thoroughly washed and boiled when necessary, and will distend greatly before bursting.

In Hewitt's and the author's inhalers the valves may be thrown out of action at will, whereupon to-and-fro breathing will occur. This is of service in the administration of "gas and ether," and may occasionally be used in prolonging an administration which would otherwise be cut short owing to the supply of gas unexpectedly giving out.

An administration of pure nitrous oxide may be briefly described as follows: The gasometer or bag having been filled from the cylinder and the face-piece accurately applied, a few respirations without gas are permitted, to accustom the patient to breathing through the valves. Gas is then turned on and breathed by the patient until the signs of complete gas anæsthesia are present. In this form of administration these signs are largely due to the deprivation of oxygen and consist chiefly in cyanosis, stertorous, jerky, respiration, twitching movements in the extremities, rotation and fixation of the eyeballs, dilatation of the pupil, and absence of conjunctival reflex. The time consumed in such an administration has been found by Hewitt to be as follows: Maximum, 70 seconds; minimum, 25 seconds; average, 51 seconds.

The duration of the anæsthesia resulting from such an administration was found by Hewitt to vary between 20 and 65 seconds, with an average of 42.1 seconds. Hewitt later reduced this average to 35 seconds as being nearer correct.

There are two plans of administering gas mixed with air, the difference depending upon the manner in which the air is admitted. In one a small percentage is mixed with the gas throughout the administration, while in the other, breaths of air are given intermittently. A single complete administration of gas and air consumes considerably more time than an administration of gas alone. The resulting anæsthesia is somewhat longer than from gas without air, and there is a marked lessening or absence of cyanosis, twitching movements, jerky respiration, and other asphyxial symptoms. If too much air is mixed with the gas excitement will appear.

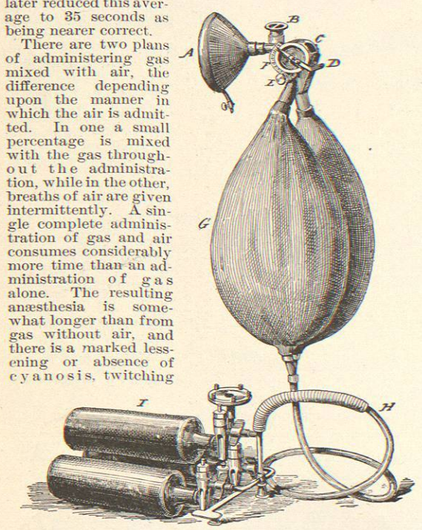


FIG. 1288.—Hewitt's Nitrous Oxide and Oxygen Apparatus. *A*, Face-piece with inflatable edge; *B*, expiratory valve; *C*, air tap for inspiration when the gas is cut off; *D*, lever by which gas and oxygen are turned on; *E*, special stopcock for turning on more oxygen than controlled by lever *D*; *F*, index showing proportion of oxygen from 1 to 10; *G*, double bag, one side for gas, the other for oxygen; *H*, double tube (one within the other); *I*, cylinders of gas and oxygen.

Nitrous oxide with oxygen is most satisfactorily administered under increased atmospheric pressure, as demonstrated by Paul Bert, but in practice this method is impracticable. Under ordinary conditions this combination may be administered in two ways. A definite percentage mixture may be given from an ordinary gas inhaler, or a special apparatus may be employed, by means of which a mixture of any desired proportions may be used.

Hewitt found the most satisfactory definite mixture to contain 12.75 per cent. of oxygen. He obtained better results, however, by means of a regulating inhaler, and the apparatus shown in Fig. 1288 is the outcome of his investigations on this subject during a period of eight years. This apparatus has a regulating mechanism by means of which nitrous oxide may be given pure or plus from 1 up to 30 parts of oxygen.

A typical administration with this apparatus may be described as follows: The bags having been emptied of air and then filled about three-fourths full of their respective gases, the face-piece is applied with the index pointing to air, which the patient now breathes through the inhaler. When it is seen that the face-piece is well applied the index is turned at once to 1 or 2, where two or three respirations are allowed; the index is now moved forward a number at a time, and at each number two or three respirations are permitted. When the index has reached 6 or 8 about a minute has elapsed, as a rule, and there should be signs of moderate anæsthesia, the breathing should be slightly stimulated, the patient quiet, the color good, and the conjunctiva somewhat insensitive. Under these circumstances the inhalation should proceed, moving the index more gradually forward till signs of complete anæsthesia are present. If the oxygen has been turned on too rapidly signs of light narcosis will appear, the breathing will become shallow, there may be excitement, phonation, movement, or retching. In this event the index must either remain stationary till the signs pass off or must be turned back a point or two for a number of breaths and then forward more slowly. When a satisfactory narcosis has been reached the patient's condition is usually as follows: The respiration is slightly stimulated, the pulse is normal or slightly stimulated, the color is normal or slightly flushed, the eyeballs are usually rotated downward and fixed, the conjunctiva is insensitive, and the extremities are relaxed. The narcosis may be continued as long as required, the administration being governed by the principles already mentioned. It will be found that as the inhalation proceeds, a gradual increase in the percentage of oxygen will be necessary. All changes in the proportions of the gases should be made gradually if possible. Sudden changes produce marked effects which are apt to interfere with the smoothness of the narcosis. The bags should be kept about two-thirds full and equally distended throughout the administration.

