Technical oxygen group

Medical Surge Capacity

Good practices in the rational and effective use of oxygen

PAHO
Pan American Health Organization
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Preliminary document 3.1, December 2021

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Good Practices in the Rational and Effective Use of Oxygen. Preliminary document 3.1, December 2021

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In the face of rapid increases in the number of hospitalizations due to COVID-19 in Latin America and the Caribbean, coupled with shortages of human and material resources, including medical equipment and gases, there is a need to redesign models of care in the Region to optimize available resources and ensure that more patients receive the quantity and quality of oxygen they need (PAHO, 2021).

Oxygen is included in the World Health Organization's list of essential medicines and is used to care for patients at all levels of integrated health services networks.

The efficacy of oxygen use in the treatment of patients with respiratory conditions caused by COVID-19 has been demonstrated (PAHO, 2020b), but there is great opportunity to improve the effectiveness of its use if it is used in a rational, sustainable, and safe way. Bearing in mind that the efficacy of a health technology is measured by its benefit under actual conditions of use, practical actions can be taken to improve the use of medical oxygen and avoid oxygen shortages (PAHO, 2020b) (Panerai and Mohr, 1990).

A drug is considered to be used rationally when patients receive it according to their clinical needs, in doses appropriate to their individual needs, for an appropriate period, and at a low cost to them and their community (Carvalho, 2016). By providing instruction on the rational use of oxygen and promoting it, negative repercussions can be avoided, such as loss of efficacy as a result of activities related to oxygen storage, distribution, and administration.

Rational use of oxygen also involves controlling waste due to leaks in storage and distribution systems, use of gas at incorrect pressures, use of incorrectly adjusted flowmeters, and disconnections, among other problems. Another aspect to consider is the provision of adequate technical support for all oxygen production systems, in terms of maintenance and calibration, availability of electrical energy, and specific knowledge about these systems.

For these reasons, a set of guidelines has been put together for the development of an efficient management system to deal with situations of oxygen scarcity, both now and in the future.

ORGANIZATION OF SERVICES

Use of algorithms:

Based on the severity of lung involvement in COVID-19 patients, apply the recommended algorithms to improve arterial oxygen tension and peripheral oxygen saturation (SpO2). This will be established during the initial triage and evaluation – continuous monitoring at a health care facility (PAHO, 2020a; PAHO, 2020b).

Organizational structure:

It is recommended that units of increasing complexity be established in order to rationally allocate both the human and technology resources necessary for the management of patients based on their severity.

MANAGEMENT

Creating and using indicators:

In disaster situations, management must have responses ready to keep the hospital running. To that end, it is important to determine mean effective consumption in advance. Mean effective consumption is the arithmetic mean of use over the last 12 months. The overall strategy for dealing with gas shortages can then be established. If the hospital already has this type of information, it will be possible to better analyze the impact of the pandemic on this indicator and plan future actions.

Supply structure:

Many countries have decided that the oxygen supply structure should be composed of a primary supply, a secondary supply, and an emergency reserve. Management should look for ways to structure this matrix and improve patient safety.

Quality:

Together with the pharmacy team, management should provide the means for assessing the quality of produced or purchased oxygen prior to use.

Training:

Management should identify training needs and provide the means to train key people in all stages of hospital oxygen use: determination of patients' oxygen needs, specifications, purchase, receipt, storage, distribution, and administration. In cases where the hospital produces its own oxygen, a training program on quality control and maintenance of the gas produced is recommended.

PATIENT CARE PROFESSIONALS

Dosage:

Oxygen therapy is recommended for all severe and critical COVID-19 patients. Dosage levels in children are 1-2 liters/minute; in adults, start with 5 liters/minute administered with nasal cannula, and move to moderate flow rates of 6-10 liters/minute using a Venturi-type mask or higher flow rates of 10-15 liters/minute using a mask with a reservoir bag. Oxygen can also be delivered at higher flow rates and in higher concentrations using high-flow nasal cannula (HFNC), non-invasive ventilation (NIV), and invasive ventilation devices (WHO, 2020).

Use flowmeters with correct pressure:

Flowmeters are calibrated to operate at a specific pressure. If the supply pressure is higher than this value, the amount of gas delivered will be much greater than indicated on the device, in a range of 0 to 15 liters/minute, for example. If the pressure in the system is greater than the flowmeter calibration value, it is advisable to use flowmeters with regulator valves that can adjust the outlet pressure to the level recommended for the device. Have someone check this daily and provide guidance to the health care team (SOBRASP, 2021).

