

# **Sudden Sensorineural Hearing Loss**

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**Dick Clarke, CHT**



# Sudden Sensorineural Hearing Loss

Primary Training in Hyperbaric Medicine

Columbia, South Carolina

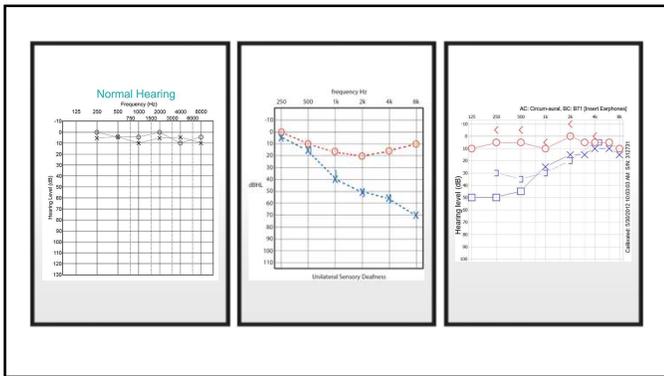
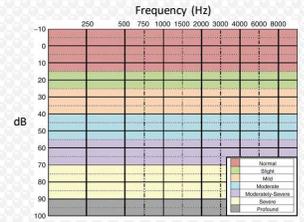
## Definition

Hearing loss of at least 30 decibels occurring over three consecutive audiometric frequencies and lasting at least three days

Majority are idiopathic - 10% have defined etiology

## Postulated causes

- Circulatory disturbances-vascular occlusions
- Acoustic trauma: firing weapons, nearby explosions & other sudden loud noises
- Viral infections
- Labyrinthine membrane leaks; cochlear membrane damage
- Neoplasms (sudden onset in rare cases); other abnormal tissue growth
- Ototoxicity; prescription & OTC
- Immune associated disease



**THE LARYNGOSCOPE.**

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**EXPERIMENTS ON TEMPORARY OBSTRUCTION OF THE INTERNAL AUDITORY ARTERY\***

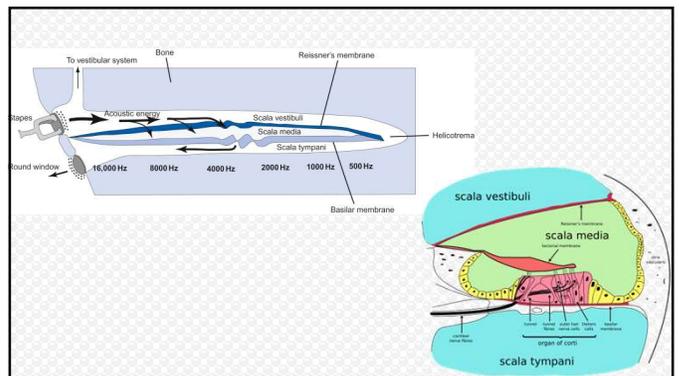
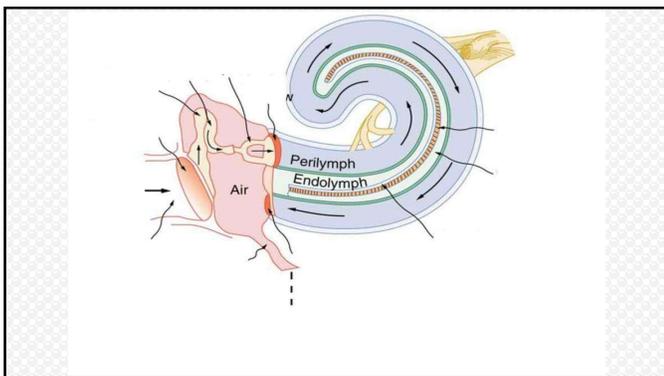
By H. B. PERLMAN, M.D.,  
EUGENE LUKINA, A.S.  
(By Invitation),  
and  
CHARLES PENLAND, M.D.,  
(By Invitation),  
Chicago, Ill.