Gas and oxygen is unquestionably the best and safest form of nitrous-oxide anæsthesia. It possesses all of the favorable characteristics of the latter, and is to a great extent free from the worst of its unfavorable features, *i.e.*, the asphyxial element, to which may be attributed practically all that is dangerous and unpleasant in ordinary nitrous-oxide anæsthesia. The unfavorable characteristics of gas and oxygen are as follows:

1. Difficulties, inconvenience, and expense of the administration.
2. Light form of narcosis.
3. Failure to procure satisfactory anæsthesia, in a small percentage of cases.

1. Gas and oxygen is vastly more difficult to administer satisfactorily than is chloroform or ether, and this is due to the fact that the method presents a great number of technical details which require considerable experience and the closest attention. It is practically impossible to move the patient after this anæsthetic has been started without disturbing the narcosis. It is therefore necessary to have the patient upon the operating-table before beginning, and any other than the supine position renders the administration too difficult to be practicable. The apparatus is large and is apt to be in the way if the operation is about the head or neck. It is necessary to protect the tubes through which the gases flow from pressure. If stepped upon they will burst, as the author has several times found out. The cost of a long administration of gas and oxygen is considerable compared with ether or chloroform; five dollars' worth of the gases not infrequently being consumed.

2. While the narcosis may be carried to a deeper degree with gas and oxygen than with gas alone, it is occasionally not deep enough, and this is very especially true in reference to rectal and abdominal operations. The abdomen is peculiarly apt to remain rigid, even though the narcosis is deep and free from signs of asphyxia, and gas and oxygen is not to be recommended for intra-abdominal operations, except in cases in which the advantages of this form of anæsthesia more than offset this particular disadvantage.

3. Failure to produce satisfactory anæsthesia is exceedingly rare and is very apt to be the result of faulty administration. The author is convinced, however, that there are patients who, with fairly skilful treatment, will not pass into that quiet, deep narcosis which is desirable. These patients probably belong to the class that take anæsthetics badly, requiring large doses and showing marked resistance to the action of the agent used.

The Choice of Gas with Air or with Oxygen as the Anæsthetic.—The limitations above noted in regard to the scope of nitrous oxide for surgical operations indicate in a way its field of usefulness. In the writer's judgment, however, the greatest indications for the employment of this form of anæsthesia are to be found: 1. In patients who are more than usually endangered by ether or chloroform, by reason of their general physical state or on account of the presence of some special pathological condition. Examples of this class are found in very weak patients, in the very aged, and in those presenting active lesions of the lungs, the kidneys, or the heart. 2. In operations that are so short or so trivial as to render the effects of ether or chloroform out of proportion to the case. 3. In patients who have previously suffered unusually from the effects of ether or chloroform and who have great dread thereof. The following list of cases from the author's personal records may be of interest as indicating the possibilities of this anæsthetic:

Amputations: Arm, for extensive necrosis of hand. Breast, for carcinoma, with removal of the axillary glands. Toe, for gangrene.

Curetting: Uterus, sinuses, abscesses, etc.

Excision: Carbuncles of neck, leg, etc.

Incision: Abscesses of neck, leg, breast, vulvo-vaginal, etc.

Laparatomy: Appendicitis, exploration, ventro-fixation.

Plastic operations of face.

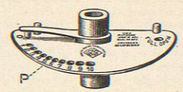
Suprapubic cystotomy for stone.

Many cases of the following: Examinations, painful dressings, suture of wounds, circumcision, ligature of hemorrhoids, anal and vaginal dilatations, breaking up joint adhesions, stretchings in orthopædic cases, etc.

The time of operation in those cases ranged from a few seconds to ninety minutes. The ages of the patients ranged from below one year to eighty-four years.

A single complete administration of gas and oxygen has been found by Hewitt to take an average of 110 seconds and the duration of the resulting anæsthesia to be 44 seconds as an average. The longer or shorter the inhalation of gas alone or in combination with proper amounts of air or oxygen, the longer or shorter the anæsthesia.

