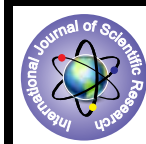


## Barotrauma in Hyperbaric Oxygen Therapy: our Experience at Institute of Naval Medicine



### Medical Science

**KEYWORDS:** Middle Ear; Barotrauma; Hyperbaric Oxygenation; Adverse effects; Otoscopy; Statistics & numerical data; Retrospective Studies; Risk Factors.

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### ABSTRACT

*Hyperbaric oxygen (HBOT) is a treatment modality in which a patient breathes near 100% oxygen intermittently while inside a treatment chamber at a pressure higher than atmospheric pressure (usually at a pressure of 2.4 Atmospheres Absolute). As in any other treatment modality, several side effects and complications from HBOT have been described. By far, the most frequent side effect is Middle Ear Barotrauma, and can be prevented or minimized by teaching auto-inflation techniques, or by inserting tympanostomy tubes.*

*A retrospective analysis of data pertaining to all patients administered HBOT during the period of one year was carried out at Institute of Naval Medicine. The overall incidence of middle ear barotrauma noted was 30 out of 123 cases corresponding to 24.3%, which is consistent with those in the literature*

### INTRODUCTION

Hyperbaric oxygen therapy (HBOT) is a treatment modality in which a patient breathes near 100% oxygen intermittently while inside a treatment chamber at a pressure higher than atmospheric pressure (usually at a pressure of 2.4 Atmospheres Absolute (ATA)).<sup>1</sup> It is approved as a primary modality of treatment or as an adjunct for a large number of indications and is also being used the world over for a number of research indications for which varying levels of evidence is available. Depending on the indication, treatment duration can vary from 45 to 300 minutes, although most treatments are in excess of 90 minutes, the number of sessions varying as per the clinical indication.<sup>2</sup>

As in any other treatment modality, several side effects and complications have been described. By far, the most frequent side effect is Middle Ear Barotrauma, and can be prevented or minimized by teaching auto-inflation techniques, or by inserting tympanostomy tubes.<sup>3</sup>

Studies, mostly European and US have reported middle ear barotrauma incidence ranging from as low as 2% to as high as 67%.<sup>4,5</sup> To our knowledge no data of patients in India are available in the public domain. We report our experience of Middle Ear Barotrauma during HBOT at the Institute of Naval Medicine, for a period of one year.

### MATERIALS AND METHODS

At this centre, before commencement of HBOT, a detailed history is elicited and examination of patients is carried out to assess patients' fitness for HBOT.<sup>7</sup> This includes a mandatory otoscopy and a referral for wax removal if so required. Thereafter, patients are briefed about the treatment procedure which mandatorily includes teaching, explaining and practising middle ear equalisation techniques to prevent occurrence of middle ear

barotrauma. Thereafter, pre-HBOT and post-HBOT examination (including otoscopy) of all patients is carried out to assess their clinical condition as well as monitor development of any complications. Occurrence of middle ear barotrauma is recorded in the patients' record sheet and is classified according to Modified Teed Classification.<sup>6</sup> Depending on the patient's condition, HBOT is discontinued for a few days during which treatment for barotrauma is prescribed.

In this study, a retrospective analysis of data pertaining to all patients administered HBOT during the period of one year was carried out. Incidence of Middle Ear Barotrauma was calculated against the number of patients being administered HBOT. Data was analysed using MS Office Excel 2013.

### RESULTS

123 patients having various clinical indications for HBOT representing 2126 treatment sessions were analyzed. The overall incidence of middle ear barotrauma noted was 30 out of 123 cases corresponding to 24.3%. Distribution of patients developing middle ear barotrauma as per age and sex is given as per Table 1. The highest incidence of middle ear barotrauma was seen in the age group of >65 years of age. Of the total of 30 cases of middle ear barotrauma, 25 cases (83.33%) were seen in patients >45 years of age.

