉李、葡萄乾；香蕉及柑橘類須減量至一日半份	蘋果、莓果、桃子、梨子、梅干等
特殊料理	比薩、千層麵、通心粉、肉醬麵、冷凍肉丸等	新鮮食材，清淡烹調為最佳選擇

Medical Treatment of VM (By order of escalation)

1st line	**8 weeks**	**Best life habit adjustment, patient educations**	Supplements: Riboflavin, Magnesium, Coenzyme Q10, H&N physical therapies
		PRN medications: antiemetics, antivertigo, pain killers	
2nd line		CCBs, β-blockers: Flunarizine, Verapamil, Propranolol	Muscle relaxants
3rd line	**2-6 months**	Anticonvulsants Topiramate (25mg per night as initial, Max 100mg) Sodium Valproate (250mg BID, Max 500mg)	Psychiatrist Consultation Rehabilitation Consultation (Vestibular rehabilitation) Neurologist Consultation Botox A local injection
		TCAs Amitriptyline (25 mg per night as initial, Max 100mg) Nortriptyline (25 mg per night as initial, Max 100mg)	
		SSRIs, SNRIs Triptans Venlafaxine (Effexor®, 37.5mg per day, Max BID)	
4th line	**Acute on Chronic /Severe**	CGRP antagonists Gepants (Rescue): Atogepants, Ubrogepants, Rimegepant Monoclonal Ab(Prevention): Erenumab, Galcanezumab, Eptinezumab, Fremanezumab	Vagus nerve stimulators (VNSs) Trigeminal nerve stimulators (TNVs) Remote electrical neuromodulators (RNS)

Teixido M, Carey J. Migraine - More than a headache. Otolaryngol Head Neck Surg 2014;14:1-14.

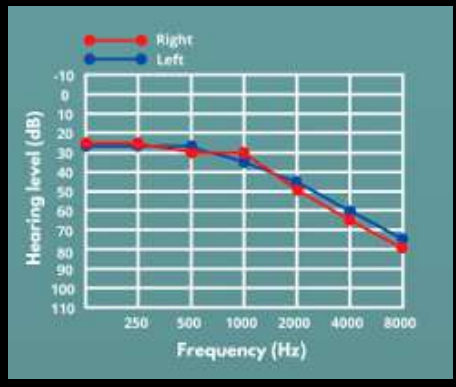
The Impact of **Migraine & Vestibular Migraine** on Audiometric Profiles & Quality of Life in Patients with **Tinnitus**

Kaohsiung Veterans General Hospital
Since 1909
ORL-HNS
高雄榮民總醫院
耳鼻喉頭頸外科部

Primary Tinnitus

- "Idiopathic" tinnitus, may or may not be associated with SNHL

- 90% tinnitus patients have varying degrees of hearing loss.
- Persistent tinnitus: > 6 months
- Bothersome tinnitus: Distressed, affected QoL and/or functional health status



Tunkel DE et al. Clinical practice guideline: tinnitus. Otolaryngol Head Neck Surg. 2014 Oct;151(2 Suppl):S1-S40.

Tinnitus Handicap Inventory (THI)

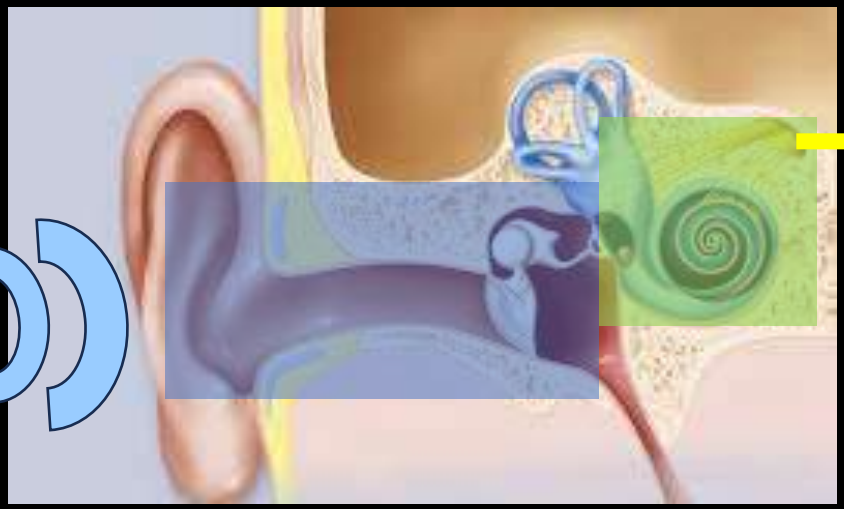
- Developed by Newman et al. in 1996.
- 25 items -- Always (4 pts), Sometimes (2 pts) & Never (0 pts)
- Total scores and severities:

