Chloroform, the best of anaesthetics / by Julian J. Chisolm ; read before the Baltimore Academy of Medicine and revised.

Contributors

Chisolm, Julian John, 1830-1903.
Francis A. Countway Library of Medicine

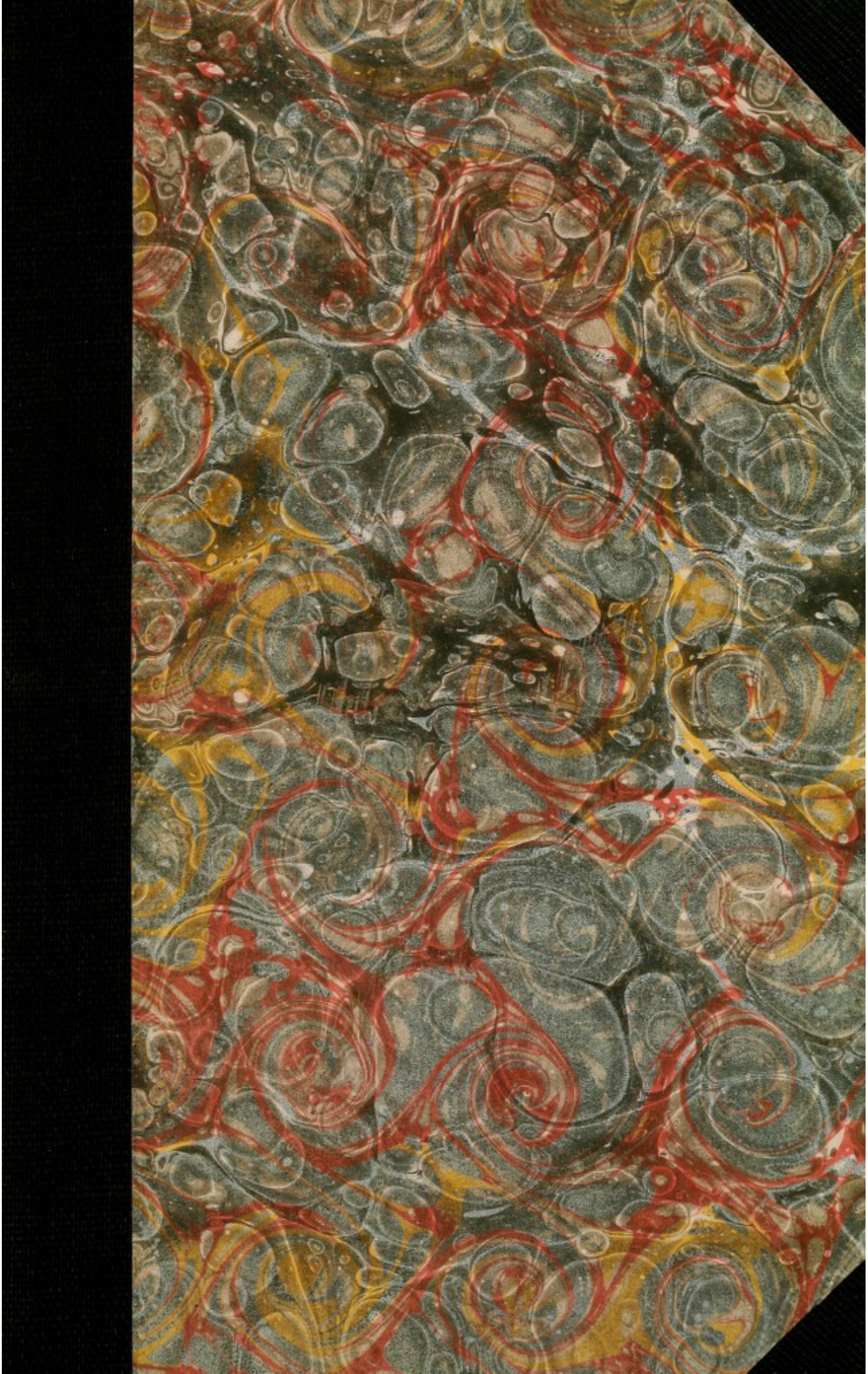
Publication/Creation

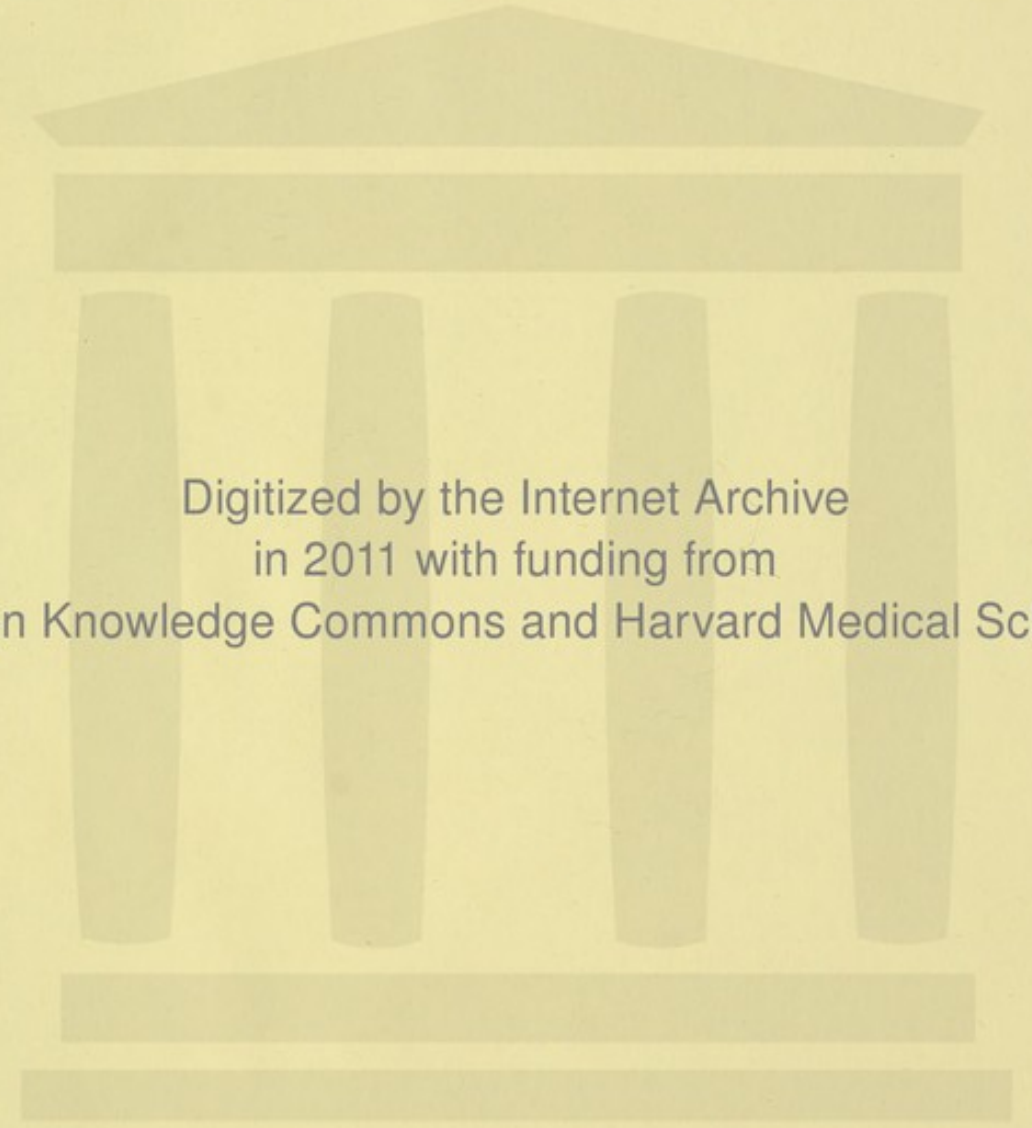
Baltimore : Sun Book and Job Printing Office, 1888.

