

Oxygen Therapy

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Adequate oxygen therapy means the early administration of oxygen to restore normal physiology. It cannot be emphasized too strongly that the recognition of incipient hypoxia and the prompt institution of oxygen therapy are essential factors in the securing of good results. No longer should the administration of oxygen be delayed until cyanosis develops, nor should the oxygen cylinder be wheeled in, only as a last resort to impress the relatives and frighten the patient.

Signs of Oxygen Want.

The most reliable sign of early oxygen want is the pulse rate. As hypoxaemia or hypoxia develops the pulse rate increases, and as hypoxaemia or hypoxia is relieved by excess oxygen the pulse rate returns to its original level. One can assume that the tachycardia is not due to oxygen want if there is no change in the pulse rate with the administration of proper concentration of oxygen. The pulse rate can also be used as a guide to the proper time for discontinuance of oxygen therapy. If oxygen therapy is discontinued and the pulse rate rises, the patient still requires excess oxygen, but if the pulse remains the same, excess oxygen is no longer needed.

The character and rate of respiration may change very little until acute oxygen want develops, at which time the rate increases.

The changes in the central nervous system manifested in the early stages of oxygen want, are represented by SIGHING, YAWNING and RESTLESSNESS, which may progress to acute delirium at times. Restlessness is a common manifestation of oxygen want and too often is mistakenly treated with sedative drugs. These drugs serve only to increase the oxygen want and fail to control the restless-

ness until dangerous doses are given. Restlessness and apprehension in any patient should suggest hypoxia, and oxygen therapy should be tried before sedative drugs are given.

PRECORDIAL PAIN may develop in the early stage of oxygen want, and some patients may have fibrillary muscle twitchings.

In acute oxygen want the pulse may become slow and bounding and the pupils fixed and dilated and the respirations which may have been rapid and shallow, will become depressed and irregular. Cyanosis, which may have been only slight, may become severe and convulsions may replace the muscle twitchings. There should be no question of the need for oxygen in the patient exhibiting these signs of early oxygen want. Remember that cyanosis is a late sign of hypoxaemia and that serious hypoxia may be present in the absence of cyanosis. Cyanosis cannot develop in patients who have less than 6 gram of haemoglobin per 100 c.c. of blood, but these patients can have acute oxygen want.

Respiratory Centre and Carotid Body.

One must realize that there is no storage of oxygen anywhere in the body, even though oxygen is the absolute essential to the maintenance of life. We live a minute to minute existence, dependent on our ability to provide oxygen to the tissues. A total deprivation of oxygen to the cells of the higher centres for as short a period as eight minutes will cause irrevocable damage and death.

Normal respiration is maintained by rhythmic impulses from the respiratory centre which influence inspiration and expiration. The cells of respiratory centre are subject to influence by oxygen and carbon dioxide tension in the blood and by nervous reflexes of manifold origin.

The cells of respiratory centres are particularly susceptible to hypoxia, and their activity is diminished or suppressed with only moderate degree of hypoxia. In states of hypoxia, the reflex drive for respiration is maintained by the carotid body. The carotid body and similar tissues elsewhere in the body exert some influence on respiration when the respiratory centre is well oxygenated and functioning properly, but the principal function of the carotid body is to maintain respiration in states of hypoxia. Acute asphyxia will ultimately depress the carotid body. If a patient is exposed to hypoxia of such degree that the carotid body is governing respiration and the patient is suddenly given sufficient oxygen to eliminate hypoxaemia, respiration may cease momentarily. This respiratory stoppage is due to the fact that the carotid body ceases to function when the hypoxaemia is relieved and the cells of the respiratory centre have not yet become sufficiently resuscitated by the oxygen to resume their function.

A number of terms have entered into this discussion—1. *Anoxia* is a state of complete lack of oxygen in tissues. 2. *Hypoxia* is a state of partial oxygen lack in tissues. *Anoxaemia* is a state of complete oxygen lack in blood. 3. *Hypoxaemia* is a state of partial oxygen lack in blood. 4. *Carotid body* is a ductless gland situated at the bifurcation of common carotid artery.

Types of Oxygen Want.

Oxygen want has been classified into four types :—

1. *Anoxic hypoxia*—occurs when tension of oxygen in blood is reduced. As the tension is reduced, the haemoglobin is not saturated to normal extent, and full oxygenation is not possible. It is seen in obstruction of airway. The function of haemoglobin is to carry oxygen and the oxygen content of the blood depends on the haemoglobin value. Each gram of haemoglobin carries 1.34 c.c. of oxygen

when it is exposed to an oxygen tension of 100 m.m. of Hg. and a carbon dioxide tension of 40 m.m. of Hg.

