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The use of hyperbaric oxygen treatment for sudden sensorineural hearing loss in Europe

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Abstract

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Background: The aim of this study was to identify the practice differences in the use of hyperbaric oxygen treatment (HBOT) for sudden sensorineural hearing loss (SSNHL) in Europe.

Materials and methods: A questionnaire comprising nine questions was built using the surveymonkey.com website. The medical directors of hyperbaric centres in Europe were invited by e-mail to complete the survey.

Results: A total of 192 centres were invited to participate, of which 80 (41.6%) from 25 countries responded. Of these, 70 were using HBOT for SSNHL. The number of patients with SSNHL treated in these centres over a 12-month period ranged from 2 to 150 (mean 34, median 18). The majority of these centres (44 of 60) were accepting patients if they applied within 30 days of SSNHL diagnosis; 26 of these 60 centres were also treating patients presenting with tinnitus in isolation. The number of treatments ranged from five to 40 (mean 19, median 20). Forty-three of 56 centres used one session a day, whilst 13 reported using twice daily sessions for at least part of the HBOT course. Treatment duration varied between 60 and 140 minutes, and treatment pressure between 151 and 253 kPa.

Conclusion: This study has documented a wide range of approaches to the treatment of SSNHL with HBOT across Europe.

Key words

Hearing; hyperbaric oxygen therapy; hyperbaric facilities; survey

Introduction

Sudden sensorineural hearing loss (SSNHL) is characterized by a hearing loss of at least 30 dB in three sequential frequencies in the standard pure-tone audiogram developing over three days or less.[1] Hyperbaric oxygen treatment (HBOT) has been recommended in the management of SSNHL.[2–4] Although the application of HBOT appears to significantly improve hearing loss for people with early presentation of idiopathic SSNHL, the clinical significance of the level of improvement remains unclear, and a specific treatment for SSNHL is missing.[1–3] The European Committee for Hyperbaric Medicine (ECHM) and the Undersea and Hyperbaric Medicine Society (UHMS) both recognize SSNHL as an indication for HBOT and, accordingly, have released recommendations on various aspects of its utilization.[5,6] The aim of this study was to identify the practice differences in the treatment of SSNHL with HBOT amongst European hyperbaric centres.

Methods

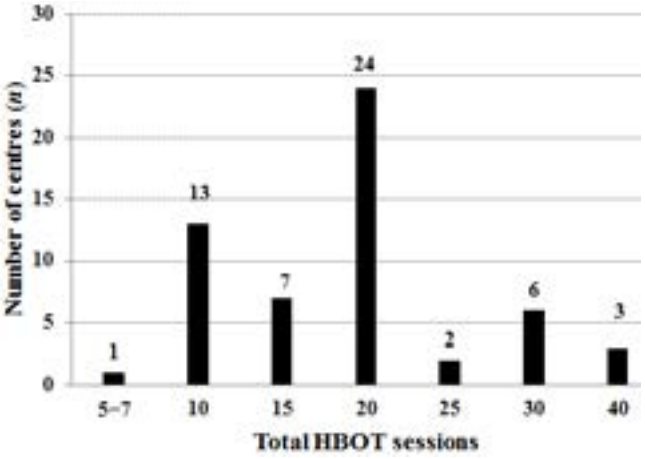
This study was conducted between 01 September and 30 November, 2014. Using a commercial online survey website,[7] we created a questionnaire* consisting of a total of nine questions. Whilst some of the questions were mandatory, others were not and response rates varied among the questions. To define our target list of facilities, we accepted inclusion in the directory of European HBOT centres on the oxynet.org website.[8] We excluded centres that did not have an e-mail address in the directory. The directors were invited to participate in this study by an e-mail containing a link directing the responders to the survey website. Non-responders were re-invited to participate in the survey at weeks two and four after study onset and the survey was closed one month after the last invitation. An Excel® spreadsheet of the answers was created and the results analyzed using basic descriptive statistics.

Results

A total of 192 centres were invited to participate, of which 80 (41.6%) from 25 different countries responded. Of these, 70 were using HBOT for SSNHL. The number of patients treated with SSNHL in the past year in each centre ranged from 2 to 150 (mean 34, median 18). Almost half of the centres responding to this specific question (26 of 60) also reported treating patients presenting with tinnitus in isolation. Twenty-six out of 56 centres noted that the treatment of SSNHL with HBOT was not covered by their national health care services. While the maximum permissible delay time to HBOT varied among centres, the majority (44 of 60) limited treatment to patients presenting within 30 days (19 within 14 days or less) of disease onset, whilst ten accepted patients even after a delay to treatment of ≥ 90 days.

*** Footnote:** Survey questionaire available on request from authors.

Figure 1
Total number of hyperbaric oxygen treatment (HBOT) sessions given for sudden sensorineural hearing loss at 56 European hyperbaric centres



The frequency of HBOT delivery varied between centres; 43 of 56 were giving one session a day whilst 13 used twice daily HBOT. Of these, ten were using twice daily HBOT only in the first three to five days, then switching to once-daily treatments thereafter. The total number of HBOT sessions delivered per patient ranged from five to 40 sessions (mean 19, median 20; Figure 1).

