

*A. A. Gould, M.D.
With the respects of
J. C. Warren.*

EFFECTS
OF
CHLOROFORM
AND OF
STRONG CHLORIC ETHER,
AS NARCOTIC AGENTS.

BY JOHN C. WARREN, M.D.

AUTHOR OF "ETHERIZATION, WITH SURGICAL REMARKS," ETC.



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CHLOROFORM

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STRONG CHLORIC ETHER.

A SHORT time since, I received a letter from a distinguished person in Canada, in which my opinion was requested as to the state of the ether practice, and the use of chloroform. This communication led me to see the propriety of publishing some observations and results of a practical nature, which had occasionally presented themselves in the course of my reading and experience. I had, in fact, already promised to do this at the meeting of the "American Medical Association" in Baltimore, last spring, as will be explained hereafter. A natural reluctance to take up a subject, which, however important, has already been so hackneyed, had prevented me from executing this design, until I was repeatedly inquired of as to the actual condition of the ether practice. The very unfavorable influence exerted on this practice by the fatal cases of chloroform seemed also to add to the necessity of a careful consideration of the phenomena with which they were attended. At length I received, among others, the letter already alluded to, from which the following passage is extracted: —

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“ The use of chloroform had been just announced as your book was going to press ; and you reserved your opinion on its merits, till you could speak from experience. In the interim, it does not seem to me, that, in this vicinity, the medical profession are availing themselves generally and with confidence of the aid of the one agent or the other, which I am at a loss to account for ; and I am surprised that more has not been said of this wonderful discovery, than appears to have been within the last six months. . . . I have a curiosity to know whether, as you have become more familiar with the use of ether and chloroform, your confidence in it has been confirmed or shaken. Judging from the clear and succinct summing up at the end of your treatise, which all readers can understand, I should expect to hear, that, unless something has occurred to change your views very materially, you would scarcely think of leaving a patient to endure the pain of a severe operation, without giving him, at least, the choice of such relief as you describe. And yet I am not sure that this is now the general practice with you : it certainly is not with us.”

In the “ Remarks on Etherization,” which I published about a year since, it was said, that another year was necessary to give us the means of judging fully and definitively on the merits of the ether practice. Before that publication was fairly out of the press, a new agent was proposed, which was destined to effect a great change in the use of ether.

The introduction of chloroform produced an ex-

citement scarcely less than that of the discovery of the narcotic effect of ether. The beauty of the article, and the rapidity of its influence, gave it an immediate and general currency; for not only was it employed by physicians, but the community took the narcotizing drug into their own hands, and, from the highest to the lowest, indulged themselves in the chloroform excitement. This substance, as proposed and promised in the remarks I had occasion to make on the subject of etherization, was taken up by me, and fairly tried in a great number of instances, and among the first on my own person; so as to give it a thorough trial in every way. In the cases under our direction, it was used with all the precautions possible. The quantity of chloroform was limited; and an inhaling apparatus commonly employed, varying in form according to the ingenuity of the contriver. The apparatus more particularly resorted to was arranged to accomplish inhalation by the nostrils, a sponge or rag being so placed in the box as to permit the mixture of air with the narcotic vapor.

We were soon awakened from our dreams of the delightful influence of the new agent, by the occurrence of unfortunate and painful consequences, which had not followed in this country on the practice of etherization. The profession were led to hesitate, many of them to suspend the use of chloroform, to watch its effects with a jealous eye; and, finally, when the lapse of time produced new cases of fatality in pretty regular succession, some were induced

to relinquish it entirely, and employ the safer and less violent substances, — the sulphuric and chloric ethers.

The loss of a single life, from an application used for the purpose of preventing pain, must make a strong impression on the mind of any conscientious physician or surgeon; and when this occurrence presents itself repeatedly within a short space of time, — affording, as it must do, reason to apprehend the same result in cases otherwise the most favorable, — it becomes the duty of a professional man, either to relinquish the practice, or to find out some way of rendering it safe. Now, it appears that no less than ten well-authenticated fatal cases have presented themselves to the public eye within little more than a year. When we consider that there are other cases not well ascertained, and probably others which have never become public, we are called on to investigate these fatal occurrences with the greatest care, and to discover, if possible, why these patients died, while others have escaped, and whether there are any means of avoiding similar results in the future practice.

Some writers have thought that the fatal effects in these cases did not arise from chloroform, but might be well explained by other causes. In instances, where the fatal result has followed the use of chloroform, with scarcely a longer intervention than death from a wound in the heart follows the stroke of the knife, chloroform has by learned and experienced surgeons been pronounced to be abso-

lutely guiltless of the mortal consequence ; and the death has been attributed to fainting, or syncope ; to apprehension, or fear ; to bleeding at the lungs ; to diseased heart and enlarged liver ; to asphyxia : and, finally, the well-known fact, which we ourselves have formerly cited, that deaths sometimes take place from a violent constitutional impression, has been quoted as the cause. In regard to this last, if such were the true explanation, the crowding of so many cases of rare occurrence into the compass of a few months must form an epoch in the history of this constitutional sympathy.

In order to present the phenomena of the fatal cases produced by the administration of chloroform, we shall bring them together in such way, that they may be readily compared. But, before doing this, some may be mentioned as precursors of the formidable train of results which was to follow.

The cases which first gave me uneasiness as to the effect of chloroform were, among others, the following : —

A lady, Mrs. H. about forty-five years old, in good health, of rather a delicate temperament, had a tooth extracted under the use of ether, in 1847, with favorable effect. In the early part of 1848, having occasion to undergo the same operation again, she applied to the same dentist, a gentleman well practised in the use of ether. Instead of this article, he thought best to employ chloroform, which was given her on a handkerchief, to the amount of about thirty drops. After five or six inspirations, she

had a partial convulsion, was deadly pale and faint. Being laid on the sofa, she recovered in a degree; in ten or fifteen minutes became very sick at the stomach, and continued so all that day. On the day following, the sickness still remained; she had severe headache, loss of appetite, with nervous twitchings of the muscles. At the end of five days she was able to walk out, and came to consult me. Her symptoms at this time were an uneasy sensation in the stomach, stricture across the chest, loss of appetite, headache, and great prostration of strength. The last symptom continued to the month of December; when she came into town again, for the purpose of consulting me once more.