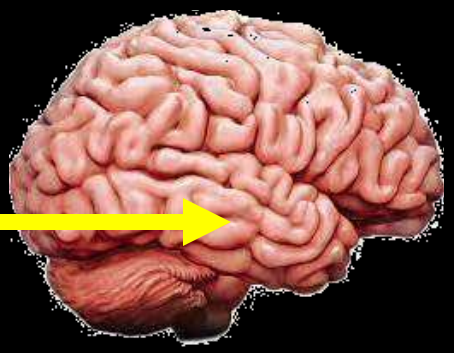
Grade I	0-16	Slight
Grade II	18-36	Mild
Grade III	38-56	Moderate
Grade IV	58-76	Severe
Grade V	78-100	Catastrophic

- Bi-directional translated in Traditional Chinese in 2020

Newman CW, Jacobson GP, Spitzer JB. Development of the Tinnitus Handicap Inventory. Arch Otolaryngol Head Neck Surg. 1996 Feb;122(2):143-8.

Auditory Process & Generation of Tinnitus



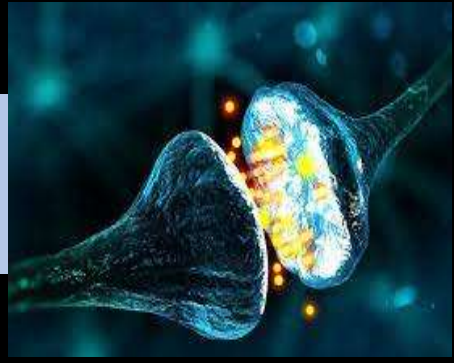


Speaker

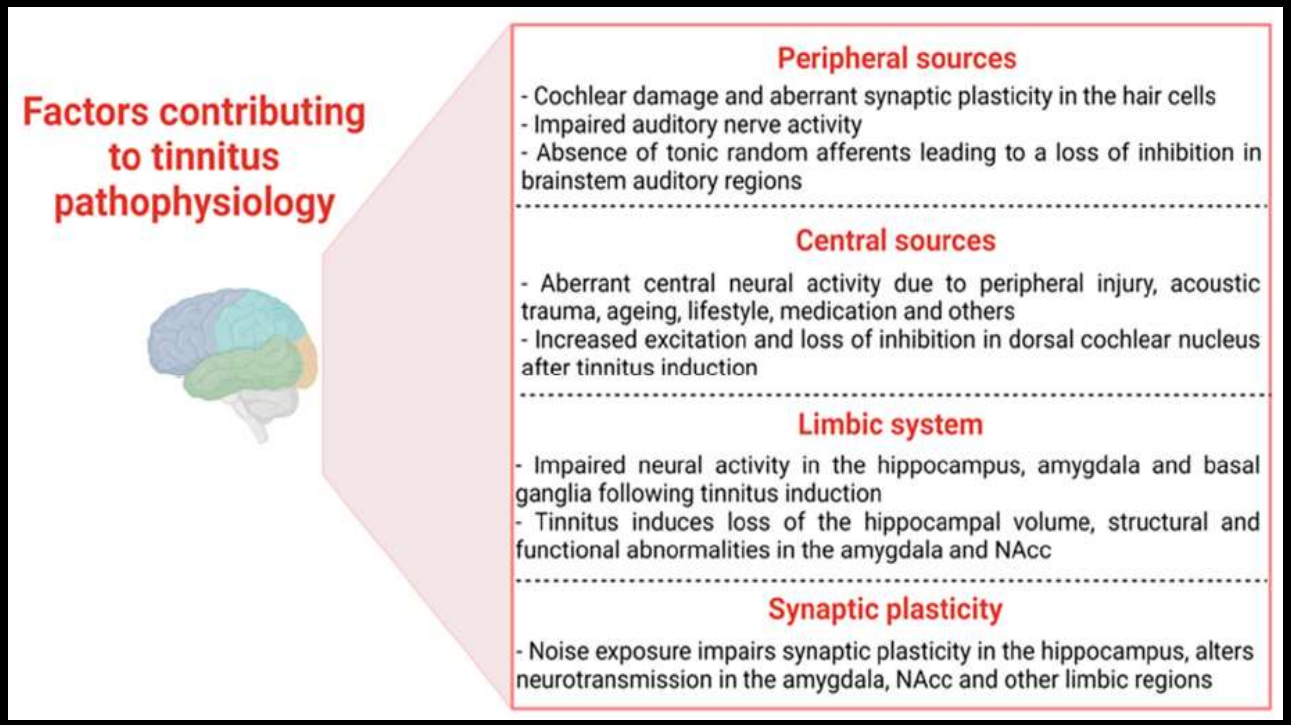
Transmitter

Receiver

Molecular & Patho-physiology of Tinnitus



- **"Generators of Tinnitus"**



Causes of HL:
CHL (COM, ossiculopathy, etc..)
SNHL(MD, ARHL, NIHL, Ototoxicity, etc…)

Genetic factors
GABA receptors

Endo-cannabinoids(CB) receptors
Dopaminergic pathways

GABA receptors
NMDA receptors

Singh A, Smith PF, Zheng Y. Int J Mol Sci. 2023 Jun 8;24(12):9889.

