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Hyperbaric Oxygen Therapy Side Effects – Where Do We Stand?

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I recently had the opportunity to present this topic at the ACCWS 7th Annual Symposium. The following is a synopsis of that presentation. We use hyperbaric oxygen therapy (HBOT) for a variety of both elective and emergent indications. It is always important to weight risk and benefit when considering patients for therapies such as HBOT. In addition to an understanding of the benefits, we must also be able to discuss the potential side effects with our patients.

HBOT side effects are primarily the result of increased pressure or hyperoxia. When we consider the effects of pressure, we must consider physiologic and pathologic air spaces within the human body. This should lead us to consider the middle ear, sinuses, dental air spaces following a procedure, and anatomic lung abnormalities.

Middle ear barotrauma (MEB) is one of the most common side effects encountered as a result of hyperbaric oxygen therapy. There has been wide variation in the incidence reported in the past, but a more recent publication indicated an incidence of 43% with a vast majority (84%) of these being minor trauma (TEED 1 or 2 – tympanic membrane (TM) injection or TM slight hemorrhage) and no cases of TM rupture.¹ Risk factors that have been identified include a very slow or high rate of compression (2 psi/min recommended), intubation, acute upper respiratory infection, and a history of head and neck malignancy.

Sinus/Paranasal barotrauma is thought to be the 2nd most common barotrauma after MEB, but the exact

incidence is not well established. Dental barotrauma (tooth squeeze) incidence is also not well established, but it has been reported at 0.26–2.8% of aircraft passengers and 9.2–21.6% of civilian divers.² Both these forms of barotrauma can occur either during compression phase or during decompression phase a ‘reverse squeeze’ during the expansion phase. Pulmonary barotrauma should not occur with normal lungs and an open glottis. It is important to obtain screening chest x-ray prior to HBOT to rule out any anatomic abnormalities (i.e. bullous lung disease) and avoid treatment if there is active bronchospasm or mucous plugging.

In addition to side effects as a result of pressure changes, there are also side effects as a result of hyperoxia. One of the rare yet most concerning of these is oxygen toxicity seizure. The risk has been historically reported at 1 in 10,000 treatments, but more recent evidence suggests the risk is closer to 1 in 2000–3000 treatments. Risk factors that have been identified include higher treatment pressure, carbon dioxide retention, hypoglycemia, brain tumor/brain soft tissue radionecrosis, and carbon monoxide poisoning.³ Pulmonary oxygen toxicity is not expected from routine daily HBOT used for typical elective indications. One should consider the possibility if using an extended US Navy treatment table 6 or frequent high pressure treatment for an indication such as central retinal artery occlusion. Symptoms do resolve rapidly when the exposure is removed. Finally, hyperoxic myopia is another common side effect from HBOT. The incidence has been reported at 25%–100% in previous literature, although the incidence seems closer to 100%. It is a reversible effect within 6–8 weeks of HBOT completion. Cataract de novo formation

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is not expected with limited HBOT exposure (no more than 60 treatment course), but HBOT can cause more rapid progression of pre-existing cataracts.²

A few miscellaneous side effects include confinement anxiety which has been reported at an incidence of 8 in 10,000 treatments although it is likely more common.² Hypoglycemia is a risk of HBOT and can increase the likelihood of oxygen toxicity seizure, but symptomatic hypoglycemia is actually quite rare. One recent publication suggested an incidence of symptomatic hypoglycemia of only 0.19%.⁴ HBOT effect on blood pressure has been found to be minimal with overall increase of only 7 mmHg systolic, 4 mmHg diastolic, and 5 mmHg mean arterial pressure.⁵ Finally, acute pulmonary edema is unlikely with reported incidence of 0.1% and 0.02%. It should not occur in the presence of a normal cardiac output. Risks include a low ejection fraction (<35%) and severe aortic stenosis.⁶

It is important to quantify both benefit and risk when considering use of hyperbaric oxygen therapy. The goal of this editorial is to provide additional information towards

that goal. More detailed information should be sought out including the references listed below.

References

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