Treatment duration and pressure differed amongst the centres, ranging between 60 and 140 minutes and between 151 and 253 kPa, respectively. The majority of centres (48/56) were using a treatment pressure of 243/253 kPa, four were using 202 kPa, two 182 kPa and two others 151 kPa. Twenty-nine of 56 centres reported using between 90 and 105 minutes of HBOT, 20 between 120 and 140 minutes and seven 60 to 75 minutes of HBOT. The most frequently used treatment protocol was 90 minutes at 243/253 kPa by 19 of 56 centres. Forty-four of 55 centres expressed interest in participating in studies that would compare the effectiveness of different HBOT protocols in SSNHL.

Discussion

Although HBOT is now recognized as a treatment option for SSNHL by a number of national and international medical societies,[3,5,6] this study demonstrates that there are still hyperbaric centres in Europe (10 of 80 responders) that do not treat SSNHL. Given that centres that do not treat SSNHL would be less likely to respond to this survey, this proportion is almost certainly a considerable underestimate. It is possible that lack of coverage of this indication by the health care services in several countries may, in part, account for this situation.

Whilst SSNHL has been an accepted indication for HBOT (Type 2 recommendation) by the ECHM since 1994, no specific recommendations have been released concerning the maximum permissible delay duration or the treatment protocol.[5] On the other hand, the UHMS recommends its use in patients with a hearing loss greater than 40 dB who present within 14 days of disease onset.[6] Additionally, the UHMS suggests daily treatment at 202–253 kPa for 90 minutes for a total of 10 to 20 sessions.[6] In the current study, only 17 of 56 of responders were complying with both parameters of these UHMS recommendations.

Delay to HBOT is known to negatively affect treatment outcomes in patients with SSNHL.[9–11] HBOT started two weeks after the onset of the hearing loss significantly reduced the likelihood of healing.[12] In prospective randomized trials that showed beneficial effects for HBOT in SSNHL, delay to HBOT was between 48 hours and 14 days.[13–17] While current evidence, in accordance with the UHMS recommendations, indicates a benefit in the first two weeks of disease onset,[2,6] some patients presenting after this time may also experience improvement with HBOT.[18] One of the pivotal papers in this regard demonstrated that, if the onset of hearing loss was more than two but no longer than six weeks, half the cases showed a marked improvement in their hearing of more than 20 dB in at least three frequencies.[19] However, this conclusion is based on the review of observational studies rather than randomized prospective evidence.[19] The American Academy of Otolaryngology Head and Neck Foundation guideline recommends HBOT as a treatment option up to three months from symptom onset.[3]

The fact that some ENT specialists refer patients to HBOT after initial medical therapy fails, may in part account for delayed referrals. An initiative of the ECHM, the COST B14 project, has revealed that optimal cooperation between the referring ENT and the HBOT centre was crucial to minimize treatment delays.[20]

An interesting finding was the number of centres treating patients with tinnitus alone. The effectiveness of HBOT in these patents is controversial, with a Cochrane review finding no evidence to support the use of HBOT in tinnitus.[2] In addition, neither the ECHM nor the UHMS recommends the use of HBOT for tinnitus.[5,6]

The published literature on HBOT for SSNHL includes studies that utilised various treatment pressures ranging from 151 kPa to 303 kPa.[2,11–18] To our best knowledge, there has been only one study that compared the effectiveness of HBOT at different treatment pressures.[21] In this retrospective study, mean hearing gain levels in patients who received no HBOT or HBOT at 151 kPa were similar (2.6 ± 15 dB and 3.1 ± 9 dB respectively), but was significantly better with HBOT at 253 kPa (19.7 ± 23 dB). Because the baseline pure tone audiometry levels (no HBOT 32.5 ± 26.3dB; HBOT at 151 kPa 32.3 ± 27.8dB; HBOT at 253 kPa 76 ± 27.5dB) differed significantly between the groups, a firm conclusion could not be deduced from this study.

Also of note is the difference in treatment duration amongst the centres. Although we asked respondents for the 'total duration of oxygen breathing', rather than the 'total duration of the complete treatment', it is possible some centres actually reported the latter (particularly those who reported that their treatment duration with oxygen was over 120 min). The longer times in this survey may include air breaks and compression and decompression periods.

Another variation in the reported HBOT protocols was in the frequency of treatments. Whilst most centres used one session a day, some used twice-daily regimens, especially in the early part of the HBOT course. In one study of patients with SSNHL, those referred within 36 hours of exposure received twice daily HBOT for three days and once daily for an additional seven days, combined with intravenous steroid therapy followed by oral steroid therapy.[22] Patients who were referred after 36 hours received HBOT once a day for ten days combined with oral steroid therapy. While patients in both HBOT groups had better healing rates than those in a control group of patients who received oral medication only, average hearing gain and average residual hearing loss levels were similar.[22]

Our study has limitations. Although we invited non-responders to participate to the survey three times in total, the response rate remained at 41.6%. The fact that we invited centres by e-mail and not by phone, as well as language barriers, may together account for the low participation rate. Nevertheless, it was higher than a recent survey which achieved a 30% response rate from European hyperbaric centres.[23] Additionally, the rate of participation in the survey differed among countries and this may have biased our estimates of the true practice across Europe as a whole.

Conclusions

Our results showed that both the criteria for acceptance of patients with SSNHL for HBOT and the protocols used at European hyperbaric centres for this condition varied significantly. Questions remain to be answered: "*When, how and for how long should we use HBOT in the treatment of SSNHL?*" Further prospective, randomised studies are warranted.

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