Common Predisposing Factors of Tinnitus

- **“Amplifiers of Tinnitus”**

New, progressive or fluctuated hearing loss from any cause

Sleep Disorders

Psychiatric Disorders

Migraine or VM

Myofascial Disorders

Psychiatric & Sleep disorders + Tinnitus

- Taiwan native studies for the issue:

→ 70.8% tinnitus with sleep difficulty, especially old woman

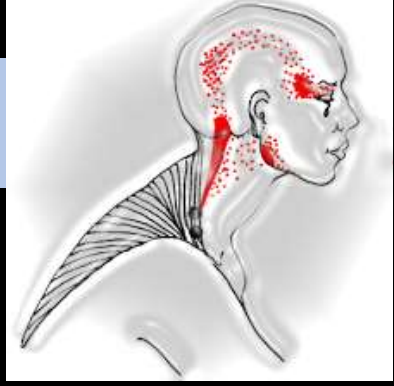
→ Tinnitus patients prone to have anxiety disorder(42.1%) and depression (24.7%) (Li et al. 2021)

→ Higher THI scores significantly associated with higher sleep / psychiatric questionnaires scores (PSQI, ESS, HADS-A, HADS-D)

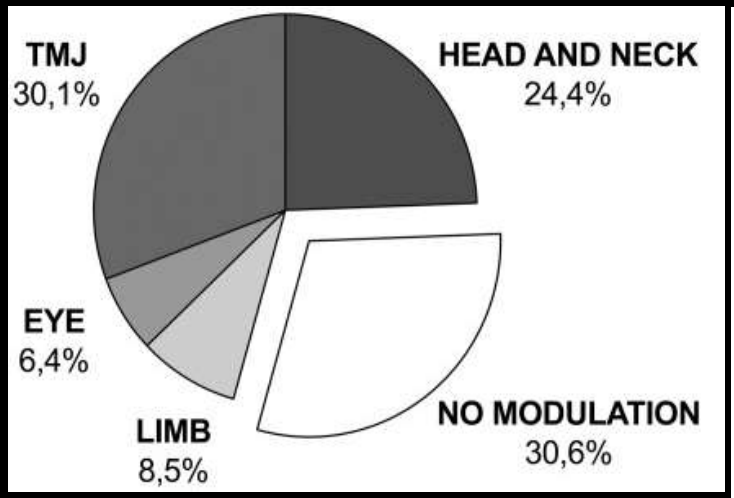
→ "Tinnitus patients prone to have OSAS by polysomnography. (p= 0.024)." (Yen et al. 2022)

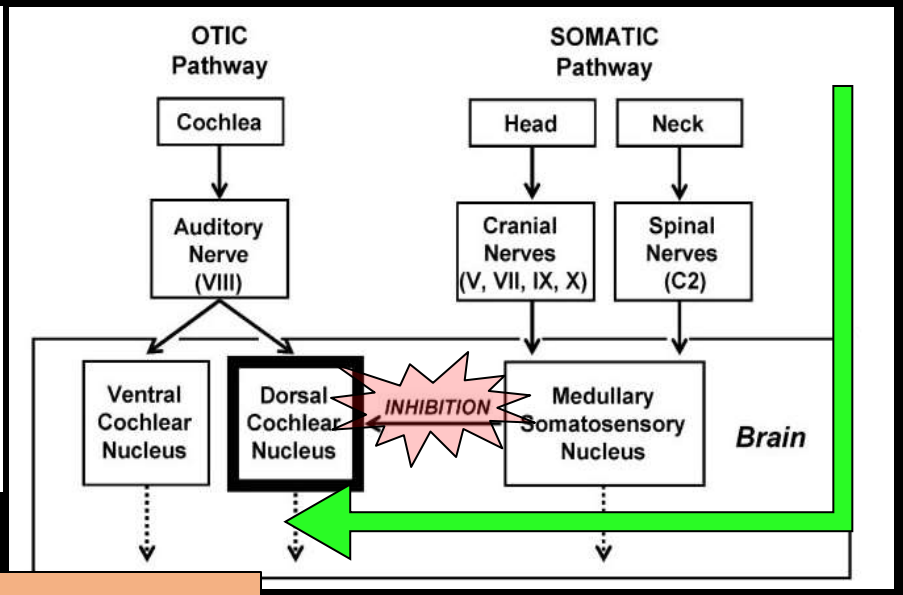
@May both derived from the disorder within the **limbic system**.

