

Hospital Sensation and Procedure of Hyperbaric Oxygen Therapy for COVID-19 Patients (simplified version)

I. Treatment Site and Equipment

The hyperbaric oxygen department of sinopharm dongfeng general hospital is a single building, which is 300 meters away from buildings in surrounding wards and residential areas. The ventilation is good and there is no relevant person in and out. The air pressurized cabin operation hall is a separate treatment hall, with a separate entrance. The 14-person cabin in 24-seat air-pressurized cabin with three chambers and seven doors is used as a special treatment chamber for COVID-19 with other doors closed. The equipment and auxiliary facilities of air pressurized cabin are intact and have passed annual inspection by Hubei Provincial Special Inspection Institute. And they have safe treatment conditions. Among them, the door of 14-person cabin is directly opposite the gate with a 2.5-meter distance. It can be constructed as a closed connection passage, and has the conditions of setting three zones and two passages. Outlets of exhaust pipe and oxygen exhaust pipe are in separate yards. After transformation, above-mentioned can meet relevant requirements for infectious diseases treatment. During the treatment of COVID-19 patients, no other patients are treated.

II. Related Operation Documents

Formulated "Notice of Hyperbaric Oxygen Therapy for COVID-19 Patients in the Hyperbaric Department", "Introduction to COVID-19 Patients into the Cabin of Hyperbaric Oxygen Therapy", "Cautions for COVID-19 Patients into the Cabin", "Measures and Procedures for Prevention and Control of Hyperbaric Oxygen Therapy in COVID-19 Patients", "Emergency Plan for Hyperbaric Oxygen Therapy for Patients with COVID-19", "Informed Consent Form for Hyperbaric Oxygen Treatment for COVID-19 Patients", "Job Duties of Staff in the Treatment of COVID-19 Patients" and other operational documents. And strictly implemented.

III. Treatment Range of Hyperbaric Oxygen in COVID-19 Patients

Patients hospitalized in our hospital with confirmed COVID-19 mild, normal and heavy. Critically ill patients are contraindicated.

IV. Treatment Process

1. Consultation Application: According to indications of hyperbaric oxygen therapy, clinicians in patients' department select appropriate patients to submit the application by computer and telephone.
2. Consultation Method: Hyperbaric oxygen physicians consult by consulting medical records and communicating with patients and tube bed physicians to determine whether there are therapeutic indications or not and exclude contraindication cases. For patients requiring hyperbaric oxygen therapy, medical personnel of hyperbaric oxygen

department shall inform the patients of matters needing attention and arrange treatment time.

3. In-Cabin Propaganda: Medical staff in the ward shall inform patients of matters needing attention and conduct preliminary propaganda (see below). After patients enter the cabin, hyperbaric oxygen chamber operators shall conduct propaganda through intercom system and video.

4. Transfer: Special transport vehicle notified by the ward shall transfer patients to the entrance compartment at the side door of hyperbaric oxygen department according to agreed treatment time. A special person shall be assigned by the hyperbaric oxygen department to meet patients here to check whether patients are wearing masks or not, and issue shoe covers, arrange patients to enter the compartment for treatment. Upon completion of treatment, transfer vehicle shall be notified to transfer patients to the ward.

5. Signature of Informed Consent Form: During this pandemic period, the informed consent form is resigned when patients are discharged, and medical staff explains special situation to patients and obtain patients' consent.

V. Propaganda and Education Measures Before Entering the Cabin

(1) Clinicians inform patients about hyperbaric oxygen therapy:

1. The safety of hyperbaric oxygen treatment is high, just like by plane. The most common type of discomfort is ear discomfort (incidence $\leq 5\%$, reversible) that can be relieved by pinching, swallowing, or pinching the nose.

2. Before going to hyperbaric oxygen department, emptying and urinating in the ward and doing hand hygiene. Wear surgical mask before and after entering hyperbaric oxygen chamber from the ward.

3. Do not carry valuables. Inflammable and explosive items (mobile phones, lighters, pens, etc.) are prohibited to enter the cabin.

(2) Propaganda and education of hyperbaric oxygen operators

In addition to traditional propaganda, the following propaganda should be focused on COVID-19 patients:

1. Before going to hyperbaric oxygen department, emptying and urinating in the ward, do hand hygiene and wear a surgical mask.

2. After arriving at hyperbaric oxygen department, patients shall enter the cabin through a special passageway, and keep a distance of more than 1 meter from each other. Please do not walk other passageways by yourself.

3. After entering the oxygen cabin, please follow the arrangement of staff and sit according to seats with names on them. Do not walk around at will. Do not touch or tamper with cabin equipment.

4. During the treatment, medical staff shall fully communicate with patients through intercom system and monitoring system. If patients have any discomfort or questions, please sit well, raise your hand and inform medical staff loudly (mask must be worn).

