Hyperbaric oxygen for sudden hearing loss: Influence of international guidelines on practice in Australia and New Zealand

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Key words
ENT; General interest; Hearing loss, sudden; Hyperbaric facilities; Hyperbaric oxygen therapy; Medical society

Abstract
(Sherlock S, Kelly S, Bennett MH. Hyperbaric oxygen for sudden hearing loss: Influence of international guidelines on practice in Australia and New Zealand. Diving and Hyperbaric Medicine. 2021 March 31;51(1):68–71. doi: 10.28920/dhm51.1.68-71. PMID: 33761543.)

Introduction: Idiopathic sudden sensorineural hearing loss (ISSHL) is an otolaryngologic emergency. The Undersea and Hyperbaric Medicine Society (UHMS) revised practice guidelines in 2014 adding ISSHL to approved indications. This study investigated whether the UHMS guidelines influenced referral and practice in Australia and New Zealand.

Methods: Retrospective review of 319 patient referrals in two time periods (five years prior to addition of ISSHL to indications (T-PRE) and three years post (T-POST)).

Results: Seven of eight participating hyperbaric facilities provided data down to the level of the indication for HBOT for analysis. In T-PRE 136 patients were treated with HBOT for ISSHL, representing between 0% and 18% of the total cases to each facility. In the T-POST period 183 patients were treated for ISSHL, representing from 0.35% to 24.8% of the total patients in each facility. Comparison between the two periods shows the proportion of patients treated with ISSHL among all indications increased from 3.2% to 12.1% ($P < 0.0009$). One facility accounted for 74% (101/136) of ISSHL patients receiving HBOT in T-PRE and 63% (116/183) in T-POST. ISSHL case load at that facility increased from 18% to 24.8% ($P = 0.009$) after the UHMS guideline publication. Three of the seven units had a significant increase in referrals after the guideline change.

Conclusion: There remains equipoise regarding HBOT in the management of ISSHL. Only three out of seven units had a significant increase in ISSHL patients after the UHMS guidelines publication. Without well controlled RCTs to develop guidelines based on good evidence this is unlikely to change and practice variation will continue.

Introduction

Idiopathic sudden sensorineural hearing loss (ISSHL) is considered an otolaryngologic emergency. The clinical practice guidelines published in 2012 and updated in 2019 by the American Academy of Otolaryngology and Head and Neck Surgeons (AAOHNS) suggest consideration of hyperbaric oxygen treatment (HBOT) within two weeks of symptom onset.[1,2] The Undersea and Hyperbaric Medicine Society (UHMS) revised their guidelines in 2014 with the addition of ISSHL to the approved list of indications. The society also recommend treatment within two weeks of symptom onset for initial treatment or within four weeks if used as salvage treatment.[3] This study was designed to ascertain whether the publication of the UHMS guidelines influenced referral patterns and practices in Australia and New Zealand (A/NZ).

Methods

HREC (ethics) exemption was provided as a quality assurance project by the Royal Brisbane and Women's Ethics Committee (LNR/2019/QRBW/60494).

This was a retrospective cohort study of 319 patients with ISSHL who received HBOT in A/NZ facilities during two defined time periods before and after ISSHL was added to the UHMS guidelines. ISSHL was defined using criteria described by the National Institute on Deafness and Other Communications Disorder for consideration of HBOT.[4] Data were collected over a five-year period (Jan 2010 to Dec 2014) from eight participating units collaborating on a previously published study and compared to a data set collected over a 3-year period after the UHMS added ISSHL to their indication list.[5]

Data for the second time period (July 2016 to June 2019) was provided by the Hyperbaric Technicians and Nurses Association (HTNA) and is collected annually for their scientific meeting. The first time period is designated T- PRE and the second time period is designated T- POST. An e-survey was sent to participating units to follow up on reasons for practice variation in 2018. A total of 6,284 patients received HBOT during the study periods. One unit treated enough patients to be independently analysed and the other units' data were combined, due to small numbers, to allow comparison between the two time periods.