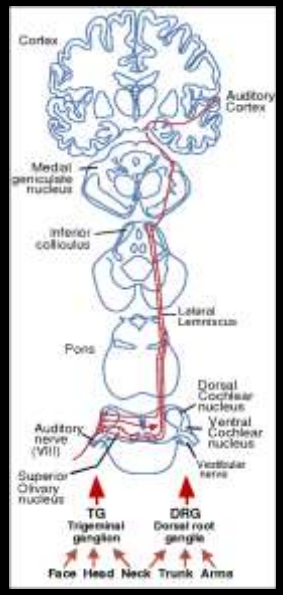
Somatosensory Tinnitus (ST)



- Definition: Tinnitus can be modulated by physical contact or movement.







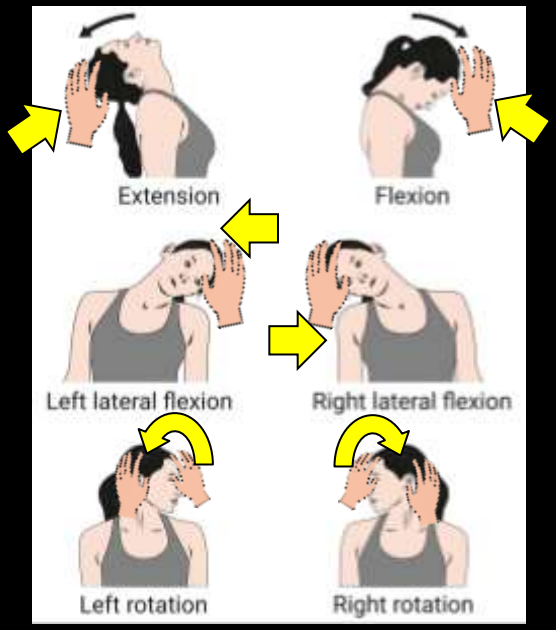
Tinnitus(+)

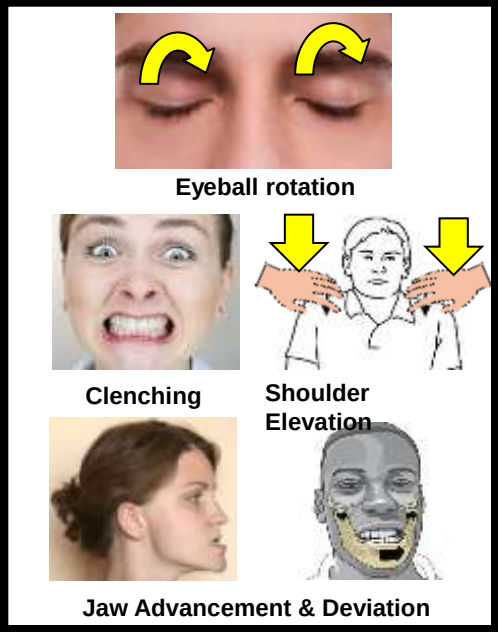
Ralli M, et al. 2017; Haider HF, et al. 2017; Levine et al. 2007

Tests for Detecting ST

- Neck, Jaw and eye movements

  ➔ Applying a reacting force if needed





If the volume of tinnitus significantly changed → **ST test(+)**

Migraine-associated Tinnitus (MAT)

- 20%-36% migraine patients have tinnitus. (3-fold risk)
  - Possible interactions between CGRP and GABA

- No definite diagnostic criteria for MAT so far. (Lai, Liu; 2018)
- Major diagnostic criteria of "**Cochlear Migraine**": migraine features with recurrent or fluctuating unilateral SNHL

- Personal opinion for CM (After excluding all other possible causes):
  - Definite CM: migraine or VM + PTA-recorded fluctuated HL ± bothersome tinnitus
  - Probable CM: migraine or VM + fluctuated bothersome tinnitus

Benjamin T, Gillard D, Abouzari M, Djalilian HR, Sharon JD. Vestibular and auditory manifestations of migraine. Curr Opin Neurol. 2022 Feb 1;35(1):84-89.

