



The importance of identifying eustachian tube dysfunction prior to hyperbaric oxygen therapy (HBOT): Are we able to identify those at risk for barotrauma?

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INTRODUCTION

Hyperbaric oxygen therapy (HBOT) is a common treatment modality used for various medical conditions. One commonly encountered side effect is middle ear barotrauma (MEB) with an incidence ranging from 2-82% due to eustachian tube dysfunction (ETD) [1-7].

Currently there are no objective criteria which can effectively predict and identify which patients scheduled to undergo HBOT will have MEB due to ETD. In addition, there is no consensus on the use of various treatment modalities (i.e. topical decongestants, systemic decongestants, tympanotomy tubes).

OBJECTIVES

Determine whether specific risk factors, symptoms and clinical examination findings are associated with risk of hyperbaric oxygen therapy (HBOT)-related eustachian tube dysfunction (ETD), middle ear barotrauma (MEB) and subsequent tympanotomy tube placement.

METHODS

A retrospective chart review was conducted from 2007 to 2016 of patients undergoing HBOT clearance. Patient charts were reviewed for risk factors, symptoms and clinical examination findings related to HBOT ETD and MEB. From the sum of each factor in these categories, a risk factor, symptom, clinical and HBOT susceptibility score was calculated (Supplement). Relative risk was calculated for each variable to determine risk for HBOT intolerance and need for tympanotomy tube placement.

RESULTS

Our total study population consisted of eighty-one (n=81) patients who were evaluated prior to starting HBOT. 50 (61.7%) patients tolerated HBOT. A total of 31 (38.3%) patients did not tolerate HBOT. Of those 31, 8 (25.8%) improved with oxymetazoline, while 23 (74.2%) eventually required tympanotomy tube placement).

Relative risk was calculated for each risk factor, symptom and physical examination variable as it related to HBOT intolerance and tympanotomy tube placement (Table 1).

Mean risk factor, physical examination and HBOT susceptibility score was significantly higher in patients who did not tolerate HBOT compared to patients who tolerated HBOT. Mean symptom score was higher in patients who did not tolerate HBOT compared to patients who tolerated HBOT. However, it did not reach statistical significance (Table 2).

CONCLUSIONS

- Those who reported a history of otitis media, tinnitus, vertigo and/or prior ear surgery were at a higher risk for HBOT intolerance.
- Patients who had a history of pressure intolerance and prior ear surgery were more likely to undergo tympanotomy tube placement.
- Patients noted to have otologic findings such as tympanosclerosis, monomeric tympanic membrane, and tympanic membrane retraction prior to HBOT were at a higher risk for both HBOT intolerance and need for tympanotomy tube placement.
- Patients with higher mean risk factor, physical examination and HBOT complication-susceptibility scores are susceptible to HBOT intolerance.

Table 1. Relative Risks of Factors Associated with HBOT Intolerance and Tympanotomy Tube Placement.

	HBOT Intolerance			Tympanotomy Tube Placement		
	Relative Risk	95% CI	P Value	Relative Risk	95% CI	P Value
Past Medical History						
Pressure intolerance	1.54	0.80 - 2.98	0.20	2.22	1.09 - 4.51	0.03 ^a
Rhinitis	0.44	0.12 - 1.59	0.21	0.61	0.16 - 2.23	0.45
Ear infections	2.06	1.09 - 3.90	0.03 ^a	1.83	0.64 - 5.21	0.26
Tinnitus	2.19	1.31 - 3.65	0.003 ^a	1.92	0.87 - 4.25	0.11
Hearing loss	1.54	0.88 - 2.70	0.13	1.65	0.81 - 3.35	0.17
Vertigo	2.67	2.01 - 3.54	<0.0001 ^a	0.86	0.08 - 9.73	0.90
Ear trauma	0.64	0.06 - 7.20	0.72	0.86	0.08 - 9.73	0.90
Ear surgery	2.72	2.04 - 3.64	<0.0001 ^a	3.76	2.61 - 5.43	<0.0001 ^a
Review of Systems						
Otologic symptoms	1.85	0.98 - 3.52	0.06	1.88	0.77 - 4.54	0.16
Sinonasal symptoms	0.86	0.27 - 2.77	0.80	0.57	0.09 - 3.52	0.54
Physical Examination						
Positive otologic exam	1.86	1.07 - 3.22	0.03 ^a	2.25	1.14 - 4.43	0.02 ^a
Positive sinonasal exam	1.40	0.76 - 2.58	0.29	1.01	0.40 - 2.51	0.99
Abbreviations: 95% CI, 95% confidence interval						
^a Statistically significant risk in developing HBOT (<i>P</i> value ≤ 0.05)						
^b Statistically significant risk in requiring tympanotomy tube placement (<i>P</i> value ≤ 0.05)						

Table 2. Score Results: HBOT Intolerance vs. Tolerance.

Score Type	Score, Mean ± SD ^a			
	HBOT Intolerance	HBOT Tolerance	t-score	P value
Risk Factor	0.90 ± 1.14	0.50 ± 0.79	1.73	0.04 ^b
Symptom	0.19 ± 0.48	0.12 ± 0.33	0.75	0.23
Physical Examination	0.48 ± 0.68	0.22 ± 0.51	1.87	0.03 ^b
HBOT Complication-Susceptibility	1.58 ± 1.78	0.84 ± 1.31	2.00	0.02 ^b
^a Degrees of freedom = 79				
^b Statistically significant value (<i>P</i> value ≤ 0.05)				

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