Persistent URL

https://wellcomecollection.org/works/qw343wvx

License and attribution





CHLOROFORM

THE BEST OF ANÆSTHETICS.

BY JULIAN J. CHISOLM, M. D.

Professor of Eye and Ear Diseases, University of Maryland, and Surgeon in Charge of the Presbyterian Eye and Ear Charity Hospital of Baltimore City.

READ BEFORE THE BALTIMORE ACADEMY OF MEDICINE AND REVISED.

BALTIMORE:
THE SUN BOOK AND JOB PRINTING OFFICE.
1888.

CHLOROFORM THE BEST OF ANÆSTHETICS.

Surgeons in all parts of the world have been much exercised of late over this most important subject, and a question of greater interest to suffering humanity it would be difficult to frame. For the past forty years anæsthetics have been in use, and millions who have been operated upon under their benign influences attest the inestimable value of this greatest of modern discoveries. Ether, although the first introduced, had made but little headway when Simpson, in 1847, gave chloroform to the world. It met with immediate acceptance from professional men; and within a very few years there was scarcely a surgeon of note in either hemisphere who had not used it, and extolled it in the strongest expressions of his mother tongue.

From its universal adoption, the inhalation of chloroform became the precursor of every serious operation; those who enjoyed with it quiet sleep, and who without it would have experienced intense suffering, were soon numbered by hundreds of thousands. Ever-recurring wars, with thousands of wounded, gave surgeons an opportunity of using chloroform on a very large scale, which only added to the well-deserved reputation which it seemed to have enjoyed from its very introduction.

There was but one single alloy in this general jubilee. Now and then some patient would die when chloroform had been inhaled. In former times such fatal accidents on the operating table were common enough to every surgeon of large experience; but now, since the introduction of chloroform, there was an uncomfortable suspicion that in some way the inhalation was to be blamed for these fatalities; for under its life-saving influences nobody ought to die. With this impression once excited, each accident, as reported and copied from journal to journal and from newspaper to newspaper, frightened the public, and slowly undermined the confidence which surgeons had previously had in this anæsthetic. A strong desire was expressed to discover some

kindred agent which would establish general anæsthesia without danger.

For many years the ether anæsthetic had been abandoned, and was nearly forgotten, chloroform having superseded it and driven it out of use. It was now remembered that so far very few deaths had been attributed to ether, and hence this older anæsthetic began to take the place that chloroform had so completely occupied. At this present time ether is nearly as much used as chloroform, its votaries being irregularly distributed. With many chloroform holds its original undisputed sway; while with others sulphuric ether is exclusively used. Now that ether is more extensively employed, deaths under its administration are more frequently reported, and hence the question which is forcing itself on the profession for solution, viz: which of these two anæsthetics is the safer, and by what safeguards can their administration be surrounded?

The many substances for anæsthetic purposes which have been brought to the notice of surgeons in the past few years have had but a very ephemeral existence; and with the exception of nitrous oxide gas, which dentists find so useful for their momentary operations in teeth extracting, and the bromide of ethyl, a powerful but evanescent anæsthetic, very valuable for operations of very short duration only, all have passed from general use. Chloroform and ether still remain as giants combatting for superiority.

That death occasionally occurs during the administration of both ether and chloroform, there can be no question. That deaths have occurred from the inhalation of either of these potent agents, even when the purest drug had been obtained and the inhalation most carefully administered, must be equally admitted. That deaths are numerous when either of these fluids are carefully administered, no one well informed believes. That deaths are often wrongfully attributed to both of these anæsthetics, every one must acknowledge. It is found very convenient to put the shortcomings of surgeons upon these agents. In common with the mal-administration of anæsthetics—the dangers incident to the extreme protraction of operations, so exhausting to patients—clumsiness in the surgical manipulation, with consequent excessive loss of blood—temerity in undertaking operations, in which, from

their magnitude, no reasonable success should have been expected —are disowned in the face of inhalation, to which death is often conveniently attributed, even when the patient dies, many hours or days after the operation, from causes which would have been properly named prior to the discovery of anæsthetics.

I have seen anæsthetics administered carefully and carelessly, boldly and timidly, by those well instructed in their use, and by others totally ignorant of their action. I have seen instances, during the inhalation, in which the most serious accidents would have happened had not steps been promptly taken to prevent them. I propose in brief to analyze these cases, amounting to many thousands, which have come under my own personal observation, and from their careful consideration deduct rules for the guidance of the surgeon in the administration of anæsthetics, by following which, safety and success in the use of these most valuable agents can be secured.

For successful inhalation, much will depend upon the mode of offering the anæsthetic to the patient. The method I adopt for administering anæsthetics is simple, and is the one in general use. Should I have control of the patient for twenty-four hours before I operate, I always insist upon a fast for at least six hours prior to the inhalation. This rule, however, I am compelled to break daily. I use anæsthetics extensively in my office practice to aid in diagnosis in the ophthalmic diseases of irritable and fretful children, as well as in operations at the Eye Clinic, which being held at one o'clock in the day, immediately after the midday meal of the working classes, often compels me to administer the anæsthetic a very short time after a full meal has been taken. Beyond the vomiting, which is very annoying to the operator, and delays the speedy completion of the surgical procedure, I have seen no bad result from it. The precaution of loosening the clothing, especially that encircling the throat, chest and abdomen, so as to facilitate respiration, I never omit. I also make it a rule to inspect the mouth of adults and always remove false teeth. These may become displaced during the anæsthesia and make serious complications.

