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-- HISTORY OF ANAESTHETICS. --

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The use of anaesthetics has been known for hundreds of years. The art of catalepsis, a sort of mesmerism, was one of the first methods of allaying pain that was put into practice. Herodotus, a Greek historian B. C. 484-420, Pliny, a Roman naturalist 23-79, and Dioskorides, a Greek medical writer who flourished in the second century, mention in some of their manuscripts drugs that were used for the purpose of deadening pain. Mandragora was used by Italian physicians for this purpose. There is a Chinese physician who is credited with having used Cannabis, hemp, for the purpose of obviating the pains of surgical operations, by inhalation. It has been claimed that physicians of the middle ages were very skillful in the producing of insensibility by artificial means, and that many of the astonishing exhibitions of unconsciousness to pain were the effect of drugs and vapors.

Sir Humphrey Davy, 1778-1829, one of the leading English chemists, appears to have been the first to comprehend the practicability of using anaesthesia for surgical purposes. He discovered that nitro-genic protoxide would, with a reasonable degree of safety, remove the sense of pain and set the mind free from its bodily duties. Michael Faraday, a pupil of Davy's, secured similar results from inhaling sulphuric ether, but it was not until the latter part of the century that this was put to any practical use. It was then that Crawford W. Long of Georgia, Horace Wells of Hartford, and William T. G. Morton of Boston ventured to make some practical

demonstrations with it. The latter two, who were dentists, used it in their practice, Wells using nitrous oxide, and Morton, sulphuric ether. Morton's success was so complete that he induced a surgeon to use it in the hospital. After many trials and legal conflicts the credit for the discovery was conceded to Morton. At first his discovery was not accepted very generally in the United States, but received a very speedy appreciation abroad.

In the preceding lines I have tried to give a brief history of the use of anaesthetics leading up to the discovery of the use of ether by Morton.

In considering the subject of anaesthesia the first and most important question which arises is as to the choice of the anaesthetic. In the selection of an anaesthetic the question of safety is of greatest importance. Up to the present time there is no true anaesthetic known, the use of which is not accompanied by danger.

The number of substances which have been used by surgeons to produce anaesthesia is quite large, yet three anaesthetics, nitrous oxide, ether, and chloroform, on account of their extensive use, stand out in a class by themselves. The following are some statistical reports on the three. Dr. George M. Gould, of the St. Bartholomew Hospital, reports that from 1875 to 1890 inclusive anaesthesia was produced 19,526 times by chloroform, 8491 times by ether, and 12,941 times by ether preceded by nitrous oxide. The number of deaths were respectively 13, 3, and 1, giving the mortality of chloroform as one in 1502, ether as one in 2830, and ether preceded by nitrous oxide as one in 12,941. The most recent, and probably the best, table that has been prepared is the one given

by Dr. Gould, Jullard and Compte. In this table are included 638, 461 administrations of chloroform with a total of 170 deaths, and 300,157 administrations of ether with a total of 18 deaths, giving a mortality with chloroform of one in 3749, and with ether, one in 16,675. The closeness with which these results coincide with the large statistical reports from Europe go to prove their correctness.

The anaesthetic which holds the record as having caused the fewest deaths is nitrous oxide, N₂O. Dr. Charles M. Buchanan, in the Medical News, Vol. 62 of 1893, says that the probable mortality of nitrous oxide inhalation is two in 10,500,000. The reason for this low death rate is that in the production of anaesthesia it acts by excluding the oxygen from the blood, as is shown by the fact that an animal will live in nitrogen, hydrogen, or even in a vacuum as long as in pure nitrous oxide. This has been proved by a number of the French observers, who have shown that anaesthesia is not produced until the oxygen in the blood has been reduced to three or four per cent. Dr. H. C. Wood of the University of Pennsylvania has proven by his experiment that the time required for the production of anaesthesia with nitrous oxide is practically the same as with mechanical asphyxia. He has also shown that the addition of three per cent of oxygen doubles the time necessary for the production of anaesthesia, while the addition of five per cent of oxygen more than sextuples the time, and that eight per cent of oxygen indefinitely prolongs the time for complete anaesthesia. On that account nitrous oxide cannot be used for any great length of time and is of little value for the purposes of the operating surgeon.