Disconnect any pneumatic assistive device from the system whenever it is not in use:

Unused equipment connected to the system can produce leaks if the connection is not checked regularly.

Instruct the health care team to record the use of medical gas for each patient in the medical prescription:

Prescription records allow for proper accounting of the amount being administered. This amount can then be compared to the amount being purchased. The difference between the amount prescribed and the amount purchased can indicate losses occurring in the system or in the process of delivering this health care resource.

Report leaks or suspected leaks and check connections:

Encouraging health care professionals to report leaks, even small ones, helps to ensure the best use of this health technology resource. It is also important to perform daily checks of device connections and oxygen inlets when they are being used on patients to verify that there are no preventable leaks.

Be careful when cleaning and disinfecting medical gas equipment:

Flowmeter and pulmonary ventilator connections may become loose during cleaning and disinfection, leading to small, sometimes imperceptible leaks. Ensuring that the team knows how to perform these procedures properly is a good medical gas management practice.

LOGISTICS AND CONTROL

Involve the pharmacy team in the management process:

As medical gases are considered drugs, it is important to support the pharmacy team's leadership in their management (SOBRASP, 2021).

Maintain an emergency reserve:

Maintain at least a 72-hour supply of medical gases as a reserve, as recommended in the Hospital Safety Index for disaster situations (WHO/PAHO, 2018).

Systematically monitor the amount of medical gas purchased:

The amount of gas purchased and used per month should be monitored. This practice makes it possible to accurately calculate mean effective consumption and reduces mean calculated consumption and the respective standard deviation, leading to a more precise calculation of consumption and enabling better work planning (SOBRASP, 2021).

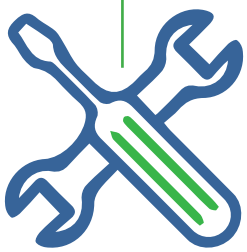
Know and review your gas purchase agreement:

Agreements commonly include clauses that release the parties from liability in cases of force majeure, such as strikes, revolutions, power outages, breakdown of distribution equipment, natural disasters, embargoes, or government prohibitions. It is important for all concerned parties to be aware of these contingencies, since the hospital may stop receiving oxygen due to contract stipulations (SOBRASP, 2021). In practical terms, both the hospital management and the procurement staff can contribute to sustainability in the oxygen procurement process. (SOBRASP, 2021).

Supplier proximity:

Confirm whether the supplier of medical gas is nearby and has sufficient reserves to maintain an adequate supply chain in case of emergency (WHO/PAHO, 2018).

ENGINEERING AND MAINTENANCE



Decrease system pressure whenever possible:

Current equipment requires low operating pressures. Flowmeters, pulmonary ventilators, and anesthesia devices have evolved a great deal technologically and no longer require high pressure levels as in the past. This practice can eliminate the need for specific flowmeter regulators. While serving a good purpose in systems with higher pressure, these may be unnecessary when the pressure is appropriate. In addition, there will be fewer connections and leakage points. There are also other options, such as using two levels of pressure in the system: one higher and one suitable for the devices that will be connected to it.

Technical documentation:

The engineering and maintenance division should have an operations manual and preventive maintenance records for medical gas storage, distribution, and delivery devices, such as mechanical pulmonary ventilation equipment and flowmeters (SOBRASP, 2021).

Seismic zones:

In seismic zones it is important for gas cylinders to be firmly attached to the building structure. As cylinders are heavy, they can cause significant damage in case of uncontrolled movement during an earthquake (WHO/PAHO, 2018).

Quality:

If the hospital itself produces oxygen, the engineering and maintenance service should work with the pharmacy team on risk and quality management in the gas production process (WHO-UNICEF, 2019).

System pressure:

In many countries, oxygen system pressure is not specified, but it is important to bear in mind that many pieces of equipment are designed to operate at lower pressures. The NFPA 99 Health Care Facilities Code and the United Kingdom National Health Service recommend a pressure of 3.5 kgf/cm² (50 PSI or 345 kPa), which is an important consideration for engineering teams (NFPA, 2018; Department of Health, 2006).

Use flowmeters with regulator valves at 3.5 kgf/cm² (50 PSI or 345 kPa):

Flowmeters are generally calibrated to operate at this pressure level. If the supply pressure is higher than this value, the amount of gas delivered will be much greater than indicated on the device, in a range of 0 to 15 liters/minute. Someone should check this daily and provide guidance to the care team.

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