5. Garbage bags and paper towels are provided on the seat. When you cough, please hold your mouth and nose with a paper towel, cough up the sputum on the paper towel, put it in the garbage bag, seal the mouth of the bag, and throw it into the

medical waste bin in the cabin.

6. During the pressurization process, adjust the pressure in the middle ear and chew the gum on the seat. In case of ear pain and other discomfort, raise your hand and explain loudly to medical staff. Do not hold your breath during decompression.

7. When being treated in hyperbaric oxygen chamber, a mask must be worn when oxygen is not inhaled.

8. When inhaling oxygen, keep the mask close to the cheek. Do not leak air. Breathe normally.

9. At the end of treatment, please wait on your seat to exit the cabin. When you leave the cabin, place the oxygen tube on your seat.

10. Pay special attention to psychological nursing of patients.

11. Establish a WeChat group for treating patients, and publish methods of installing oxygen masks, pressure-adjusting action videos, scheduling treatment time, communication procedures, exchanging treatment experience, answering questions, etc., and release scientific knowledge about hyperbaric oxygen and COVID-19.

VI. Prevention and Control Measures of Hospital Infection

Disinfection and isolation measures for whole treatment of COVID-19 patients in hyperbaric oxygen department are formulated under the guidance of hyperbaric oxygen department and approved by leading group of prevention and control work of the hospital, strictly abide by relevant regulations of health committee and the hospital's "NOVID-19 infection pneumonia hospital infection prevention and control system

(1) . Reform measures of Hyperbaric Oxygen Department

1. Divide into three districts and two channels

① Pollution district: the area inside 14 people chamber, the outlet of the patient's dedicated channel and the area near the outdoor exhaust oxygen pipe is the pollution area. The 14 people chamber, which pressurized by air, used for patients' treatment area. Enclosed type patient special channel is built to connect the door of Hyperbaric Department with the door of the chamber. Patients could enter the chamber through this channel. Before HBOT treatment, the 6-person chamber and transition chamber were pressurized more 0.01Mpa pressure higher than the set pressure for the treatment of the patient. After the end of treatment, the 6-person chamber and transition chamber pressure were reduced to normal pressure to prevent the chamber gas spilling into outside. Building a observation district beside Hyperbaric Department door so that doctors and nurses , who have contacted with patients, could wait and have a rest here during patients in HBOT treatment. They need equip with walkie-talkie to contact with doctors who operate the chamber in case of emergency. The area near escape-pipe should be blocked and put warning signs. The area near Hyperbaric Department door should be set up cordon.

② Half-Pollution district: Building a room near the department door as half-pollution district for doctors and nurses to change protection suit.

③ Sterile district: the chamber outside hall, monotype chamber and infant chamber room, doctors and nurses' office area, warehouse, machine room, air storage tank room etc.

④ Staff channel: After taking off the protective clothing, the staff entered the sterile district through the front door of the department.

2. Modification of Outdoor air and oxygen input port: The exhaust port is extended to the ground with a rigid plastic tube, the upper end of the plastic tube is sealed at the junction with the exhaust pipe, the lower end of the tube is filled with activated carbon, which is not added into the bucket with disinfectant, the cabin exhaust gas is fully mixed with disinfectant, then expelled into the atmosphere.

(2) . Medical Staff Protection

1. Keep doctors who control the chambers stay in sterile district; secondary containment.
2. People who have direct contact with the patients and deal with emergency situations should be in pollution district ; level three protection.
3. chamber operators communicate with patients in direct contact via intercom.
4. Before treatment, the 6 people chamber and transition chamber should be pressurized up to more 0.01Mpa high than patients treatment pressure. All chamber door should be closed till treatment end(the sterilization of the chamber should be doing before treatment end). After disinfection, slowly decompression to atmospheric pressure, and keep the chamber door closed, so as to avoid decompression when the patient's treatment chamber gas through the opposite side cabin door cracks into the operation room hall, threatening the safety of the staff.
5. The medical staff in the pollution district will check in at the hospital after work and are not allowed to go out at will.

(3) . Infected patients' protection during the treatment process.