DANGERS OF ANÆSTHESIA AND THEIR TREATMENT.—The dangers which result from the administration of anæsthetics are connected with either the circulation or the respiration. The dangers of chloroform are chiefly in connection with the circulation and are manifested by various degrees of circulatory depression. The dangers of ether and nitrous oxide are chiefly in connection with the respiration and are manifested by various degrees of asphyxia. The nature and manner of production of these conditions have been discussed in the article *Anæsthetics* (Vol. I.), under "Physiological Action" and "Phenomena of Anæsthesia," while the class of cases in which they are most likely to occur will be found under "Choice of the Anæsthetic."



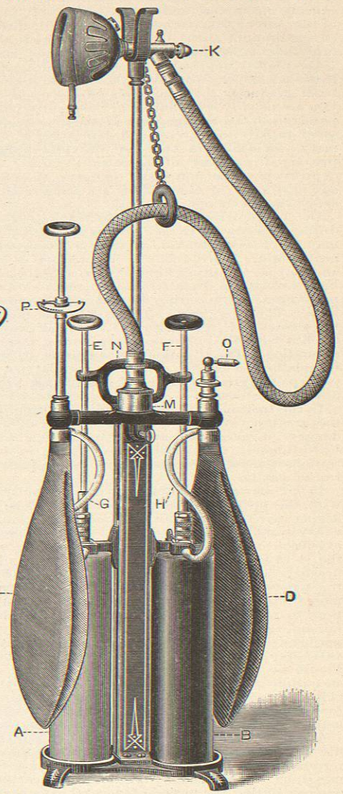


FIG. 1289.—White's Nitrous Oxide and Oxygen Apparatus. A, Red cylinder containing 40 gallons of oxygen; B, black cylinder containing 100 gallons of nitrous oxide; C, oxygen bag; D, nitrous oxide bag; E and F, keys controlling flow of the gases through the tubes G and H; O and P, keys controlling flow of gases to the mixing chamber M and thence to the face-piece K. If O is opened and P closed, pure nitrous oxide will be breathed. If O is closed and P opened fully, pure oxygen will be breathed. Oxygen may be turned on in varying amounts according to the index shown in P *enlarged*.

The various degrees of asphyxia met during the administration of anæsthetics are due, for the most part, to the following causes: *Direct obstruction to respiration*, as caused by stertor, valve-like action of the air passages and orifices above the larynx, and foreign bodies; *spasm of the respiratory muscles; paralysis of the respiratory centre* by an overdose.

The various degrees of circulatory depression met during anæsthesia, which are attributable, directly or indirectly, to the anæsthetic, are due either to too little or to too much of the agent. Too little of the anæsthetic causing incomplete anæsthesia may result in depression of the circulation through nausea and through reflex effects brought about by operative procedures. This is rare under ether, but not uncommon under chloroform.

Circulatory depression from an overdose of the anæsthetic occurs in two ways. If the overdose is administered gradually the dangerous effects upon the circulation are usually secondary and consecutive to dangerous paralysis of the respiration. If the overdose is administered rapidly the circulatory depression is usually primary, especially in the case of chloroform. Unduly prolonged narcosis often causes gradual circulatory depression. The immediate dangers, therefore, in the administration of anæsthetics are manifested by either asphyxia or syncope.

One of the greatest sources of respiratory obstruction during anæsthesia is that associated with *stertor* which may be of nasal, buccal, palatine, pharyngeal, or laryngeal origin. Stertor may be inspiratory or expiratory, and may occur during light or deep anæsthesia. During light anæsthesia it is frequently reflex from operative procedures, while during deep narcosis it is usually paralytic. The direct cause of stertor is the interference of the tissues and organs situated in the air way above the trachea with the currents of air during inspiration and expiration. The situation of the tongue, its weight, and its relations with the epiglottis and larynx, render it perhaps the greatest source of obstruction to respiration during anæsthesia.

In the treatment of these conditions prophylaxis is of the greatest value, for a majority of the difficulties and dangers of anæsthesia are due to faulty administration. Unfortunately, a considerable experience in the administration of anæsthetics is necessary before faulty administration can be corrected.

Reflex stertor, if troublesome and distinctly connected with the operative manipulations, should be met by a deeper narcosis. Stertor not resulting from too light narcosis may be relieved by the following measures: extension of the head by moving the chin away from the sternum; pushing the lower jaw forward by pressure beyond its angles; pulling the tongue forward by the tip or hooking it forward from its base. One or more of these measures will relieve all ordinary obstructions to respiration during anæsthesia; but should they fail and the asphyxia be alarming, tracheotomy should be performed promptly. Obstruction to respiration due to valve-like action of the nares, cheeks, lips, and pharynx should be prevented or relieved by the use of a nasal speculum or by opening the mouth and preventing its closure by a small prop. Obstruction to respiration from foreign bodies, as blood, mucus, stomach contents, or other material, should be met by the prompt removal of same.