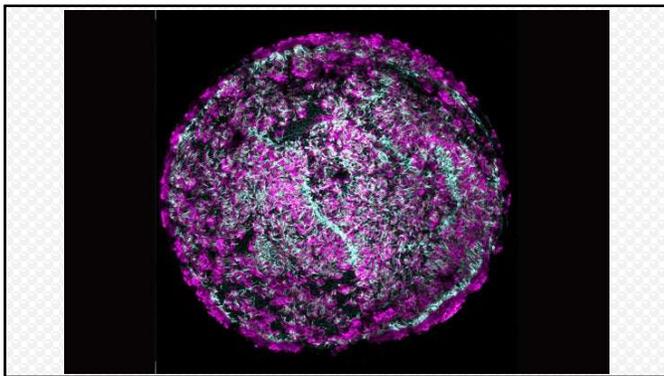
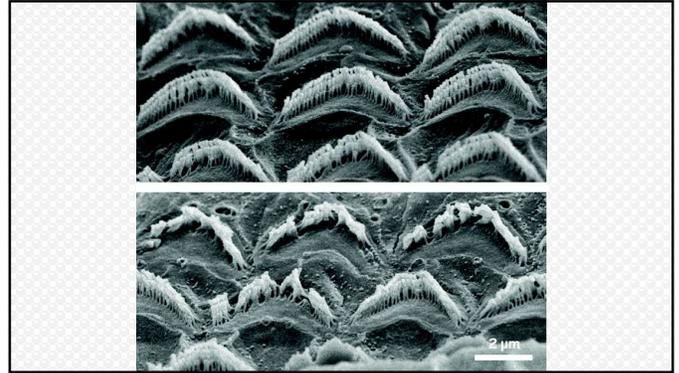
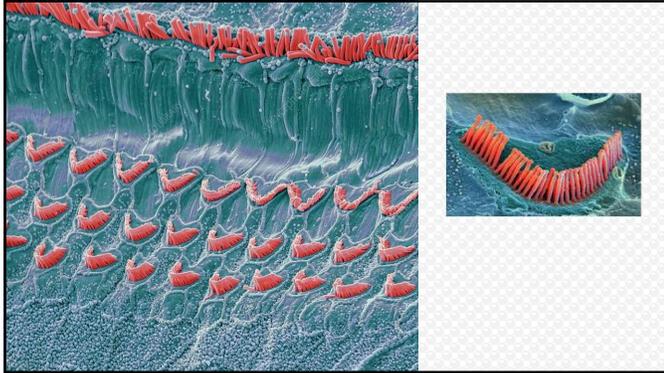
Certain types of sudden deafness are commonly considered to be the result of a vascular disturbance in the inner ear and not infrequently associated with a considerable degree of recovery.

There is little factual information regarding these clinical observations. However, animal experiments indicate that the cochlea is exceedingly sensitive to the oxygen supply and when the oxygen supply is cut off electrical activity deteriorates within seconds. Experiments have shown that the vascular system of the inner ear is vital for the continuous supply of oxygen and metabolism. Permanent obstruction of the inferior cochlear vein and its tributaries, and permanent occlusion of the internal auditory artery, produce rapid loss of function and characteristic histologic damage.† These observations are the first reported direct results of the auditory system.

\*From the studies of otoneurology of the University of Chicago. †These studies were supported by the National Aeronautics and Space Administration, Grant N5-107-001, and the General Electric Corporation, Grant N5-107-001, and the General Electric Corporation, Grant N5-107-001.

Perلمان H.B., et al. Laryngoscope 1959;69(6)





**Identifying a hypoxia etiology**

- Depressed cochlear potentials failed to recover upon restoration of blood flow following brief transient anoxia  
*Kusakari J, et al. Auris Nasus Larynx 1981;8(2):55-64*
- In lowered oxygen states, cochlear evoked potentials < 20 mV lower than during normally oxygenated states  
*Other FF, et al. Hear Research 1987;29(2-3):117-124*
- Acute sound shock wave induced decline of more than half (50-80%) of perilymph oxygen pressure  
*Lamm K, et al. HNO 1988;36(9):367-372*
- Oxygenation of cochlear perilymph decreased by 20% during high-intensity (125 dB) acoustic exposure  
*Scheibe F, et al. Hear Research 1992;63(1-2):19-25*

**Early clinical studies of elevated oxygen as primary treatment**

- Idiopathic SSNHL. 3 groups randomized. HBO & stellate ganglion block = best outcomes  
*Goto F, et al. Acta Otolaryngol 1979;88:335-342*
- 122 soldiers allocated to 4 groups. Combination HBO & vasodilators = best outcomes & reduced relapse  
*Pigramm M, Schuman K. Arch Otorhinolaryngol 1985;241*
- Compared carbogen breathing to other agents re: perilymph O<sub>2</sub> tension in 34 pts. yielded better results  
*Fisch U. Otolaryn Head Neck Surgery 1983;91(1):3-8*
- Studied 50 pts. randomized HBO or vasodilator. HBO significantly greater mean improvement  $p=0.005$   
*Fattori B, et al. Ear Nose Throat J. 2001;80(9):655-660*