Not long after the occurrence of this case, we received by the "London Medical Gazette" for Dec. 1847, an account of an instance of asphyxia and convulsions, under the influence of chloroform, in Halesworth, England. The writer, Mr. Beales, represents his patient as a young lady, twenty-seven years old, who had labored under neuralgia for three years, and from whom he extracted an upper molar tooth, on the left side. A drachm was at first used; but finding slight effect, from twenty to thirty drops more were poured upon the sponge, which in two or three seconds produced rigidity of the extremities, slight convulsions of the abdominal muscles, extreme dilatation of the pupils; succeeded by the most alarming state of asphyxia, lasting for at least a minute. When re-action came on, she fell apparently into a calm sleep, during which the

attempt was made to extract the tooth. But before the instrument could be removed, the jaws became so firmly fixed as to hold it for two or three minutes ; while the arms, legs, and whole body, underwent the most distorted convulsions. At length, the instrument and tooth were removed ; the convulsions continuing for five or six minutes longer, though with less violence. She then became half conscious, muttering, " More, more, or I cannot have my tooth out." To this state, which continued half an hour, succeeded a most excruciating pain at the top of the head, lasting twenty minutes ; and it was not till the expiration of an hour and a half, that she was enabled to return home.

Within a month from this date, there appeared in the public newspapers an account of a case of convulsions, lasting sixteen hours, at New Bedford, Mass. in an apothecary, who undertook to divert his friends by an exhibition of the effects of chloroform. There also occurred in Baltimore a case of asphyxia from the same cause, continuing an hour and a half, and by which an unfortunate medical student nearly lost his life. In New York, about the same time, a lady, after having a tooth extracted under chloroform, lay fainting for several hours : the recovery of her mental faculties was attended with prostration, paralysis of the tongue, and loss of voice. To these, many similar instances might be added.

But these occurrences were of trifling importance, compared with others which followed. A number

of individuals, in the full vigor of youth and health, were struck dead under the very hands of the surgeon raised for their relief; and, in one or two instances, the proposed operation was unknowingly performed on a lifeless body.

The causes of death from chloroform have naturally attracted the careful attention of physiologists and physicians. They have been anxious to discover, why this article has produced many more dangerous effects than ether, and what organ was attacked with so great violence as to interrupt suddenly its functions, and consecutively the other functions of animal and organic life.

Very careful and minute investigations and discussions, intended to answer these questions, have been undertaken by learned physiologists and pathologists in various countries. My intention is not to follow in the search so ably pursued elsewhere by others, but to endeavor to throw some light on these critical inquiries, by bringing together, in a comparative view, the most remarkable phenomena these fatal cases have presented, in order to ascertain whether they agree in any one or more circumstances which may offer a clue to the peculiar effects of chloroform, and the means of obviating them. To attain this object, it was necessary to present simply the most remarkable phenomena in each case, and then to compare them by constructing a Table.

CASE I.

NAME. — Hannah Greener.

DATE. — Jan. 25, 1848.

DISEASE. — Onychia.

PREVIOUS USE. — Sulphuric ether, two months previous.

TIME OF INHALATION. — About half a minute.

QUANTITY CONSUMED. — About a drachm.

POSTURE. — Sitting.

LAPSE OF TIME TILL DEATH. — Two minutes.

SYMPTOMS. — In half a minute, no change of breathing or alteration of pulse; arm rigid; insensibility; after semilunar incision, a twitch; sudden blanching of lips; spluttering at the mouth; not the slightest attempt at a rally; death.

MORBID APPEARANCES:

Brain. — External and internal congestion more than usual; rather more than usual quantity of serum in ventricles.

Heart. — Healthy; dark fluid in both cavities, less in left.

Lungs. — Not collapsed; one or two slight adhesions; external surface of both highly congested; mottled with deep purple, bluish, or scarlet patches; crepitant; small emphysematous bubbles along outer and interior border of both, more on upper lobe of left; bloody froth in tissue and in bronchi; epiglottis reddened; also mucous

membrane of larynx reddened and mottled; dark mucus in the sinuses.*

Liver, kidneys, and spleen, congested; digestive organs healthy.

Some veins more distinct than usual.

Rigidity as usual.

CAUSE OF DEATH ASSIGNED BY JURY. — Congestion of the lungs produced by chloroform.

CASE II.

NAME. — Arthur Walker.

DATE. — Feb. 5, 1848.

DISEASE. — None.

PREVIOUS USE. — Frequent.

TIME OF INHALATION. — Unknown.

QUANTITY CONSUMED. — About half an ounce.

POSTURE. — Leaning forwards.

LAPSE OF TIME TILL DEATH. — Uncertain.

SYMPTOMS. — Not known.

MORBID APPEARANCES :

Brain. — Veins on the upper surface full, not turgid; pia mater injected; puncta vasculosa larger than usual; velum interpositum and choroid plexus much loaded with dark-colored blood.

Lungs. — Turgid; loaded with dark-colored blood, particularly at the upper margin of the lowest lobe of right lung; lower lobe of left and

* *Query.* — Sacculi laryngis?

smaller portion of upper lobe of right engorged, of apoplectic character, emphysematous.

Heart. — Old adhesions of pericardium; right side distended with thin and dark fluid blood; walls of right ventricle unusually thin; cavity enlarged.

Blood. — General mass darker than usual.

CAUSE OF DEATH ASSIGNED BY JURY. — Asphyxia, consequent on the inhalation of chloroform.

C A S E III.

NAME. — Mrs. Martha G. Simmons.

DATE. — Feb. 23, 1848.

DISEASE. — Extraction of the stumps of teeth.

PREVIOUS USE. — None.

TIME OF INHALATION. — About a minute.

QUANTITY CONSUMED. — Uncertain.

POSTURE. — Sitting.

LAPSE OF TIME TILL DEATH. — Estimated by two witnesses at about two minutes; by the dentists, from five to ten.

SYMPTOMS. — Face pale during inhalation; groans during extraction, but no other sign of consciousness. In two minutes from beginning of inhalation, head turned to one side; arm slightly rigid; body drawn backwards; pulse feeble, and instantly stopped, so with respiration; face, previously pale, now livid; lower jaw dropped; tongue pro-

jected at one corner of the mouth ; arms perfectly relaxed.

MORBID APPEARANCES :

Brain. — Integuments contained but little blood ; more than usual in vessels of dura mater ; superficial vessels moderately distended ; from sinuses of dura mater, two or three ounces of fluid blood mixed with bubbles of air ; aspect, character, and color, normal.

