

# **Sudden Sensorineural Hearing Loss**

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**Dick Clarke, CHT**

# Sudden Sensorineural Hearing Loss

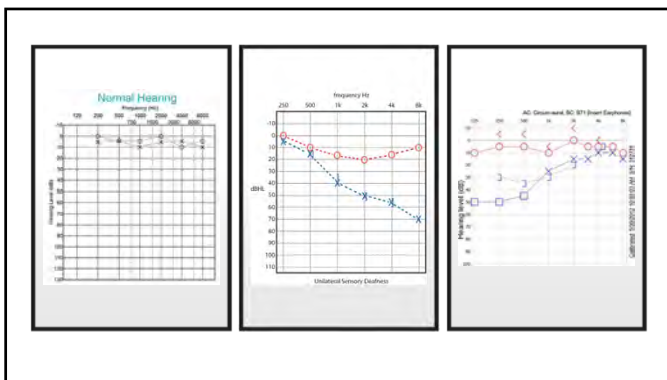
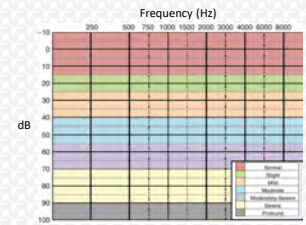
Primary Training in Hyperbaric Medicine  
Columbia, South Carolina

### 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.**  
Vol. LXXX JUNE, 1959 No. 4

**EXPERIMENTS ON TEMPORARY OBSTRUCTION OF THE INTERNAL AUDITORY ARTERY\***  
H. S. PERLMAN, M.D.,  
EUGENE COVINA, A.B.,  
(By Invitation),  
and  
CHARL PERMAN, M.D.,  
(By Invitation),  
Chicago, Ill.

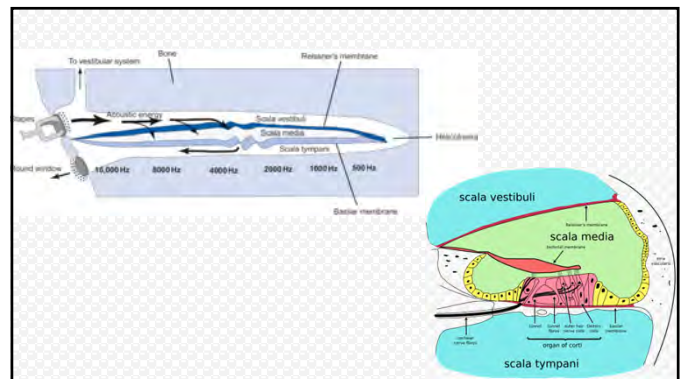
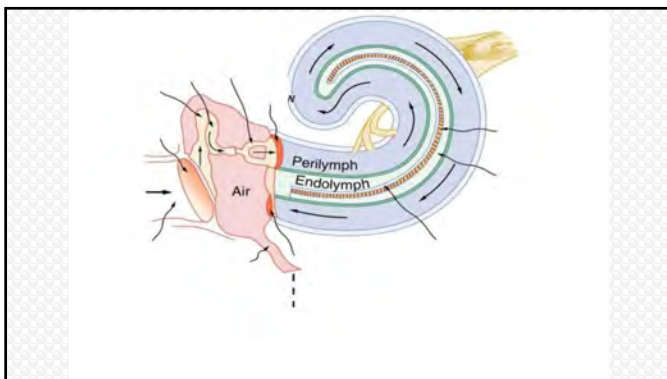
Certain types of sudden deafness are commonly considered to be the result of a vascular phenomenon in the inner ear and not infrequently associated with a considerable degree of recovery.