**Hyperbaric oxygen as salvage therapy**

- 50/155 pts failed primary therapy. Randomized HBO or ITS; only HBO groups improved all frequencies  
*Cvoirovic L, et al. Otolary Neurology 2013;34:1021-1026*
- 103 pts randomized: HBO (22), ITS (35), both (19) or control (27). Gain in the "both"/combined group  $p=0.05$   
*Yang CH, et al. Otolary Neurology 2013;34:1411-1416*
- 58/135 failed primary therapy; 44 offered 23 accepted HBO. Mean improvement 15.6dB vs 5.0 dB in 'controls'  
*Pezzoli M, et al. European Arch Otorhinolaryn 2015;272*

**Bayoumy AB, de Ru JA. Euro Arch Oto-Rhino-Laryngol 2019;276**

**PubMed & cross-referencing > 68 clinical studies**

**Early treatment = consistently better recovery**

within or after 48 hrs  
within or after 7 days  
within or after 10 days  
within or after 14 days

**Higher losses appeared to benefit more when HBO used**

Younger pts (<50 yrs) appeared to benefit more

**HBO as salvage therapy 'is not the most effective option'**

Other blood-flow promoting agents (vasodilators, diuretics, dextran, pentoxifylline) failed to show clinical effectiveness

\*HBO time-consuming\* 10 daily hospital visits

*one study found no outcome difference if provided BID*

**'We recommend starting therapy as early as possible, preferably <48 hrs, using combination HBO and corticosteroids'**

**UNDERSEA & HYPERBARIC MEDICINE**

**International Multicenter Registry for Hyperbaric Oxygen Therapy: Results through June 2021**

2011-2021: 2,880 pts. 30,577 treatments, 22 centers

118 (4%) referred with ISSNHL

84 formally evaluated 83 HBO indicated

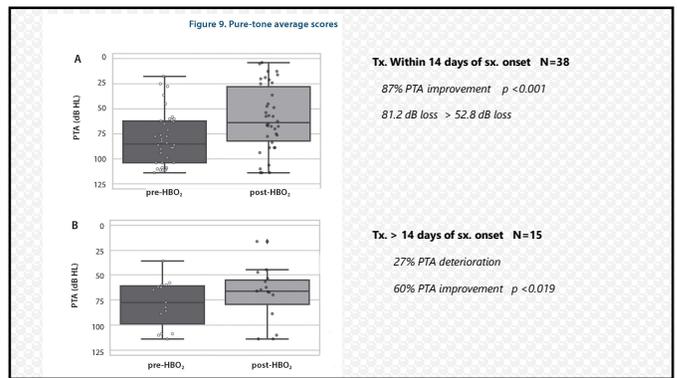
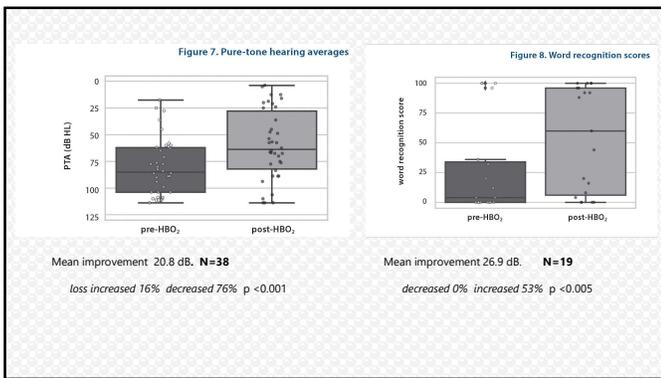
11 declined & 4 tx elsewhere = 68 tx "In Registry"

