

# Hyperbaric Oxygen Therapy in the Treatment of Idiopathic Sudden Sensorineural Hearing Loss

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# Hyperbaric Oxygen Therapy in the Treatment of Idiopathic Sudden Sensorineural Hearing Loss

## Executive Summary

### ISSHL

1. Idiopathic sudden sensorineural hearing loss (ISSHL) is an otolaryngologic emergency.<sup>1</sup>
2. ISSHL is defined as a 30 dB or greater hearing loss over at least three consecutive frequencies, over a period of 72 hours.<sup>2</sup>
3. Treatment with steroids within 7-14 days<sup>3,4</sup> of onset of ISSHL is demonstrated to be the critical window for best outcomes.

### HBOT

4. Hyperbaric oxygen therapy treatment (HBOT) has demonstrated significant improvements in hearing in people with acute ISSHL; however, the underlying mechanisms are not well understood.<sup>5,6</sup>
5. HBOT within two weeks of mild to moderate hearing loss onset can be combined with steroid therapy for either initial treatment or salvage therapy.<sup>3,4</sup>

### Tinnitus

6. ISSHL is commonly accompanied by tinnitus.<sup>7</sup>
7. Cognitive behavioural therapy (CBT) is an evidenced-based treatment for tinnitus that provides sustained improvement in tinnitus-related distress,<sup>2,8,9,10,11</sup> mood<sup>9</sup> and sleep.<sup>8,12</sup> Eriksonian hypnosis has also been found to be effective.<sup>13-16</sup>
8. Wesley Hyperbaric is the only hyperbaric centre in Australia that provides a multidisciplinary approach for tinnitus, by appointment.

## What is ISSHL?

For more information visit <https://www.wesleyhyperbaric.com.au/hbot-and-idiopathicsudden-sensorineural-hearing-loss/>

- Idiopathic sudden sensorineural hearing loss (ISSHL) is defined as at least 30 dB or greater hearing loss over at least three contiguous frequencies over a period of 72 hours.<sup>2</sup>
- ISSHL is diagnosed by a pure tone audiogram.<sup>2</sup>
- The amount of hearing loss in ISSHL can vary from 30 dB at three frequencies to 120 dB at more frequencies.<sup>17</sup>
- ISSHL can range from mild hearing impairment to a total loss of hearing, and may be temporary or permanent.
- Approximately 90% of SSSL cases are idiopathic (no identifiable cause despite adequate investigation).<sup>4</sup>
- ISSHL can occur at any age but most commonly affects individuals 43 to 53 years old.<sup>2</sup>
- Spontaneous recovery estimates range from approximately 30%-60%.

## Possible causes of ISSHL

There is currently no consensus over the aetiology of ISSHL. Suggested mechanisms include:<sup>18</sup>

- Cochlear ischemia
  - Vascular occlusion
  - Hypercoagulability
- Viral infection
  - Direct cochlear infection
  - Reactivation of latent virus
- Cochlear membrane damage
- Immune associated disease
- Abnormal cochlear stress response
- Abnormal tissue growth

## Prognostic factors

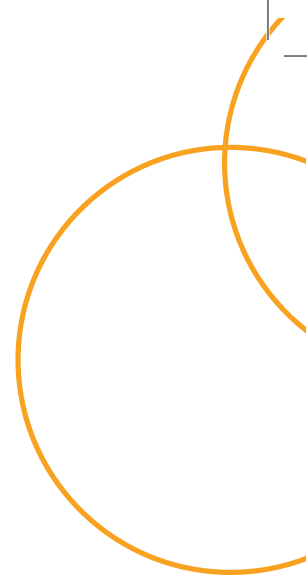
Prognosis of ISSHL is determined by<sup>19</sup>

- Age
- Presence of vertigo
- Degree of hearing loss: Greater hearing loss has poorer outcomes.
- Configuration of audiometric loss
- Time between onset of hearing loss and treatment: Longer time to treatment leads to poorer outcomes.
- Worse with increasing age
- Vertigo - worse prognosis

## Challenges

- Prompt recognition and management of ISSHL is essential for a chance to improve hearing recovery and quality of life.