Heart. — Flaccid, cavities empty, inner surface of all deeply stained ; six drachms of bloody serum in pericardium ; aorta and pulmonary artery empty ; cava empty in chest, containing very little in abdomen ; lining membrane of all blood-vessels deeply stained.

Lungs. — Considerable congestion, crepitant, no extravasation ; congestion of lining membrane of bronchi ; deeply stained ; great injection of pleura ; six drachms bloody serum in right, two ounces in left.

Liver. — Pale. Kidneys engorged.

Blood. — Everywhere fluid as water ; no coagulum in any vessel ; examined by the microscope some alteration in the form of globules ; some irregular ; generally more distended and globular than normal, also somewhat fragmentary ; number somewhat diminished ; color, dark venous.

NOTE. — Professor Mussey, who was called upon to superintend the examination of the dead body of Mrs. Simmons, informs me that this patient inhaled through an apparatus “ in such manner as to prevent air passing

through her nose, so that probably little or no air was received into her lungs, except through the valve of the inhaler. It is impossible to determine how much chloroform was consumed. A piece of sponge, occupying about two-thirds of the space in the globe of the inhaler, was saturated with chloroform, besides not far from half an ounce of the free liquid remaining in the vessel. This was after the experiment made by Mrs. Simmons."

C A S E IV.

NAME. — Patrick Coyle.

DATE. — March, 1848.

DISEASE. — Fistula.

PREVIOUS USE. — Once.

TIME OF INHALATION. — About one minute.

QUANTITY CONSUMED. — About thirty drops.

POSTURE. — Upon the side.

LAPSE OF TIME TILL DEATH. — About one minute.

SYMPTOMS. — Showed signs of pain by putting hand to the part; in a moment, his pulse, which was full and natural, sunk; death.

MORBID APPEARANCES :

Brain. — This, with the membranes, natural and healthy.

Heart. — Enlarged, pale, soft; two or three ounces of serum in pericardium; blood-vessels with dark fluid blood.

Lungs. — Studded with tubercles; abscess in in each; lower parts congested; pleura extensively adherent.

Stomach. — Mucous membrane softened, its veins turgid.

CAUSE OF DEATH ASSIGNED. — Disease of the lungs.

CASE V.

NAME. — Mlle. Stock.

DATE. — June, 1848.

DISEASE. — Opening an abscess in hip.

PREVIOUS USE. — None.

TIME OF INHALATION. — Less than one minute.

QUANTITY CONSUMED. — From fifteen to twenty drops.

POSTURE. — Sitting.

LAPSE OF TIME TILL DEATH. — Very brief.

SYMPTOMS. — After several inspirations, tried to withdraw handkerchief; crying, — “I choke;” face suddenly pale; countenance changed; breathing embarrassed; foam at the mouth.

MORBID APPEARANCES:

Brain. — Superior longitudinal sinus empty; veins on convex surface not engorged, but the column of blood broken at intervals with bubbles of gas, also air in veins at base of the skull, also escaped with the blood from ophthalmic veins, cavernous sinuses, and inferior cerebral veins; serum in lateral ventricles moderate; substance firm.

Heart. — Serum in pleura and pericardium;

heart excessively flaccid; right and left cavities empty; not the smallest clot; frothy blood in the orifice of ascending cava; a little blood mixed with air from pulmonary veins; internal membrane of heart red, especially of right cavities; tissue pale.

Lungs. — Especially left, voluminous, visibly engorged in lower lobes; on incision, a very black fluid blood; remarkable crepitation; pulmonary vesicles dilated with air, probably from the artificial respiration; neither interlobular nor subpleural emphysema; tracheal mucous membrane bright red; no froth in bronchi.

Liver. — Very large; air-bubbles with much black and fluid blood escape on incision. *Intestines* distended with fœtid gas. *Spleen* softened, gorged with blood, bubbles of air escape on pressure.

Blood. — As black as ink; air bubbles up from a remarkably black and very fluid blood from internal saphæna and left crural; blood-vessels near the wound found to be perfectly entire.

CAUSE OF DEATH ASSIGNED. — Syncope, caused by sudden suspension of the cerebral functions under chloroform.

C A S E VI.

NAME. — Daniel Schlyg.
 DATE. — JUNE 25, 1848.
 DISEASE. — Disarticulation of thigh.
 PREVIOUS USE. — None.
 TIME OF INHALATION. — Four or five minutes.
 QUANTITY CONSUMED. — Not stated.
 POSTURE. — Recumbent.
 LAPSE OF TIME TILL DEATH. — Three quarters of
 an hour.
 SYMPTOMS. — Face very pale, lips discolored, pupils
 dilated, eyeballs rolled upwards; respiration in-
 frequent and sighing; pulse no longer percepti-
 ble; limbs perfectly relaxed.
 MORBID APPEARANCES. — No autopsy was made.
 CAUSE OF DEATH ASSIGNED BY THE SURGEON,
 M. ROBERT. — Syncope.

C A S E VII.

NAME. — Walter S. Badger, gentleman.
 DATE. — June 30, 1848.
 DISEASE. — Operation on teeth.
 PREVIOUS USE. — None.
 TIME OF INHALATION. — One minute.
 QUANTITY CONSUMED. — A drachm and a half.
 POSTURE. — Sitting.

LAPSE OF TIME TILL DEATH. — One minute.

SYMPTOMS. — Face livid, pupils dilated, temperature of the body lower than natural.

MORBID APPEARANCES :

Brain. — Nothing abnormal; slight congestion of corpora striata and optic thalami; membranes congested.

Chest. — Lungs and heart pushed up as far as third and fourth ribs; lungs healthy; crepitant throughout; some adhesions; on right, little congestion.

Heart. — Pale; flaccid; not hypertrophied or dilated; some adipose spots on surface; walls of left ventricle thinner than usual; fatty degeneration of tissue, especially at apex; clots of dark grumous blood in both ventricles; inner surface of aorta rough; mitral valves unequal at their edges; tissue hard, grating.

Abdomen. — Omentum fatty; stomach not distended; liver very large, reaching up to third and fourth ribs; pale, brownish, dirty-white; weight, eight pounds.

CAUSE OF DEATH ASSIGNED BY JURY. — Obstruction to the heart's action from an enlarged liver, and the influence of chloroform thereupon.

C A S E VIII.

