

HyperBaric Oxygen Therapy (HBOT) in the Emergency from COVID-19: Position Statement in Italy

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Abstract

Abstract: World Health Organization (WHO) called pandemic the novel SARS-CoV-2 (Severe Acute Respiratory Syndrome Corona Virus 2) causing COroNaVirus Disease-19 (COVID-19); this clinical condition is significantly impacting the safety aspect, in all the ways in which health care, generally speaking, is now usually delivered. In the presence of a particularly contagious and/or aggressive infection, i.e. coronavirus, undoubtedly there is an increased relative risk of infection administering any therapy in a confined room, therefore You have to agree that infection transmission is consequently facilitated in hyperbaric chamber environments. This document has been jointly worked out by all the Italian Scientific Societies and Associations in the Hyperbaric Medicine field (SIAARTI, SIMSI, ANCIP, ASPATI); it analyzes both guidelines and recommendations that must be proposed, from now on, to all of the public and private stakeholders nationwide operating in the field of the HyperBaric Oxygen Therapy (HBOT) Services. Concomitant government provisions, as well as the mandatory behaviors resulting from such a consensus, are stringent but necessary for a reduction of the infection; reduction in disseminating the infection must be the primary end-point whose corner stones are social distancing and sanitization. Any Italian Diving & Hyperbaric Medicine Unit (DHMU), is currently administering HBOT only in multiplace chambers (where several patients can be simultaneously allocated, and where they will be seated or laid on a stretcher according to their clinical needs). Therefore HBOT showed itself to be a treatment that exposes to the critical issues of a confined space, leading to some inevitable considerations in terms of safety for both patients and healthcare professionals.

For these reasons the document opts out that for every patient with a confirmed or suspected COVID-19 positivity, even in the absence of pneumonia: HBOT is not recommended, but in cases in which he/she be exposed to an immediate life-threatening risk if not treated. This document will probably be just the 1.0 version of this national statement, as this threat is still in front of us and almost surely we are going to need some upgrades in the forthcoming future.

Introduction

To date the World Health Organization (WHO) called pandemic the SARS-CoV-2 (COVID-19). COVID-19 is also significantly impacting the safety aspect, in all the ways in which health care, generally speaking, is now usually delivered. The provisions to be followed

are stringent, but necessary for the reduction of the infection: this must be the primary endpoint [1]. This document has been jointly worked out by all the Italian Scientific Societies and Associations of the Hyperbaric Medicine discipline (SIAARTI, SIMSI, ANCIP, ASPATI); it analyzes both guidelines and recommendations that must be proposed, from now on, to all of the public and private stakeholders nationwide operating in the field of the HyperBaric Oxygen Therapy (HBOT) Services.

The infection responsible of COVID-19, in order to be related to health care (also in the specific case of HBOT), must be traceable only to those moments following the start of the treatments, and usually at least 48 hours after than that.

Any Italian Diving & Hyperbaric Medicine Unit (DHMU), is currently administering HBOT only in multiplace chambers (where several patients can be simultaneously allocated, and where they will be seated or laid on a stretcher according to their clinical needs). Therefore, in terms of a possible major exposure to contagious infections, HBOT showed itself to be a treatment that exposes to the critical issues related to the presence of many subjects in a confined space, leading to some inevitable considerations about safety for both patients and healthcare professionals. In the presence of a particularly contagious and/or aggressive infection, i.e. coronavirus, one would presume that there is an increased relative risk of infection in a confined space with multiple individuals, such as a hyperbaric chamber [2,3].

Technical Report

The Decree of the President of the Council of Ministers (DPCM) dated March 4th, 2020 and its subsequent revisions (as of March 20th, 2020), prescribe to maintain, in any social contact, an interpersonal distance of more than one meter, with a maximum exposure time of 15 minutes for distances of less than two meters [4,5,6]. The surfaces of the premises where COVID-19 patients are treated or can tarry, could maintain contamination for a long time in the absence of an adequate sanitization [7,8,9,10], while there is still no specific data on the circulation of droplets inside the hyperbaric chamber during pressurization phases and at depth.

At the present time, even within a hyperbaric chamber, both social distancing and sanitization are still proving to be fundamental in fighting the spreading of this infection, obviously without prejudice to the maintenance of all those other general and specific obligations that are already set for the usual operations of national health activities. About sanitization: SARS-CoV-2 is eliminated after 1 minute of exposure either to ethanol solution at 62-71% (alcohol), or to hydrogen peroxide at 0.5% (oxygenated water), or to sodium hypochlorite at 0.1% (chlorine, bleach) [4].

Discussion

During a pandemic, such as the one we are nowadays experiencing, where lock-down appears the first choice to get an immediate reduction of the risk of infection (and at least until an adequate bending of the curve registering the new cases): it is recommended to limit DHMU operations only to those urgencies/emergencies that are presenting an indication to HBOT that cannot be postponed.

