

OXYGEN SERVICE

Introduction

This outline constitutes the general plan for oxygen service in the 12th General Hospital.

I. Purpose:

The purpose of the oxygen service is to supply and administer an adequate amount of oxygen in a prompt, efficient, and economical manner to those patients who may be benefited by it.

II. Indications for oxygen therapy:

The symptoms of anoxia vary greatly, but they appear chiefly in this order of appearance: restlessness, headache, increase in pulse rate, increase in rate and depth of respiration. Occasionally shallow breathing, faintness, dilatation of the pupils, and anorexia may be the first symptoms to appear. Dyspnea, cyanosis, increase in temperature in infectious processes, abdominal distention, nausea, weakness, impairment of memory and judgement, diminution of sight, cough, euphonia may appear in greater states of anoxia. In severe anoxia, periodic breathing, orthopnea, motor incoordination and paralysis, vomiting, diarrhea, convulsions, and coma may insue.

The presence of anoxia should be anticipated and watched for carefully. Oxygen, to be of the greatest value, must be used promptly, early in the disease, and with adequate concentration to combat the pathologic effects of anoxia and to conserve the patients energy in disease.

III. Personnel:

The personnel of the Oxygen Service consists of (1) the chief of Oxygen Service, a medical officer who is familiar with all the physical details of oxygen therapy and who will assume entire responsibility for its proper administration in the hospital; (2) the assistant chief, a medical officer who will assume the responsibility at the direction of the chief; (3) three nurses who understand the working principles, and who are responsible for the teaching of these procedures; (4) a number of enlisted men who understand the purpose, application, and maintenance of all oxygen equipment.

IV. The location of oxygen service:

Oxygen equipment will be located in a specified place, preferably near the source of oxygen storage in the medical supply building.

V. Institution of oxygen therapy:

A requisition will be written in the order book by the ward officer; he will note the time, the patients full name and bed number, the type of apparatus desired, and the dosage of oxygen to be given in liters per minute, or in the case of tents, the oxygen concentration.

The nurse in charge will notify the chief of Oxygen Service and will send a ward man to obtain the necessary equipment. The ward man will make a memorandum receipt which is to be signed by his ward Surgeon. The ward man will also sign for the apparatus in a book located in the oxygen room, giving date, time, type of apparatus, ward, and his own name.

Oxygen will be ordered on the blue non-expendable form #16A. An extra tank should be obtained for replacement, at least one hour before the tank in use is exhausted.

VI. Responsibility on the ward:

The operation, maintenance, and care of the apparatus is the responsibility of the ward officer on the ward in which it is in use. Advice may be obtained from the personnel of the oxygen service at any time that it may be required. After use, the apparatus is to be properly cleansed, (see regulations for cleaning oxygen therapy equipment) and promptly returned to the oxygen equipment depot. The original of the memorandum receipt will be obtained at this time.

VII. Safety:

Oxygen in therapeutic concentrations strongly supports combustion in the presence of inflammable materials. It is imperative that the entire hospital personnel be on guard to prevent accidents. Verbal and as well as conspicuously written warnings should be freely used. All forms of fire, electrical devices, oil and grease must be kept from the vicinity of oxygen apparatus in use. Patients should be thoroughly searched for matches and cigarettes and should be strongly warned against the dangers of trying to smoke while receiving oxygen treatment. Their visitors should be warned of the danger of fire and cautioned against giving smoking articles to the patient. No portable x-ray or diathermy apparatus should be brought into the room while oxygen equipment is in operation. Hot water bottles should be used instead of electric heating pads. Patients should not be rubbed with alcohol when in an oxygen tent. If oil rubs are given the attendant must under no conditions touch any part of the oxygen cylinder or reducing valve until such time as his hands have been thoroughly cleansed of oil.