- NAME. — A young woman of Hyderabad.
 DATE. — July 11, 1848.
 DISEASE. — Amputation of middle joint of middle finger of left hand.
 PREVIOUS USE. — None.
 TIME OF INHALATION. — Very brief.
 QUANTITY CONSUMED. — A drachm.
 POSTURE. — Sitting.
 LAPSE OF TIME TILL DEATH. — Instantaneous.
 SYMPTOMS. — Slight cough, with a few brief convulsive movements.
 MORBID APPEARANCES. — No autopsy was made.

C A S E IX.

- NAME. — John Griffith.
 DATE. — Jan. 19, 1849.
 DISEASE. — Chancres and hemorrhoids.
 PREVIOUS USE. — Chloroform on Dec. 26, 1848.
 TIME OF INHALATION. — None given.
 QUANTITY CONSUMED. — About three drachms.
 POSTURE. — Lying on one side.
 LAPSE OF TIME TILL DEATH. — About ten minutes.
 SYMPTOMS. — Face and neck of a livid, leaden hue ; the eyes turned upwards ; the pulse imperceptible

at the wrist ; respiration laborious ; the whole body relaxed ; after two or three gasps, he ceased to breathe.

MORBID APPEARANCES :

Brain. — Healthy ; no other appearances than in persons dying when in full health.

Heart. — Large ; its ventricles and auricles empty ; its condition flabby ; the substance of the left ventricle rather softer than natural.

Lungs. — A good deal congested ; and discharged, when cut, a large quantity of bloody serum.

About half an ounce of a watery fluid was found in the pericardium.

C A S E X.

NAME. — Abby Pennock.

DATE. — March 6, 1849.

DISEASE. — Toothache.

PREVIOUS USE. — Frequent.

TIME OF INHALATION. — Unknown.

QUANTITY CONSUMED. — Three drachms in two applications.

POSTURE. — Recumbent.

LAPSE OF TIME TILL DEATH. — Probably instantaneous.

SYMPTOMS. — Unknown.

MORBID APPEARANCES :

Externally, the body livid over the whole left

side ; face and neck swelled ; pupils slightly dilated ; thyroid gland enlarged.

Brain. — Free from congestion, or any other morbid aspect.

Heart. — Flaccid ; empty of blood ; only a very small coagulum in its cavity.

Lungs. — Not much collapsed ; both congested ; the left throughout, the right of a bright vermilion color ; entrance to the larynx inflamed, and covered with small ulcerations.

Abdomen. — Semi-digested food in stomach ; lacteals full of chyle ; intestines in a remarkably decomposing condition. *Liver* not altered. *Spleen* rather large, and contained great numbers of distinct whitish bodies smaller than the head of a small pin, not tubercles. *Left kidney* congested. *Uterus* with catamenia.

TABULAR RECAPITULATION.

