



EUBS & ECHM position statement

on Hyperbaric Oxygen Therapy (HBOT) in multiplace hyperbaric chambers during the Coronavirus disease (COVID-19) outbreak

In Europe, most of Hyperbaric Oxygen (HBO) sessions are conducted in multiplace chambers under the direct supervision of medical personnel. Regardless of strict cleaning and disinfection procedures of breathing masks or oxygen hoods implemented in all hyperbaric medical facilities, a cumulation of several patients in the confined space creates the risk of cross-infection when concerning highly infectious germs, including coronavirus. This is of great concern taking into account advanced age of most patients with specific indications for HBOT, e.g. diabetic foot lesion, as well as severe comorbidities usually present in some patients, e.g. immunocompromised state in patients with post-radiation tissue injuries or immunosuppression by using steroids in patients with sudden deafness, to name a few.

Taking into account the current epidemiological situation in Europe due to coronavirus disease (COVID-19) outbreak, **it is highly recommended that every single medical hyperbaric facility should re-evaluate the risks of using HBOT for specific indications as the extension of standard risk analysis and compliance to the recommendations of the Hospital / Health Authorities.** This evaluation should include at least:

- epidemiological restrictions for medical services in the region, hosting hospital (if any) and location of the HBO centre,
- the urgency for using HBOT in every single patient,
- limitation of indications for HBOT and number of sessions to the minimum taking into account clinical indication, treatment progress, patient's age and general status and comorbidities,
- size of the chamber and possibilities to separate occupants inside.

The following recommendations for conducting HBO session should be considered if there is an increased risk of COVID-19 in the region where the hyperbaric facility operates or from which patients are referred for HBOT. Any other general recommendations issued by the Hospital / Health Authorities, i.e. washing hands, limitation of persons in the locker room and waiting area, should be followed.

For every non-intensive care HBO session without patients with confirmed or suspected COVID-19, it is **recommended**:

1. not to allow patient or medical personnel with clinical signs or symptoms of infection or reporting episodes of recent fever (not necessarily just before the HBOT session). Patients should be instructed to abstain from arriving at HBO centre in such cases.
2. To limit the number of chamber occupants in every session to ensure the proper distance between persons (minimum 1.0 m in all directions). For some chambers, this can mean single patient per session (plus medical attendant).
3. To isolate patients from ambient air by starting to breathe through the individual breathing systems (masks or hoods) as soon as possible after closing the hatch, even before reaching a therapeutic level of pressure. Such breathing should continue until the end of decompression (or until exhalation valves allow).
4. To limit or preferably eliminate air-breaks, if such breaks are conducted using internal atmosphere of the chamber and not by switching breathing gas inside closed breathing systems.
5. That medical attendants use a proper personal protection mask (as recommended by appropriate authority) throughout the session and switch to the oxygen breathing system only for decompression (if applicable). After session, the personal mask should be discarded as by instruction manual. Alternatively, the medical personnel can either use Nitrox 50% oxygen / 50% nitrogen during whole session or stay within the personal lock with the closed hatch between compartments.
6. To either discard or disinfect properly patient's individual breathing system after every HBO session ensuring that no part is stored in the personal lock.
7. To clean and disinfect the hyperbaric chamber between sessions with appropriate solutions using broad-spectrum agents against pathogens also covering (corona)viruses and compatible with the chamber materials. The chamber atmosphere should be appropriately cleaned with closed UV systems (avoiding direct exposure on PVC windows).

For severe cases of direct life-threatening disorders which are indications for HBOT (e.g. gas embolism, necrotizing soft tissue infection, gas gangrene, severe carbon monoxide intoxication) in a patient with confirmed or suspected COVID-19, HBOT should be conducted only after careful evaluation of all risks related with the primary disease, comorbidities, possibilities for transportation as well as for safely conducting HBO sessions.

All the abovementioned recommendations (1 through 7) are still valid with the following additional ones:

8. a medical attendant should wear proper isolating garments, including a personal mask (as recommended by appropriate authority) according to the standard procedures for coronavirus during the hyperbaric session. This creates an additional risk of fire due to HBO non-compatible materials. Double-check of a fire-fighting system including manual fire extinguishers inside the hyperbaric chamber is a must with increased alertness of both attendant and the chamber operator. Fractional amount of oxygen inside the chamber should be kept at 21% keeping in mind the risk of local oxygen clouds.

9. If conscious, the patient should wear the proper protective mask (as recommended by appropriate authority) until switching to the hyperbaric closed breathing system (mask or hood). The protective mask should be properly discarded, and new mask should be used after stopping breathing through hyperbaric breathing system. As depending on the material of the protective mask, after additional risk-analysis, there is a possibility to use this mask under oxygen hoods for the whole hyperbaric session. Optionally, in order to decrease the risk of oxygen cerebral toxicity, in non-anaerobic infections, HBO treatment pressure can be decreased from 2.4-2.5 ATA to 2.0-2.2 ATA.

For every patient with confirmed or suspected COVID-19, unless considered absolutely necessary to mitigate **Life-Limb Threatening (LLT) or severe functional incapacity conditions**, it is recommended to avoid/postpone HBO due to:

- involvement of pulmonary tissue which can lead to unknown efficacy of the HBO session, as well as an unpredictable effect of oxygen toxicity on involved pulmonary tissue,
- inability of safe attendance using currently available full-body protective disposal uniforms / patient protective masks.

The possibility that HBOT may have a beneficial effect in the treatment of certain patients with COVID-19 cannot be excluded and recent, although very limited case study reporting, suggest a possible effect in ameliorating patient symptoms. The current level of anecdotal reporting does not allow for recommendations nor the issuing of guidelines with respect to the use of HBOT in the specific treatment of covid-19. The mode of action of HBOT could be due to mechanisms such as e.g. alleviating the oxygen debt caused by the ventilation/perfusion mismatch, reducing the inflammatory reactions and/or the effect of SARS-CoV2 on the oxygen-carrying capacities of hemoglobin, or other mechanisms which are still insufficiently documented in this setting and thus remain speculative in some aspects.

Multiple clinical research projects using HBOT as adjuvant therapy in COVID-19 are currently being conducted worldwide. The EUBS welcome and encourage the use of HBOT as part of preplanned and ethically approved randomized trials.

For the time being, in accordance with the ECHM Consensus Conference 2016 recommendations for conditions in which HBOT is considered not to be indicated ¹, we propose that HBOT is used for COVID-19 outside a research setting only after careful consideration of the benefit/risk balance for each specific patient and the possible alternative treatments, as well as recognising that HBOT may be harmful by withholding/interrupting essential supportive treatments or exposing staff and other patients to a risk of SARS-CoV2 infection.

¹ Mathieu D, Marroni A, Kot J. Tenth European Consensus Conference on Hyperbaric Medicine: recommendations for accepted and non-accepted clinical indications and practice of hyperbaric oxygen treatment. *Diving Hyperb Med.* 2017 Mar;47(1):24-32. doi: 10.28920/dhm47.1.24-32. Erratum in: *Diving Hyperb Med.* 2017 Jun;47(2):131-132. PMID: 28357821; PMCID: PMC6147240.

In case of any doubts, please contact the ECHM (www.ECHM.org) or EUBS (www.eubs.org).

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