An exceedingly rare form of obstruction to respiration during anæsthesia is that due to spasm of the muscles of respiration with absolute cessation of all respiratory movement. This usually occurs in the early stages of narcosis during the period of general muscular rigidity. All that can be done in such cases is to see that the air way is free and then perform vigorous artificial respiration. All forms of obstructed breathing resulting in asphyxia, with cessation or practical cessation of respiration, should be treated by performing artificial respiration after determining the unobstructed condition of the air way. The administration of oxygen during this time would seem to be indicated in hastening the relief of the asphyxia. Asphyxia from paralysis of the respiration by an overdose of the anæsthetic is to be treated on the lines already referred to. In all cases of asphyxia the heart should be sustained by the administration of stimulants, which will be referred to under "syncope."

The best methods of performing artificial respiration for the purpose under consideration are: simple compressions of the chest, Silvester's method, and forced respiration.

Forcible compression of the chest and its subsequent expansion not only creates a considerable movement of air in the lungs, but is a powerful excitant of respiratory effort, if the patient's condition renders such response possible. Air expelled from the lungs in this way also serves to relieve obstructions, such as firm apposition of the epiglottis to the laryngeal opening, foreign bodies, etc.

Silvester's method of artificial respiration is more readily carried out and more effectual than other similar methods. Faradism of the phrenic nerves is a decided aid to artificial respiration. Forced respiration by means of the Fell-O'Dwyer or similar apparatus would probably be of great value in extreme cases of asphyxia of this nature if it could always be at hand and ready for use.

The manner in which syncope is produced through the action of the anæsthetic has been considered in the first part of this article under "action on the circulation." The syncope which occasionally occurs from nausea and from operative procedures under light narcosis by chloroform should be avoided by not permitting the conditions which allow it to occur.

The minor degrees of circulatory depression occurring under chloroform may be relieved by lessening the administration if the narcosis is of moderate or deep degree, or by changing to ether or A. C. E. and by the administration of restorative measures to be considered later.

Alarming degrees of syncope call for prompt and energetic treatment. The administration should be stopped and nothing allowed to interfere or delay the application of restorative measures. The condition of the circulation and respiration should be carefully noted. The anæsthetic contained in the air of the patient's lungs should be removed by rapid and effective artificial respiration, and throughout the subsequent treatment of the case the air way should be maintained in an unobstructed condition. In the treatment of the graver forms of syncope the following are the chief measures of value:

Posture.—More or less inversion of the patient (Nélaton's plan) is almost invariably practised under these circumstances, and there can be no doubt that many lives have been saved through this means. The improvement in the pulse and respiration following inversion in *approaching* collapse from chloroform is proof of its value under these circumstances. It is supposed to act by determining a flow of blood to the medulla and to the heart, thus stimulating respiration and circulation. Inversion has been employed, however, in nearly all of the fatal chloroform accidents, and it is thus evident that it is not invariably effective; indeed, it is probable that it is often positively harmful.

In sudden complete syncope we have seen that the heart is paralyzed and distended with blood, as are the great vessels of the chest and abdomen. Hill has pointed out that to invert a patient under these circumstances is "worse than useless," as "the paralytic dilatation of the heart is thereby increased." Hill recommends the following measures which he has found to relieve nearly every case of this kind in animals. "Artificial respiration is at once applied, the thorax is rhythmically squeezed over the region of the heart, while the animal is placed in the horizontal position. If the pulse does not speedily return the animal is dropped into the vertical, feet-down posture. By this simple means the heart, owing to the influence of gravity, is emptied into the splanchnic area, and thus the dilatation of the organ is relieved. Artificial respiration is maintained throughout this manœuvre. After a few seconds the animal is returned to the horizontal posture, and the heart is thus filled with a fresh supply of blood. If the pulse does not return, the manœuvre is once more repeated. When the pulse has returned and the heart beat has become efficient, the artificial respiration can be discontinued, and after a short space of time the natural breathing will usually return, owing to the excitation of asphyxia. During this period the pulse must be carefully watched, and artificial respiration renewed if there be any signs of failure. . . . The second type of collapse (slow and gradual overdose) is relieved by the vertical head-down position (Nélaton's

method). It is equally relieved by the horizontal position and artificial respiration. As the anæsthetist can never be sure which type of collapse he has to deal with, it seems to me that Nélaton's method should never be employed. If we have to deal with the first type of collapse (sudden overdose) Nélaton's inversion is a fatal mistake; if the second type of collapse confronts us, recovery can be brought about by performing artificial respiration and placing the patient in the horizontal position."