1. Mark patients' name on chamber seats: the seat is marked with patients' name patient, not to allow to move around. When patients have problem should raise their hands for the operator, must wear a mask when they speak.
2. The chamber seats are covered with disposable bedding. After treatment, bedding are treated as medical waste.
3. The vent unused is secured with latex gloves to minimize pipe contamination.
4. Before the treatment, patients should be informed with safety education and how to do the swallowing. In addition to the oxygen inhalation time in the cabin, patients must wear a mask all the time. Removing the mask and the oxygen inhalation should be as seamlessly as possible;
5. Each person is provided with plastic bags and paper towels. When coughing, hold the mouth and nose with paper towels, cough on the paper towels, then put them in the plastic bags, seal the mouth of the bags, and throw them into the medical waste bin in the cabin; All the items discarded by the patient in the cabin are thrown into the medical trash can. After the treatment is over, the trash can is treated as medical waste by medical staff.
6. Patients inhale oxygen with a disposable oxygen mask and an oxygen circuit. A composite filter is added between the oxygen inhalation and exhaustion pipeline and the mask to prevent viruses and bacteria from entering the oxygen exhaustion pipeline in the oxygen cabin.
7. After treatment and after the patient is out of the cabin, the oxygen chamber is rapidly increased to 0.05MPa and then quickly decompressed, and the exhaust pipe is flushed with high-speed air.
8. Hand hygiene of medical staff and patients should be strengthened, and hand sanitizer and paper towels should be placed in the oxygen chamber.
9. During the hyperbaric oxygen treatment, the air conditioner is not used, and the air outlet of

the cabin air conditioner should be covered with a plastic film.

10. During hyperbaric oxygen treatment, large flow ventilation should be used throughout the process.

(4) Disinfection measures

After the patient leaves the cabin, the hyperbaric oxygen chamber and all related items should be strictly disinfected in accordance with regulations:

1. Air disinfection: 2 ultraviolet lamps are used to illuminate the air for 1 hour. After disinfection, the air should be fully ventilated.
2. Disinfection of oxygen tank floor and object surface: Use 2000mg/L chlorine-containing disinfectant to mop the floor and wipe the object surface;
3. Fabric disinfection: Clean the waterproof and impermeable material of the seat jacket in the oxygen cabin, or soak it with 500mg/L chlorine-containing disinfectant for 30 minutes before routine cleaning and disinfection;
4. Disinfection of abandoned items in the cabin of patients: Treated as medical waste;
5. Disinfection of the surrounding environment and the patient passage: The healthcare security department should assign specially-assigned person to complete the disinfection.
6. Outdoor exhaust pipe disinfection: Replace disinfectant before each treatment.
7. Ventilation: After disinfection, the hall door and cabin door should always be open to ensure ventilation.

(5) Medical waste disposal

According to the relevant regulations and procedures of the hospital, it will be handled by a special person.

VII. Emergency plan

In addition to strictly implementing the emergency plan stipulated in the "Safety Management and Application Specifications of Medical Oxygen Chambers", a special "Emergency Plan for Respiratory and Cardiac Arrest in the Cabins of New Coronary Pneumonia Patients" is specially formulated for hyperbaric oxygen treatment of patients with new coronary pneumonia:

During hyperbaric oxygen treatment, the medical staff of the department are divided into: 1) cabin operators, in the clean area, with two levels of protection; 2) emergency rescue personnel, in the contaminated area, with three levels of protection. The two sides communicate via intercom.

1. When the operator finds that the patients in the cabin have abnormal vital signs, please call the emergency rescue personnel immediately through the intercom.
2. Open the exhaust valve and emergency oxygen release valve immediately to reduce the pressure as soon as possible.
3. Notify the transfer truck to transfer the patient immediately, so that the relevant department is ready for rescue.
4. After opening the hatch, rescuers immediately brought the LED equipment into the oxygen chamber for CPR or other treatment on the spot.
5. While rescuing, quickly guide other patients in the cabin to a safe place outside the oxygen

chamber.

6. Assist other rescue personnel to move the patient to the ward.

7. Report the situation to the hospital leaders as soon as possible.

Note: The above items can be performed simultaneously.

VIII. Patient safety precautions

1. In addition to strictly complying with the duties stipulated in the "Safety Management and Application Specifications of Medical Oxygen Chambers", hyperbaric oxygen medical staff should also perform division of labor in each link, consult doctors, and inform patients of treatment, patient transfer and treatment methods. surroundings. Eliminate and remove medical waste. Hospitals need to arrange staff stops to ensure a smooth treatment process for patients.

2. Slowly increase and decrease pressure, pay attention to the impact of barotrauma on patients, and increase patient compliance;

3. The operator pays close attention to the situation in the oxygen chamber. The patrol must increase the number of patrols and conduct careful inspections.

4. Equipped with special LED equipment for patient rescue use.

IX. security risks prevention

There are flammable and explosive products in the chamber, such as paper towels and medical disposables. During the treatment period, the first stage of oxygen inhalation was not used, and the entire process was ventilated.

Based on the above full preparation and improvement, our hospital has formulated effective prevention measures and procedures. Since February 17, 2020, our hospital has treated hyperbaric oxygen for ordinary patients with new coronary pneumonia for 20 days. Major results have been achieved. No medical safety incidents or medical staff infections were found. The above diagnosis and treatment plan deserves the thinking and improvement of medical staff.

Translated from Shanghai Baobang Medical Equipment Co., Ltd.

If there is any objection, please refer to the original Chinese narrative