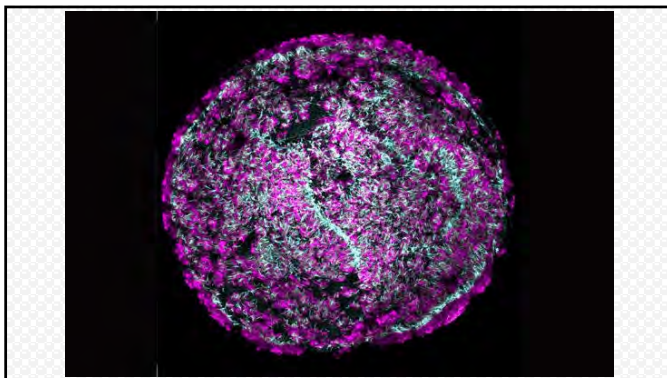
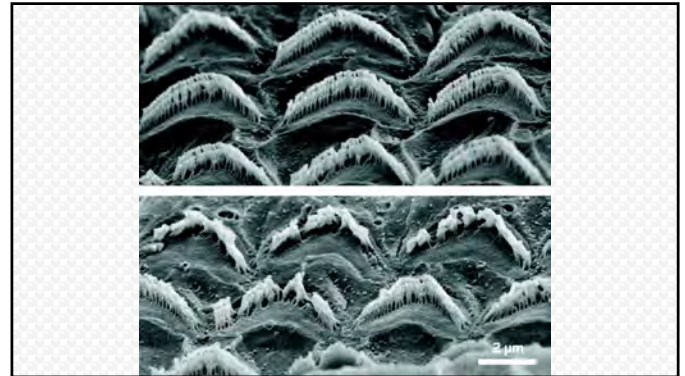
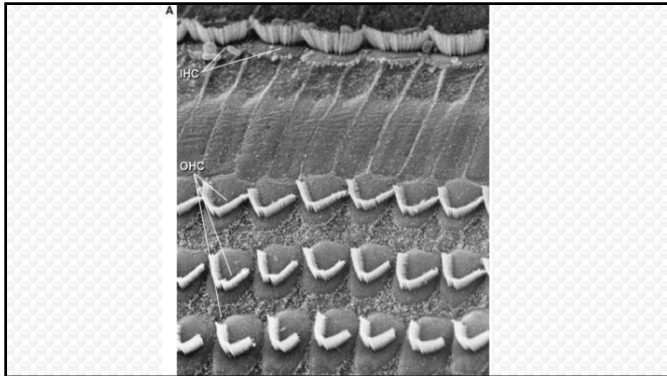
There is little clinical information regarding these clinical observations. However, animal experiments indicate that the middle ear is essentially insensitive to its oxygen supply and while the oxygen supply to the cochlear sensory structures is sensitive to its oxygen supply. Experiments have shown that the vascular system of the inner ear is vital for the continuous supply of oxygen and nutrients. Permanent obstruction of the internal auditory artery and its tributaries, and permanent occlusion of the internal auditory artery, produce rapid loss of function and characteristic histologic changes in the inner ear.

\*Presented at the National Research Council of the National Academy of Sciences, Washington, D.C., December 15, 1958.

These are abstracts of the manuscript of the temporary of the internal auditory artery. The authors are H. S. Perlman, M.D., Eugene Covina, A.B., and Charles Perman, M.D. The authors are grateful to the National Research Council of the National Academy of Sciences for the facilities and equipment provided for the study.

Perlman HB, 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

Offner 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

Scheibel 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

Pilgramm M, Schuman K. *Arch Otorhinolaryngol* 1985;241

Compared carbogen breathing to other agents on 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

Cvorovic L, et al. *Otology Neurotology* 2013;34:1021-1026

103 pts randomized: HBO (22), ITS (35), both (19) or control (27). Gains in both groups; combined  $p=0.05$

Yang CH, et al. *Otology Neurotology* 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:

**The use of hyperbaric oxygen therapy in acute hearing loss: a narrative review**

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 for ISSNHL

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

Bayoumy AB, et al. Eur Arch Oto-Rhino-Laryngol 2019;276

**Two-year retrospective analysis Dutch military hospital 30 male pts. 49 ears**

Mean time to steroids...1 day

Mean time to HBO in 31 ears < 2 days

Mean time to HBO in 18 ears > 2 days (2-4 days)