Artificial respiration carried out by rhythmic compressions of the thorax, by Silvester's method, by methods of forced respiration, and by faradism of the phrenic nerves, probably affords the most effective means of treating syncope from anæsthetics.

The method of *heart compression*, commonly referred to as the method of Koenig or the Maas method, has proved to be of great value in many cases of chloroform syncope. The following description is that of Maas: "The operator stands on the left side of the patient with face toward the head of the patient; the cardiac region is pressed upon with rapid and strong pressure by the ball of the right thumb laid upon the chest between the place of apex beat and the left border of the sternum; one-hundred and twenty shocks or compressions are to be made per minute. Care must be taken to exert enough force. Fix the patient's body by the left hand on the right side of the thorax. Success is denoted by artificially produced carotid pulse and contraction of pupils, which should control the force and rapidity of impulses. An assistant should watch the pupil and carotid pulse. As long as the condition of the patient does not improve the pauses in treatment should be as far between and as short as possible. When the pupil contracts you may wait till it begins to dilate, or as long as spontaneous respiratory movements continue."

Drugs.—The experiments of Wood have demonstrated the great value of strychnine and digitalis in the treatment of syncope from chloroform, and the inefficiency of alcohol, atropine, ammonia, amyl nitrite, and caffeine in this condition.

Strychnine must be used in large doses under these circumstances. The author has given as much as gr. $\frac{3}{10}$ in divided doses with advantage upon several occasions, and others have given still more.

The experiments of Schäfer and others prove that suprarenal extract acts as a powerful vaso-motor stimulant, and, as an antidote to the depressant effect of chloroform, it is highly recommended.

The striking effect of the rectal, subcutaneous, or intravenous injection of saline solution in conditions of shock and collapse is proof of its value in syncope from anæsthetics. Laborde's method of "tongue traction" has been resorted to in many cases of apparent death from anæsthetics with excellent results. The tongue, being grasped by the tip, is pulled forward over the teeth as far out of the mouth as possible; it is then permitted to spring back into the mouth. This is repeated at about the normal respiratory rate till respiration is re-established. Success has been attained after long-continued and apparently hopeless effort.

Briskly rubbing the lips often excites increased respiratory efforts, and in the light breathing which occurs early in an overdose this may be used with advantage. Faradism of the heart and puncture of that organ with a needle have been recommended in chloroform syncope, but are of doubtful value.

The following valuable analysis of chloroform fatalities is taken from Hewitt on anæsthetics:

AN ANALYSIS OF 210 CHLOROFORM FATALITIES (= 109 COLLECTED BY THE COMMITTEE OF THE ROYAL MEDICAL AND CHIRURGICAL SOCIETY, AND 101 COLLECTED BY KAPPELER).

(a) Sex.

Males	150
Females	59
Not stated	1
	210

(b) Age.

Under 5 years	2
6–15 years	21
16–30 "	49
31–45 "	53
46–60 "	37
Over 60 years	3
Not stated	45
	210

(c) Nature of Operation.

Amputations	36
Dislocations	16
Removal of tumors	17
Examinations of injuries (including putting up of fractures)	9
Operations on male genito-urinary organs	20
Operations on anus, rectum, etc	11
Operations on female genital organs	5
Operations on eye	16
Hernia	3
Castration	4
For necrosis, excision of bone, etc	7
Excision of joints	2
Forcible straightening of joints	7
For application of escharotics	8
Plastic operations	6
Ligature of arteries	1
Opening abscesses and sinuses	7
Impaction of fæces	1
For removal of teeth	18
Removal of toe-nail	5
For relief of neuralgia	2
For delirium tremens	2
For maniacal excitement	1
Not stated	6
	210

(d) Period of Inhalation at which Death Occurred.

Under one minute	10
One to three minutes	13
Three to five minutes	12
Six to fifteen minutes	33
Over fifteen minutes	7
Not stated	135
	210

(e) Stage of Anæsthesia at which Death Occurred.

Commencing to inhale	14
Stage of excitement	30
Incomplete anæsthesia	49
Fully under influence	68
After operation	31
Not stated	18
	210
Or, Before full effects of chloroform	93
During full effects	68
After operation	31
Not stated	18
	210

(f) Mode of Death.

It is best, perhaps, to keep the two analyses under this heading separate.

Royal Medical and Chirurgical Committee.