Name.	Date.	Disease.	Prev. Use.	Time of Inhalation.	Mode of Inhalation.	Quantity.	Posture.	Lapse of Time till Death.	Symptoms.	Morbid Appearances.	Assigned Cause of Death.
I. — Hannah Greener . . .	Jan. 25, 1848.	Onychia.	Sulphuric ether, two months previous.	About half a minute.	From a handkerchief.	About a drachm.	Sitting.	Two minutes.	In half a minute, no change of breathing or alteration of pulse; arm rigid; insensibility; after semilunar incision, a twitch; sudden blanching of lips; spluttering at the mouth; not the slightest attempt at a rally; death.	<i>Brain.</i> — External and internal congestion more than usual; rather more than usual quantity of serum in ventricles. <i>Heart.</i> — Healthy; dark fluid in both cavities, less in left. <i>Lungs.</i> — Not collapsed; one or two slight adhesions; external surface of both highly congested; mottled with deep purple, bluish, or scarlet patches; crepitant; small emphysematous bubbles along outer and interior border of both, more on upper lobe of left; bloody froth in tissue and in bronchi; epiglottis reddened; also mucous membrane of larynx reddened and mottled; dark mucus in the sinuses. <i>Liver, kidneys, and spleen,</i> congested; digestive organs healthy. <i>Some veins</i> more distinct than usual. <i>Rigidity</i> as usual.	BY JURY. Congestion of the lungs produced by chloroform.
II. — Arthur Walker . . .	Feb. 5, 1848.	None.	Frequent.	Unknown.	From a towel.	About half an ounce.	Leaning forwards.	Uncertain.	Not known.	<i>Brain.</i> — Veins on the upper surface full, not turgid; pia mater injected; puncta vasculosa larger than usual; velum interpositum and choroid plexus much loaded with dark-colored blood. <i>Lungs.</i> — Turgid; loaded with dark-colored blood, particularly at the upper margin of lower lobe of right lung; lower lobe of left and smaller portion of upper lobe of right engorged, of apoplectic character, emphysematous. <i>Heart.</i> — Old adhesions of pericardium; right side distended with thin and dark fluid blood; walls of right ventricle unusually thin; cavity enlarged. <i>Blood.</i> — General mass darker than usual.	BY JURY. Asphyxia, consequent on the inhalation of chloroform.
III. — Mrs. M. G. Simmons.	Feb. 23, 1848.	Extraction of stumps of teeth.	None.	About a minute.	From a towel.	Uncertain.	Sitting.	Estimated by two witnesses at two minutes; by the dentists, from five to ten.	Face pale during inhalation; groans during extraction, but no other signs of consciousness. In two minutes from beginning of inhalation, head turned to one side, and slightly rigid; body drawn backwards; pulse feeble, instantly stopped, so with respiration; face, previously pale, now rigid; lower jaw dropped; tongue projected at one corner of the mouth; arms perfectly relaxed.	<i>Brain.</i> — Integuments contained but little blood; more than usual in vessels of dura mater; superficial vessels moderately distended; from sinuses of dura mater, two or three ounces of fluid blood mixed with bubbles of air; aspect, character, and color, normal. <i>Heart.</i> — Flaccid, cavities empty, inner surface of all deeply stained; six drachms of bloody serum in pericardium; aorta and pulmonary artery empty; cava empty in chest, containing very little in abdomen; lining membrane of all blood-vessels deeply stained. <i>Lungs.</i> — Considerable congestion, crepitant, no extravasation; congestion of lining membrane of bronchi; deeply stained; great injection of pleura; six drachms of bloody serum in right, two ounces in left. <i>Liver.</i> — Pale. Kidneys engorged. <i>Blood.</i> — Everywhere fluid as water; no coagulum in any vessel; examined by the microscope some alteration in the form of globules; some irregular; generally seem more distended and globular than normal, also somewhat fragmentary; number somewhat diminished; color, dark venous.	
IV. — Patrick Coyle . . .	March, 1848.	Fistula.	Once.	About one minute.	From a sponge.	About thirty drops.	On the side.	About one minute.	Showed signs of pain by putting hand to the part; in a moment, his pulse, which was full and natural, sunk; death.	<i>Brain.</i> — With membranes natural and healthy. <i>Heart.</i> — Enlarged, pale, soft; two or three ounces of serum in pericardium; blood-vessels with dark fluid blood. <i>Lungs.</i> — Studded with tubercles; abscess in each; lower parts congested; pleura extensively adherent. <i>Stomach.</i> — Mucous membrane softened, its veins turgid.	Disease of the lungs.
V. — Mlle. Stock	June, 1848.	Opening an abscess in hip.	None.	Less than one minute.	From a handkerchief.	From fifteen to twenty drops.	Sitting.	Very brief.	After several inspirations, tried to withdraw handkerchief, crying, "I choke;" face suddenly pale; countenance changed; breathing embarrassed; foam at the mouth.	<i>Brain.</i> — Superior longitudinal sinus empty; veins on convex surface not engorged, but the column of blood broken at intervals with bubbles of gas, also air in veins at base of skull, also escaped with the blood from ophthalmic veins, cavernous sinuses, and inferior cerebral veins; serum in lateral ventricles moderate; substance firm. <i>Heart.</i> — Serum in pleura and pericardium; heart excessively flaccid; right and left cavities empty; not the smallest clot; frothy blood in the orifice of ascending cava; a little blood mixed with air from pulmonary veins; internal membrane of heart red, especially of right cavities; tissue pale. <i>Lungs.</i> — Especially left, voluminous, visibly engorged in lower lobes; on incision, a very black fluid blood; remarkable crepitation; pulmonary vesicles dilated with air, probably from the artificial respiration; neither interlobular nor subpleural emphysema; tracheal mucous membrane, bright red; no froth in bronchi. <i>Liver.</i> — Very large; air-bubbles, with much black and fluid blood escape on incision. <i>Intestines</i> distended with foetid gas. <i>Spleen</i> softened, gorged with blood, bubbles of air escape on pressure. <i>Blood.</i> — As black as ink; air-bubbles up from a remarkably black and very fluid blood from internal saphena and left crural; blood-vessels near the wound found to be perfectly entire.	Syncope, caused by sudden suspension of the cerebral functions under chloroform.
VI. — Daniel Schylg . . .	June 25, 1848.	Disarticulation of thigh.	None.	Four or five minutes.	From an apparatus.	Not stated.	Recumbent.	Three quarters of an hour.	Face very pale, lips discolored, pupils dilated, eyeballs rolled upwards; respiration infrequent and sighing; pulse no longer perceptible; limbs perfectly relaxed.	No autopsy was made.	BY THE SURGEON, M. ROBERT. Syncope.
VII. — Walter S. Badger .	June 30, 1848.	Operation on teeth.	None.	One minute.	From an apparatus.	A drachm and a half.	Sitting.	One minute.	Face livid, pupils dilated, temperature of the body lower than natural.	<i>Brain.</i> — Nothing abnormal; slight congestion of corpora striata and optic thalami; membranes congested. <i>Chest.</i> — Lungs and heart pushed up as far as third and fourth ribs; lungs healthy; crepitant throughout; some adhesions; on right, little congestion. <i>Heart.</i> — Pale; flaccid; not hypertrophied or dilated; some adipose spots on surface; walls of left ventricle thinner than usual; fatty degeneration of tissue, especially at apex; clots of dark grumous blood in both ventricles; inner surface of aorta rough; mitral valves unequal at their edges; tissue hard, grating. <i>Abdomen.</i> — Omentum fatty; stomach not distended; liver very large, reaching up to third and fourth ribs; pale, brownish, dirty white; weight, eight pounds.	BY JURY. Obstruction to the heart's action from an enlarged liver, and the action of chloroform thereupon
VIII. — A young woman of Hyderabad.	July 11, 1848.	Amputation of middle joint of middle finger of left hand.	None.	Very brief.	From a handkerchief.	A drachm.	Sitting.	Instantaneous.	Slight cough, with a few brief convulsive movements.	No autopsy was made.	
IX. — John Griffith . . .	Jan. 19, 1849.	Chancres and hemorrhoids.	On Dec. 26, 1848.	Not given.	From a towel.	About three drachms.	Lying on one side.	About ten minutes.	Face and neck of a livid, leaden hue; the eyes turned upward; pulse imperceptible at the wrist; respiration laborious; whole body relaxed; after two or three gasps, he ceased to breathe.	<i>Brain.</i> — Healthy; no other appearance than in persons dying when in full health. <i>Heart.</i> — Large; its ventricles and auricles empty; condition flabby; substance of left ventricle rather softer than natural. About half an ounce of watery fluid in the pericardium. <i>Lungs.</i> — A good deal congested; and discharged, when cut, a large quantity of bloody serum.	
X. — Abby Pennock . . .	March 6, 1849.	Toothache.	Frequent.	Unknown.	From a handkerchief.	Three drachms in two applications.	Recumbent.	Probably instantaneous.	Unknown.	<i>Externally,</i> body livid over whole left side; face and neck swelled; pupils slightly dilated; thyroid gland enlarged. <i>Brain.</i> — Free from congestion or any other morbid aspect. <i>Heart.</i> — Flaccid; empty of blood; only a very small coagulum in its cavity. <i>Lungs.</i> — Not much collapsed; both congested; the left throughout, the right of a bright vermilion color; entrance to the larynx inflamed, and covered with small ulcerations. <i>Abdomen.</i> — Semi-digested food in stomach; lacteals full of chyle; intestines in a remarkably decomposing condition. <i>Liver</i> not altered. <i>Spleen</i> rather large, and contained great numbers of distinct whitish bodies smaller than the head of a small pin, not tubercles. <i>Left kidney</i> congested. <i>Uterus</i> with catamenia.	

By the above Tables, we learn the

TIME OF INHALATION to have been —	Cases.
Less than a minute in	3
About a minute	3
Four or five minutes	1
Uncertain	3

QUANTITY.

Half a drachm and under	2
A drachm, but less than two	3
Between two and three	1
Uncertain	4

POSTURE.