All cylinders should be securely fastened to the wall or bed to prevent them from falling. Full oxygen cylinders should be kept separate from the empty cylinders and these should never be stored where they may be subject to high temperatures; that is, they should be stored away from boilers, furnaces, steam pipes, radiators, etc. Also, cylinders should never be stored in the vicinity of oil, grease, or other such highly inflammable material, or where they might be struck or knocked over, or where heavy articles might be dropped on them.

Empty cylinders are both labeled and dated and should be promptly returned to medical supply where they shall be kept distinctly apart from full cylinders. The protective cap should always be in place when the cylinder is not in use. Should a partially empty cylinder be returned it should bear a notation showing the reading on the cylinder pressure gauge at the time of discontinuing the treatment. These cylinders should also be labeled graphically as to whether they are one-half full, one-third full or whatever the proportionate contents remain therein.

Whenever possible it is advisable that the medical supply be informed of the approximate amount of oxygen to be needed so that an uninterrupted supply can be maintained.

VIII. Oxygen Regulators:

Oxygen regulators or reducing valves are one of the most important parts of the oxygen therapy apparatus and they are necessary for efficient delivery of gas from the oxygen cylinder. The function of a regulator is first to reduce the high pressure in the cylinder to a safe lower working pressure which provides a steady, even, predetermined rate of flow. The second function of a regulator is to

accurately meter oxygen in liters per minute so that exact dosage may be administered under medical officers prescription. While regulators are rugged enough to give uninterrupted service they are delicate in certain respects and the following rules must be followed when handling them.

1. Before handling an oxygen regulator, any oil or grease on the hands of the attendant should be thoroughly removed by washing with soap and water.
2. Before attaching the regulator to a cylinder of oxygen, the cylinder valve should be "cracked" (opened slightly and quickly closed) to blow out any dust that may have lodged in the cylinder valve opening.
3. After the regulator is attached to the cylinder, always make certain that the flow-adjusting screw is in the off position before opening the oxygen cylinder valve.
4. The cylinder valve should be opened slightly and slowly at first. As soon as the pointer on the cylinder contents gauge of the regulator stops moving, the cylinder valve should be opened completely.
5. Oxygen is delivered to the patient at the desired rate of liter flow by turning the adjusting screw of the regulator until the pointer on the liter flow gauge is at the correct location.
6. When the regulator is not in use and not attached to the cylinder, always close the cylinder inlet connection with the dust plug and make certain that the flow adjusting screw is in the off position.
7. Never use oil or grease on an oxygen regulator, oxygen cylinder valve, or any oxygen connections.

IX. Oxygen Tent therapy:

The patient should be in a well-ventilated private room, or at one end of the ward to facilitate rest and nursing care. He should be mentally prepared by briefly explaining to him the purpose of the oxygen tent, its benefits and necessity. This will help greatly to reassure him.

Proper preparation of the bed is important. All sides of the bed should be made available. Place a rubber sheet (or an extra sheet if a rubber sheet is not available) at the upper half of the bed over the mattress as this conserves oxygen. Elevate the head of the bed, or the patient may be elevated with pillows in the semi-sitting position. Extra blankets and pillows should be assembled at the bedside.

In the physical preparation of the patient the nurse will toilet the patient, give all medication, give fluids, and change gown. Sputum tissues and a bag for their disposal should be assembled within easy reach inside the tent. Mechanical signalling devices are made available to the patient within the tent. Pillows under the knees or arms may make the patient more comfortable as well as provide a suitable foot rest to prevent him from slipping too far down in the bed.

X. The Tent:

The ice chamber should be filled with pieces of ice about the size of a grapefruit. If soda lime is to be used a check should be made to see if it is fresh. The oxygen cylinder in use as well as the spare are to be securely fastened to the wall or bed so that they may not accidentally fall. Bath blankets or additional protection for the patient's chest or head should be adjusted at the start of the treatment.