"Syncope	56
Syncope during stage of excitement	6
Died suddenly	6
Died in a fit	10
Pulse and respiration ceased together	9
Failure of respiration (pulse not noted)	6
Failure of respiration (pulse remaining)	2
Not stated	14
	109"

Kappeler.

Group 1. Imperfectly recorded cases, or cases in which death could not be ascribed directly to chloroform	61
Group 2. Fully reported cases in which death occurred as the immediate result of chloroform	40
	101

Analysis of Group 2.

A. Death with primary evidences of circulatory failure (14 fully under and 9 partially under chloroform)	23
B. Cases in which respiration ceased first (10 fully under and 7 partially under chloroform)	17
	40

(g) Mode of Inhalation.

On handkerchief, towel, napkin, or lint	87
Lint with sponge	5
On sponge	11
With an ether inhaler	2
Snow's inhaler	5

An inhaler	23
Paper bag or cloth cone	3
Skinner's mask	2
A mask	1
Esmarch's mask	5
Metal inhaler with plenty of air	2
Clover's apparatus	5
Not stated	59
	210

After-Effects.—The following is a brief account of some of the chief conditions which have been called the after-effects of anæsthetics.

Nausea and vomiting constitute the most conspicuous and distressing, though not the most dangerous of the consequences of anæsthesia. Nitrous oxide causes the least after-disturbance of this kind; and while ether causes nausea and vomiting more frequently than chloroform, more cases of protracted and dangerous vomiting are met after chloroform than after ether.

Patients differ greatly in respect to this effect, and a patient may vomit excessively on one occasion and little or none on another under apparently like conditions.

Patients properly prepared for the administration have less sickness, as a rule, than those not so prepared, although in many instances a case presenting a full stomach and no preparation will not be nauseated after anæsthesia.

Washing out the stomach at the close of the administration will lessen or prevent nausea and vomiting in a large percentage of cases, and is an excellent routine practice if carefully done.

At later periods this is also one of the best means of treatment, and after consciousness has been restored it may be carried out at proper intervals by allowing the patient to drink a glass of warm water and expel it by vomiting. A large dose of the bromide of sodium or potassium by way of the rectum will often act beneficially in this condition, and the administration of opium is occasionally the only means that will control it.

Headache following anæsthetics, commonly seen after prolonged administration of nitrous oxide, may be best relieved by cold applications to the head, bromides, or opiates.

Bronchitis, broncho-pneumonia, and typical lobar pneumonia have occurred with noticeable frequency after anæsthetics. These conditions are observed after all anæsthetics, but more commonly after ether than after chloroform. They are probably not due to the direct effect of the anæsthetics upon the pulmonary tissues, but are caused, for the most part, by infections of the lungs through material aspirated into them from the throat during the narcosis, such material often carrying pneumococci and other bacteria derived from the throat and nose. Add to this the chilling influences attending the anæsthesia and the operation, the repression of coughing after certain operations, and the exposure incident to change from the operating room, change of clothing, etc., and it is not surprising that these pulmonary after-effects occasionally develop.

The treatment of these conditions is the same as though they occurred under other circumstances. Prophylaxis consists chiefly in the use of clean inhalers, cleansing the mouth, nose, and throat before the administration, avoiding the aspiration of foreign material into the air passages, keeping the patient from exposure and depression.

Renal congestion, nephritis, and urinary suppression are not infrequently observed after the administration of anæsthetics, as referred to under "Physiological Action." The effects of the deprivation of fluids before and after operation, exposure, and sepsis must not be overlooked in this connection. Treatment should be carried out on usual lines. Saline infusion by way of the rectum, cellular tissue, or veins has proved of great benefit in promoting kidney action under these conditions.

Jaundice, glycosuria, insanity, and other abnormal states have been noted after anæsthetics have been administered. Their exact relations to the narcosis are not fully understood.

After-Care.—During the recovery of patients from the effects of anæsthetics they should have certain special care made necessary by their condition. They should receive assistance during the vomiting which may follow, and, owing to the suddenness with which this may occur, the patient should never be left alone till he is quite capable of taking conscious care of himself. Vomiting is most easily and safely accomplished if the patient is on the side, and this position should be assumed if possible. If the dorsal position is necessary, the head should be turned well to the side during vomiting and elevation of one shoulder will help the position. Large particles of vomited matter should be removed from the mouth as quickly as possible. The common custom of pushing the jaw forward during vomiting is unnecessary and dangerous. It defeats the effort of the patient to protect his air passages.

The patient must be guarded from exposure during recovery. The chilling influences of the anæsthetic and the operation render the patient unusually sensitive, and more than usual covering should be provided. Artificial heat should be used if necessary, but in its application it should be remembered that the patient is more or less anæsthetic and may not notice the presence of a hot-water bag or bottle that is burning him. This is a frequent and disastrous accident. The patient should not be exposed to draughts. Undue sweating should be avoided.

