PHOTO ESSAY

Guided tour to the hyperbaric oxygen therapy center in Hong Kong

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On 29 September 2022, a guided tour to the hyperbaric oxygen therapy (HBOT) center at the Pamela Youde Nethersole Eastern Hospital was held. Central retinal artery occlusion (CRAO), also known as ocular stroke, is an ophthalmic emergency that may result in blindness.[1,2] Its treatments include breathing into a paper bag, carbogen inhalation,[3] intraocular pressure lowering medications, ocular massage, anterior chamber paracentesis,[4] thrombolysis,[5] and HBOT.[6] In 2018, the HBOT center was set up for treatment of CRAO.[6,7]

The HBOT center is equipped with multiple chambers (Haux-Starmed-Quadro 3300-2300) with three locks: main lock, emergency lock, and intensive care unit lock (**Figure 1**). The entire chamber is measured 13 m (length) × 3.8 m (width) × 2.8 m (height) and weighed about 100 tonnes; it has a maximum capacity of 16 patients. Most patients with CRAO are ambulatory with no ventilation problems and are treated in a chamber where patients sit on the sofa and wear a transparent hood that delivers 100% oxygen for breathing, while the chamber is pressurized

Figure 1. (a) An overview of the three locks of the hyperbaric oxygen chamber. (b) The chamber for ambulatory patients with central retinal artery occlusion who sit on the sofa and wear a transparent hood that delivers oxygen during treatment. (c) A stretcher is placed in the intensive care unit lock. Balloons are used to demonstrate pressurization and depressurization. (d) A toilet is located behind the orange curtain. Patients are kept under pressurization while going to toilet.

Figure 2. An enabling lock in the hyperbaric oxygen chamber.

Figure 3. Control station with control panels for opening/closing of doors, working pressures of the chamber, breathing gas (air/oxygen), humidity, temperature, cooling/heating, and fire extinguishing system. Live videos inside the chamber are also displayed.

Figure 4. The manual control panel is used in case the computer control system breaks down.

Figure 5. Monitor display of parameters of desired and actual pressure, gradient, oxygen concentration, and temperature.

according to protocols. Patients can watch television through the transparent hood. Patients can go to the adjacent equally pressurized chamber for toilet needs. There is an enabling lock for transporting medications, intravenous fluid, glucose monitor device, and dressing materials into and out of the chamber without pressure break. It is a small chamber where pressure inside is adjusted according to the side it is opened (**Figure 2**).

There are several important parameters for operating the HBOT chamber: desired and actual pressure in kPa, gradient in kPa/min, and oxygen concentration in %. Temperature is less important; it changes with pressure. These parameters are monitored and recorded by computers at the control station (**Figure 3**). Contingency manual control is feasible in case of machine failure (**Figure 4**), but smooth transition of parameters by hands is difficult. There is a control panel to display opening/closing of doors, working pressures of the chamber, breathing gas (air/oxygen), humidity, temperature, cooling/heating, and fire extinguishing system. Display of these parameters can be projected to the hall display (**Figure 5**). Live videos inside the chamber are also displayed. During the guided tour, balloons were used to

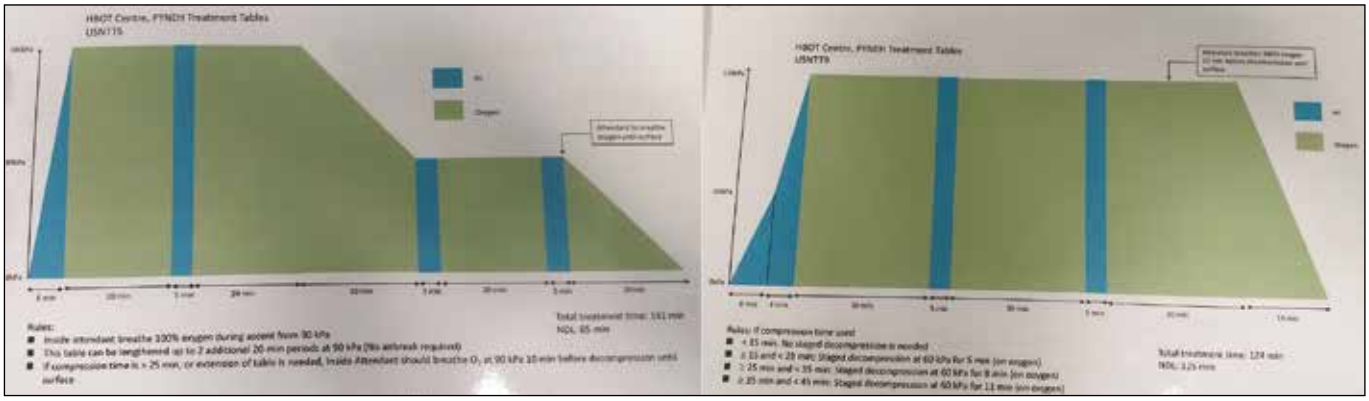

Figure 6. The United States Navy Treatment Tables 5 and 9.

demonstrate chamber pressurization; balloons shrank upon pressurization and expand upon decompression.

The 5-day HBOT for CRAO is based on the guidelines of the Undersea and Hyperbaric Medical Society[8] and the United States Navy Treatment Tables (**Figure 6**). For patients undergoing the first HBOT, Treatment Table 5 algorithm is used. Pressure is increased to 180 kPa, with three air-breaks in-between. The treatment session takes 141 minutes. For subsequent twice-daily treatment, Treatment Table 9 algorithm is used. Pressure is increased to 136 kPa, with two air-breaks. The treatment session takes 124 minutes. The entire treatment requires 10 sessions of HBOT.

Vitals are measured before and after HBOT. During pressurization, patients may feel discomfort in ears when ear pressure increases. Maneuvers to equalize pressure such as mouth opening and saliva swallowing are taught by nurses. If these maneuvers fail, an Otovent is used, which is a balloon attached to the nose. Patients are instructed to blow up the Otovent through a nostril while pressing the other nostril closed with a finger. If difficulties persist or signs of barotrauma appear, HBOT is ceased for myringotomy. During HBOT, when pressure plateau is reached, patients usually do not feel anything special. Frequency of monitoring depends on premorbidity and conditions of patients on site. Blood glucose level is usually monitored, as hypoglycemia can occur during HBOT. Vitals are checked again before discharge.

Basic physics on hyperbaric medicine were introduced to visitors. The Henry's law states that the amount of gas that dissolves in a liquid is directly proportional to the partial pressure of that gas above the liquid. The Dalton's law states that the total pressure exerted by a mixture of gases is equal to the sum of the pressures exerted by each gas if it alone occupies the total volume. For example, if a patient is breathing a mixture of 40% oxygen at 180 kPa, the partial pressure of oxygen is 72 kPa.

Contributor

The author designed the study, acquired the data, analyzed the data, drafted the manuscript, and critically revised the manuscript for important intellectual content. The author had full access to the data, contributed to the study, approved the final version for publication, and takes responsibility for its accuracy and integrity.

Conflicts of interest

As an editor of the journal, SCLA was not involved in the peer review process and has disclosed no other conflicts of interest.

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Data availability

All data generated or analyzed during the present study are available from the corresponding author on reasonable request.

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