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Gold Standard Treatment for Sudden Sensorineural Hearing Loss

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Figure 1. H-Series monoplace chamber, made by Sechrist Industries.

In this case study, a man with hearing loss after a stroke benefits from hyperbaric oxygen therapy and steroid treatments, as well as a coordinated team effort.

Sudden sensorineural hearing loss is defined as an abrupt loss in hearing that is 30dB or more, over at least three audiometric frequencies occurring within 72 hours. SSNHL may result in complete or partial loss of hearing.[1] SSNHL is estimated to impact 5-20 individuals per 100,000 annually.[1] There are many factors that can impact the success of treatment and level of recovery, including age, degree of hearing loss, frequency range, presence of dizziness, and timeframe between the symptom onset and treatment initiation.[1,2] Many of these factors are out of the provider's control. However, reducing the amount of time between onset and treatment is a

modifiable factor that has been shown to improve outcomes.

FDA-approved treatments for SSNHL include steroid injections (administered intra tympanically), oral steroids, hyperbaric oxygen therapy (HBOT), or a combination of these treatments. A combination of treatments is the evidence-based, gold standard for treatment of SSNHL. Halwani et al. found that inclusion of HBOT resulted in improvement in thresholds in 81% of cases.[3] These findings are supported by several studies demonstrating significant improvement in patients receiving HBOT treatment in addition to standard steroid treatments.[2,3,4,5,6,7,8]

HBOT physiologically increases the oxygen density in the blood, which may provide structures of the inner ear with increased circulating oxygen, resulting in reduced cochlear inflammation.[1,9] Currently, 16,000-20,000 facilities in the United States have implemented HBOT programs.[10] The combination of steroid treatment and HBOT is the gold standard, the FDA has approved this therapeutic combination, and HBOT chambers are widely available across the United States. Yet, only one-third of insurance companies provide coverage for HBOT in treatment of SSNHL, which severely limits patients' ability to access this critical treatment.[11] It is not clear how many facilities with HBOT therapy have direct access to audiology, further limiting a provider's ability to identify and treat SSNHL in a timely manner.

In a condition where time to diagnosis and treatment can have a significant impact on a patient's outcome, the aforementioned modifiable factors should be brought to the forefront and addressed at facilities nationwide to improve care for patients with SSNHL.

Case Study: HBOT for SSNHL

An 81-year-old Caucasian male arrived in the emergency room reporting bilateral hearing loss and a popping sensation in the right ear. Prior to admission, there were no reports of hearing loss by the individual or his family. This patient immediately underwent imaging studies which revealed an ischemic stroke in the cerebellum bilaterally. He was subsequently admitted as an inpatient for monitoring.

Two days following admission, the patient completed his first hearing evaluation. Testing revealed left sided thresholds with moderately severe to severe sensorineural hearing loss and right sided thresholds with profound sensorineural hearing loss. Tympanometry revealed normal middle ear function bilaterally. Word recognition testing was performed with and without visual cues, revealing very poor word recognition ability and little improvement between conditions. The difference in performance between the two word recognition tests could have been related to the individual's cognitive sequelae from his stroke. Following completion of this evaluation, an otolaryngology (ENT) consult was obtained to better discern the cause of the patient's sudden decline in hearing.

The following day (3 days after admission), at the recommendation of ENT, the individual began a 12-day course of 20 mg oral prednisone daily. The ENT recommendation also included HBOT, which was initiated 3 days later (6 days after admission). Fifteen 1-hour HBOT treatments were completed daily over the course of 3 weeks.

HBOT was completed by placing the patient into the H-Series monoplace chamber, made by

Sechrist Industries. Once in the chamber, the pressure was increased to a maximum of 30.0 pounds per square inch, 3.0 atmospheric absolute (ATA), with pressurization lasting 10-15 minutes. During the treatment, the patient breathed 100% pure oxygen. Once the session was complete, the decompression phase was initiated whereby the pressure decreased inside the chamber. The patient was in the chamber for a total of 1.5 to 2 hours during each session.