The oxygen is turned on and the circulation started in the tent. The patient's comfort is again ascertained. The apparatus is now placed next to the bed so that the canopy can be lowered to make its sides available for placing under the patient. The canopy at the head of the bed is tucked in first and is followed by tucking it in at the sides using all available slack canopy for tucking in tightly across and under the hips. This may be reinforced by bath blankets folded lengthwise

and wedged between the canopy and the bed. A Longitudinally folded bath blanket is placed over the canopy at the hips and pulled taut with its ends tucked under the mattress. Care with these procedures will conserve oxygen considerably.

XI. Operation of Tent:

A. Set oxygen flow at 15 liters per minute and continue for at least 20 minutes. This will aid in building up rapidly the desired oxygen concentration. After this concentration is obtained reduce the flow to about 10 liters per minute.

B. The nurse should carefully observe the patient and record changes in the following on the patient's chart:

- Respirations
- Pulse
- Color
- Cough
- Restlessness
- Pupillary change
- Rectal temperature
- Comfort of Patient

Check the tent every 2 to 4 hours, and even more frequently at the start of treatment, or if the patient is restless or has a high temperature.

Look for leakage in the tent, especially where the canopy is folded under the patient and around the hips.

With the motor running and oxygen flowing, if the tent is working properly the canopy should bulge slightly at the sides.

Check the temperature of the tent; the humidity of the tent; the rate of oxygen flow; the amount of oxygen remaining in the cylinder and for the presence of a reserve cylinder.

Check the oxygen concentration by gasometric analysis. Check the condition and quantity of ice. Add salt if necessary to further reduce the temperature under the canopy.

Empty the waste water frequently and check to be sure the water trap is open and free of debris. If the water trap is allowed to become clogged the circulation in the tent may be completely stopped or water may be actually blown over into the canopy.

Replace the oxygen cylinder promptly, when it becomes empty, with the reserve cylinder. Label the "EMPTY" tank plainly and arrange for a full one to be immediately delivered from medical supply.

C. Ward men and nurses are to acquaint themselves thoroughly with the written instructions provided by the manufacturer of the tent.

XII. Nursing Care:

The head nurse will instruct her ward man and nurses in the care and maintenance of apparatus.

Plan nursing care so that everything can be done for the patient at the same time about every four to six hours, so that the remainder of the time he may rest unmolested. The things to be done at this time include bath, food, fluids, medications,

toilet, servicing of tent, and the surgeons examinations.

The sleeves in the tent canopy should be opened only when necessary and then with celerity. When entering the canopy thru the sleeve cover the sleeve, with the free hand, around the arm that is in the tent. This will help to conserve much oxygen. Close the sleeve promptly and completely.

Bath: The patient's head and neck may be washed with the tent off or with the nurse standing inside the canopy. The hood of the canopy may be tucked carefully around the patients neck and the bath completed. The bath and change of bed linen may be greatly facilitated by the help of an additional nurse or ward man.

The tent should operate quietly and smoothly. Should the tent require servicing during treatment, this should first be explained to the patient. The patients comfort is the first responsibility of the nurse; equally as important is the patients confidence in this therapy.

Should the patient become alarmed or uncomfortable, this should be considered as evidence of inefficient operation of the apparatus; and the oxygen concentration, the carbon-dioxide concentration, humidity and temperature should be carefully checked and any deficiency corrected.

XIII. Care of the Tent:

After use, the tent canopy is washed inside and out with mild soap and water and dried thoroughly, preferably exposed to the sun for several hours.

IMPORTANT - NEVER USE STRONG SOAPS, CLEANSERS, OR LISOL as they will deteriorate canopy and leave objectionable odors.

The ice chamber or conditioning cabinet should be drained thoroughly. It should then be scrubbed out vigorously with mild soap and hot water. The cabinet door should be left open for some time after cleaning and preferably exposed to sunlight. These measures will aid in removing objectionable odors which tend to gather in the ice chamber.

The soda lime compartment should be emptied and dried thoroughly.