Sitting	5
Leaning forwards	1
Recumbent	4

LAPSE TILL DEATH.

Within one minute	4
Within two minutes	2
In ten minutes	1
In three quarters of an hour	1
Uncertain	2

MORBID APPEARANCES.

Not given	2
<i>Brain</i> —	
Congestion moderate	4
,, none	4

<i>Heart</i> —		<i>Cases.</i>
Healthy		1
Enlarged and soft		2
Disordered		1
Excessively flaccid		2
Flaccid		1
Flaccid, compressed by liver		1
Mostly free of blood in all.		
<i>Lungs</i> —		
Congestion great		4
„ considerable		3
„ little		1
<i>Blood</i> — In each instance black and fluid.		
Dark and fluid		1
Darker than usual		2
Dark, venous, fluid as water		1
Black as ink		1
Not stated		3
AIR IN THE VEINS mentioned in		2
MODE OF INHALATION.		
From an apparatus		2
„ a sponge		1
„ a towel		3
„ a handkerchief		4

It has been stated, that the greater part of the victims of chloroform were females. An examination of the cases recorded shows, that the numbers are exactly equal, five males and five females. The questionable cases hereafter cited are two males and one female.

In a Review in the "London Medical Gazette" for Sept. 1848, page 424, a quotation is made from "Remarks on the Employment of Anæsthetic Agents in Midwifery," by G. T. Gream, in which he says : — "For they should know that fatal consequences have ensued from the use of chloroform during parturition."

We have thought it right to mention this allusion ; but, as there is uncertainty about it, it should not be considered, in the present state of our information, as a well-authenticated statement of death from chloroform. It seems a little remarkable, that in these cases, and also in some others mentioned above, in which it could scarcely be doubted that chloroform was the cause of death, no examination of the dead body was made, or at least none reported.

M. Malgaigne, in the "Proceedings of the French Academy of Medicine" for October 31, 1848 (*vide* "Gaz. Med. de Paris" Nov. 18), reports a case as follows : —

"A man, wounded in June, had the neck of the humerus broken by a ball, which was lost in the flesh. Two abscesses formed, and were opened without discovery of the ball. Finally, gangrene appeared in the wound, and the patient was sinking under secondary hemorrhage. Having at length decided to attempt the scapulo-humeral disarticulation, with scarcely any hope of saving him, but rather to prevent him from dying of hemorrhage,

the patient was put to sleep by chloroform. He aroused after the operation; but the search for the ball, which had been split in two against the scapula, and buried in the walls of the thorax, requiring another incision, chloroform was again applied to the nostrils; and the incision, commenced upon the living, was finished upon the dead body. His condition was so desperate, that I could not for an instant attribute his death to chloroform; and there is no surgeon who, in similar circumstances, has not had the grief to see patients die under his hands."

M. Roux, at the sitting of the Academy of Medicine for Jan. 16, 1849 ("Gaz. Med. de Paris," Jan. 20), related the following interesting case, in which he attributed the death to syncope:—

"Some months since, I was called on to operate upon a female, fifty years of age, with a cancer of the breast. She was much debilitated. Besides the tumor of the breast, the glands of the axilla were also much diseased, and their extirpation judged necessary. I did not hesitate to put her under the influence of chloroform: during the sleep, which was sound, I removed the tumor. The first operation was hardly ended, when the patient awoke. It then remained for me to extirpate the glands in the axilla: this I begged her to permit me to do without resorting to chloroform. She consented. The operation was long and laborious. The dressing was applied; then, according to my usual custom, a bandage rolled around the body. To apply this

bandage, she was made to sit up; syncope at once took place; all efforts to re-animate were vain; the patient was dead."

In the "Paris Medical Gazette" of Jan. 20, 1849, a case is related, in which chloroform produced very alarming appearances. The patient was a lady, who had passed the middle period of life, affected with a tumor in the groin, of very large size. Chloroform, being previously administered, produced some rigidity of the muscles; but the patient, ultimately coming under its full influence, went to sleep, and the operation was performed without pain. After the operation was over, she awoke; and, the dressing requiring a painful application of sutures, chloroform was again administered, and the dressing was completed under its influence. Immediately after, alarming symptoms presented themselves. The patient was taken with a chattering of the teeth, extreme paleness of the face, almost complete discoloration of the lips, dilatation of the pupils, rapid depression of the pulse, which became imperceptible for some time, convulsive movements of the face, and contractions of the flexor muscles of the hands, rigidity of all the extremities, stertor, a little rattling, slight delirium, muttering. This condition lasted for about seven or eight minutes. Fresh air was thrown upon the face, and she was stimulated by the vapor of ammonia; by which applications she was gradually brought to herself, though not without great anxiety on the part of her medical attendants.

The following case is one of so recent occurrence, that I am induced to give it at length : —

“ John Griffith, an Irishman, aged thirty-one years, a seaman in the navy, who was admitted into the New York Hospital early in December, on his return from Mexico, suffering with diarrhœa, chancres, and hemorrhoids, died from the administration of chloroform on Saturday, while undergoing an operation. A coroner’s jury so declared, adding that the use of it was proper and justifiable in the case. The affidavit of Dr. Buck tells the whole story :

“ Gurdon Buck, jun. attending surgeon to the New York Hospital, being sworn, says, ‘ That, on or about the 26th December, I advised that chloroform should be administered to the deceased, for the purpose of examining the condition of the rectum ; the parts being in a state of such excessive irritability as scarcely to admit of a separation of the nates. The patient recovered from the effects of the chloroform, and remained in all respects in the same condition as before its use. On the 19th of January, the deceased being in a sound condition, except the local ailments spoken of, and he having never complained of either his head or his chest, and not having suffered from the first administration of chloroform, I directed it to be administered to him for the purpose of performing an operation upon the rectum, and the operation of circumcision, to remove a phymosis caused by the chancres. The patient soon became excited by the chloroform, as

is usually the case, but not beyond a degree which I have often observed. Shortly after, he became more tranquil. The deceased was placed upon his side, and the operation performed, which consisted in the removal of two external tumors, and the tying of one internal tumor.