The patient returned for a second audiogram following the conclusion of his steroid treatment (15 days after admission). Results revealed left sided thresholds were stable in relation to his initial audiogram and right sided thresholds had improved from severe rising to moderate sensorineural hearing loss. Tympanometry revealed middle ear dysfunction bilaterally. Evidence shows that abnormal tympanometry is a common side effect following HBOT, as nearly half of patients who undergo HBOT experience some form of eustachian tube dysfunction post treatment. Approximately half of those who experience eustachian tube dysfunction then experience middle ear dysfunction in the form of otitis media.[12,13]

The patient was unable to be conditioned to speech testing at this follow up, which may have again been related to his cognitive status due to his stroke. Recommendations included continuing therapies indicated by collaborating professionals and to return to discuss hearing aids post discharge.

The patient completed 15 sessions of HBOT. Four days following the conclusion of HBOT, he completed his final audiogram. At that time, right sided thresholds were stable in relation to his previous audiogram. His left sided thresholds were mildly improved with comparison to his initial evaluation, rising to mild sloping to profound sensorineural hearing loss. Tympanometry revealed reduced tympanic membrane movement bilaterally. Word recognition scores remained poor with and without the use of visual cues.

It was recommended that the patient follow up after discharge to discuss amplification. The individual was discharged from in-patient care 4 days following his last audiogram, but has not yet returned for further hearing healthcare.

Initial Visit Thresholds	Tymp	250	500	1000	2000	4000	6000	8000	SRT
Right Ear	A	95	100	100	90	80	95	NR	80
Left Ear	A	60	65	65	70	75	75	85	55

Final Thresholds	Tymp	250	500	1000	2000	4000	6000	8000	SRT
Right Ear	As	70	75	75	65	70	85	100	65
Left Ear	As	40	45	45	40	50	75	100	35

Figure 2. Type A tympanometry consistent with normal middle ear function. Type As tympanometry consistent with reduced tympanic membrane mobility with normal peak pressure bilaterally. All threshold values listed are in dB HL. SRT = Speech Reception Threshold

Discussion

Time to implement treatment in SSNHL is a key factor impacting the success of treatment in this population. The availability of HBOT in our facility, coupled with a prompt multidisciplinary evaluation and discussion, allowed the patient to receive treatment within 3 days of admission. Furthermore, immediate access to audiology for diagnosis and follow-up allowed for streamlined continuous evaluation of the patient.

As supported by the literature, this patient demonstrated improved hearing thresholds throughout his hospitalization. However, his baseline hearing thresholds were not available for comparison, presenting a significant limitation in our understanding of his overall hearing status before and after treatment. While the patient and his family reported that he did not have any hearing impairment prior, the patient's true baseline thresholds were unknown, limiting our ability to both truly determine the initial degree of SSNHL the patient experienced and to assess his rate of recovery in response to treatment.

Finally, this case does not involve SSNHL in isolation. The impact the patient's stroke had on behavioral data cannot be determined and greatly complicates analysis of his treatment outcome. In reports from collaborating professionals caring for this patient, he demonstrated cognitive deficits with decreased awareness, participation, and attention. Other therapies used as part of the patient's multidisciplinary treatment may have improved the patient's attention and his ability to follow directions, in turn improving his hearing evaluation results. The initial audiogram was judged with good response reliability. However, the introduction of visual cues during word recognition testing revealed no improvement, which may indicate higher order processing difficulty during evaluation.

Conclusion

The conjunction of HBOT and oral administered steroids is the gold standard treatment for SSNHL. In this case, we saw thresholds improve bilaterally when both treatments were administered. Having access to the necessary tools in this case, including HBOT and access to ENT and audiology techniques and expertise, highlights how appropriate care was able to be delivered in an effective timeframe, yielding an improved outcome for the patient. Although the direct impact provided by each therapy in isolation is unknown, HBOT in conjunction with conventional steroid therapy should be considered for all individuals with SSNHL.

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