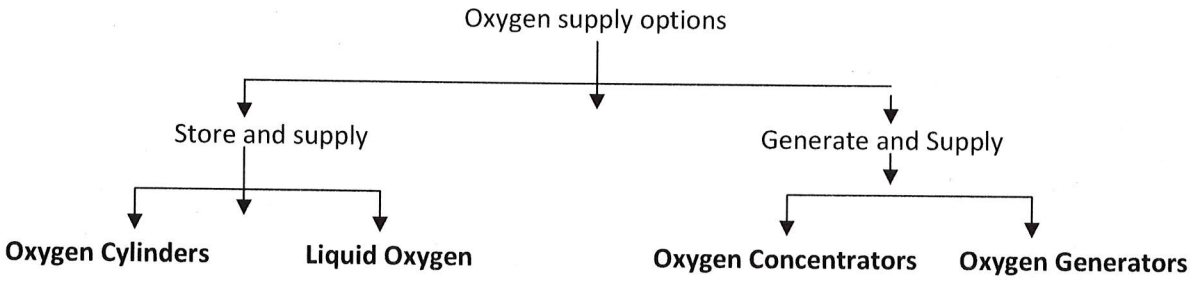
NOTE ON SUPPLY OF OXYGEN TO HOSPITALS AND INDIVIDUAL PATIENTS IN A CORONA INFESTED ENVIRONMENT

Corona virus pandemic has presented such challenges to the norms of medical care in the world that responding and countering this challenge will demand a major functional and behavioral change to our working environment.This note intends to present a method of supplying oxygen to medical facilities and individual patients in the current environment.

I. Major Source for Supply of Oxygen

Oxygen to medical facilities is supplied and fed through four primary methods:



1. Oxygen Cylinders - These are primarily used in hospitals where Medical Gas Pipeline (MGPS) has not been laid, however many hospitals use cylinders connected in series to supply oxygen to the wards through a manifold. The Jumbo cylinders are used in critical areas like Operation Theatres, ICUs, HDUs, etc. Smaller cylinders (B Type) are used for stretchers, ambulances, general wards, etc. The use of oxygen cylindersrequires three times the inventory of cylindersconsumed in a hospital in a day (one setof cylinders in use, one set as backup and one set in refilling station). It is labour intensive, logisticallychallenging, unsafe, unhygienic (chances of carrying infection from hospital) and expensive method. However this is the most easily adaptable method in short term and emergency situations.

2. Liquid Medical Oxygen (LMO) – This demands a MGPS, a safe, open, unhindered space upto 9M x15M in a hospital premise. It also demands installation of a storage tank which needs a PESO license and a third party supply dependence. It also demands one day of oxygen supply through cylinders as a backup. But this is a far better, cheaper, safer method than supply through cylinders, however this is again a supplier dependent method.

3. Oxygen Concentrators – An oxygen concentrator is a self-contained, electrically powered medical device designed to concentrate oxygen from ambient air. This is used on the bedside without MGPS and caters to 1-2 patients at a time. This oxygen cannot be used with ventilator, because the pressure generated is very low.

4. Oxygen Generators (Plant)–This demands a MGPS and an assured cylinder backup. It allows ownership of oxygen with the user with no third party dependence. It is safe, efficient, cheapest, least polluting, non human dependent for operations and most contemporary form of oxygen supply.

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II. Oxygen System components

Oxygen distribution, conditioning, delivery, patient monitoring, power supply and maintenance support are some of the critical components of oxygen systems. Consumables and ancillary devices such as regulators, breathing circuit, mask, nasal prongs, cannula, filters, flowmeter, air oxygen blender, , etc. are crucial for operational use of oxygen therapy equipment. Please refer the below figure for details of the same.

The accessories that are downstream of the oxygen source should be single use/disposable. These include the tubing and facemask/nasal cannula/nasal prongs. They should be changed for every patient and should be disposed of as per Ministry of Health & Family Welfare, Government of India guidelines.