2. *Anaemic hypoxia*—occurs when there is a diminution of functioning haemoglobin and so the oxygen carrying capacity of blood is reduced though the oxygen tension is normal. It is seen in anaemia.

3. *Stagnant hypoxia*—occurs when circulation is slowed so that in spite of normal oxygen tension and normal haemoglobin the supply of blood to the tissue is insufficient. It is typically seen in surgical shock and cardiac failure.

4. *Histotoxic hypoxia*—occurs when the tissues are unable to utilize the normal supply of oxygen brought to them. It is seen in overdosage of narcotics and anaesthetics.

Methods of Administration.

There are five fundamental and practical criteria by which the various methods can be evaluated. The criteria demand that a method that is (1) clinically and scientifically efficacious, (2) readily available for large number of patients, (3) economical, (4) simple, and (5) convenient to nursing care.

There are four common means of administering oxygen therapy : (1) the tent, (2) the mask, (3) the box, and (4) the oropharyngeal catheter. The best source of supply of oxygen for all these is the 40 cu. ft. cylinder of oxygen or a central supply from which oxygen is piped to the bed side. A reducing valve is needed to reduce the high pressure of the large cylinder to a safe delivery pressure. The reducing valve should have incorporated in it a regulator valve with a flowmeter or a gauge to show the flow of the oxygen in litres per minute.

Oxygen Tent.

The principal advantages of the oxygen tent are the ability to obtain relatively high concentrations of oxygen, efficiently; the cooling of the atmosphere and the absence of

appliances on patient's face. The disadvantages are the relatively high initial cost, making it not economically available to large number of patients, the need for close and constant supervision to maintain proper concentrations and its interference with complete nursing care.

Oxygen Mask.

The principal advantage of the mask, is the ease with which very high concentrations may be obtained. It is also useful in patients who object to the oropharyngeal catheter or tent. Contrary to what might be expected, the oropharyngeal catheter is better tolerated than the mask for long continued oxygen therapy. The disadvantages are discomfort to the patient when worn over long periods and interference with nursing care, particularly when the oronasal type of mask is used. If the nasal mask alone is used, the patient must co-operate by keeping his mouth closed. Practical use of this method is confined to patients who require high concentrations of oxygen.

Oxygen Box.

The oxygen box is a convenient, economical and simple means of supplying excess oxygen to infants and small children. Relatively high concentrations can be obtained with reasonable flow rates. Nursing care is unhampered. Use of oxygen box is not as wide-spread as it might be.

Oropharyngeal Catheter.

The oropharyngeal catheter method, popularly but improperly termed the nasal catheter method, is most readily available in all situations. A concentration of 35-45 per cent of oxygen in the alveoli is obtained with a moderate flow rate (7-8 litres per minute), making the method clinically and scientifically efficacious and suitable for almost all patients requiring oxygen therapy. The low initial cost of equipment and the small maintenance cost make it readily available to large number of patients. The technic is simple, requiring minimal

supervision. It is economical, and there is no interference with nursing care.

There are few fundamental requirements for the proper use of the catheter method. Failure to adhere to these fundamental requirements results in inefficient therapy and accounts for many poor results obtained with this method. The first requirement is the proper humidification of the oxygen, since the dry oxygen from the cylinder is irritating and causes discomfort. The second requirement is proper placement of the right type of catheter. The most acceptable catheter should be of size F. 14, and should have a large lumen. Several holes should be present along a distance $1\frac{1}{2}$ inches from the tip of the catheter. Proper placement of the catheter in the oropharynx is a simple procedure. With the oxygen flowing, the catheter can be introduced along the floor of the nose into the oropharynx a distance equal to that from the side of the nose to the tragus of the ear. Another method is to introduce the catheter until the patient begins to swallow oxygen. The catheter then is retracted to a point just short of the swallowing reflex. It is unnecessary to visualize the tip of the catheter in the oropharynx.

The disadvantages of the catheter method are few, being chiefly the inability to obtain high concentrations when needed and occasionally an objection by the patient to the presence of the catheter. Most objections by patients can be traced to use of improper catheters, to catheters which have become dirty, to inadequate humidification of the oxygen and to incorrect placement of the catheter. The oropharyngeal catheter method provides an efficient means for the routine treatment of oxygen want.

Uses of Oxygen Therapy.

Oxygen therapy is used most often in patients suffering from oxygen want because of respiratory obstruction, cardiac failure, shock and impaired

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