Given that actual recommendation is to strictly limit treatments solely to urgencies/emergencies, each DHMU Medical Director - in case of differing case-specific orientations - will have to assess those risks of administering HBOT in those specific cases and, until the return to normal operating conditions, will have to keep full adherence to what recommended by the competent Authorities, as of the date, and perform an in extended analysis of both standard and specific risks [\[1,2\]](#).

The specific assessment required should include at least:

- eventual restrictions to medical services that were issued in the meanwhile in the Region where that DHMU is located (due i.e. to epidemiological considerations);
- physical dimensions of the available hyperbaric chamber, and ability to distance the occupants inside the unit;
- each single patient evaluation as per his/her real individual need for HBOT and the number of treatments needed;
- eventual consequences arising from deferring HBOT, always taking into account both the patient's age, general health conditions, comorbidity and possible clinical response to treatment.

Present government instructions [\[6\]](#) and good practice regulations [\[2,3,4,5\]](#) suggest to:

1. Use, as a primary prevention strategy and where possible, remote consultation, offering a consultation by remote telecommunications between doctor and patient.
2. Check the patient's self-certification (questionnaire) for
 - a. absence of a quarantine measure as of the date (due to the absence of having been diagnosed or presumably diagnosed with COVID-19),
 - b. his/her not having been exposed to positive COVID-19 people,
 - c. absence of signs or symptoms related to a respiratory infection.

3. Exclude from treatment all patients who are presenting respiratory symptoms [regardless of the presence or not of fever ($BT \geq 37.5 \text{ } ^\circ \text{C}$)]; keep a daily monitoring of those patients already under HBOT.
4. Restrictively regulate the access to the premises of the Hyperbaric facility for caregivers, ambulance staff and consultants.
5. Require each patient under HBO treatment to sanitize hands (water and soap or an adequate hydroalcoholic solution) both at the entrance and the exiting the Unit.
6. Organize the positioning of any single patient, both in waiting areas and in the hyperbaric chamber as well, so to always grant an interpersonal distance of not less than one meter, at any time.
7. Prefer disposable breathing circuits that have to be changed with each treatment. In the case HBOT masks and respiratory circuits are instead routinely sterilized, given a current increased relative risk: it is recommended to insert a second cross-check in the procedure used in verifying the proper sterilization of these devices.
8. Verify that in-chamber assistant (Tender) is using the appropriate facial PPE (FFP3/FFP2/KN95 mask, according to specific risk assessments). This PPE will be worn by the operator throughout the hyperbaric treatment, until the adopted dive profile has to require a possible switch to an oxygen-breathing mask. Alternatively, the medical staff can breathe a mixture of 50% oxygen / 50% nitrogen, during the whole hyperbaric dive. At the end of the required/timed oxygen breathing, the in-chamber assistant must wear again his/her facial PPE, taking care in avoiding possible contamination.
9. Eliminate the usual ambient-air breaks at depth, preferably by an automatically switching and directly in mask, from oxygen to air and vice versa. It is necessary to take into account an increased probability - for some patients - of incurring seizures during the dive in case of one's keeping continuous oxygen breathing throughout the treatment.
10. Patients have to use surgical masks whenever they are not wearing their HBOT masks.
11. Maintain a close adherence to disinfection and sanitization procedures, complying with the protocols recommended by hospital/health Authorities and to be carried out at the end of each HBO treatment.

In a patient confirmed, or even suspected for COVID-19 positivity, and affected by life-threatening disease that is among the accepted indication to HBOT (e.g.: gas embolism, necrotizing soft tissue infection, gas gangrene, severe carbon monoxide intoxication), the

therapeutic dive should be conducted only after a careful evaluation of all those risks related to the primary disease, the comorbidities, the transportation of that patient, as well as the possibility of a safe administering of the HyperBaric Oxygen treatment.

Conclusions

At the present time few other additional recommendations are to be added, as it follows:

1. During the hyperbaric treatment, an in-chamber medical assistant would have to wear appropriate impervious gowns, gloves, and a personal mask (as recommended by the competent authority) according to standard coronavirus procedures during the hyperbaric dive. The fractional amount of oxygen inside the chamber should be kept as close as possible at 21%, keeping in mind the possible risk of some in-chamber oxygen-entrapments.
2. If conscious, the patient should wear the proper protective mask (as recommended by appropriate authority) until switching to the hyperbaric breathing closed-system (mask or hood). Then the protective mask should be properly discarded and a new mask should be used after stopping breathing through the hyperbaric breathing system.
3. It is reaffirmed that, for every patient with confirmed or suspected COVID-19, even in the absence of pneumonia: HBOT is not recommended, except in cases in which he/she be exposed to an immediate life-threatening risk if not treated.

References

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