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Treatment is time critical – for mild to moderate hearing loss treatment with steroids is recommended within two weeks<sup>3,4</sup> which mediates cell death cascade.

- Recovery depends on the severity of the hearing loss and characteristics of the diagnostic audiogram.<sup>1</sup>
- The high rate of spontaneous improvement presents challenges in proving the effectiveness of treatment, especially in first two weeks when most improvements occur.
- Wide variation in institutional treatment protocols presents challenges in determining evidence-based practice.
- There is currently a lack of large scale trials to compare local preferences in treatment protocol.<sup>3</sup>

## Diagnosis: time is of the essence

It is critical that patients with mild to moderate ISSHL receive treatment within two weeks to have an opportunity to recover hearing. General practitioners have a key role in raising awareness of ISSHL, swiftly recognising ISSHL and providing urgent referral for an audiogram to confirm diagnosis and initiating steroid treatment quickly.

### The Weber test using a tuning fork

GPs need to distinguish sensorineural hearing loss from conductive hearing loss. Patients with ISSHL report quieter sound from the vibrating tuning fork in the affected ear, while patients with conductive hearing loss (the majority of hearing loss cases seen in general practice) report the sound loudest in the affected ear. The sensitivity of the tuning fork Weber test to initially detect ISSHL may be an issue.

### Audiogram

Diagnosis of ISSHL is confirmed by quality audiogram – each ear is tested separately. Both air and bone conduction are tested together with tests for the ability to recognise words. In the absence of baseline audiology the contralateral ear is used as a baseline comparison. To measure the movement of the tympanic membrane a test called tympanometry is carried out.

### Initiating steroid treatment

GPs may start steroids in patients suspected of having ISSHL even if the audiogram test result is pending. Most Ear, Nose and Throat (ENT) surgeons will see a patient without the audiogram if they are suspected as having ISSHL as the outcome is dependent on how soon the patient starts steroids.

### Magnetic resonance imaging

Magnetic resonance imaging (MRI) is performed to exclude retrocochlear, vascular and neurological causes of hearing loss. In clinical practice, ENT specialists use a lower threshold hold to determine the extent of the hearing loss because of the significant impact of any hearing loss on the patient's quality of life. Performance of MRI investigations should not delay treatment.

### Counselling

Guidelines<sup>4</sup> recommend that clinicians should counsel patients with sudden sensorineural hearing loss who have residual hearing loss and/or tinnitus about the possible benefits of audiological rehabilitation and other supportive measures.

## Current treatment protocol for hyperbaric oxygen therapy in ISSHL

Systemic and intratympanic steroid monotherapy have been accepted treatments despite low evidence to support them.<sup>20</sup> There is increasing evidence that combination therapy of steroids plus HBOT significantly improves hearing in people with acute but not chronic ISSHL.<sup>5,6,21</sup> Well-controlled randomised controlled trials are required to develop treatment guidelines based on good evidence.

If steroid treatment fails, prompt HBOT is required within two weeks of mild to moderate hearing loss onset for any benefit.<sup>3</sup> HBOT may improve hearing by improving oxygen supply to the cochlea, which is dependent on adequate oxygen levels in the blood. It may also reduce inflammation which can occur in damaged tissues.<sup>17,22</sup>

There is a wide institutional variation in optimal treatment protocol for HBOT in ISSHL. The Undersea and Hyperbaric Medicine Society (UHMS) revised their practice guidelines in 2014 adding ISSHL to approved indications for HBOT, but uptake is low as not all countries fund this indication.<sup>1</sup> The UHMS suggests 10-20 HBOT treatments at 2.0 to 2.4 ATA.<sup>1</sup> Specialised HBOT treatment for ISSHL is not widely offered due to funding and access to facilities not always being available.<sup>20</sup>