**ABSTRACT**

**INTRODUCTION**

**CONCLUSIONS**

**KEYWORDS**



**medicina**

**Randomized 171 pts between 2016-2019**

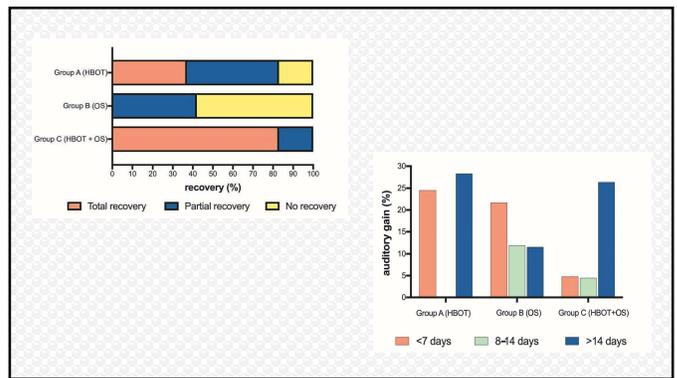
**Inclusion criteria**

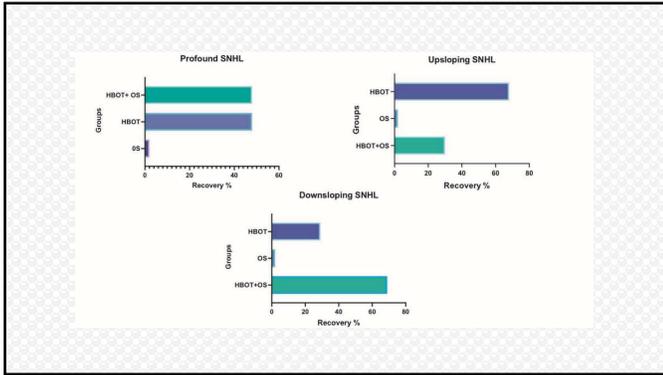
- > 58 yrs
- onset within 30 days
- unilateral and/or bilateral (1)
- unknown cause
- no fluctuations in hearing loss
- normal Eustachian tube function
- all underwent MRI to r/o retrocochlear pathology

**Block Randomization**

- Group A:** HBO therapy exclusively 2.5 ATA x 90 min
- Group B:** Oral steroids exclusively: prednisone
- Group C:** Combination HBO & steroids

**Caavaliere M, et al. Medicina 2022;58:1421**





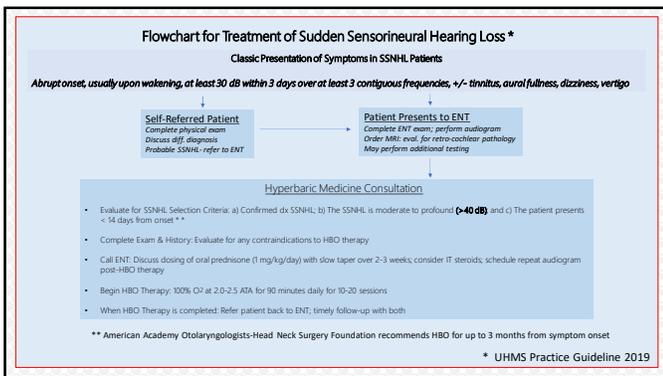
**Sudden Hearing Loss: Update to Guideline to Improve Implementation and Awareness**

**KAS9a: Initial Therapy with Hyperbaric Oxygen Therapy**  
 - **Option**  
 Clinicians may offer, or refer to a clinician who can offer, hyperbaric oxygen therapy (HBOT) combined with steroid therapy within two weeks of onset of SSNHL.

**KAS9b: Salvage Therapy with Hyperbaric Oxygen Therapy**  
 - **Option**  
 Clinicians may offer, or refer to a clinician who can offer, hyperbaric oxygen therapy (HBOT) combined with steroid therapy as salvage within one month of onset of SSNHL.

AMERICAN ACADEMY OF OTOLARYNGOLOGY-HEAD AND NECK SURGERY  
 Foundation published the Clinical Practice Guideline: Sudden Hearing Loss (Updated Today) in Otolaryngology-Head and Neck Surgery. Sudden sensorineural hearing loss (SSNHL) affects the to 27 per 100,000 people annually, with about 60,000 new cases per year in the United States.

"Sudden hearing loss is a frightening symptom for patients that can dramatically decrease their quality of life. Prompt recognition and management of sudden sensorineural hearing loss may improve hearing recovery and quality of life. That is why the American Academy of Otolaryngology-Head and Neck Surgery Foundation published this guideline to improve implementation and awareness."