With adults a drink of whiskey, in my practice, always precedes the inhalation. Young persons bear anæsthetics so uniformly well

that no such precaution is needed with them. A hypodermic injection of morphia just before the inhalation facilitates the administration of the anæsthetic and aids in sustaining the action of the heart. It also extends sleep when the narcotic action of the anæsthetic has passed off, and mitigates the after pains of the operation, a very desirable effect.

A towel many times folded and formed into a hollow cone *with open top* if chloroform is used, and *closed top* if ether is to be administered, makes the very best inhaler that I am acquainted with, and should be the one in universal use. It may not be so economical, as are many of the special inhalers, in the consumption of chloroform, but it does not become the receptable of the throat excretions of successive patients, and is in this respect much more cleanly and desirable. A thick towel can always be obtained, can be had clean, and will permit the more or less ready passage of air (as folded for the special anæsthetic to be used), without which neither chloroform nor ether can be administered with safety. In my operating case I carry several long, stout pins, known as shawl pins, for the purpose of pinning together the ends of the towel, folded in cone form. These simple instruments I find equally valuable with any in the operating case. There are innumerable special apparatus for administering anæsthetics—some made of metal, others of hard rubber. All of them are more or less bad and unsatisfactory when compared with the home-made towel cone.

In using ether the cone, with closed apex, having its cavity well sprinkled with the fluid, is placed directly over the nose and mouth of the patient and held firmly upon the face, notwithstanding the struggles and cries for breath, until the patient becomes prostrate and insensible, or until more ether is needed. While the patient is struggling to escape from what he conceives to be an attempt to strangle him, be careful to keep only the free base of the folded towel pressed upon the face, leaving the mouth and nose free in the ample cavity of the cone, which pressure has not effaced or in any way interfered with as an air chamber. Should the cone be flattened against the patient's nose, very ugly symptoms of suffocation may be brought about, not by the ether, but by the towel.

With chloroform such a procedure, as the above described mode of administering ether, would properly be called a very dangerous mal-administration, and deserving of severe censure. Chloroform well diluted with air, must be *slowly* inhaled so as not to cause any suffocating feelings whatever. Into the cone, *with apex open*, is poured a small quantity of chloroform. The towel is then held at some distance from the nose, and is slowly approached as the effects of the drug are experienced, until the base of the cone reaches the face about the time when the patient is half anæsthetized. From time to time an additional amount of chloroform is sprinkled in the cone to replace that lost by evaporation. The upper end of the cone is always carefully kept open for the free admission of air. By commencing the inhalation with a very dilute chloroform vapor no discomfort of suffocation is experienced by the patient, and sleep soon begins to mark the approach of anæsthesia.

During the inhalation I watch the face more than I do the pulse, although the face, the chest movements and the pulse, as felt in the temple, are all kept under constant observation. The color and expression of the face will always be a sure index of the working of the heart and lungs. As soon as sleep begins to show itself, I take away the pillow from the head of the patient, so as to insure a horizontal decubitus, which would often be seriously objected to by the patient during the sensible condition. Should symptoms of vomiting show themselves, the patient is immediately turned over on the side until emesis is accomplished. The anæsthetic is continued, notwithstanding the retching. I find the continued inhalation of the anæsthetic the best method for checking that involuntary contraction of the abdominal muscles, which accompanies vomiting.

I continue to administer the anæsthetic until I find the reflex action suspended, as expressed by absence of contraction in the lids when the eyeball is touched. Then I consider the patient ready for operation, and in a safe condition to have it successfully performed. The patient lies in deep sleep, undisturbed by any peripheral irritation. The heart and lungs continue to work harmoniously, through their own nerve centres, uninterfered with by reflex agencies, transmitted as they would otherwise be from

the peripheral nerves through the cerebro-spinal axis to these special nerve centres. While the patient escapes all pain, and the surgeon avoids all the inconvenience of movements, the patient lies in motionless sleep, undisturbed by the surgeon's knife, all the faculties essential to life being in full operation. *This is the condition which I recognize as full and safe anæsthesia.* Less than this would permit dangerous and even fatal reflex complications. More than this would be extreme narcotism, which, by suspending the influence of the nerve centres, would stop the working of the organs—the heart and lungs—which these centres, when undisturbed excite. Fortunately it would require much more of the anæsthetic to bring about this suspension of the vital function—a degree of narcotism which should justly be called an overdose. Between *this excessive narcotism and the safe and thorough anæsthesia there is a broad gulf, which only the rash or ignorant are likely to bridge.* When the patient is fully anæsthetized, the inhalation is stopped, to be renewed from time to time if the operation be tedious, and signs of returning consciousness make themselves apparent.

Anæsthetics are among the most powerful drugs of the Pharmacopœia, and must always be administered with caution. "To bring a living being to that borderland in which life in many respects so simulates death, should at no time be a fool's occupation." It is a condition which the strongest-hearted patient cannot face without some uneasiness, and many submit to with great alarm. The administration of anæsthetics should therefore be only entrusted to skilled hands, who, knowing what they have to do, will give all of their attention to the serious matter which should absorb them. Hence it is better for a surgeon to have as an administrator of anæsthetics a physician who takes no interest in surgical operations, and who will not have his attention for even a moment diverted from the face of his patient.

From my own experience and observation, I can readily see how there can be, at least, *seven recognized causes for death* during the administration of anæsthetics, even when pure drugs are used, the patient being in the recumbent posture, with loose clothing, and in a proper position for its inhalation.

The inhalation of a general anæsthetic in the sitting posture is dangerous, and should never be undertaken.

May not the perfect safety with which chloroform is used in obstetrical practice depend much upon the empty condition of the stomach, the loose clothing, *and the horizontal decubitus*, which are considered the best preparation for safe inhalation, accompanied, as it always is in obstetrical cases, with no fear of, but a longing for, the anæsthetic to escape the pain of labor?

In the first place, I can understand how a cloth saturated with chloroform, and covering up the face of a patient so as to exclude air, may necessitate the inhalation of so saturated an atmosphere as to cause excessive irritation of and spasmodic closure of the air-passages. This will act injuriously upon the respiration and circulation. Should a fatal result occur under this crowding process, a faulty administration, we would not call this a death from chloroform under careful use, but its careless abuse. This result could not occur if common precautions are taken, such precautions as every physician is expected to use who administers any of the efficient drugs of the materia medica. Should a physician, intending to administer hypodermically a few minims of Magendie's Solution from a full syringe, carelessly inject the entire contents under the skin, no one would attribute the blame to the morphia, but to the hand that worked the syringe. In this case life is sacrificed by carelessness in the use of a remedy known to be potent, and therefore one to be used with caution.