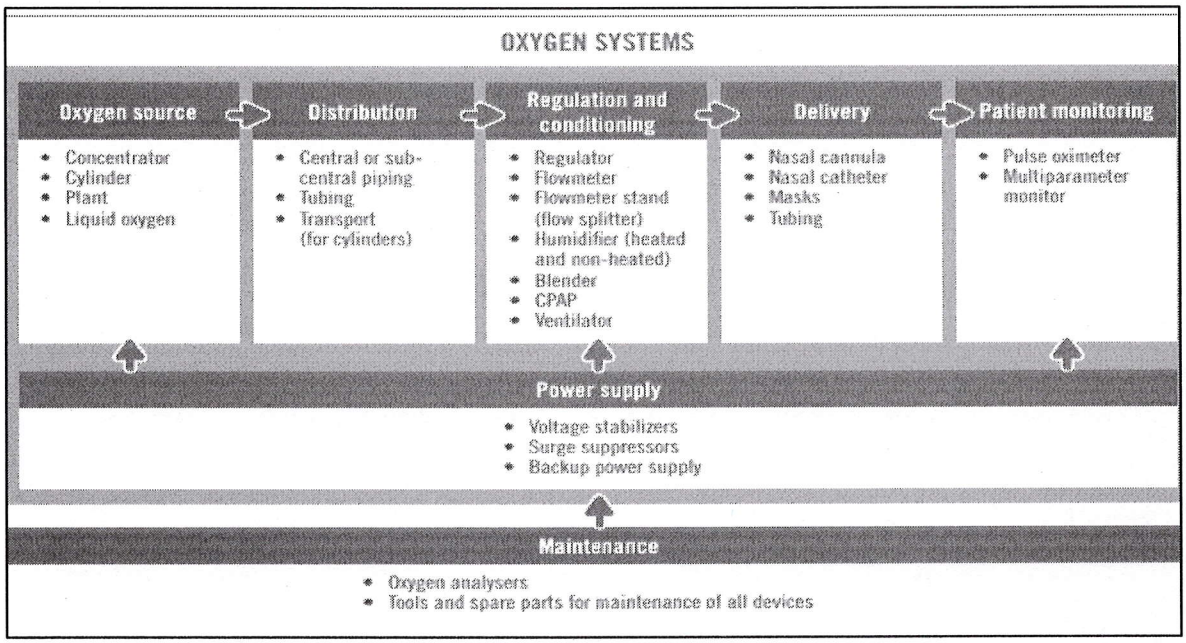

Figure 1- Oxygen System components (Source WHO)

III. Normative requirement of quantity of oxygen for a 200 bedded(with oxygen) hospital is as below:

Source of Oxygen	Volume of oxygen generated/required	Back up
Oxygen Generated in House using PSA Generator	475 Litre per minute – with required Power load (40 KW) and space of 4 x 5 m	90 'D type Jumbo cylinders'
Liquid Oxygen through a Supplier	20,400 cubic meter/month.	90 'D type Jumbo cylinders'
Oxygen Cylinders	7.25 cubic meter per cylinder (D type) * 90 cylinders per day	90 'D type Jumbo cylinders'

It is pertinent to note that cleaning/disinfection of oxygen cylinders is crucial and if not done by the hospital, before sending back to the oxygen supplier for refilling, could become a major source of infection.

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IV. Precautions needed in using any of the methods of oxygen supply in corona virus infested environment

Liquid Medical Oxygen, Oxygen generators and in some cases cylinders are methods which use a MGPS to supply oxygen to a hospital facility. These equipment will need exactly the same disinfection as is been given to any other machinery and surfaces in the hospital. All parts which are regularly and frequently touched or operated should be sanitized before and after use. Only relevant operators should handle the equipment.

Use of cylinders brings a need for a major change in procedure of handling them. Right from filling point to transportation, loading, unloading, use, exchange, carriage in the hospitals and in critical care facilities, cylinders see handling by various people, usage by patients and being very close to actual infected patients. The safe handling of cylinders is a major challenge which needs a very focused and concentrated effort by all involved.

The following guidelines should be adopted for handling Oxygen cylinders (and related accessories):

- The cleaning & disinfection procedure should be performed at the hospital in a designated area.
- For initial cleaning, hot potable water with detergents, not exceeding 50 degrees Celsius (50 °C) should be used for cleaning cylinders, wheeled cylinder trolley, spanner, keys, regulators and wrench. Valves & inlets should be closed & covered so that the water doesn't get inside the cylinders/containers. Under no circumstances medical gas cylinder/container should be immersed in water.
- After cleaning the cylinder/accessories with water and soap, the cylinder/container should be cleaned with 1% sodium hypochlorite solution.Fogging is a suitable alternative.
- While cleaning the cylinder/container, avoid cleaning agents that contain ammonia, amine based compounds or chlorine based compounds as they can cause corrosion of steel or aluminium alloy components or stress cracking of brass, including copper alloy components.
- In case the used cylinders have not been disinfected , then the cylinders should be kept in an isolated area, with a tag clearly mentioning that the cylinder is infected. The cylinders should be sent to the supplier only after these steps are followed.
- It is important to note that even hospitals having central supply systems/MGPS may need to rotate cylinders in new areas created for patient care. Therefore special precautions mentioned as above to be observed when exchanging the cylinders.
- Personnel involved in filling, storing, handling & transporting of Medical Gas Cylinder/container should be trained in this procedure and should be wearing protective gear at all times as per MoHFW guidelines

These steps and methods highlighted above is not the last word on precautions which can be taken while handling oxygen supply related equipment during the outbreak of COVID – 19. These guidelines would be updated as and when required.

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