	First Audiogram	Last Audiogram	Absol. Gain (dB)	Relative Gain (%)
< 2 days	38.7 +/- 12.9	15.9 +/- 9.8	22.9 +/- 14.1	56.3 +/- 28.0
> 2 days	37.2 +/- 11.3	24.3 +/- 15.6	11.6 +/- 12.9	30.6 +/- 30.6
p =	0.66	0.02	0.007	0.004

Bayoumy AB, et al. J Otolaryngol 2021;16:237-241

**The Use of Hyperbaric Oxygen Therapy and Corticosteroid Therapy in Acute Acoustic Trauma: 15 Years Experience at the Czech Military Health Service**

15-year retrospective analysis Czech military hospital 108 pts. 141 affected ears

Steroids (vasodilators in 7 pts) on presentation

Failed response to PTA day 7 > HBO as rescue therapy

Therapy	Count	Improved	Normalized (threshold losses > 20 dB)
Primary Therapy	61 ears	82%	64%
Rescue Therapy	73 ears	77%	37%

Holy R, et al. Int. J Environ Res Public Health 2021;18

**UNGARIA & DIFFERENTIARY MEDICINE**

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

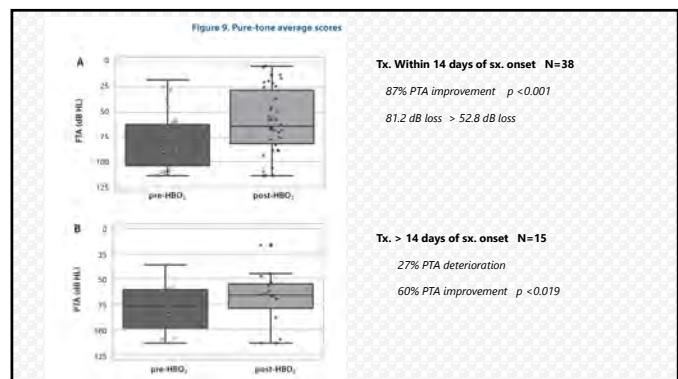
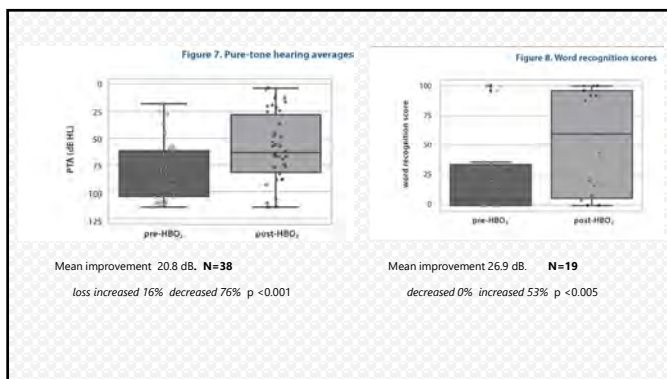
2011-2021: 2,880 pts. 30,577 treatments, 22 centers

118 (4%) referred with ISSNHL

84 formally evaluated 83 HBO indicated

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

Harlan NP, et al. UHM 2022;49(1):275-287



**medRxiv** | 1001.129

**Combination of Hyperbaric Oxygen Therapy and Oral Steroids for the Treatment of Sudden Sensorineural Hearing Loss Early or Late?**