A second cause of death may readily occur with the early administration of both ether and chloroform. In many cases the local action of the inhaled vapor so irritates the throat as to cause contraction in the tongue muscles and a closure of the laryngeal opening by the close approach of the arytenoid cartilages and the overlapping of the epiglottis. This condition is evinced by stertorous breathing, change of countenance, congestion of face, impeded thoracic movements, and vain attempts at thoracic expansion. The patient is threatened with asphyxia by an involuntary but successful effort at partially swallowing his tongue. Should he be allowed to remain in this condition, death will as surely take place as when one is seized by the throat and is fatally strangled. As soon as this noisy breathing commences, seize the chin of the

patient and draw it forcibly upwards. The object of this manipulation is to efface the indentation of the neck by drawing the hyoid bone forward and with it the root of the tongue. When a straight line is made of the neck, from the sternum to the chin, the whole front wall of the throat is pulled away from its posterior vertebral wall, giving the greatest amplitude to the laryngeal opening, and making a straight passage for the inspired air from the nose through the pharynx into the lungs. As the chin is forcibly raised a sonorous inspiration is immediately heard, the noisy stertorous breathing at once stops, respiration becomes easy and the congestion disappears from the face. Pulling the root of the tongue forward by stretching forcibly the Sterno-hyoid and Genio-hyoid muscles is much more efficient in opening the laryngeal passage than the plan recommended by some Surgeons of pulling out the tongue by forceps. At this stage of anæsthesia, before relaxation is brought about, it is not easy to open the mouth. The jaw muscles are firmly contracted, requiring force to seperate the rows of teeth. The fingers can not be gotten into the mouth, and if they could the tongue is too slippery to be drawn out by them. A forceps of some kind must be used. A proper ring forceps for drawing out the tongue, an instrument that will hold by pressure and not by sticking into the organ, is seldom found in the operating case of Surgeons. In the pressing emergency any forceps at hand is made available. Either a dressing forceps or perhaps the toothed forceps used for the ligating of arteries is thrust into the mouth, the tongue is seized, and as it resists the drawing out its substance is torn by the teeth of the slipping forceps. For days after the operation a swollen painful tongue annoys the patient. Pulling up the chin needs no apparatus. It is the most convenient as it is the most efficient means of procuring immediate relief. It is only necessary to have the knowledge and apply it. Should the drawing forward of the tongue be omitted when this ominous congestion of the face occurs, we would have another glaring instance of death from the mal-administration of the anæsthetic. A surgeon who is not prepared to protect his patient from this accident, while inhaling an anæsthetic, would have as good reasons for escaping censure as he who, after an amputation, neglects to secure the arteries, and hence allows the patient to die from hæmorrhage.

A third cause of danger in the inhalation of anæsthetics resides in the inexperience of the administrator or in his inattention. I have already said that the physician who administers an anæsthetic has full occupation in the part assigned to him. He should not permit his attention to be diverted to the surgical work performed by another, and for which he is preparing the patient. I have seen instances in which the administrator of the anæsthetic, often a student of medicine, in his eagerness to follow the several steps of the operation on some distant part of the body, had become so oblivious to his responsible trust as to allow the thickly folded cloth to compress firmly both nose and mouth of the patient, who, with asphyxia imminent, was too insensible and powerless to push away the obstacle and escape the threatened suffocation. Had the patient a feather pillow pressed over the face he could not be more surely suffocated than by this thickly folded towel. Many a time, in doing general surgical work, have I pulled the chloroformed cloth from the face of the patient to the immediate relief of the respiration. Had the careless administrator been permitted to smother his patient we would have had a death announced from chloroform, while a towel which had never known chloroform if applied in a similar way would have done equally efficient work. Another clear case of careless administration. In ophthalmic surgery, to which my work is now exclusively confined, this accident can not occur, as the face is constantly under my own observation.

Still a *fourth cause* of death will be wrongly attributed to the anæsthetic should it occur during the act of vomiting. A watchful administrator of an anæsthetic can always forsee the coming vomiting and prepare for it by turning the patient over, *before* the contents of the stomach escapes. In the hands of careless operators I have seen the contents of the stomach come up with a gush, a perfect water spout of partly digested food, then falling back over the face making a horrible mess, and threatening the breathing. If the patient be allowed to remain upon his back during emesis, and be not rolled over upon his side or face, during the sudden inspiration which immediately follows some of the contents of the stomach might pass downwards from the pharynx into the trachea and cause death by suffocation. Autopsies are not often

thoroughly made after death attributed to an anæsthetic. Usually the brain, the heart and the kidneys are examined, and possibly the stomach, liver and bladder, and all found healthy, but the throat, and especially the larynx, have not been inspected, and therefore the cause of death is not discovered. In a reported death during chloroform inhalation, in which a patient suddenly expired immediately after the act of vomiting, the larynx and trachea were found packed with food ejected from the stomach. The patient did not die from chloroform poisoning, but was suffocated by a piece of half-digested meat. In another case at the University College Hospital, London, of death following vomiting under ether during an operation for strangulated hernia, the autopsy exhibited stercoraceous matter in the trachea and right bronchus. Again, a case of death at the hands of the careless administrator in his bad manipulation of the patient, and certainly not from the anæsthetic.

The *fifth cause* of death from both chloroform and ether, probably the most common of all, has been more active of late years, being rendered so by the unsettling of the former confidence which surgeons have had in the safety of anæsthetics. In their present timidity, surgeons do not now push the inhalation to the degree of suspending the functions of such parts of the cerebro-spinal system as preside over the emotional, sensational, motor and reflex acts; *the only condition recognized as one of perfect safety in chloroform and ether anæsthesia.* I refer to that condition in which peripheral irritation can no longer be transmitted through the cord to the brain, and then back, by the vagus and pneumogastric nerves, to the cardiac ganglia. Any condition short of this stage of temporary suspension of reflex agencies leaves the heart exposed to those serious inroads from peripheral irritation through which its movements may be suddenly and permanently arrested. Such fatal results are identical with instances of nervous shock, so familiar to operators in former times, before the discovery of anæsthetics, and then deemed a sufficient explanation of death under the circumstances. In this way can be satisfactorily classified the many deaths under anæsthetics for trivial operations, as tooth drawing, opening of abscesses, etc., when only enough of the agent was inhaled in the sitting posture to partially stupefy, but not to protect against reflex accidents from emotional or peripheral excite-

ment. When a patient, who has been under an anæsthetic during a painful operation, utters a scream and then stops breathing, although the death may be called one of fatal anæsthetic narcosis, the true state of the case is, *not enough of the anæsthetic* to protect the heart from reflex influences. Many such cases are reported under the heading "death from chloroform." The heading ought to be "death for want of more chloroform."