**The Optimized Protocol of Hyperbaric Oxygen Therapy For Sudden Sensorineural Hearing Loss**

**Prospective study saves profound loss**  
 112 pts, 105 completed protocol 3-month/4u

**All received systemic & intra-tympanic steroids + 10 HBO bx.**

**Group 1: 2.5 ATA 60 mins.**  
**Group 2: 2.5 ATA 120 mins.**  
**Group 3: 1.5 ATA 90 mins.**

**Mean Hearing Gain (dB)**

1. 53.8 +/- 16.0  
 2. 52.5 +/- 18.0  
 3. 36.5 +/- 24.8 > \*similar to historic controls\*

\* We recommend adding HBO, at 2.5 ATA x 1 hr x 10, to corticosteroids as initial therapy\*  
 \* Studies on the optimal HBO protocol for salvage therapy are also needed\*

Kim H, et al. Laryngoscope 2023;133:363-368

**UNDERSEA & HYPERBARIC MEDICINE**

**Sudden hearing loss and early hyperbaric oxygen therapy: A preliminary study**

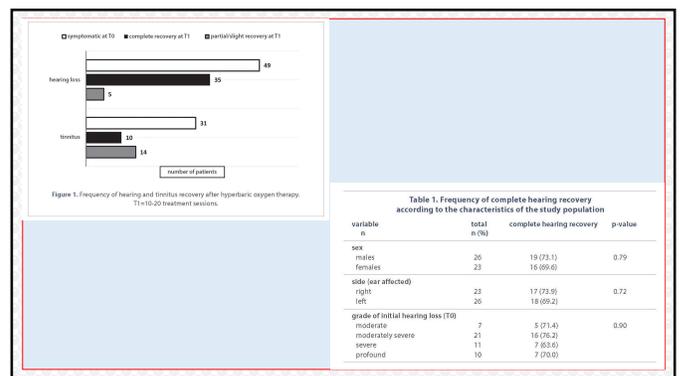
**Nine yr retrospective review 158 pts, 109 excluded**

**Identifiable cause**  
**Mixed loss**  
**Predominant Tx with steroids**  
**HBO stated > 3 days post onset**

**Steroids either contraindicated or refused**

**HBO at 2.5 ATA x 10**  
**additional 10 > partial recovery**

Alde M, et al. UHM 2023;50(2):145-153



Salvage treatment strategies for refractory sudden sensorineural hearing loss—a comprehensive review and meta-analysis with practical recommendations

January 2010–April 2025: 41 publications  
 ITS methylprednisolone outperformed dexamethasone:  $p < 0.05$   
 HBO also effective, particularly low frequencies  
 ITS alone better than HBO alone  
 \*Combination ITS & HBO achieved best results

Meliante PG, et al. *Frontiers Neurology* 2025;16:1627892

Hearing loss associated with diving/other hyperbaric exposures

Differential diagnosis

- "Sensorineural" secondary to inner ear decompression sickness (IEDCS)
- "Conductive" secondary to inner ear barotrauma (IEB)

	IEDCS	IEB
Symptom onset	..... Upon surfacing	..... Common upon compression; ascent; upon surfacing
Ear equal. difficulty	..... Not anticipated	..... Yes, commonly during compression +/- ascent
Otoscopic exam	..... Unremarkable	..... Associated with Teed Scale TM changes
Associated symptoms	..... Other DCS	..... Isolated to inner ear
Dive profile	..... Risk for DCS	..... No/low DCS risk; rapid compression
Hearing loss type	..... Sensorineural	..... Conductive

Spontaneous recovery rate of idiopathic sudden sensorineural hearing loss: A systematic review and meta-analysis

60% spontaneous resolution  
 Of 765 articles retrieved 753 excluded  
 67% of which no spontaneous recovery reported  
 Of 13 remaining 6 had unusual protocol  
 66.7% resolved  
 Spontaneous recovery didn't mean "recovered"  
 100% of 13-56% per MDCT definition up to 60% using alternative definitions

Chaushu H, et al. *Clinical Otolaryngology* 2023;48

AETNA  
*Clinical Policy Bulletin # 0172 Hyperbaric Oxygen Therapy; Last revision 4/8/2022*  
 Idiopathic sudden sensorineural hearing loss (SSHL) > 30 dB affecting greater than 3 consecutive frequencies of pure-tone thresholds when member has failed oral and intra-tympanic steroids & HBOT is initiated within 3 months after onset (up to 20 sessions).

CIGNA  
*Medical Coverage Policy Hyperbaric Oxygen Therapy #0057; Effective Date: 5/15/2022*  
 Idiopathic sudden sensorineural hearing loss (ISSHL) within four weeks of symptom onset.

HUMANA  
*Medical Coverage Policy HUM-0450-026; Review date 4/28/2022*  
 Idiopathic sudden sensorineural hearing loss as an adjunctive treatment to systemic or intratympanic steroid therapy with documentation of diagnosis from a specialist (e.g., otolaryngologist) when the following criteria are met:

- At least three consecutive frequencies are affected with no identifiable cause, AND
- Decrease in hearing of greater than or equal to 30 decibels (dB)