Materials and Methods

Primary Tinnitus

Adult
2020/05-2021/08

History, PE Audiometry THI Survey

Retrospective

Statistical Data Analysis

SPSS Ver. 22

Results

- Total 298 cases, F：M = 1：1
- Age: Median 58.03, range: 19.22 – 94.58 (yrs)
- BMI: Mean 24.34 ± 3.59

- 125 cases with THI at the 1st visit (41.9%)
  - ➔ Medium: 32 (range 2 – 90)
  - ➔ Mean: 34.99 (± 21.01)

Factors Associated with Tinnitus

Concomitant Symptoms		N	(%)	THI(+) N'	(%)	Mean THI	P value
Gender	Male	149	50.0	49	39.2	33.45	0.308
	Female	149	50.0	76	60.8	37.39	
Subjective HL	Yes	198	66.4	85	68.0	34.71	0.825
	No	100	33.6	40	32.0	35.60	
Objective HL (by PTA)	Yes	246	82.6	103	82.4	35.46	0.595
	No	52	17.4	22	17.6	32.82	
Dizzy/Vertigo	Yes	124	41.6	80	36.0	42.27	0.003
	No	174	58.4	45	64.0	30.90	
Migraine or VM	Yes	70	23.5	27	21.6	50.00	<0.001
	No	228	76.5	98	78.4	30.86	
Somatosensory test(+)	Yes	60	20.1	27	21.6	38.95	**0.121**
	No	238	79.9	98	78.4	32.84	
Cervicalgia	Yes	117	39.3	52	41.6	41.04	0.006
	No	181	60.7	73	58.4	30.68	
Otalgia	Yes	42	14.1	22	17.6	39.27	0.294
	No	256	85.9	103	82.4	34.08	
Aural Fullness	Yes	60	20.1	24	35.2	37.00	0.604
	No	238	79.9	101	64.8	34.51	

Results: Demographics & Impact on QoL

- 20% ST test(+), 40% fluctuated cervicalgia or TMJ myalgia.

➔ **Prevalence of ST in our study: 20% ～ 40%**

- The only contributing factor of a significantly higher total THI score:

➔ **Migraine or VM (23,5%, p<0.001, OR=19.41, mean score 50.00)**

- More "non-HL tinnitus" with ST and MAT. (Amplified hidden HL?)

➔ All tinnitus patients: 34% subjective / 17% objective

➔ MAT: 50% subjective (p=0.002) / 38% objective (p=0.005)

➔ ST: 44% subjective (p=0.025) / 28% objective (p=0.008)

Result: Audiometric Profiles MAT

N=298	Dx of Migraine or VM		No Dx of Migraine or VM	P
Right ear (dB threshold)				
SRT	20.0	<	25.2	0.016*
MCL	46.1	<	51.4	0.007*
UCL	90.8	<	92.4	0.067
DR	70.8	>	67.2	0.055
PTA4 mean	22.2	<	29.5	0.002*
Left ear (dB threshold)				
SRT	20.2	<	25.5	0.019*
MCL	46.9	<	51.4	0.021*
UCL	90.5	<	92.3	0.047*
DR	70.2	>	66.8	0.075
PTA4 mean	22.5	<	30.4	<0.001*

SRT:
speech recognition threshold
MCL:
most comfortable level
UCL:
uncomfortable loudness levels
DR:
dynamic range
PTA4:
Mean value of 500, 1000, 2000 & 4000 Hz of pure-tone audiometry

Result: Audiometric Profiles MAT

- **Patients with MAT have significantly better hearing thresholds than non-MAT.**

➔ **More "non-HL tinnitus" with MAT** (PTA all Fqs < 25 dB threshold).