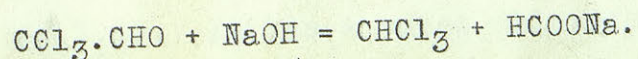
Nitrous oxide is a colorless, almost inodorous gas of a sweetish taste, and is a very active supporter of combustion. It is

made by the distillation of the nitrate of ammonium, which resolves itself into the gas and water, $\text{NH}_4\text{NO}_3 = \text{N}_2\text{O} + 2\text{H}_2\text{O}$. The inhalation of pure nitrous oxide gas causes unconsciousness in from one-half to three minutes, which usually comes on quietly but is sometimes preceded by hilarious excitement. During anaesthesia the face becomes swollen and intensely livid, and it is probable that the nerves become paralyzed the same as in the course of etherization.

Ether, or ethyl oxide, is a colorless, very volatile liquid, and is obtained by the interaction of alcohol and sulphuric acid. Both the liquid and the vapor are very highly inflammable. The vapor is about two and one-half times heavier than air. Its specific gravity, when pure, is 0.713 and it has a boiling point of 35° and will not solidify at -80° .

The first effect of ether when inhaled is a burning in the back part of the mouth, and a feeling of strangulation. This is due to the irritating effect of the vapor. The next indication of its action is a sense of exhilaration and a lightness of the head, which is sometimes accompanied by a roaring in the ears, and these sensations are soon succeeded by a far-off feeling which soon fades into a semi-unconsciousness, with visions and illusions. The second stage of ether narcosis does not really begin until the period of complete unconsciousness is reached. After this the muscles do not remain rigid for any length of time, but pass into a perfectly relaxed and quiet state.

Chloroform, or trichloro-methane, CHCl_3 , may be prepared by distilling alcohol with bleaching powder. The product prepared in this way is not of a very pure quality. A much purer substance may be prepared by distilling chloral hydrate with caustic soda,-



Chloroform is a heavy, pleasant-smelling liquid with a sweetish taste, and having a specific gravity of 1.5. When chloroform vapor is inhaled it produces symptoms similar to those induced by ether, except for the absence of the choking sensation and that the stage of excitement is of much shorter duration and less violent.

Chloroformization is divided into four stages by some experimentors, and into three by others, and the latter has the preference. In the first stage the symptoms are similar to alcoholic intoxication. This stage is generally of very short duration, except in the case of drunkards, when it may be very long and in some cases impossible to overcome without endangering the life of the patient. In this state consciousness is not lost, but the sensibility to pain is somewhat lessened. Anaesthesia proper comes on during the second stage, when consciousness and sensibility are abolished, the muscles are relaxed, and the patient lies quiet, as if in a deep sleep. This is sometimes called the surgical stage because all ordinary operations are performed while the patient is in this condition. The third stage is one of profound narcosis; it is accompanied by very deep breathing, extreme muscular relaxation, and the absence of ordinary reflex action. This is a dangerous stage. The pulse in the first stage of anaesthesia from chloroform may be quickened and, to all appearances, strengthened; in the second stage it is generally about normal in frequency, but is weakened to a more or less degree; in the third stage it is increased in frequency and weakened to a very noticeable extent.

There are a number of other anaesthetics which might be mentioned, but are not worthy of any great consideration.

Bromide of ethyl is a colorless, volatile liquid having a specific gravity of 1.49. It has a sweet chloroform-like smell

and is not very readily inflammable. The physiological action of the bromide of ethyl has been only partly studied, and therefore there is a great deal of dispute over its action. Two objections to its use are that the narcosis is of very short duration and that it is very difficult to get a pure preparation, and even when pure it undergoes chemical change so readily that it is very dangerous to use it.

Pental-Trimethylethylene is a colorless, highly inflammable liquid with a boiling point of 100.4° F. It acts with great promptness, but produces a very short narcosis. Its depressing effect on the heart and its action upon the kidneys place it in a class of very dangerous anaesthetics.

Concerning the mode of action of the true anaesthetic, it is held by the larger number of experimentors that there is a poison circulating in the blood, and this belief has been strengthened greatly by the reports of the Lancet Commission which has tabulated the records of chemical reports of 384 deaths during anaesthesia with chloroform, and has shown that out of this number in 227 cases the pulse failed entirely before cessation of respiration, and that 77 times the heart's action and respiration ceased simultaneously. In only 80 cases did respiration stop before the heart.

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