The tent canopy should be inspected for holes or other leaks. These are apt to first occur in the seams and then around the windows. All holes or tears should be immediately repaired using scotch tape for there is not time to make a permanent repair.

Inspection, washing and other maintenance of the oxygen tent motor should be left to the personnel of the Oxygen Service. If any motor trouble is suspected whatever report it immediately to the Oxygen Service.

The inspected tent should be labeled by the inspector and dated.

Replacements and adjustments that are expected should be placed in the Oxygen Service book.

The tent and accessory apparatus when returned to the storeroom after cleaning and exposure to the sun should be kept properly covered.

Remember that with proper care the apparatus will give longer and better service and it will not fail when it is critically needed.

XIV. Oxygen Analyzers:

Oxygen analyzers should be used routinely with tents in order for oxygen therapy to be effective and economical. An analyzer accurately measures the dosage of oxygen that the patient receives and also makes it possible to reduce oxygen waste. The instructions which accompany the analyzer apparatus are to be carefully followed. In some instances it may be necessary to test the carbon dioxide content of the tent. This is done much in the same manner as is an oxygen analysis and can be accomplished by the following instructions.

Analysis should be frequent enough to maintain the desired oxygen concentration in the tent at all times. A test should be made shortly after the tent is put in service and one should be made each time after the tent has been open for any length of time at all. Routine analysis should be taken every four hours. The results of every analyses should be entered on the patient's chart. The analyzer should be kept clean and potent solutions maintained in them. The accuracy of the oxygen analyzer can always be checked by testing a sample of room air; the oxygen concentration of room air is always 21%.

XV. Nasal Catheter Technique of Oxygen Administration:

The success of the catheter method of oxygen therapy depends upon the temperament of the patient, the nature of his illness, and the anatomical condition of his nose. The division of the septum, history of allergy or of polyps and previous severe local infections.

The equipment necessary consists of sterile, soft, fresh nasal catheters, numbers 8 to 12; a humidifier, (to moisten the oxygen) an oxygen flow regulator and one cylinder of oxygen. A tube of vaseline or other petroleum jelly should be available.

Soft, old catheters are better than new ones as they are easier to insert. If a new one is to be used it is desirable to boil it first. There should be 8 or 10 perforations in the terminal inch of the catheter tube. If these are not present they should be punched with a hot needle. If adaptors are not available for attaching the catheter to the large rubber tubing of the humidifier these may be easily made by using a glass eye dropper.

Before doing anything else, explain the procedure and its benefits to the patient reassuring him that he will quickly become accustomed to the catheter.

XVI. Technique:

Note the natural droop of the catheter as this will facilitate its introduction to the naso-pharynx. Approximation of the depth of insertion may be obtained by laying the catheter across the patient's cheek and measuring the distance from the tip of the nose to the tragus of the ear. This approximate measurement should be marked with adhesive tape. Lubricate the catheter lightly with vasoline. Light oils and jellies are not to be used as they are soluble in water and will dissolve in a short while leaving the catheter unlubricated, thus making it possible for it to severely irritate the patient and even adhere to the back of his throat. **IMPORTANT - OXYGEN SHOULD BE FLOWING AT THE TIME WHEN THE CATHETER IS LUBRICATED.** This will keep the small holes from becoming occluded with the lubrication.

The catheter is inserted on the floor of the nose, below the inferior turbinates, using a very gentle twisting pressure. Care should be taken to permit the natural droop of the catheter to turn into the naso-pharynx. As mentioned above, oxygen should

be flowing before the catheter is inserted. Push the catheter down into the oro-pharynx until the patient's swallowing reflex is stimulated. If he will swallow oxygen a time or two then it is obvious the catheter is down too far. Slowly withdraw it until the patient just does not swallow oxygen. This should be checked with a flash light and tongue depressor to be sure that the tip of the catheter is on a level with the soft palate, or slightly above. The catheter should be anchored to the opening of the nares, turning it up over the nose, and fastening it to the patient's previously cleaned forehead with adhesive tape. The connecting tubing should have approximately 18" slack to permit the free movement of the patient's head.