	All Tinnitus	MAT	p
Subjective non-HL	34%	17%	0.002
Objective non-HL by PTA	50%	38%	0.005

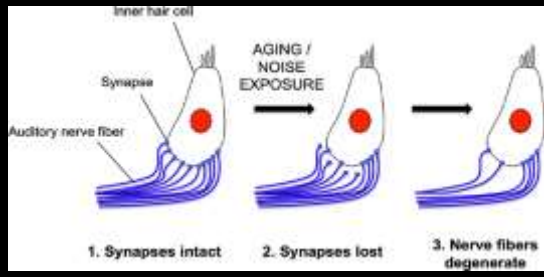
➔ Better Speech recognition threshold but lower uncomfortable levels

➔ Dynamic ranges: no significant difference but trends of lower thresholds

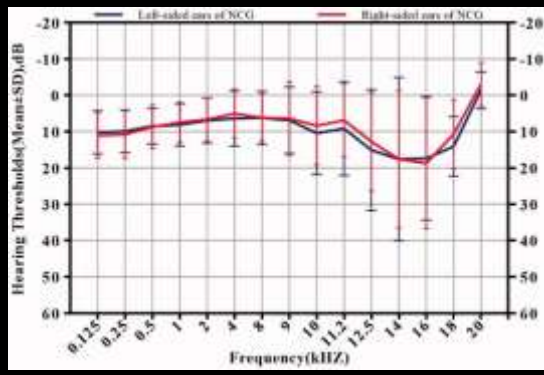
(Better hearing, but more phonophobia/hyperacusis?)

Discussion: Possible Etiology?

- Liberman et al. : Early cochlear synaptopathy in patients w/o threshold shifting (Hidden Hearing Loss)*
- Undetectable sensorineural hearing loss (>8K)



- **CGRP ←→GABA interactions at the limbic system**?
- TVS-related transient vascular contracture
- "Cochlear hydrops"; VM-MD syndrome



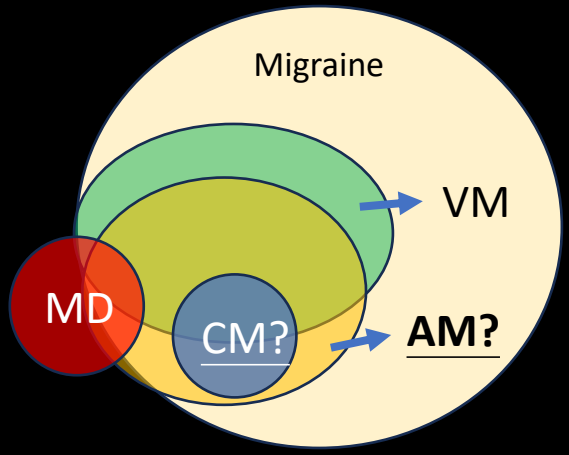
- Screening: PTA/SRT/SDS, OAEs, high-frequency PTA

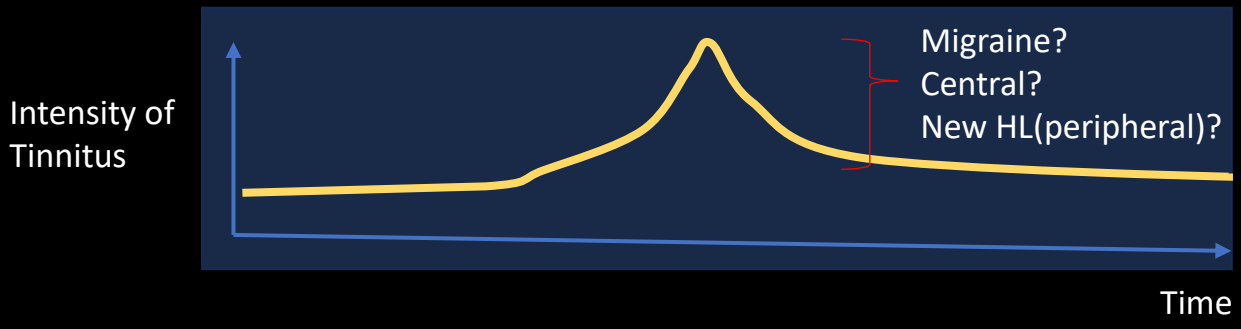
*Liberman MC, et al. Toward a Differential Diagnosis of Hidden Hearing Loss in Humans. PLoS One. 2016 Sep 12;11(9):e0162726.

Discussion: Nomenclature of MAT?

- Concept of "Auditory migraine" by Prof. Rauch

	Auditory Migraine (AM)	Cochlear Migraine (CM)
Tinnitus	+	-
Hyperacusis	+	-
SSNHL	+	+
Fluctuated HL	+	+
Aural Fullness	?	?





The concept of AM is better at covering MAT.