The question of food and drink is important. The custom of withholding everything for many hours is unnecessary. The patient's desire for food or drink is often a reliable guide for the beginning of the same. Weak patients should not be kept as long as others without nourishment. As a rule, it seems best to begin with rather small quantities of warm fluids, proceeding according to the particular conditions present. Thirst may often be relieved by the combination of large amounts of fluid by the rectum and small amounts by the mouth.

Thomas L. Bennett.

[As this article is going to press the "report of the Anæsthetics Committee of the British Medical Association" is announced. It comprises a careful and minute study in great detail of 25,920 cases from reliable sources. The following conclusions, taken from the *Lancet*, London, are thought to be justified:

CONCLUSIONS.

Relative Safety of the Various Anæsthetics.—1. The relative safety of the various anæsthetics may be gathered from the statistical tables in the report. When only those cases of danger which were held to be due entirely to the anæsthetic are considered the following instructive figures are obtained, further emphasizing the danger of chloroform as contrasted with ether. Cases of danger (including deaths) considered to be due entirely to the anæsthetic: under chloroform, 78, giving a danger rate of .582 per cent.; under the A. C. E. mixture, 1, giving a danger rate of .147 per cent.; under mixtures of chloroform and ether, 2, giving a danger rate of .478 per cent.; under the A. C. E. mixture followed by chloroform, 1, giving a danger rate of 1.694 per cent.; under chloroform preceded by ether, 5, giving a danger rate of 2.2 per cent.; under chloroform followed by mixtures of alcohol, chloroform, and ether, 1, giving a danger rate of .36 per cent.; under ether, 2, giving a danger rate of .065 per cent.; under "gas and ether," 3, giving a danger rate of .096 per cent.; under ether preceded by chloroform, 1, giving a danger rate of .480 per cent.; under ether preceded by the A. C. E. mixture, 0; under the chloroform group of anæsthetics (addition of the first six headings above), 88, giving a danger rate of .584 per cent.; and under the ether group of anæsthetics (addition of the last four headings above), 6, giving a danger rate of .085 per cent. 2. Although (excluding nitrous oxide) ether may be accepted as the safest routine agent, certain circumstances determined by the state of the patient, the nature of the operation, etc., may render the use of some other anæsthetic or combination of anæsthetics both safer and easier.

The Best Methods of Administration.—3. No method of

administration of chloroform is free from danger, but an examination of the complicated cases appears to show that the occurrence of danger depends largely upon the administrator who employs any particular method. 4. No conclusion from the evidence before the committee as to the best method of administration of ether and "gas and ether" is possible. 5. The data warrant the conclusion that the A. C. E. mixture should not be given from a closed inhaler—*e.g.*, Clover's. This conclusion applies to all mixtures containing chloroform.

Best Methods of Restoration.—7. The sub-committee are unable from the material at their disposal to draw any conclusion upon this point.

Clinical Evidence Regarding Anæsthetics Generally.—8. Anæsthetics are more commonly associated with complications and dangers in males than in females. 9. Excluding infancy, and taking anæsthetics collectively, the complications and dangers of anæsthesia increase *pari passu* with advancing age. 10. Anæsthetics are notably more dangerous in proportion as the gravity of the patient's state increases. 11. Danger to life is especially likely to be incurred at early periods of the administration of anæsthetics, while the tendency to less grave complications increases directly with the duration of anæsthesia. 12. The tendency for complications, dangerous and otherwise, to occur increases *pari passu* with the gravity of the operation.

Clinical Evidence Regarding Chloroform.—13. Chloroform is about twice as dangerous in males as in females. 14. Chloroform is most dangerous during early infancy and after thirty years of age; least so from ten to thirty years of age. 15. In conditions of good health chloroform is very much more dangerous than other anæsthetics. In grave conditions chloroform still remains the least safe anæsthetic, but the disparity between it and other anæsthetics is far less marked than in health. 16. When danger occurs under chloroform, whatever its exact nature may be, there is abundant evidence that in a large proportion of cases the symptoms that are observed are those of primary circulatory failure. 17. Imperfect anæsthesia is the cause of a large number of cases of danger under chloroform. 18. Vomiting during anæsthesia, which may lead to danger, seems to be more frequent under chloroform than under other anæsthetics. 19. Struggling is very much more frequent in the complicated cases under chloroform than in the uncomplicated, and this phenomenon must therefore be regarded as a source of grave danger under chloroform. 20. The tendency for circulatory complications to appear increases directly with the relative amount of chloroform n the anæsthetic employed. 21. While vomiting is more common after administrations of ether, severe and prolonged vomiting is more common when chloroform has been used. 22. Circulatory depression following anæsthetics is more common after chloroform than after ether. 23. While the respiratory complications of anæsthesia as a whole are of equal frequency under the ether and chloroform groups respectively, yet those that occur under ether are mostly of a trifling and transitory nature while those that occur under chloroform are more grave and persistent.