Randomized 171 pts between 2016-2019

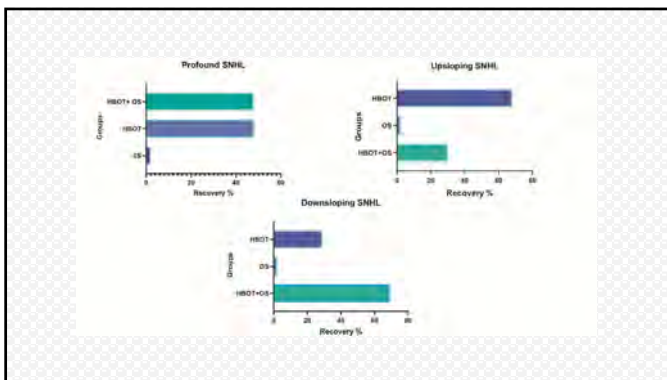
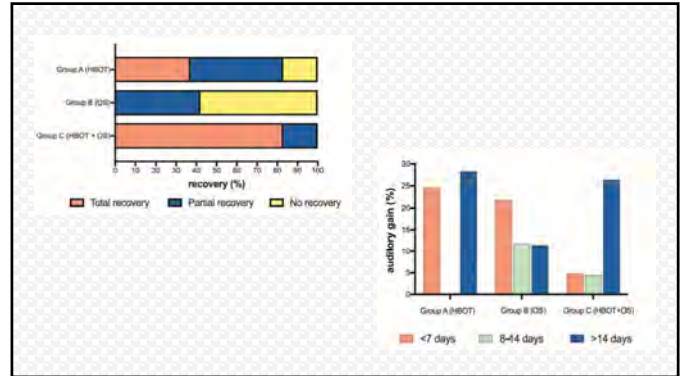
**Inclusion criteria**

- > 18 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 retro-cochlear 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

Cavaliere M, et al. Medicina 2022;58:1421



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

August 1, 2019

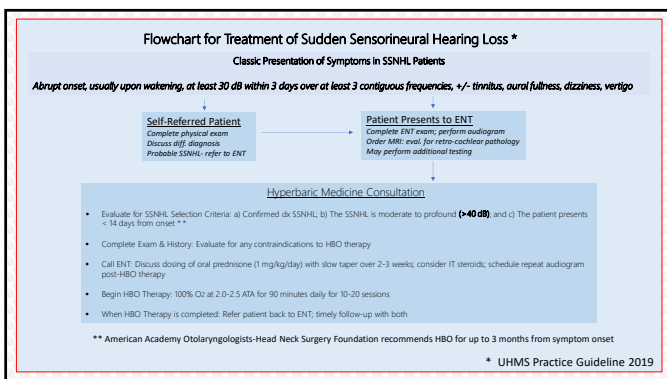
**KAS9a: Initial Therapy with Hyperbaric Oxygen Therapy**

- Option**
- Clinicians may offer, or refer to a clinician who can offer, hyperbaric oxygen therapy (HBO) 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 (HBO) combined with steroid therapy as salvage within one month of onset of SSNHL.

American Academy Otolaryngology-H/N Surgery Foundation 2019



**The Optimal Protocol of Hyperbaric Oxygen Therapy for Sudden Sensorineural Hearing Loss**

Prospective study severe profound loss  
112 pts. 105 completed protocol 3-month f/u

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

Group 1: 2.5 ATA 60 mins.  
Group 2: 2.5 ATA 120 mins.  
Group 3: 1.5 ATA 60 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;133:383-388

**Humana & Systematic Medicine**

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

**Nine yrs retrospective review 150 pts, 109 excluded**

**Identifiable causes**  
**None**  
**Podiatric pts**  
**16 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

**Figure 1. Frequency of hearing and hearing recovery after hyperbaric oxygen therapy**

variable	total n (%)	complete hearing recovery	p-value
sex			
males	26	19 (73.1)	0.779
females	23	18 (78.3)	
side (non affected)			
right	23	17 (73.9)	0.727
left	26	14 (53.8)	
grade of initial hearing loss (HL)			
mild/moderate/severe	7	5 (71.4)	0.809
profound	23	15 (65.2)	
profound	11	7 (63.6)	
profound	10	7 (70.0)	

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

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

Chauhu H, et al. Clinical Otolaryngology 2023;48

**60% spontaneous resolution**

**Of 766 articles retrieved 753 excluded**

**82 of which spontaneous recovery reported**

**Of 13 remaining 6 had unusual protocol**

**30, 7 revised using 10 years**

**Spontaneous recovery didn't mean "recovered" ranged from 25-50% per ICD-10 definition up to 60% using alternative definitions**

**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 & HBO 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)