Differential Diagnosis between “MAT” & “ST”

- Cervicogenic dizziness & Cervicogenic / Tension-type headache
- Somatosensory tinnitus (criteria by Michels 2018)
  - So far, no definite diagnostic criteria for cervicogenic headache & dizziness
  - Tension headache may be concomitant with migraine headache. (60%-70%)
  - Highly associated with cervical myalgia, TMJ myalgia & correlated with “ST”

- Our study: no significantly association between MAT & ST (p=0.150)
  - Different headache hypothesis → 2 different subtypes of tinnitus!
  - **20%** patients diagnosed with both MAT and ST

Seemungal BM, et al. The Bárány Society position on 'Cervical Dizziness'. J Vestib Res. 2022;32(6):487-499.
Michiels S, et al. Diagnostic Criteria for Somatosensory Tinnitus. *Trends in Hearing*. 2018;22.
Krøll LS, et al. Migraine co-existing tension-type headache and neck pain: Validation of questionnaires. Scand J Pain. 2015;8(1):10-6.

Impact of Migraine and Vestibular Migraine on Audiometric Profiles and Quality of Life in Patients With Tinnitus

*Keng-Sheng Li and †‡Yu-Hsi Liu

**Department of Medical Education and Research, Kaohsiung Veterans General Hospital; †Department of Otorhinolaryngology, Head and Neck Surgery, Kaohsiung Veterans General Hospital; and ‡Institute of Biomedical Science, National Sun Yat-Sen University, Kaohsiung, Taiwan*

Objective: To investigate the clinical manifestations and complete auditory function in primary tinnitus patients with and without migraine or vestibular migraine.
Design: Retrospective case-control study.
Setting: A tertiary referral center.
Participants: This study enrolled 298 patients from the Kaohsiung Veterans General Hospital. All patients were diagnosed with primary tinnitus by a neurotologist between April 2020 and August 2021. Patients were excluded if they had histories of chronic otitis media, idiopathic sudden sensorineural hearing loss, Ménière's disease, skull base neoplasm, or temporal bone trauma.
Interventions: Twenty-five-item Tinnitus Handicap Inventory (THI), speech audiometry including speech recognition threshold, most comfortable level, uncomfortable loudness levels, dynamic range, and pure-tone audiometry.
Main Outcomes Measures: Objective hearing loss is defined as a mean threshold greater than 25 dB. Extremely elevated THI is defined as a score greater than 1 standard deviation above the mean THI.
Results: Among the 298 patients with tinnitus, 149 were women and 149 were men, with a mean age of 57.06 (range, 19.22–94.58) years. A total of 125 patients completed the THI questionnaire during their initial visit. The median THI score was 32 (95% confidence interval: 13.98–56.00), and the mean score was 34.99 with a standard deviation of 21.01. The sole contributing factor significantly associated with higher total THI score was the diagnosis of migraine or vestibular migraine ($p < 0.001$, odds ratio = 19.41). Tinnitus patients with migraine or vestibular migraine exhibited significantly lower mean pure-tone auditory thresholds (right 22.2 versus 29.5, $p = 0.002$; left 22.5 versus 30.4, $p < 0.001$), speech recognition threshold (right 20.0 versus 25.2, $p = 0.016$; left 20.2 versus 25.5, $p = 0.019$), and most comfortable levels values (right 46.1 versus 51.4, $p = 0.007$; left 46.9 versus 51.4, $p = 0.021$) compared with the tinnitus patients without migraine.
Conclusions: In this population-based study, patients with primary tinnitus experienced significantly higher THI scores and exhibited concurrent symptoms, including dizziness/vertigo, cervicalgia, and migraine or vestibular migraine. Among these parameters, the diagnosis of migraine or vestibular migraine was the sole contributor to significant higher THI score.
Key Words: Audiometry—Tinnitus—Tinnitus Handicap Inventory—Vestibular migraine.

Otol Neurotol **45**:e443–e449, 2024.

Proposals for A Precise Tinnitus Treatment Algorithm

Chronic or Fluctuated Bothersome Tinnitus

Hx, PE, Comprehensive Audiometry

Secondary Tinnitus

CHL, ISSNHL, OETD, COM, VS, trauma…

Treat underlying causes…

Primary Tinnitus

Severe to Profound SNHL → **CI**

Moderate to Severe SNHL → **HA**

Mild SNHL → **Obs**

"Hidden HL?" → **Obs**

Life habit adjustment, medication review, family support, TRTs, CBTs, white noise coverage…