The patient's comfort, color, pulse rate and depth of respiration, ear disturbances, evidence of nasal irritation should be noted and recorded.

The oxygen flow should be set at between 6 to 8 liters per minute. A rough dosage is as follows: For each liter of oxygen that is given to the patient the oxygen concentration of the air he inhales is increased approximately 4 percentage points. Thus, assuming that there is 21% oxygen to begin with (as is present in room air; that is not exactly correct due to CO₂, water vapor, etc. present in the lungs) the addition of one liter of oxygen by nasal catheter will raise the concentration in the patient's lungs to approximately 25%. Two liters of oxygen per minute will give him approximately 29%; 3 liters, 33%; 4 liters, 37%; 5 liters, 41%; 6 liters, 45%; 7 liters, 49%; 8 liters, 53%. It is generally agreed that oxygen therapy is not effective until the patient is being given at least 40% oxygen.

The complete apparatus should be checked frequently. Make sure that there is an adequate amount of water in the humidifier. The usual depth of water should be about half the capacity of the humidifying jar. Make sure that all connections are tight and that oxygen is not leaking around them. Make sure that the flow is correctly set at the regulator. Make sure that the catheter tip is still correctly placed in the oro-pharynx.

The nasal catheter should be removed approximately every six hours and a sterile one replaced. A new catheter should preferably be inserted in the opposite nostril from the old one. Used catheters are best cleaned in cold, running water and then boiled for five minutes.

Stop or reduce the oxygen flow when the patient is eating or taking fluids. BUT REMEMBER TO INCREASE THE FLOW IMMEDIATELY AFTER THE PATIENT HAS FINISHED HIS MEAL OR DRINK.

XVII. Oxygen Masks:

Oxygen masks permit the administration of concentrations of oxygen as high as 95%, and over and may be used to administer oxygen under positive pressure which is some times desirable particularly in the presence of pulmonary edema.

Equipment Necessary - There are two types of face masks in general use today. One is called the BIB and the other the OEM Meter Mask, which will be discussed separately.

To give oxygen therapy by mask the following equipment is necessary; one cylinder of oxygen, one oxygen reducing valve, the face mask, rubber tubing, etc. (With the OEM Meter mask make sure that the meter is available)

As with other forms of oxygen therapy the oxygen cylinder valve should be "cracked" outside the patient's room and the usual precaution taken included under the section on regulators.

When giving oxygen by any type of mask it is important to prepare the patient psychologically. Most people seriously object to having anything placed over their face and if this natural fear can be overcome the success of the treatment will be greatly increased. If the patient is conscious explain to him the purpose of the therapy. It can be pointed out that the type of mask being used is used by thousands of Army and Navy pilots and other members of the crews of fighting planes. It is also of considerable help to tell the patient that if the mask becomes seriously uncomfortable he can feel free to remove it for a few minutes. The mere fact that he knows he has some control over the treatment goes a long way towards keeping him from being afraid of having the mask placed on his face. Where oxygen therapy by mask is started on an unconscious patient an effort should be made to have some one nearby when the patient returns to consciousness in order to reassure him regards the use of the mask.

BLB Mask - The BLB mask is available in large and small sizes in both the nasal and oro-nasal types. Patients who are mouth breathers, uncooperative or unconscious require the oro-nasal type. Otherwise, the nasal type will be found more comfortable as a general rule. Choice of the correct size and type of mask is important.

The complete mask apparatus consists of three parts. (1) the mask proper; (2) the connecting device which joins the mask to (3) a reservoir-rebreathing bag. The BLB is a partial rebreathing mask in which approximately the first third of the expired air - that part which is richest in oxygen and poorest in carbon dioxide - is saved in the reservoir bag and rebreathed. The earlier models were equipped with a metal connecting-regulating device provided with three small portholes, one or more of which could be opened or closed to control the concentration of oxygen in the inspired air. The newer models are provided with two sponge rubber discs which act as both inspiratory and expiratory valves.