In this class are placed those many fatal cases during the more serious operations, in which the timidity or anxiety of the surgeon, with unsettled confidence in the article he is using, induces him to *arrest the inhalation before the period of safety has been reached*, or not continuing the administration so as to keep up the protection during the final painful steps while completing the operation. He commences the cutting operation with the vital organs all exposed to injurious reflex peripheral irritation, and under the cloak of the anæsthetic, without its protection, invites disaster. Hence it is that an operator, who has once been frightened during an insufficient administration of anæsthetics, continues to have accidents which do not occur to others who, never having seen trouble, administer the drug boldly. Timidity here must be classified with ignorance, both being dangerous negative qualifications for successful surgery. When deaths occur under these circumstances, the fatal result is not to be attributed to the anæsthetic, but, on the contrary, *to the want of a sufficient amount of it*—clearly a defective administration, induced by unwarrantable and unworthy fright on the part of the operator.

Under this heading I would also class the deaths said to be occasioned by heart diseases under the inhalation of chloroform. Richardson, of London, after a critical examination of the various diseased conditions of the body, said to be hostile to the administration of chloroform, and especially after maturely considering the many varieties of heart disease, including valvular growths, vascular contractions, cardiac hypertrophies, stenosis of heart orifices, and in fact the entire list of heart troubles, sums up his experimental observations with the following remarks: "On the whole, the only diseased condition which I could give as a warning to practitioners from exceptional danger in the administration of chloroform is the diagnostic of a dilated and weak right heart.'

And then states that in one such case he had forewarned the surgeon, who then gave chloroform and had a fatal result. But what guarantee have we that the patient with such a heart would not have succumbed to the operation itself, without having inhaled an anæesthetic? These heart conditions are so prone to syncope that anæsthetics are needed during painful operations to prevent the fatal emotional shock, so prone to arise from reflex irritations. In such cases we recognize the necessity for a cardiac stimulus, whiskey and a cardiac sedative, hypodermic of morphia, which will prevent the fatal depression.

Diseased conditions of the heart, regardless of kind, may make this important organ peculiarly susceptible to syncopetic influences, when reflex action has full sway; hence we find violent emotional excitement a fruitful cause for mortality in the subjects of heart disease. Many such persons having to undergo painful surgical operations in former times, before the introduction of chloroform, suddenly collapsed with the first incision; and they *still die as of old when they are not properly protected by complete anæsthesia.* Should chloroform be freely given to patients with heart disease, regardless of kind, who must submit to painful operations for the cure of some surgical affection, *by its liberal use they are put in a condition of safety against all emotional and reflex annoyances*, without which they could not escape trouble.

I look upon chloroform as the strong bridge which will conduct patients suffering from serious heart disease safely over serious operations. As a surgeon in large ophthalmic practice, I frequently am compelled to perform the most delicate and painful operations upon the eyes of timid patients suffering from heart disease in some one of its various forms. Cataracts occurring usually at an advanced age, most frequently between 60 and 85 years of age, are often associated with organic diseases of the heart in patients enfeebled by senility. Prior to the introduction of cocaine, that wonderful local anæsthetic for eye work, I never refused to give such patients chloroform; on the contrary, I urged its use. The only difference that I made in such cases over other patients was by exercising even more care in establishing the safe stage of complete anæsthesia through the liberal use of the drug. Kidney diseases are referred to as a very dangerous element to the anæs-

thetized with sulphuric ether, and many operators examine with care the urine of patients prior to administering ether as an anæsthetic. Bronchial troubles are also considered antagonistic to the safe administration of sulphuric ether, not directly, but indirectly. In such cases, after the operation has been completed and the resuscitated patient has been put to bed, a fatal pneumonia has developed, which follows too often the administration of ether to be considered a mere coincidence. This fatal pneumonia has not been noticed as a sequel of chloroform anæsthesia. Using chloroform exclusively, I have never thought it necessary to examine the urine nor the chest for lung diseases, and have had no occasion to regret my seeming neglect in this connection. From the standpoint of my own personal experience, I know of no organic lesion which contra-indicates the careful and thorough administration of chloroform.

The *sixth cause* of death during the administration of ether or chloroform, is from excessive administration. No one can doubt for a moment that chloroform and ether possess toxic action, and that in common with all other active agents in medicine, the danger is dependent upon the size of the dose used. The dose of an anæsthetic can easily be made large enough to kill by enfeebling, and finally paralyzing the nerve centres from which the heart and lungs draw their inspiration. This class of remedies are clearly cumulative, and when enough has been inhaled to cause the suspension of voluntary motion, sensation and reflex action, if their administration be continued, instead of being suspended, an amount can be concentrated in the circulation quite sufficient to stop respiration and the heart's action.

As I have said before, there is usually a broad gulf between that degree of anæsthesia which only suspends so much of cerebral action as still allows full play to the vital organs—a perfectly safe condition for surgical operations—and that fatal overdose of the anæsthetic from which there is a suppression of the cardiac and respiratory centres for innervation. Surgeons often employ ignorant assistants to administer the anæsthetic, who conceive it to be their duty to keep the saturated cloth to the nose of the patient, and they know no stopping point. They are told to give the ether, and they do it, showing neither jugdment nor discretion in

the administration. Unless watched by the surgeon, whose attention should be concentrated elsewhere, they go on applying the vapor notwithstanding complete narcotism has been secured. Fortunately, the elimination of the lethal vapor from the blood through the lungs is so rapid that by removing the towel a very few expirations will reduce the amount in the system to a safe standard and dissipate the threatened danger.

Cases will occur now and then, fortunately at long intervals, in which, under an anæsthetic, there is a sudden weakening of the heart's action, accompanied by a death-like palor of the face and a very feeble respiration. I have had cases in my personal experience in which, under chloroform, breathing suddenly stopped with the disappearance of the pulse at the wrist. The patient looked like a corpse and was apparently dead. From even this very alarming condition the vital function can be still reëstablished by promptly inverting the patient, hanging him up by the feet with head down, so as to allow blood to gravitate toward the anæmic brain.

When a piece of the skull of an animal is removed so as expose the brain,and chloroform is then administered, the vessels are seen to shrink in volume, the surface bleaching as narcotism advances. These experiments show that chloroform produces an anæmic condition of the brain, and that the various phenomena observed during the administration of an anæsthetic are in a measure caused by the diminished blood supply to the various nerve centres. Nelaton's experiments with rats gave to the surgical world that admirable method for restoring strength to the enfeebled heart by hanging the patient up by the feet. He found that when rats were thoroughly chloroformed, if immediately hung up by the tail they would revive; if left lying on the table, they died. It is a mooted point whether the resuscitation is brought about by an additional supply of blood to the anæmic brain alone, or by the emptying of the blood from the great reservoir, the liver, through the vena cava into the cavities of the heart, stimulating them into renewed activity. Most likely both of these influences work. Certain it is that when the lungs and heart fail under anæsthesia, the immediate suspension of the patient, with head down, will

reëstablish lung and heart action, *provided no time has been lost between the arrest of breathing and the inversion of the patient.*

When, during the administration of an anæsthetic, breathing stops, the great danger to the patient is in the recumbent posture. The chief reason why remedies used for resuscitation fail is because they are applied to the inanimate body when lying flat on the bed or table. Water splashing, spanking the surface to excite reflex action, hypodermics of whiskey, artificial respiration, electricity—all of them unfortunately usually go for nothing, as the various reports of deaths during the use of anæsthetics show.

