

Q. What is hyperbaric oxygen therapy?

A. Hyperbaric oxygen therapy (HBOT) involves breathing oxygen in a chamber with higher than normal atmospheric pressure, resulting in increased amounts of oxygen gathered by the lungs and dissolved in the blood (Eve, Steele, Sanberg, & Borlongan, 2016; U.S Food and Drug Administration [FDA], 2013; Hyperbaric Chamber, 2017). HBOT thus far has been approved by the FDA for 13 uses, none of which includes treatments for mental health conditions. Approved uses include treatment for air or gas embolisms, carbon monoxide poisoning, decompression sickness, and thermal burns (FDA, 2013). More recently, HBOT has been investigated as a treatment for brain disorders such as traumatic brain injury (TBI) and post-concussive syndrome. Due to the high comorbidity between TBI and posttraumatic stress disorder (PTSD), as well as the overlapping symptom profile, HBOT has been proposed as a treatment for PTSD as well.

Q. What are the potential mechanisms of action underlying HBOT for the treatment of PTSD?

A. The mechanisms behind the therapeutic effects of HBOT are complex, but suggest that exposure to higher than normal atmospheric pressure increases levels of oxygen in the blood which, in turn, improves oxygen delivery to tissues to aid in fighting infection and minimizing injury (FDA, 2013; Liu, Khatibi, Sridharan, & Zhang, 2011). For example, HBOT was first used to relieve tissue hypoxia (oxygen deficiency) that occurs in a range of injuries and illnesses (Sjöberg & Singer, 2013). There is some preliminary evidence, mostly from animal studies, to suggest that PTSD is associated with decreased nitric oxide production. HBOT advocates propose that increasing blood oxygen could help treat PTSD by raising nitric oxide levels (Bersani et al., 2015). However, at this time there is a lack of evidence demonstrating that PTSD can be effectively treated via these mechanisms.

Q. Is HBOT recommended as a treatment for PTSD in the Military Health System (MHS)?

A. **No.** The 2017 VA/DoD *Clinical Practice Guideline for the Management of Posttraumatic Stress Disorder and Acute Stress Disorder* states that there is insufficient evidence to recommend for or against HBOT.

The MHS relies on the Department of Veterans Affairs (VA)/Department of Defense (DoD) clinical practice guidelines (CPGs) to inform best clinical practices. The CPGs are developed under the purview of clinical experts and are derived through a transparent and systematic approach that includes, but is not limited to, systematic reviews of the literature on a given topic and development of recommendations using a graded system that takes into account the overall quality of the evidence and the magnitude of the net benefit of the recommendation. A further description of this process and CPGs on specific topics can be found on the VA clinical practice guidelines website.

Q. Do other authoritative reviews recommend HBOT as a treatment for PTSD?

A. **No.** Other authoritative reviews have not substantiated the use of HBOT for PTSD.

Several other recognized organizations conduct systematic reviews and evidence syntheses on psychological health topics using similar grading systems as the VA/DoD CPGs. These include the Agency for Healthcare Research and Quality (AHRQ) and Cochrane.

- AHRQ: No comparative effectiveness reviews were identified that include HBOT as treatment for PTSD.
- Cochrane: No systematic reviews were identified on HBOT as treatment for PTSD.

Q. Is there any recent research on HBOT as a treatment for PTSD?

A. A March 2021 literature search identified no randomized controlled trials of the therapeutic use of HBOT for PTSD. There have been a small number of case studies and uncontrolled trials, but these studies lack the methodological rigor for treatment conclusions to be drawn. There are clinical trials evaluating the efficacy of HBOT as a treatment for cognitive dysfunction or persistent post-concussive symptoms after TBI, which examine PTSD symptoms as a secondary outcome, but there are no trials examining the effects of HBOT on PTSD in patients with a primary PTSD diagnosis (Hart et al., 2019).

Q. What conclusions can be drawn about the use of HBOT as a treatment for PTSD in the MHS?

A. Because there is insufficient evidence that HBOT is effective in the treatment of PTSD, HBOT is not recommended by current guidelines or authoritative reviews. Randomized controlled trials with adequate placebo controls that utilize consistent treatment protocols are needed to establish the efficacy of HBOT as a treatment for PTSD (Biggs, Littlejohn, & Dainer, 2021).

References

- Bersani, F. S., Wolkowitz, O. M., Lindqvist, D., Yehuda, R., Flory, J., Bierer, L. M., ... & Epel, E. S. (2016). Global arginine bioavailability, a marker of nitric oxide synthetic capacity, is decreased in PTSD and correlated with symptom severity and markers of inflammation. *Brain, Behavior, and Immunity*, *52*, 153–160.
- Biggs, A. T., Littlejohn, L. F., & Dainer, H. M. (2021). Alternative uses of hyperbaric oxygen therapy in military medicine: Current positions and future directions. *Military Medicine*. Advance online publication. doi:10.1093/milmed/usab022
- Department of Veterans Affairs/Department of Defense. (2017). *VA/DoD clinical practice guideline for the management of posttraumatic stress disorder and acute stress disorder. Version 3.0*. Washington, DC: Department of Veterans Affairs/Department of Defense.
- Eve, D. J., Steele, M. R., Sanberg, P. R., & Borlongan, C. V. (2016). Hyperbaric oxygen therapy as a potential treatment for post-traumatic stress disorder associated with traumatic brain injury. *Neuropsychiatric Disease and Treatment*, *12*, 2689–2705.
- Hart, B. B., Weaver, L. K., Gupta, A., Wilson, S. H., Vijayarangan, A., Deru, K., & Hebert, D. (2019). Hyperbaric oxygen for mTBI-associated PCS and PTSD: Pooled analysis of results from Department of Defense and other published studies. *Undersea & Hyperbaric Medicine*, *46*(3), 353–383.
- Hyperbaric Chamber, 21 C.F.R. § 868.5470 (2017).
- Li, X. M., Han, F., Liu, D. J., & Shi, Y. X. (2010). Single-prolonged stress induced mitochondrial-dependent apoptosis in hippocampus in the rat model of post-traumatic stress disorder. *Journal of Chemical Neuroanatomy*, *40*(3), 248–255.
- Liu, W., Khatibi, N., Sridharan, A., & Zhang, J.H. (2011). Application of medical gases in the field of neurobiology. *Medical Gas Research*, *1*, 13–31.
- Sjöberg, F. & Singer, M. (2013). The medical use of oxygen: A time for critical reappraisal. *Journal of Internal Medicine*, *274*, 505–528.
- U.S. Food & Drug Administration. (2013, August 22). Hyperbaric oxygen therapy: Don't be misled. Retrieved from <https://www.fda.gov/ForConsumers/ConsumerUpdates/ucm364687.htm>