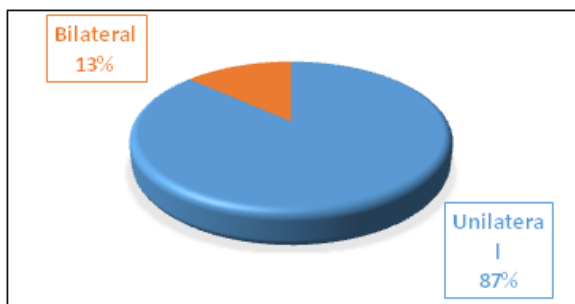
Category	Total no of Patients	No of Cases of Middle Ear Barotrauma	
<b>Sex Distribution</b>			
Male	74	14	18.91
Female	49	16	32.65
Total	123	30	24.39
<b>Age Distribution</b>			
<25	7	1	14.29

25 – 34	16	1	6.25
35 – 44	18	3	16.67
45 – 54	37	9	24.32
55 – 64	22	7	31.82
> 65	23	9	39.13
Total	123	30	24.39

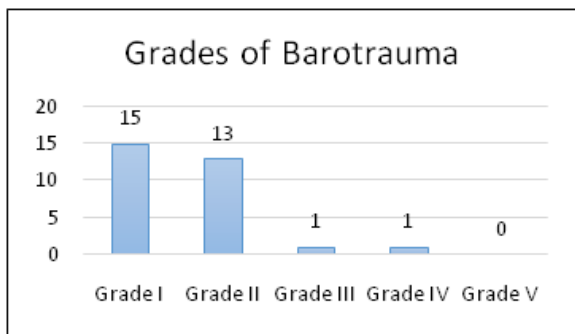
**Table 1: Age and Sex distribution of patients**

Of the 30 patients who developed middle ear barotrauma, 26 were unilateral and 4 cases had bilateral barotrauma (Figure 1). Most patients had Grade 1 or Grade 2 barotrauma (Figure 2). No patients developed Grade 5 barotrauma.

Out of the 30 cases of middle ear barotrauma, 28 occurred during the first sitting of HBOT itself. Two cases reported middle ear barotrauma in the first as well as the second sitting of HBOT. On occurrence of middle ear barotrauma, all patients were given a break of four days after which HBOT was recommenced. Middle ear barotrauma did not result in any patient to drop out from HBOT.



**Figure 1: Unilateral and bilateral Middle Ear Barotrauma**



**Figure 2: Grades of Middle Ear Barotrauma (as per Modified Teed Classification)**

**DISCUSSION**

Saunders had reported that incidence of middle ear barotrauma during HBOT ranged from 2% to 94%.<sup>4</sup> The overall incidence of middle ear barotrauma in our study too is consistent with those in the literature.

The incidence of middle ear barotrauma is important for patients undergoing HBOT because it can lead to interruption of treatment or delay in commencement of treatment. In our study, all of middle ear barotrauma was minor (Grade 1 and Grade 2) and therefore treatment sessions were interrupted only for a short period of three-four days for each patient. Thereafter HBOT was continued with concurrent nasal decongestant sprays, anti-histaminics and reinforced counselling on auto-inflation techniques.

Incidence of middle ear barotrauma is also related to the rate of compression of HBOT chamber. Sanders mentioned in his study on middle ear barotrauma that a rate of compression of 2 psi per minute was adequate in preventing the occurrence of middle ear barotrauma and a compression at any slower rate did not add to the reduction in number of cases of middle ear barotrauma. In our centre too, we compress the chamber at a rate of 2 psi per minute and is therefore consistent with other literature.<sup>4</sup>

Another important aspect in the development of middle ear barotrauma is the understanding and practise of auto-inflation techniques inside the HBOT chamber. We noted in our study that a vast majority of the patients (25 out of 30) were in the age group of 45 and above. This data is important because most of the patients reporting for HBOT are in the age group of >45 yrs. In these patients, it is imperative for us that more time be devoted towards explaining and making them practise auto-inflation techniques before subjecting them to HBOT.

Further to the discussion on understanding of auto-inflation techniques, generally it has been seen at our centre that patients with lower literacy level do have higher incidence of middle ear barotrauma. Till date, we did not record literacy level as a result of which we cannot substantiate this statement. However, towards this effect, we have added literacy level in our pre-HBOT data sheet and commenced recording literacy level as part of our initial history taking.

In conclusion we are of the opinion that HBOT is a safe treatment modality with minimal overall risk. Middle ear barotrauma is the most common complication in HBOT but it does not result in discontinuing HBOT for the patient all together. Proper screening of patients to rule out any predisposing illness and proper practise of auto-inflation techniques before commencement of first HBOT session can go a long way in keeping incidence of middle ear barotrauma low.

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