In my own cases of suspended animation, four in number, my patients looked dead, and would have died had I not promptly, and without one instant's delay, hung them up by the feet. In one case, when I laid him down too soon, the breathing again stopped, necessitating the immediate resumption of the inversion, and this was repeated three times before the respiration became permanently reëstablished. In each of the four cases I depended upon inversion alone to bring back the pulse. After a few minutes of suspension I was gratified in seeing respiration and heart's action reëstablished, and my patients were saved. These would have been among the so-called deaths from chloroform had I lost precious time in making the usual applications of cold water to the face, hypodermics of whiskey, or even in practicing artificial respiration with the patient lying on the operating table. Do all of these things if you will, but in my opinion always hang up the patient first.

When under an anæsthetic the respiration suddenly stops and the pulse disappears, the patient is rapidly dying, but is not yet dead. Hang him up immediately, with head down, and he will not die. Leave him supine while you apply the remedies recommended in books on surgery, after a very short interval death, the end of mundane life, will have taken place. Time now bestowed in trying to bring back the dead to life is wasted energy. How often do we read of the herculean efforts of the doctors, using every known remedy (except the efficient one of inversion of the patient) and keeping up the work for hours, but all to no purpose. When, through an overdose of chloroform or ether, the vital functions are suspended and the patient dies, the death should be put

to its proper cause—want of knowledge or lack of activity on the part of the surgeon in applying the proper remedy. Another clear case of mal administration.

The *seventh, the only legitimate and rarest of all causes of death from anæsthetics*, now faces us. It is that unknown condition called idiosyncrasy, in which anæsthetics show themselves poisons of extreme activity, and at some stage of the administration kills promptly. Patients who carry about with them this innate fatality exhibit it by no recognized signs. When such persons die from the toxic inhalation, the autopsy reveals absolutely nothing to indicate the destructive effects of the poison.

The effects of anæsthetics depend on the immediate influences exerted by the drug upon the sensitive elements of the nerve centres, in virtue of which their properties are temporarily suspended. In cases of idiosyncrasy, these functions, so essential to life, become permanently suppressed. With the death of the individual, the changes in these nerve elements are of such a nature that, so far, they have altogether escaped detection by pathological investigators.

We call the practice of medicine empirical, because every dose of medicine we administer to a patient for the first time is more or less an experiment. We cannot in advance say that because a drug is expected to act in a previously established way it will do so in the case before us. The every-day experience of physicians teaches them not to be surprised if now and then they should obtain from drugs diametrically opposite results from those looked for; and very often intensity of action not at all commensurate with the very small dose administered. I have known opium to produce intense pain; it is the common remedy to allay it. I have known Dover's powder to purge violently; it is a common remedy for checking diarrhœa. I have known a single grain of quinine to produce desquamation of the cuticle, a grain of the iodide of potassium to bring on a most distressing coryza, and a grain of calomel to excite the most profuse ptyalism. On one occasion in an old lady under my care, one single drop of tincture of aconite brought on prostration that nearly proved fatal. How often a single moderate dose of the narcotics in constant use has put the patient under the sod, the grave alone can tell. To the

world, the death is always attributed to the disease for which the dose has often been judiciously but now fatally prescribed. The administration of the remedy was based upon the great good that it had accomplished in controlling these very symptoms in thousands of cases. The idiosyncrasy of the individual in these special instances was the immediate cause of the fatal issue; a condition which could not have been foreseen, and therefore no precautions could have guarded the physician against it. In these cases, which can not be very rare, from the variety and number of potent drugs used by practitioners, the fatality following the dose administered is often not recognized, even by the medical attendant. The patient died, after taking the medicine, when the symptoms of the disease had not indicated so serious or so sudden a result. The reason why the fatal issue came about, most physicians do not wish to consider.

From the exclusive use of any one potent remedy the idiosyncrasy must be rare, so that in taking one, say opium, a powerful drug most extensively used by every physician, and applicable to most of the diseases to which the human subject is liable, peculiarities in constitution, exhibiting dangerous symptoms from comparatively small doses, are only now and then met with. When we contrast, as to frequency, cases requiring serious surgical operations, against the many little and great disturbances of the various organs of the living economy brought to the notice of the physician and requiring the use of opium, we find the surgical cases in the ratio of scarcely one to a thousand. Now take such a remedy as chloroform, only used by surgeons in these serious surgical cases, and hunt up idiosyncracies for this drug. Their occurrence must be so very rare that a surgeon of very large experience is not likely to see more than one fatal case in a long life devoted to surgical practice; and a great many surgeons of very large experience have never met with one. Syme, whose surgical career in Edinburg is known to every one in the profession, was so uniformly successful with anæsthetics, never having lost a patient from the inhalation, that he adopted this axiom, "Show me a case for operation, and I will show you a case for chloroform." At the Edinburgh Infirmary, during a period of 28 years from the introduction of chloroform into surgical practice, only two deaths had been

attributed to chloroform, which, according to Ker, is one death in 36,500 administrations. Grant, in his admirable Treatise on Surgery, says: "I have seen chloroform given in some thousands of cases during upwards of twenty years, both in hospital and private practice, without a single death, or even an approach to a fatal termination." Elser, of Strasburg, had used chloroform 16,000 times, and had never seen a fatal case. Kidd, of London, had seen it administered upwards of 10,000 times, and had seen no fatal case, either in his own practice or that of his friends. Dr. Bardeleben, of Berlin, had participated in its admistration to over 30,000 patients before meeting with a death from chloroform. The French surgeons in the Crimea reported 30,000 cases of chloroform administered and not one fatal issue. In the English army in the Crimea chloroform was administered 12,000 times with one single death reported as attributed to it. In the Confederate service chloroform was exclusively used in a great many thousand operations without a death, as far as I am aware of, or have been able to ascertain, after diligent inquiry among leading surgeons of the army. Surgeon McGuire, of Jackson's corps, reported 28,000 administrations without one death. Richardson had seen it used in the London hospitals 15,000 times before he met with the first fatal case. Billroth, of Vienna, had administered chloroform 12,500 times before he met with his first accident. Clover has recorded 3,000 administrations without a single death. Erichsen has only witnessed one single death under chloroform in 25 years at the University Hospital. In the Medical and Surgical History of the war of the Rebellion, published in 1883, in the article anæsthetics, mention is made that in the Federal army chloroform was almost exclusively used in field operations. "The returns indicate that it was administered in no less than 80,000 cases. In 37 cases fatal results had been ascribed to its use," a proportion of 1 death in 2,200 administrations. The 37 cases in which a fatal issue followed are given in detail with the following comment:

"Considering the great number of cases in which chloroform was applied principally during and after the exciting circumstances of a battle when expedition was a matter of necessity, it is remarkable that not more cases of death from this agent have been recorded. With what justice the fatal issue in these cases here

cited are chargeable to the anæsthetic the reader must judge for himself."