## The Wesley Hyperbaric advantage

1. Wesley Hyperbaric is the only private Hyperbaric Center Day Hospital with ACHS accreditation, also compliant with Australian Standard ASNZ 4774.2: 2019.
2. Wesley Hyperbaric is one of only nine centres in Australia that provides HBOT for ISSHL.
3. Wesley Hyperbaric has a strong track record in education and research in ISSHL which informs its ISSHL treatment protocols and policies.
4. Wesley Hyperbaric provides collaborative support to research institutes both in Australia and overseas.
5. Wesley Hyperbaric is the only hyperbaric oxygen service in Australia to provide strategic psychotherapy and Eriksonian hypnotherapy for tinnitus related to ISSHL. This service is offered by appointment.
6. HBOT for ISSHL at Wesley Hyperbaric is informed by the latest research evidence and treatment protocols.
7. Patients may be able to access their private health insurance to cover their treatment.

## Hyperbaric Oxygen Therapy in the Treatment of Idiopathic Sudden Sensorineural Hearing Loss



### Latest evidence for efficacy of hyperbaric oxygen therapy in treating ISSHL

An updated Cochrane Review (2012)<sup>5</sup> of seven trials involving 392 participants demonstrated promising outcomes for HBOT efficacy in acute ISSHL, but noted the small samples and poor methodology. It reported hearing gains of 19.3dB for moderate hearing loss and 37.7dB gain for severe cases, but was not able to assess the effect of HBOT on tinnitus by pooled analysis.<sup>5</sup>

This level of improvement brought hearing deficits from the moderate/severe range into the slight/no impairment range, a significant gain that can markedly improve a patient's quality of life.<sup>3</sup>

Since the Cochrane review was published, higher powered studies have provided a stronger evidence base for HBOT, but treatment protocols still need to be standardised to offer better outcome comparisons.

A systematic review and meta-analysis in 2022<sup>20</sup> involving three prospective randomised controlled trials with a total of 88 participants over 18 years old with ISSHL found that HBOT, as a single or combination therapy with steroids, resulted in mean absolute hearing gain of 10.3 dB and a 4-fold increased likelihood of hearing recovery compared to control therapies such as steroids and/or placebo.

### Safety and efficacy profile of hyperbaric oxygen therapy in ISSHL

The most common risk of HBOT is bruising to the eardrum in patients who have difficulty equalising the pressure in their ears. This is similar to the pressure felt when in an airplane on descent. This is usually only minor and resolves by itself. Twenty percent of patients may have an episode early in treatment until they get used to the technique of equalising the pressure in their ears.

The risk of oxygen toxicity is around one in 5000 patient treatments (at 14 meters). This most commonly manifests as visual acuity changes in the lens of the eye causing a myopia but sometimes increased excitability of the central nervous system which may present as a seizure. Again, these side effects usually resolve with no specific treatment. Sometimes the lung is involved with oxygen toxicity (with a dry cough) and we give patients a break in their treatment until symptoms resolve.

Patients who are younger (<50 years old), present early (within two weeks) and have a moderate rather than severe loss of hearing may have a 60-70% chance of regaining their hearing. However, all patients who meet the criteria are offered treatment as this may allow some to improve to a level of hearing that will allow fitting of hearing aids to be of benefit.

For older patients or those who have very severe loss the results are less impressive however, the hearing improvement may be enough to allow a patient to benefit from a hearing aid when they otherwise would not.

## Tinnitus in ISSHL

ISSHL may be accompanied by tinnitus, which is very distressing for the patient,<sup>23</sup> and currently there is no cure.<sup>7</sup> Subjective chronic tinnitus is defined as a more or less continuous perception of sound in the absence of a corresponding external source, which can lead to various psychological problems like depression, anxiety, attentional deficits, and sleep disturbances.<sup>7,24</sup>

Although cognitive behavioural therapy (CBT) for tinnitus is not widely available, early evidence for its efficacy in improving word discrimination<sup>7</sup> and reducing stress and anxiety caused by tinnitus<sup>2,8,9,10</sup> is supported by a recent systematic review, of 19 randomised controlled trials (psychological therapies head-to-head) involving 1,543 patients.<sup>11</sup> Eriksonian hypnosis<sup>13-16</sup> has also shown potential to assist patients, although further rigorous trials are warranted.<sup>25</sup>

Patients with tinnitus may find their hearing improves but not the ringing in the ears that often accompanies the hearing loss. Wesley Hyperbaric can refer patients for strategic psychotherapy and Eriksonian hypnotherapy to assist with the tinnitus if this remains problematic after HBOT.

