GAS AND OXYGEN ANÆSTHESIA IN RELATION TO ITS SAFETY TO THE PATIENT.

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RECENTLY gas and oxygen has come into some disrepute as an anaesthetic in major surgery, more especially in cases requiring a prolonged anaesthesia. Fatal accidents upon the operating table while under gas and oxygen have been recorded; but so far, no statement of the factor or factors at fault in the anaesthetic agent or its administration has been published. The safety of any anaesthetic includes the immediate risk upon the table and the remote risk after operation. In these notes I propose to deal only with the immediate safety of the patient. The consensus of expert anaesthetic opinion, both in America and in this country, has been that nitrous oxide and oxygen, with or without ether, is the safest type of general anaesthesia we have at our command for minor or major surgery. This statement must be qualified since the safety of gas and oxygen anaesthesia is circumscribed by several factors entering into its administration.

The first is the type of patient for which the anaesthetic is chosen.

Gas and oxygen is particularly well suited and safe to the patient whose vitality has been reduced by long illness, toxæmia or loss of blood, also patients who have suffered severe shock from duodenal or appendicular perforation, from strangulation or intussusception of bowel. Cases with reduced vitality or suffering from shock are very susceptible to gas and oxygen anaesthesia. In strong contrast is the robust man accustomed to an outdoor life, alcohol and tobacco, who, having recovered

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Gas and Oxygen Anaesthesia

from a recent attack of appendicitis, comes to the operation table for appendicectomy, or the patient with emphysema, who comes with a strangulated hernia. In these cases a large proportion of oxygen is required to prevent asphyxia. The oxygen stimulates the existing tendency to excitement and prevents a sufficient concentration of nitrous oxide to anaesthetize the patient, while the addition of ether excites cough and respiratory spasm, and chloroform is always dangerous with a closed apparatus. Such cases would be ill-considered risks for gas and oxygen anaesthesia.

The second is that the co-operation of the surgeon is essential.

With gas and oxygen the surgeon must be interested in the benefits that accrue to his patient and sympathetic to the difficulties of its administration. He must frankly recognize the limitations of the anaesthesia and be prepared to act accordingly; otherwise it will be better for the patient and safer that gas and oxygen should not be the anaesthetic agent. The anaesthetist, on his part, should recognize that surgeons have been accustomed to anaesthesia with muscular relaxation by means of chloroform or ether, and they do not always find it easy to adapt themselves to the changed conditions which gas and oxygen anaesthesia, supplemented by ether, presents in, for example, an exploratory laparotomy or in cholecystectomy.

There are two things which should be done by the surgeon to enhance the efforts of the anaesthetist with gas and oxygen. The first is local infiltration of the operation area and blocking of the adjacent nerves, with \( \frac{1}{2} \) per cent. or \( \frac{1}{3} \) per cent. novocaine. The second is gentle manipulation of the organs and tissues with refined traction and retraction. These are valuable adjuncts to any type of general anaesthesia, but practically essential to good and safe gas and oxygen anaesthesia.

The third is the actual administration.

Regarding safety, the Anaesthetics Committee of the British Medical Association in 1900 reported "that by far the most important factor in the safe administration of anaesthetics is the experience which has been acquired by the administrator." The report continues: "In many cases the anaesthetisation completely transcends the operation in
gravity and importance, and to ensure success, particularly in these cases, it is absolutely essential that an anaesthetist of large experience should conduct the administration." This statement is particularly applicable to the safe administration of gas and oxygen to-day.

The following points are of great importance, and an intimate knowledge and experience of them is necessary in the administration:

1. The percentage of nitrous oxide required to produce anaesthesia, with a sufficient percentage of oxygen to prevent asphyxia or anoxæmia.

2. The toxic effects of nitrous oxide that may arise and progressively increase the more prolonged the anaesthesia.

3. The anoxæmia which may arise from a deficient percentage of oxygen without necessarily producing clinical signs of asphyxia.

4. The cerebral excitement and inefficient anaesthesia which may arise from excess of oxygen.

5. The danger of loss of carbon dioxide by excessive respiration on the valves with consequent anoxæmia and apnoea.

6. The risk of excessive rebreathing with hypercapnia and hyperpnoea.

The importance of these points vary largely in the individual case. The margin between safety and danger is much less with nitrous oxide and oxygen than with any other anaesthetic used for major operations, not on account of the anaesthetic agent itself, but rather on account of the exacting technique required in the administration. The anaesthetist must keep clearly in mind (a) that whatever be the anaesthetic action of nitrous oxide, it is not asphyxia. Asphyxia is a dangerous complication of gas and oxygen anaesthesia, and should never be allowed to arise in any degree. (b) That a theoretical standard of oxygen percentage has no foundation in practice, and may become a serious menace to the patient.

Gas and oxygen anaesthesia must be conducted on the merits and requirements of the individual patient. With nitrous oxide and oxygen alone at ordinary atmospheric
pressure, it is always difficult, and frequently impossible, to produce surgical anaesthesia with muscular relaxation without entering the danger zone of anoxaemia. Invaluable assistance will be derived from:

1. Infiltration of the operation area with novocaine.
2. Positive ventilation of the lungs by keeping the gases in the gas bag at a pressure of 3—5 mm Hg. In practice this means that the bag is distended with the mixed gases. The amount of gas in the blood depends upon its partial pressure in the pulmonary alveoli.
3. Allowing the gases to pass over or through ether.
4. Rebreathing the gases as well as the patient’s carbon dioxide. The accumulated carbon dioxide will stimulate respiration, increase the intake of gases, conserve the patient’s vitality and at least delay the onset of surgical shock.

The fourth is the nature of the operation.

Until recent years gas and oxygen anaesthesia has been used only for the big risk cases of major surgery. This fact explains the relatively high mortality upon the operating table, but to arraign the anaesthetic agent for this is to foster a fallacy and to produce most unreliable statistics. In the interest of the public, as well as the science of anaesthetics, there is urgent need that a distinction should be drawn between “Deaths under anaesthesia” and “Deaths due to anaesthesia.” At present all deaths upon the operating table are taken to be anaesthetic deaths, and, so far as the Registrar-General’s returns are concerned, are put down as anaesthetic deaths, even when it has been found post-mortem that the anaesthetic agent, as such, had nothing to do with the fatal issue. The nature of the operation for which gas and oxygen is used, whether it be dissection of neck glands or thoraco-plasty, abdominal section, hysterectomy, or disarticulation at the hip joint, calls for less consideration the more expert the administration and the more thoroughly local infiltration analgesia or nerve blocking is done by the surgeon. In infants, children and adults the immediate, as well as the ultimate, risks are less with gas and oxygen and ether than with any other general anaesthetic agent, provided the conditions of safety are properly appreciated.