To the testimony above I will add my own individual experience. I have been practicing surgery thirty-five years, and have used chloroform largely during that entire period in private and hospital practice, in the army as well as in civil life, and have administered it to the extent of fully 10,000 cases from chloroform and fully 3,000 anæsthesias from the bromide of ethyl, fully 13,000 cases in all, and without a death. For some years I have administered it on an average of at least once every day. I have given it to the very young and to the very old; to the very strong as well as to the very weak; to the healthy as well as to the extremely diseased—regardless of the organ in which the trouble may be located. I have seen patients thoroughly anæsthetized by a half drachm of chloroform, and I have seen a pound bottle wasted upon a sailor in keeping up full narcotism for a long period, and I have had occasion to keep up the anæsthesia as long as two hours at a time. I have accepted Syme's axiom and given chloroform to every one, regardless of visceral complications, who has applied to me for a serious surgical operation, and I have yet to see the first death, either in my own practice or that of my friends.

Now let us sum up the evidence which I have collected, and here we find an array of *over 300,000 administrations of chloroform with 43 deaths*, even attributing them all to idiosyncrasy, which calls for a most unbounded charity, and we only have one death in 7,000 cases. Can any stronger proof of the excessive rarity of the fatal idiosyncrasy in chloroform be needed.

Omitting army statistics as more or less unreliable, especially when taking into consideration the conditions of excitement, confusion, hurry, carelessness, necessarily pertaining to such times and circumstances, if we take only the authentic reports of well-known surgeons in civil practice, surrounded by those facilities for a careful and thorough administration which are so readily secured in modern hospitals and in the large cities, we can obtain a very fair estimate of what ought to befall a careful surgeon who uses chloroform. These are called rare instances of success, and that the experience of these well-known surgeons should not be

accepted as the true percentage of chloroform fatalities. Grant it. Still the truthfulness of these hospital reports and individual experiences, as given above, are not questioned. What one surgeon has accomplished, throughout a long life of active practice, another should surely be able to duplicate; and if any one surgeon has given chloroform 30,000 times without a fatal issue, this should become the standard for its proper administration.

I believe that deaths with ether, during its careful and full administration, are equally rare. In America, where ether was discovered and has been most used, especially by the Boston, New York and Philadelphia surgeons (for its administration seems to be chiefly confined to the Northern cities), we may find surgeons like those above mentioned who have records of thousands of cases without a single fatal issue. And yet, in proof that neither anæsthetic is absolutely safe, deaths, however rare they may be, do sometimes occur during the administration of both ether and chloroform, even when the purest article has been used and every care bestowed in the inhalation. That accidents come much more frequently to some surgeons than to others is a matter of every-day observation. No one attributes accidents to his own want of care or want of knowledge, and yet a well-informed observer can sometimes readily trace the cause of trouble in the cases of others. We see this constantly in the detailed accounts of the published reports of deaths attributed to anæsthetics. One surgeon, with a moderate practice, has lost by death two or more patients to whom he had administered an anæsthetic. Another surgeon, in large practice, has never lost a patient, although giving chloroform daily at hospital clinics. What should be the inference?

Dr. J. B. Roberts, of Philadelphia, in a paper on ether deaths, published in the Philadelphia Medical Times, says: "It has been my fortune on four occasions to witness the occurrence of death during or immediately after the production of anæsthesia. In three of these instances sulphuric ether was employed and in the other the bromide of ethyl. On numerous other occasions I have seen patients almost die from the effects of chloroform or other anæsthetics, who were fortunately revived by well-directed treatment." Truly a frightful experience, and in a city where chloroform

is denounced. I know of no one who has ever seen as many deaths from chloroform. I know a physician who in his early professional life administered chloroform to a patient and the patient died. His alarm was so great at the result of his administration that he has never used chloroform since. His mortality from chloroform therefore remains 100 per cent. He was one of the very unfortunates. Some surgeons seem to have been unlucky enough to have had a great deal more trouble with anæsthetics than should have fallen to the share of one administrator. I, for one, do not believe in lucky and unlucky surgeons. I believe, with Napoleon, that luck usually accompanies the best organized battalions.

Against the fatality of idiosyncrasies we can hardly guard, and yet something even here might be done. Three or four times in my own experience I have had cases in which I at the time thought that the anæsthetic which I was administering was badly borne. Once while giving chloroform, in my early professional life, I noticed a sudden and unusual pallor. I stopped the administration, and the patient, by breathing pure air, soon assumed a natural appearance. I resumed the chloroform with similar results. I then exchanged it for ether, and had no further appearance of these symptoms. What might have occurred, had I continued the chloroform, I am unable to say, possibly nothing but the most satisfactory anæsthesia. It might have been a groundless fright, still I am willing to call it an idiosyncrasy. In a second case, a young girl of seventeen, to whom I had given no stimulus, I thought that the pulse was rapidly enfeebled by the chloroform inhalation, and I exchanged the anæsthetic for ether. In one or two instances, some years age, when administering ether, I thought the anæsthetic badly borne, causing intense congestion of the head or excessive irritation of the throat. In these cases I stopped the ether and administered chloroform, with, as I conceived marked relief. My fears again may have been altogether groundless, as in the chloroform cases before mentioned.

I constantly see cases which excite the most anxious solicitude on the part of the timid and inexperienced operators—a marked enfeebling of the pulse, feeble respiration, pallor of the face, and relaxation of the skin, with perspiration pouring out upon the sur-

face. Experience has taught me that this relaxed condition, which so many are terribly alarmed about, is only the precursor of vomiting, and is the signal that I must prepare the patient for emesis. This condition, so constantly met with by the every-day administrator of chloroform, has so frightened many an inexperienced or timid operator as to make him believe that he had come within an ace of having on his hands a fatal case from inhalation.

When one uses chloroform or ether in the way as explained, he might confidently expect no trouble. Should he believe that chloroform always weakens the heart's action, in anticipation he puts the best of cardiac stimulants, a drink of whiskey, into the stomach of the patient, where it is ready for use if wanted, and can do no harm if it is not required. I attribute the uniform success of chloroform inhalation, in the hurry and confusion of battle field surgery, to this invaluable combination of whiskey with chloroform, and this in the face of the fact that as the Government purchases from the lowest bidder, army supplies are never of the best, and in times of war, with heavy demands, army medical supplies are very far from being chemically pure.