‘At this moment my attention was arrested by my assistant calling for a wet cloth. On examining the patient, I found his face and neck of a livid, leaden hue or color, the eyes turned upward, the pulse imperceptible at the wrist, and the whole body relaxed; after two or three gasps, he ceased to breathe. Every means was promptly used to restore the deceased, but without effect. The chloroform was obtained at Kent’s, 91, John-street, and not exceeding three drachms was administered from a napkin: a portion of chloroform from the same phial had been administered the day before to a patient, without any unfavorable effects. About ten minutes elapsed from the commencement of its administration before death took place. On making a post-mortem examination twenty-four hours after death, I found the face less livid than before death: on examining the head, the brain and its membranes presented no other appearances than are seen in persons dying when in full health; the lungs were a good deal congested, and discharged, when cut, a large quantity of bloody serum; the heart was large, its ventricles and auricles were empty, its condition flabby, the substance of the left ventricle rather softer than natural; about half an ounce of a watery

fluid was found in the pericardium; the viscera of the abdomen were healthy.

‘GURDON BUCK, M.D.

‘Surgeon to New York Hospital.’

“ Drs. Kearney Rodgers, Buel, and Bathgate testified to the proper use of the chloroform. Dr. R. has seen it used a hundred times without any bad effects.”

Dr. Parker, Professor of Surgery in New York, to whom I had written on the subject, gave me a statement confirmatory of the deposition of Dr. Buck.

Another fatal case of chloroform has this moment occurred, March 6, in Boston. The following were the circumstances:—A young woman, Abby Pennock, 17 years old, finely constituted, came a few weeks previous to live as domestic in a highly respectable family. Being troubled with toothache, and occasionally with pain in the side, she applied for medical advice. On a visit to her physician, she asked him for chloroform, and he gave her a few drops. She then took the phial, poured the liquid freely on her handkerchief, and inhaled it until fairly under its influence.

On the evening of March 6, she went out, and, having had the toothache, used chloroform. After her return home, she ate a good supper, and soon went to bed. In half an hour, a young woman who lodged in the same chamber went to her room, and, on entering it, spoke to her, but, receiving no answer, presumed she was asleep, said no more, and went

to bed herself. She noticed that the window of the chamber had been opened, as she has since thought, to take off the smell of the chloroform; and, having no objection herself to its being so, she allowed it to remain open, although the temperature was below freezing.

The next morning, when she arose, finding that Abby was not stirring, she did not attempt to rouse her, but dressed and went about her business. As the latter did not appear, her room was visited about half-past 6, A.M. and she was discovered in bed lifeless and cold. She lay on her left side with the knees drawn up, and all the limbs in a rigid state. Dr. Jeffries was immediately sent for, and very soon arrived. On viewing the appearance of the body, he perceived the left hand clenched over the mouth, and the right arm crossing the left. An examination of the left hand detected a handkerchief crowded in its hollow, which being removed, the fœtid odor of stale chloroform was perceived. Suspicion being excited, search was made around the room and in the drawers for a bottle containing the suspected liquid; but none was discovered. Afterwards, when the body was moved, a bottle of chloroform fell out of the bed. It was a two-ounce phial, and three fluid drachms of it had disappeared.

Dr. Jeffries proposed an examination of the body; and, this being consented to, he called on Dr. J. B. S. Jackson, who performed it.

EXTERNAL APPEARANCE. — The body was livid

over the whole of the left side on which she had lain. The face and neck were swelled, so that the string of her night-cap produced a distinct indentation. The pupils of the eyes were slightly dilated. The thyroid gland was much enlarged.

Thorax. — The lungs were not much collapsed; both of them were congested, but the congestion in the right was bright-colored, while that on the left was purple. As the lungs were much collapsed, the congestion could not be excessive. The *heart* was flaccid, and empty of blood. Nothing was found in its cavities, but a very small coagulum.

Head. — The brain was entirely free from congestion. There was a little water in the ventricles, but no other remarkable appearance.

Abdomen. — The stomach contained a considerable quantity of food in a semi-digested state, and the lacteals were full of chyle. No morbid change in the mucous coat. There was no appearance of poisonous substance. The *intestines* were in a decomposing condition, quite remarkable, considering that she had been alive and on her feet the evening before. The *liver* was not altered. The *spleen* rather large, and contained great numbers of distinct whitish bodies, smaller than the head of a small pin, not tubercles. The *left kidney* was congested. The *uterus* exhibited a catamenial appearance.

REMARKS.—To what has been stated above may be added, that there was reason to believe the chloroform was purchased on the evening it was taken; that it

had been used during that evening, at least once before the fatal application ; and that the three drachms which had disappeared must therefore be divided between the two applications ; that there is no reason to believe, that any other article of a poisonous nature was employed ; that there can be no reasonable doubt of the patient's having died the evening before, and died instantaneously ; that she did not die from suffocation, but of the effects of chloroform. She must have died instantaneously ; because, if the dying state had been prolonged, the hands would have been removed from the mouth in all probability by spasmodic movements of the muscles ; and she probably did not die of asphyxia, as the lungs were not so much congested as they generally are in cases of suffocation. And, on the whole, the phenomena in this case agree with those presented in the other fatal cases of chloroform.

In considering what organ might be principally affected by the deleterious agent in producing the fatal symptoms, my first impression was, that the lungs were primarily disordered, and that death arose from non-oxygenation of the blood. The suspended or struggling respiration, purple color of the skin, irregularity of the pulse, muscular spasms, &c. led to this opinion. If it were the fact, we

should find a great engorgement of the lungs, of the right side of the heart, and probably also of the brain. Now as to the lungs, we find them engorged more or less in every case, but excessively engorged in four. And, on the whole, they do not present the degree of engorgement which accompanies asphyxia. The same may be said of the heart. As to the brain, the accumulation in its vascular system has been found to be for the most part very slight. The blood, in every case where it is mentioned at all, was found in a fluid state. There does not, then, appear to be any morbid change uniformly exhibited in either of these organs, which authorizes us to consider the disturbance of such organ to be the immediate cause of death.

The facts which we have collected and compared, while they do not support the doctrine that death occurs from a visible alteration in any of these great organs, seem to leave us only the nervous system, independent of vascular action or congestion, as the seat of the sudden change produced by the rapid passage of the narcotic principle to the great nervous centres. This is, indeed, to be considered a mere hypothesis at present; but, as the object of these remarks is altogether of a practical nature, I shall not undertake to examine the subject physiologically, in order to prove the truth of this hypothesis. The fluidity of the blood, in every case where the blood is mentioned at all, goes to show, that its vitality had been suddenly destroyed by the action of a deleterious principle. The flaccid state of the

heart, which appears in every case examined, affords another fact in favor of the same opinion.