Clinical Evidence Regarding Ether.—24. Under ether the complications of anæsthesia are more frequent with males than with females, but with the former they are generally slight, ether being rather more dangerous with females than with males. 25. Ether, where employed throughout or preceded by nitrous oxide gas or by the A. C. E. mixture, is singularly free from danger in healthy patients. 26. Minor troubles in administration due to laryngeal irritation and increased secretion are more common under ether and "gas and ether" than under chloroform and its mixtures. 27. Struggling occurs more frequently with ether when given alone than with other anæsthetics, but it rarely leads to danger. 28. After-vomiting is more common with ether than with other anæsthetics, but it is usually transient. 29. Bronchitis is much more common as an after-effect of ether than of chloroform. 30. With "gas and ether," as with ether, dangers are more common in females, although complications are more frequent in males.

Clinical Evidence Regarding Mixtures and Successions of Anæsthetics.—31. The A. C. E. mixture in most of the statistical tables holds an intermediate position between chloroform and ether. 32. The A. C. E. mixture is more dangerous in males than in females, but not to such a marked degree as is chloroform. 33. The administration of ether antecedent to chloroform does not abolish the possibility of chloroform dangers. 34. The various mixtures and successions of anæsthetics were recorded too infrequently to justify definite conclusions.

General Conclusion.—35. From the evidence before the sub-committee they are convinced that by far the most important factor in the safe administration of anæsthetics is the experience which has been acquired by the administrator. In many cases the anæsthetization completely transcends the operation in gravity and importance, and to insure success, particularly in these cases, it is absolutely essential that an anæsthetist of large experience should conduct the administration.]

CHLOROL is a disinfectant and deodorizer consisting of an aqueous solution of one per cent. each of bichloride of mercury, sodium chloride, and hydrochloric acid, and three per cent. of copper sulphate. *W. A. Bastedo.*

CHLOROMA.—*Cancer vert.* A tumor belonging to the general class of sarcoma, more precisely to the group of lymphoma, lymphosarcoma, so-called leukæmic and pseudo-leukæmic tumors, etc. The name was given by King, of Glasgow, in 1853, and indicates the remarkable color of the new growth, which is usually a bright green. Chloroma is remarkable for the frequency with which it affects the periosteum of the cranium, especially in the orbital and temporal regions and in the dura. Various other parts of the periosteum are also frequently affected, besides the lymph glands, bone marrow, liver, kidneys, spleen, lungs, pleura, and other organs. In some cases the tumors have first been discovered in peripheral organs such as the mammary gland or the axillary lymphatic glands, but even in such cases it is probable that the primary growth is in the periosteum of the cranium. The new growth has a tendency to invade the connective tissue, involving fasciæ, tendons, etc., and sometimes forms very extensive infiltrations. In structure the tumor consists of a fine reticulum in which cells of the size and character of lymphocytes lie, traversed by bands of connective tissue continuous with that of the seat. The consistence varies from very soft to very hard, depending chiefly on the connective tissue. The cause of the green color is not known. According to some it is a fat pigment; others compare it to the pigment of green pus. Chloroma occurs especially in early life, although a number of cases have been observed in middle life. More cases have been observed in males than in females. Clinically, chloroma is characterized by rapidly increasing anæmia with petechiæ, nose-bleed, and sometimes scorbutic symptoms; by loss of weight, fever, headache, deafness, tinnitus aurium, blindness and double vision, and by facial paralysis and exophthalmus. Many cases have been first seen in eye or ear clinics, on account of the special symptoms mentioned, and it is possible that in some cases not examined anatomically the disease has been mistaken for an ordinary orbital sarcoma. In a number of cases increase of leucocytes has been observed, the increase affecting especially mononuclear cells having the general character of lymphocytes, the appearance of the blood in other respect closely resembling that in cases of so-called acute leukæmia. The course of the disease is rapid and progressive. The changes in the blood and the structure of the tumors have led a number of observers to assign chloroma to the group of diseases including leukæmia, pseudoleukæmia, certain cases of lymphosarcoma, and some of the tumors described as myeloma. Ignorance of the etiology of all of these processes makes a definite opinion impossible at this time. The idea of bacterial infection is very strong, but posi-