Suppose, however, that from the tediousness of the operation or otherwise there should be a very marked enfeebling of the heart's action, the course to be pursued from the stand-point of my own experience is very simple. Every one has observed the suddenness with which the anæsthetic effect is diminished with the act of vomiting, with its accompanying congestion of the head. When there is no longer the anæsthetic to the nose of the patient, as every expiration is getting rid of a certain amount of chloroform vapor from the circulation, the admission of fresh air would naturally suggest itself. If the respiration and heart's action be detected, however feebly, ample experience shows that fresh air and an inclined position with head downwards is all that is wanted for a reëstablishment of the vital functions. Death, which ought not to occur under this condition, may often with truth be attributed to the too much manipulation of the frightened attendants. Electricity may help the cardiac and respiratory effort should it be properly applied. According to Richardson's experience and observation, it is most frequently the name of electricity application only. In by far the majority of cases it does more harm than

good. If not scientifically applied, and very few who administer anæsthetics know how to apply electricity to excite the cardiac and respiratory functions, it will insure the killing by permanently stopping both heart and lung action.

In those most rare but truly unfortunate cases in which the heart stops beating and remains for only a very few minutes the patient is dead absolutely, and nothing that the surgeon can do will restore him to life. The surgeon, unwilling to acknowledge his utter helplessness, keeps up the much doing of many things, for many minutes or hours, but all to no avail. These fatal cases should be only the very rare ones of idiosyncrasy which we may hear much of, but may never see; and yet they may occur to the most careful. The majority of deaths ascribed to chloroform, properly should be attributed to mal-administration; *a fruitful source of trouble being that timidity of surgeons which will not allow them to safely anæsthetize patients, but induces them to operate before a sufficient amount of the anæsthetic is administered to protect against the dangers of reflex action.* I truly believe that a great many more cases of death under chloroform are to be attributed to the want of it than to an overdose, which comes only next in rarity to deaths by idiosyncrasy; and that the timidity of the surgeon and not the chloroform swells the mortuary list.

When persons suddenly die on the street or at their homes, the coroner is ever ready with his convenient verdict of heart disease, when most frequently the heart is a perfectly healthy organ, and has been altogether innocently accused. If in any case an anæsthetic has been used and a fatal accident occurs, death is immediately ascribed to the inhalation, when in reality it is due to other causes altogether extraneous to the administration. Notwithstanding this gross error in diagnosis, the reported death has its disturbing influence upon the profession; and when frequently reproduced in the daily papers will frighten the masses.

As chloroform has been up to within a few years the anæsthetic in nearly exclusive use in most parts of the world, very naturally a great many more deaths have been attributed to it than to the much less used ether. With its increased use, deaths from ether are now accumulating. Could rigorous statistical accounts be obtained, it would be found that ether, in proportion to the

comparably small number of inhalations, would relatively exhibit as many deaths as chloroform.

Up to within a few years surgeons at large have had every confidence in chloroform, and language was not strong enough to express their unbounded admiration. Professional confidence has been disturbed by the much talked-of toxic effects of chloroform, which has frightened the public and excited the timid in the profession. Many have imbibed the infection, not knowing why, and have taken to ether, an anæsthetic which has not had the opportunity of having as many deaths attributed to its administration. I also some years since, under the pressure of public opinion, or rather the timidity of patients who expressed a preference for it, took up ether and gave it largely. For a short time I used nothing else, but its administration proved unsatisfactory, on account of the distress occasioned by its forced inhalation in a concentrated form, its offensive odor, the large amount required, the excessive throat and buccal secretions, and the irritable cough often excited. As we have all so often done with new remedies, relinquish them after a short trial to fall back to the older ones which had previously been our reliance, so I found myself soon getting back to chloroform, which I now exclusively use with all the confidence that so useful an agent ought to secure.

Believing, as I do, that both ether and chloroform can kill, when carelessly, indifferently or excessively administered—believing also that either of them will kill when the idiosyncrasy is met with in which its usual benign effects become toxic, and that these two remedies will do so in equal ratio to the number of times in which they are inhaled, I naturally confide in the one which experience has taught me to be equally safe, more agreeable, less nauseating, and more efficient. My acquaintance with chloroform has been of the most satisfactory kind. I have seen it administered at least ten thousand times, and I have never seen fatal trouble from it.

Since my attention has been turned to the decided advantages of chloroform over the less efficient sulphuric ether, I have often asked surgeons from a distance, with whom I may have been casually thrown, what anæsthetic they use. I find many say chloroform exclusively, from which they had never had an accident, and in which they have unbounded confidence. Others tell me

that they administer ether; not that they had ever had trouble with chloroform, but that they had been made somewhat timid by reading reports of fatal cases. They at the same time acknowledge that they do not obtain that satisfactory anæsthesia such as they formerly secured under chloroform; and that even now, when they find that their patient is not properly influenced with the ether, they pour on the chloroform, feeling that they can look confidently forward to a speedy and thorough anæsthesia.

Believing, as I do, that ether and chloroform will not prove dangerous if a pure drug is selected and carefully administered, except in those extremely rare cases of idiosyncrasy, when both will prove toxic in like proportion, then in the comfort of the administration, both to the patient and surgeon, ether, in my opinion, is not to be compared to chloroform as a general anæsthetic, and can never take the place of the latter. The wave of professional opinion is moving back toward a returning confidence in the safety of chloroform, which many surgeons who administer it continually have never had shaken.

There is no remedy really good in medicine which is not capable of mischief. More persons are killed each year from the abuses of opium than have been attributed to chloroform from its discovery even to the present time. Deaths annually from opium in England alone are numbered by the hundreds. How many thousands are to be added to this list occurring under the careful administration of skilled physicians, we can easily conjecture. Yet who proposes to substitute for this king of drugs any of the milder narcotics? We are ready to accept the comparatively small fatality for the immense good it accomplishes. How often during the summer do we find in the daily papers reports of healthy persons dying suddenly from the too liberal potation of ice water, yet who would listen with any patience to the so-called philanthropist who would wage war against this universal beverage? It has been stated that more persons are killed by slipping on fragments of orange peel in the streets of London than from the inhalation of chloroform. No one suggests the destruction of orange groves on this account. No one finds fault with the laws of gravitation because persons continue to fall down and break their legs or necks. It is unfortunate for the individual, but the

great laws of Nature must ever go on, and the great designs of the Creator enjoyed with wonder and astonishment. Shall we give up the use of horses or steam because accidents happen from both? Would we have all the rivers dried up because now and then a drowned man is fished up out of them? The great discoveries are for the good of the many—not for the few. You can not avoid every danger and at the same time enjoy every good.

With the careful administration of anæsthetics, the little risk, infinitesimally small, is immensely counterbalanced by the protection from the very many dangers during operations, so well known and so often experienced when operations were performed without them. Chloroform, when judiciously used, is one of the safest active remedies of the materia medica, supplying nearly every good and avoiding nearly every danger.