Comparison between groups was made using Chi-square analysis of difference in proportions, or Fischer's exact methods if any cell contained fewer than five individuals. A *P*-value of < 0.05 indicated a statistically significant result.

Results

Seven of the eight participating hyperbaric facilities were able to provide data down to the level of the indication for HBOT for analysis (facility six was excluded from analysis, (Table 1)). In the T-PRE period 136 patients were treated with HBOT for ISSHL, representing between 0% and 18% of the total cases to each facility (Table 1). Two facilities reported no patients treated with ISSHL. In the T-POST period 183 patients were treated with ISSHL, representing from 0.35% to 24.8% of the total patients in each facility. Three facilities did not provide full data for the calendar year 2017 (facilities 3, 4, 5). The comparison between the two periods suggests the overall proportion of patients treated with ISSHL increased from 3.2% to 12.1% (Chi-sq = 128.9, $P < 0.0009$).

One facility dominated the figures accounting for 74% (101/136) of all ISSHL patients receiving HBOT in A/NZ in T-PRE and 63% (116/183) in T-POST. Data from that facility showed a statistically significant increase in case load after the UHMS guideline was introduced from 18% to 25% ($P = 0.009$). The comparison for other individual units is shown in Table 1. Three out of seven units had a significant increase in referrals over the period. Two of these units were in the same Australian state.

There was wide variation between facilities in the dose of oxygen used, both in terms of treatment pressure and duration. The pressures used were 202.6 (one facility), 243.1 (six facilities) and 283.6 kPa (one facility), for periods between 90 and 120 minutes for each session. Many units were unable to provide data concerning the actual number of HBOT sessions each patient received as this is not routinely collected for HTNA datasets. Three facilities treated only Monday to Friday, whilst three treated their patients without interruption over weekends.

There were very few referrals in some states but large numbers in others. The frequency of referrals varied greatly between locations when followed up by eSurvey, with 6 units responding. One hospital received more than one per week, one more than one per month, one less than one per month, and three less than two per year.

Table 1

Treatment data from participating hyperbaric units pre- and post-publication of the UHMS guideline accepting ISSHL as an indication for HBOT. * Data for 2017 missing. † Fisher's exact test

Facility	T-PRE (2010–2015)			T-POST (2017–2019)			Chi-square (*P*-value)
	Patients receiving HBOT	Patients with ISSHL	Proportion ISSHL (%)	Patients receiving HBOT	Patients with ISSHL	Proportion ISSHL (%)	
1	558	101	18.1	467	116	24.8	6.92 ($P = 0.009$)
2	1225	20	1.6	939	25	2.7	2.5 ($P = 0.12$)
3	275	0	0	64*	0	0	–
4	972	3	0.3	253 *	9	3.5	18.6 ($P < 0.001$)†
5	228	3	1.3	50 *	0	0	–
6		Not reported			Not reported		–
7	515	9	1.7	347	32	9.2	25.6 ($P < 0.001$)
8	473	0	0	285	1	0.4	0.06 ($P = 0.38$)†
Total	4246	136	3.2%	1571	183	11.6%	128.9 ($P < 0.001$)

Discussion

The adoption of guidelines into clinical practice can be variable. In Australia there has been a tendency to adopt the UHMS guidelines for HBOT indications as they are regularly published and are evidence based. With the amalgamation of the South Pacific Underwater Medical Society (SPUMS) and the European Underwater Baromedical Society (EUBS) as co-publishers of this journal, this may change and some units may refer to the European Committee for Hyperbaric Medicine (ECHM) Consensus Statement from 2016 which also recommends HBOT for ISSHL.

Whichever guideline is more popular, in Australia and New Zealand the majority of units do not receive referrals from otolaryngologists and this continues to be the case. This is similar to the UK experience which showed that 96% of otolaryngologists in 2014 did not use HBOT to manage ISSHL despite the EUBS recommending HBOT for ISSHL in 1994.[6,7] This may reflect both the quality of the evidence and the behaviours of both patients and clinicians.[8] Patient preferences have been shown to be a barrier for general practitioners following guidelines.[9]

ISSHL management remains controversial. The definition, spontaneous resolution rate, best drug therapy and best outcomes to measure response have all been disputed.[10] This has hampered research in the area and made meta-analysis difficult as trial protocols comparing steroids and HBOT vary widely in dose of both steroids and oxygen, and for the route of administration of steroids. Many studies describe the steroid protocol in detail but provide no detail on the HBOT protocol.