Oxygen concentrations administered with the earlier models are controlled by opening or closing the portholes and adjusting the liter flow. (4 liters - 2 portholes open - approximately 50 per cent oxygen). With the new models, the oxygen concentration is controlled by the liter flow only. (4 liters - 40 to 50 per cent; 6 liters - 50 to 60 per cent, etc.) The following applies to the old as well as the new model BLB masks; When administering concentrations approaching 100 per cent oxygen, the liter flow should be sufficiently high so that the reservoir-rebreathing bag never collapses completely even at the depth of each inspiration. When administering lower concentration, the bag should collapse during each inspiratory cycle. The duration of each collapse governs the concentration of oxygen the patient receives.

There is a plug in the bottom of the rebreathing reservoir bag and another plug in the front of the mask proper. The plug in the bag can be removed to drain off excess moisture. The plug in the mask is removed when a Miller-Abbott tube is used.

The OEM meter mask derives its name from the meter which attaches directly to the outlet of a regulator and on which the concentration of oxygen is set. This mask is available in both the nasal and oro-nasal type. The design of the mask is such that only one size is required. The operation of the OEM mask differs from that of the BLB in one important respect. Regardless of what concentration of oxygen is being administered the reservoir bag should never be allowed to collapse completely. In all other respects the operation of the OEM is similar to that of the BLB, except that it should not be used on a float type flow indicator.

Some helpful suggestions on the operation and care of BLB and OEM masks follow:
1. Choose the size and type of mask that is most suitable for the patient.

2. Turn the oxygen on so that it is flowing about 6 or 8 liters per minute. Always start with an excess flow of oxygen.
3. Adjust the mask in place; pass the rubber retaining strap around the back of the head just above or just below the ears, whichever is most comfortable to the patient. Do not make the strap too tight. Mask should be held snugly and yet firmly against the face. Make certain air does not blow into patient's eyes from top of mask.
4. Many patients instinctively breathe more deeply or more rapidly during the first few minutes the mask is in place. Wait until the respirations return to their former rate and then gradually adjust the liter flow to about the minimum that will maintain the desired concentration of oxygen. The required liter flow will vary with the pulmonary ventilation of each patient.
5. Every hour and a half to two hours, the mask should be removed and the patient's face should be washed, dried and powdered before the mask is replaced. Sometimes vanishing cream is preferable to powder. This procedure is particularly important to the patient's comfort in hot weather.
6. At the end of each case the mask, connecting device and bag should be washed in soap and water and rinsed thoroughly before being boiled for 4 or 5 minutes. Before boiling, it is recommended that each unit be wrapped in a double thickness of gauze. Dry each part thoroughly before it is put away for future use. Unless the sponge-rubber discs of the BLS are dried completely, the mask will not operate satisfactorily.

The inhalation of essentially 100 per cent oxygen is reported to be toxic to laboratory animals in thirty-six to forty-eight hours if it be administered continuously in a closed respiration chamber. As yet the average length of time that high concentrations of oxygen can be safely used on humans is not known. However, when a mask is used, the inhalation of high concentrations of oxygen is, in actual practice, by no means continuous because the patient talks, eats or has the mask removed at rather frequent intervals for general nursing care.

Theoretically the moisture built up in the face piece of a mask, from the patients' exhalations, is sufficient to prevent any dryness or irritation of the nose or throat. However, an occasional patient; particularly when 100 per cent oxygen is being administered, may complain of dryness. In such cases the oxygen is being administered, may complain of dryness. In such cases the oxygen can be humidified by passing it through a water bottle humidifier, or in the case of the OEM, by introducing 20 cc of water at a time into the meter.