

Sudden Sensorineural Hearing Loss

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Sudden Sensorineural Hearing Loss

Primary Training in Hyperbaric Medicine

Columbia, South Carolina

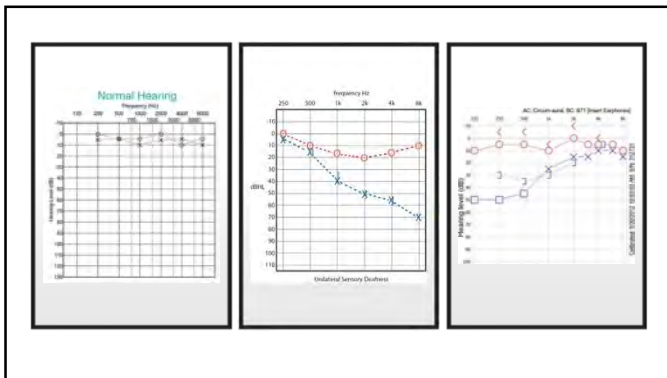
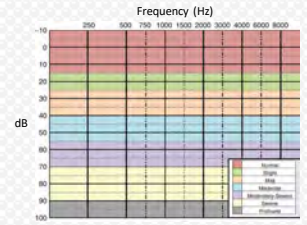
Definition

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 leak; cochlear membrane damage
- Neoplasms (sudden onset in rare cases); other abnormal tissue growth
- Ototoxicity; prescription & OTC
- Immune associated disease



THE LARYNGOSCOPE.
 Vol. LXXIX JUNE, 1959 No. 6
EXPERIMENTS ON TEMPORARY OBSTRUCTION OF THE INTERNAL AUDITORY ARTERY*
 H. S. PERLMAN, M.D.,
 ELMER EDWARDS, A.S.
 (By Invitation),
 and
 CHAS. PERMANEK, M.D.,
 (By Invitation),
 Chicago, Ill.

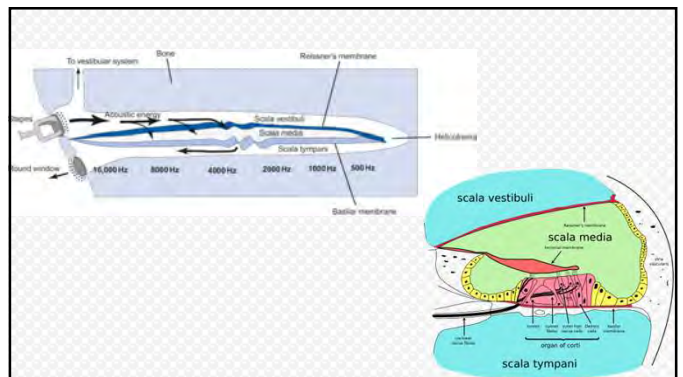
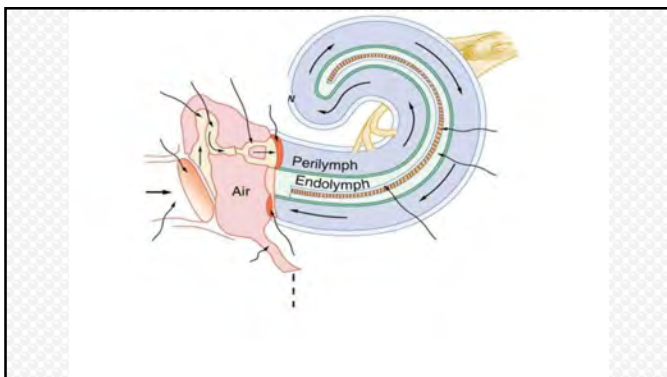
Certain types of sudden deafness are commonly considered to be the result of a vascular phenomenon in the inner ear and are infrequently associated with a measurable degree of hearing loss.