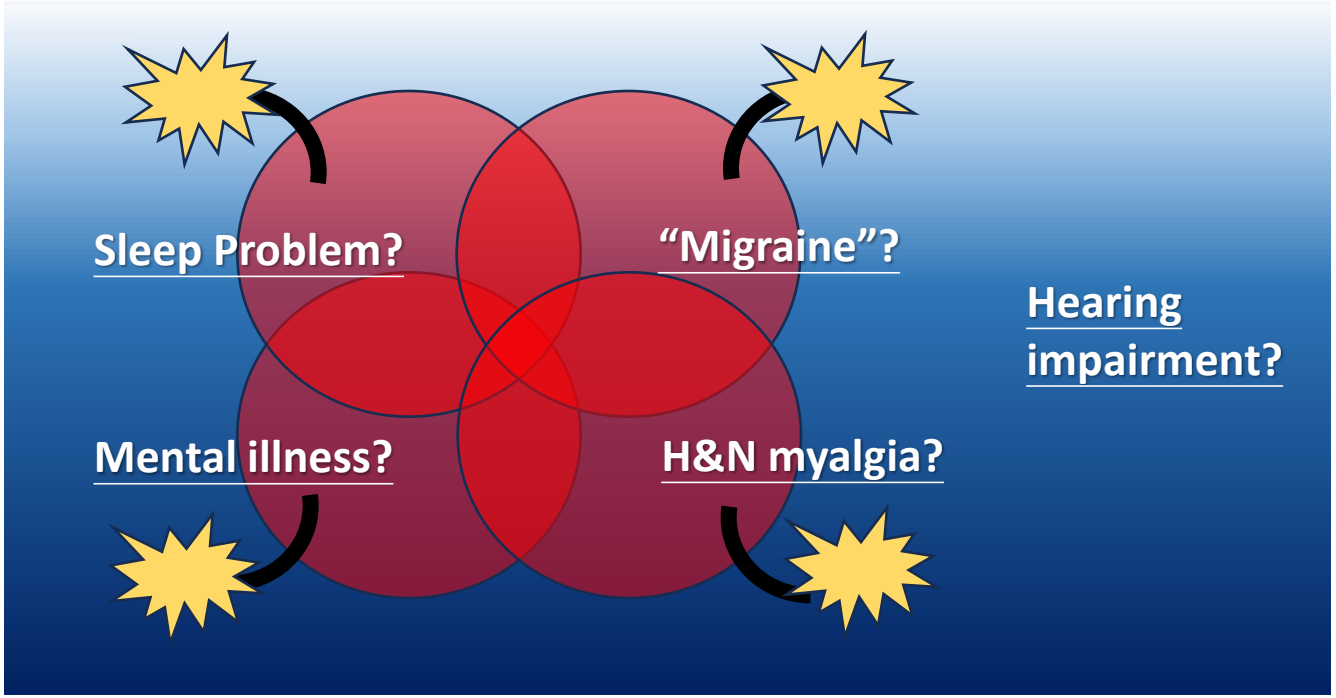
AMPLIFIERS

40% OFF **Psychiatric Disorders**	70% OFF **Sleep Disorders**	40% OFF **Somato-sensory Tinnitus**	25% OFF **Migraine or VM/CM**
Psychiatrist Consultation	Evaluation & Precise Tx	Precise Physical Tx & Rehab	Best life adjustment ± Mx

Proposals for A Precise Tinnitus Treatment Algorithm

Treating Bothersome Tinnitus
= Conducting Bomb Disposal

Daily life of otoneurologists



Kaohsiung Veterans General Hospital
ORL-HNS
耳鼻喉頭頸外科部

Conclusions & Take Home Message

1. Migraine is not only a type of headache! 也不是所有頭痛+眩暈者都是VM!

   → VM有其嚴格(或太嚴格?)的criteria

   → Migraine features: “Sensory & Somatic hyperreflexia”, 但其表現可能很多元、多變，也很主觀。

2. VM的治療有其邏輯，可考慮採升階方式進行

   → Trigger management & education are keystones!

   → 直接使用大量後線藥物可能導致治療順從性不足

3. Migraine為tinnitus的最強放大器，MAT聽力也較佳，但治療方式尚不明確，可採取與VM相同之方式。

4. 提醒自己盡量不單壓VM/MAT: 所有造成dizzy或tinnitus之原因都需小心探查及治療。

5. **CM的可能診斷條件及AM的概念值得我們更多思考並推廣。**

Special Thanks to…

Prof. Steven Rauch

馮已榕老師

薛佑玲所長

林明毅主任

康柏皇部長

林曜祥院長

Thank You For Listening!