A particular problem is the reporting of outcome measures across the many small outcome studies published to date. While many studies employ the pure tone audiogram (PTA) thresholds over different frequencies (PTA4 or PTA6), they inconsistently report the changes as 'mean threshold', 'absolute improvement in threshold' or 'proportional improvement in threshold', none of which can be combined without access to the raw data. There is little or no reporting of any patient–centred outcomes such as functional ability, quality of life or speech discrimination scores.

Evidence-based clinical practice guidelines by both otolaryngologists and hyperbaric groups agree HBOT should be started within two weeks of onset for initial management, and this has helped reduce some of the practice variation. However, the adoption of guidelines is not universal and considerable local differences in practice persist. Either otolaryngologists do not refer such patients, hyperbaric physicians do not accept them or both. Non-acceptance of guidelines often occurs due to a poor evidence base and the resulting vague and unhelpful guidelines for practice. Unfortunately the literature on ISSHL is generally of poor statistical quality.

A 2012 Cochrane Review analysed seven studies on HBOT for ISSHL and concluded HBOT probably improved outcomes, but the clinical significance of the improvement remains unclear due to small patient numbers and poor methodology.[11] A more recent review in 2018 concluded no significant difference between studies comparing steroids to steroids plus HBOT other than in patients with severe to profound loss. The review included 16 studies with various methodologies. Only two studies, contributing 117 patients in total, were randomised controlled trials, out of the 1295 patients included in the analysis.[12] The evidence for steroids in ISSHL is similarly contradictory and of poor quality.[13]

Facilities providing HBOT require a referral from a specialist who is managing the patient with ISSHL. The unit with the largest number of referrals usually only accepts referrals which are within the AAOHNS guidelines. Patients are not accepted if a patient has actively lobbied for a general practitioner to refer them without specialist input. While the AAOHNS advise those managing ISSHL to consider HBOT if within two weeks of onset, it seems the referral rate remains very low in A/NZ. While this may reflect a reluctance to consider HBOT as a viable alternative for geographical or financial reasons, it is possible the low referral rates reflect either late presentation to an otolaryngologist or a reluctance to refer to HBOT until a failure to respond to steroids is clear. The most active hyperbaric facility in this area confirms a high rate of late referral where the patient is unlikely to derive benefit from HBOT.[14]

As is the case for other indications, the differences in HBOT protocols probably reflects the historical treatment protocols used in different facilities. Any treatment involving 100% oxygen breathing between 202.6 kPa and 253.3 kPa, for 90 minutes and repeated 10 to 20 times is within the UHMS guideline. There is no guidance on the frequency of these sessions – daily or twice daily, or even whether they should be consecutive (including weekends), or only Monday to Friday. There was extensive variation in the number, timing and duration of air breaks for those units using a 243.1 kPa table. While air breaks were historically introduced to reduce pulmonary oxygen toxicity, many units now use them in the belief they may reduce central nervous system toxicity. A recent study did not support this supposition,[5] though another does.[15] The majority of units did not collect any meaningful quantitative outcome data.

Conclusion

There is considerable clinical equipoise remaining in the management of ISSHL and the place of HBOT. Only 3 out of 7 units had a significant increase in patients treated with HBOT after the UHMS guidelines were published. One State accounted for the majority of patients who received HBOT. Without well controlled RCTs to develop guidelines based on good evidence this is unlikely to change and practice variation will continue.

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Conflicts of interest and funding

Professor Bennett is a member of the Editorial Board for Diving and Hyperbaric Medicine. He had no role in the evaluation of this manuscript, or the decision to publish it.

Submitted: 22 July 2020
Accepted after revision: 20 December 2020