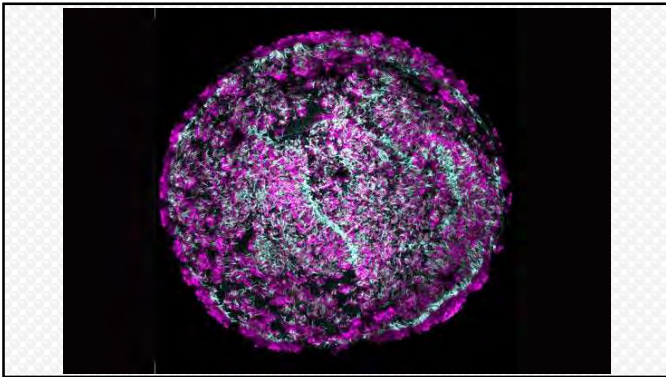
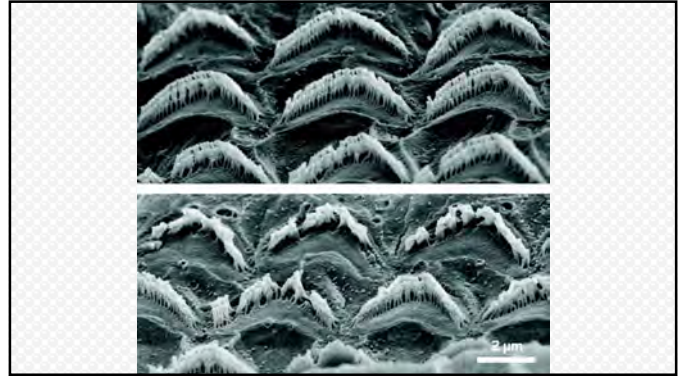
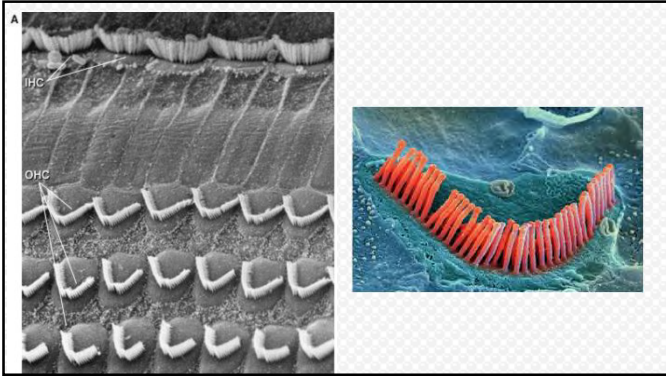
There is little clinical information regarding these clinical observations. However, animal experiments indicate that the cochlea is exceedingly sensitive to its oxygen supply and while the oxygen supply is cut off, distinct sensory deafness occurs almost immediately. Experiments have shown that the vascular system of the inner ear is vital for the continuous supply of oxygen and metabolism. Permanent destruction of the internal auditory artery and its branches, and permanent occlusion of the internal auditory artery, produce rapid loss of function and characteristic histologic changes in the cochlea.

*Presented at the 1958 Annual Meeting of the American Society of Otolaryngology and Laryngology, Chicago, Illinois, October 1958.

Reprints may be ordered from the University of Chicago Press, 530 North Dearborn Street, Chicago, Illinois 60610.

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
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
Pilgramm M, Schuman K. Arch Otorhinolaryngol 1985;241
- Compared carbogen breathing to other agents on perilymph O₂ 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. Otolary Neurology 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. 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

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

Abstract: Acute hearing loss can have a major impact on patients' lives. This article reviews the available evidence on the use of hyperbaric oxygen (HBO) in the treatment of acute hearing loss. The review includes a search of PubMed and 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

UNDERSEA & HYPERBARIC MEDICINE

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

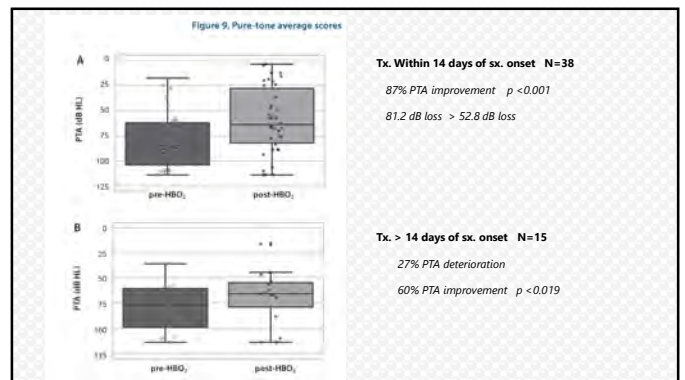
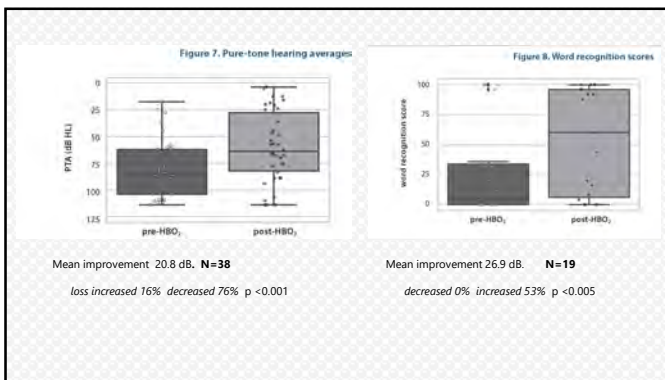
2011-2021: 2,880 pts. 30,577 treatments, 22 centers