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## Looking ahead

Well-controlled randomised controlled trials will assist the future development of guidelines to standardise ISSHL treatment protocols and offer better outcome comparisons underpinned by good evidence. Further research is required to better understand the underlying mechanisms of HBOT in ISSHL to inform treatment protocols and enable provision of Medicare funding for HBOT services.

## Summary

Rapid identification of patients with ISSHL, urgent referral for audiogram and prompt initiation of steroid treatment within two weeks is vital to the possibility of hearing recovery. There is increasing evidence that timely initiation of HBOT within two weeks but up to four weeks as an adjunctive treatment with steroids significantly improves chances of recovery of hearing in acute, but not chronic, ISSHL, although randomised controlled trails are needed to inform standardisation of treatment protocols. Psychological therapy and assistance with word discrimination is showing promise to ameliorate the distressing impact of tinnitus and improve quality of life.


Access to HBOT services for ISSHL and cost of treatment to the patient remains a challenge. Wesley Hyperbaric is able to refer you to specialists that provide CBT psychotherapy and Eriksonian hypnotherapy for tinnitus related to ISSHL. The multidisciplinary holistic approach to the treatment of ISSHL and collaborative support to research institutes both in Australia and overseas places Wesley Hyperbaric at the cutting edge of the latest research evidence and treatment protocols

ISSHL is defined as loss of **≥30** over at least three contiguous frequencies over 72 hours.<sup>2</sup>

Approximately **90%** of SSHL cases are idiopathic (no obvious cause).

ISSNHL is estimated to affect **20** per 100,000 people per year in Australia<sup>2</sup> and 8-15 per 100,000 people per year worldwide.<sup>26</sup>






Rapid identification of patients with ISSHL, urgent referral for audiogram and prompt initiation of steroid treatment within two weeks is vital to the possibility of hearing recovery.



Early intervention and treatment with HBOT can markedly improve the patients quality of life.



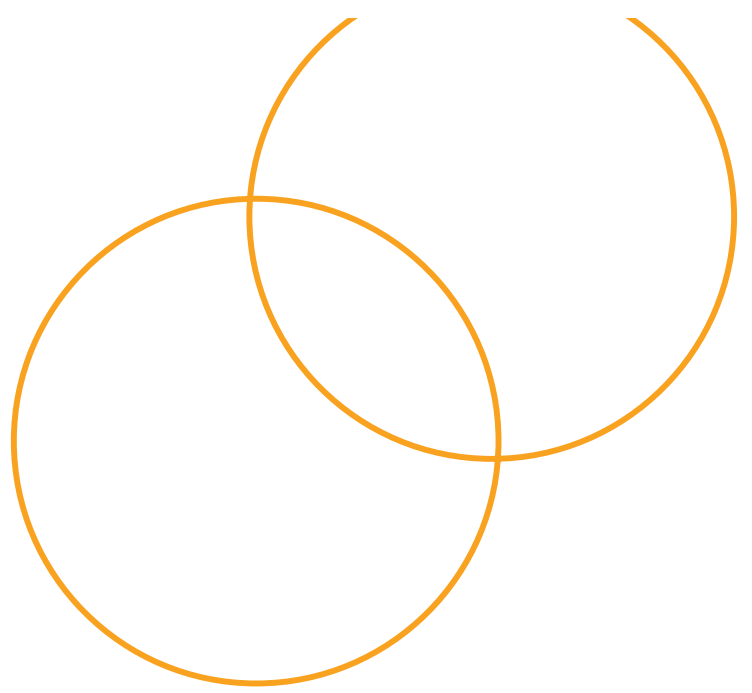
Wesley Hyperbaric recognises the importance of word discrimination in hearing recovery.

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