118 (4%) referred with ISSNHL

84 formally evaluated 83 HBO indicated

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

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



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

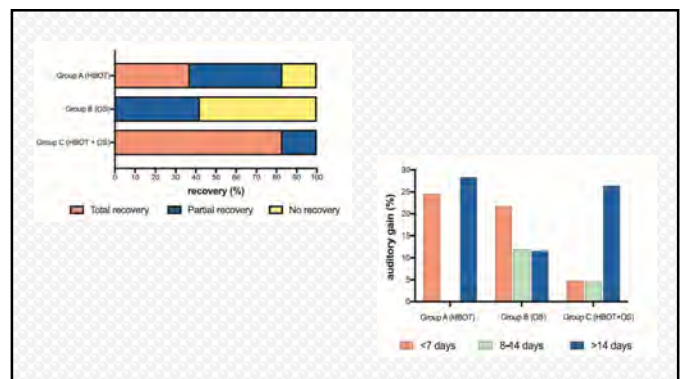
Randomized 171 pts between 2016-2019

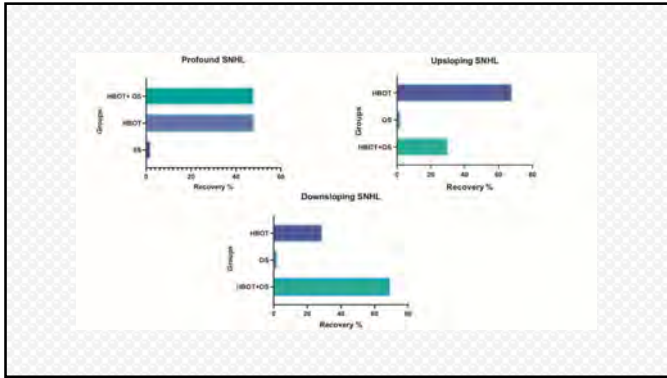
Inclusion criteria

- > 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 rule out retro-cochlear pathology

Block Randomization

- Group A:** HBO therapy exclusively 2.5 ATA x 90 min. 52
- Group B:** Oral steroids exclusively: prednisone 55
- Group C:** Combination HBO & steroids 64





Assessing the Effectiveness of Different Hyperbaric Oxygen Treatment Methods in Patients with Sudden Sensorineural Hearing Loss

Retrospective analysis 218 pts single institution all tx with steroids

- Impact on duration delay to HBO & PTA results
 - < 5 days 5-10 days > 10 days
 - delayed tx > 10 days associated with reduced tx effect
- Impact of number of hyperbaric treatments
 - < 15 15 > 15
 - improvement with all doses; greatest > 15 txs

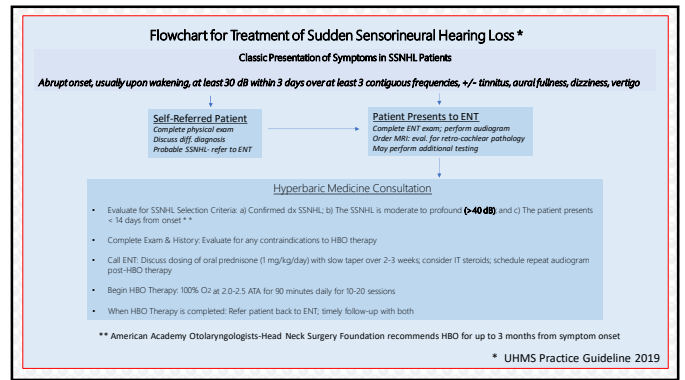
Rozbicki P, et al. Audiology Research 2024;14:333-341

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 (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 /u

All received systemic & intra-tympic steroids + 10 HBO tx.

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

UNDERSEA & HYPERBARIC MEDICINE

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

Nine yr. retrospective review 158 pts, 109 excluded

Identifiable causes
 Mixed loss
 Postlingual pts.
 Tx with steroids
 HBO started > 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

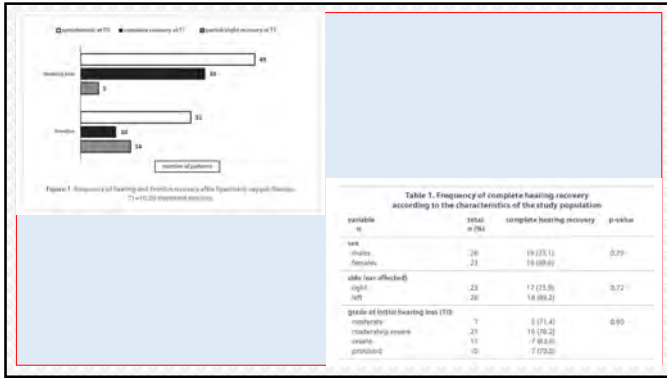


Table 1. Frequency of complete hearing recovery according to the characteristics of the study population

variable	total n (%)	complete hearing recovery	p-value
sex			
male	26	19 (73.1)	0.79
female	23	10 (43.5)	
side (ear affected)			
right	23	17 (73.9)	0.72
left	26	18 (69.2)	
grade of initial hearing loss (HL)			
mild	7	5 (71.4)	0.69
moderate/severe	25	16 (64.0)	
severe	15	7 (46.7)	
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
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 766 articles retrieved 753 excluded 67% of which no spontaneous recovery reported

Of 13 remaining 6 had unusual protocol 46.7% recovery

Spontaneous recovery didn't mean "recovered" raised from 33-59% per MDCT definition up to 60% using alternate definition

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 intratympanic 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)