In a large part of the fatal cases, one fact at least is conspicuous; and that is the suddenness with which the fatal phenomena occurred. In four cases death took place within a minute; in two, in two minutes; and in my patient, Mrs. H. five inspirations, requiring a few seconds only, produced symptoms which lasted a long time. When we compare these sudden effects of chloroform with those from its continued use in many cases of prolonged operations, it seems quite clear, that the fatal issue is not a consequence of the quantity inhaled, nor yet of the time, but rather of the instantaneous violence of the impression.

An important objection to chloroform is the facility with which it may be abused. The highly concentrated state of the toxic principle, the convenience with which the substance may be transported, the absence of the penetrating and diffusible property of ether, favor its use in an undiscoverable manner. Hence it has happened, that many persons of both sexes, and of all ages, have resorted to it for the purpose of obtaining the pleasure of a temporary delirium. The number of individuals whom I have known to use it in this way is so considerable as to lead me to believe, that those who employ it in secrecy must be very great. Persons, therefore, who recommend chloroform, for the purpose of preventing pain or procuring a transient pleasure, must take into view the probability that

the patient will resort to it afterwards without medical advice; that the habit of taking it may be thus formed, and origin given to the most pernicious consequences.*

An English gentleman, Mr. Carruthers, was in the habit of using chloroform for relief from the asthma. He was an expert angler, and sometimes sat till a late hour arranging his hooks, and making artificial flies. In this position, he was found one morning by his servant, apparently pursuing the occupation of the evening previous; but he was soon ascertained to be dead, while upon the table lay the handkerchief and chloroform. We have not heard of a post-mortem examination in this case.

A physician in New York, who had attained some distinction, and who suffered from mental trouble, resorted to the use of chloroform so frequently as ultimately to produce a delirium; during which he committed some extraordinary acts, and finally destroyed himself.

It is true, that an objection may be raised against ether on the same grounds. This has been replied to in the "Remarks on Etherization" by the fact, that the volatility of ether is so great as to reveal its use. The quantity required is also such as to make it much more difficult to conceal the employment.

* This remark has been verified, at the moment these sheets were correcting, by the case of a young woman in this city, who took chloroform for the relief of toothache, and fell a victim to its effects. — *Vide* Case X.

A practical conclusion, then, from these cases, which seems to me unquestionable, is, that chloroform, containing the narcotic principle in a highly concentrated state, like many other powerful agents in *Materia Medica*, although it may be employed in this state in some instances, yet in common practice should be used, if at all, in a diluted form. If this fact is admitted, we are naturally led to ask whether we shall use it thus diluted, return to sulphuric ether, or whether there are any other narcotic, or, as they have been called, anæsthetic agents, which may advantageously be substituted.

Various such substitutes have been proposed; among them are the nitrous oxide gas, as employed by Dr. Wells, and different articles experimented on by a number of physiologists. None of these seem well calculated to be substitutes for chloroform and sulphuric ether.

On hearing of the first fatal cases of chloroform, the thought occurred to me of giving a more thorough trial to the chloric ether of commerce. This, as is well known, is the product of the distillation of alcohol and chloride of lime. I had tried it formerly, as stated in my first publication, and now tried it a second time with great care, but without any narcotic effects.

After the preceding experiment, I tried the first portion of the product of the distillation without purification, and without mixture with the residuum, or any additional preparation. The first person to whom this was administered was a patient of Dr.

J. Mason Warren, suspected to have a stone in the bladder, who had been so very irritable, that it was impossible to sound him satisfactorily. He inhaled freely from a sponge; in about four minutes, went to sleep; the sound was at once introduced without any trouble, and a stone detected. Under the influence of the same preparation, the lithotritic operation was performed; and, after two or three applications, the stone was removed. In four or five other cases of stone, — one of them an oxalate of lime case, in which the calculus was very refractory, — the patients were conducted safely and successfully through the lithotritic treatment, under the influence of chloric ether, by the same operator.

Among the subsequent cases in which this ether has been employed, I will mention only a single class, with a couple of interesting illustrations. The admirable effect of sulphuric ether, in enabling us to break down the adhesions in joints stiffened by inflammation from fractures and other causes, has been stated in the "Remarks on Etherization." Chloric ether has been used a great number of times for the same purpose, and with results equally favorable: —

About the beginning of February, 1849, a young lady, who had fallen on the ice three weeks before, and broken the olecranon process of the ulna, was brought to me, with a stiff elbow, by her parents. Various efforts were made to move the fore on the upper arm; but the patient expressed so much pain,

it seemed necessary to desist. As she had not been allowed to move the arm at all, I recommended to her to go home and bend the arm, or have it bent, every day, and thus to increase the motion as much as possible; and, if she found that nothing was gained, to come to me again in five days. At the end of the time indicated, she was brought, and I found that nothing had been accomplished in moving the joint. She was then etherized by Dr. Mason Warren to the point of physical insensibility, and I attempted to restore the natural motions of the arm by force. It was, however, impossible for me to accomplish it in this case. She was therefore etherized with the chloric ether two minutes longer, fell asleep; and then, renewing my efforts, the adhesions and muscular contractions gave way with an audible crack. Two other etherizations were required to effect the restoration of the perfect movements of the limb.

A patient of mine, who had apparently undergone inflammation of the spinal marrow, with phenomena very curious, but which cannot properly be mentioned here, on recovering was found to have a false ankylosis in the right hip, a true ankylosis with dislocation in the left. Under the use of chloric ether, the ankylosis in the right hip was broken with a very loud crack. The left could not be at all moved. It was therefore resolved, in order to give him a fair chance, to employ pulleys for breaking down the ankylosis, and reducing the dislocation. He was bled nearly a pint; then, having used chloric

ether many times before with excellent effect, it was employed; but the state of susceptibility was so altered, that both this, sulphuric ether and chloroform were tried; the administration requiring nearly three quarters of an hour before he was narcotized. The pulleys were applied for fifteen minutes; during which one of the cords was snapped, and replaced. Efforts to move the limb were then made, but without accomplishing any motion of the os femoris on the os innominatum. The patient was then roused from his state of etherization, and recovered almost immediately. On the day following, he experienced some pain in the right hip, which I had moved during etherization; but the force applied to the left had not produced any pain or soreness. This happy immunity is to be attributed, I think, to the precursory bleeding.

As the dislocated left limb was inverted to such a degree, that the left knee constantly impinged upon the back and inner part of the right, thus interfering in an embarrassing and painful way with its motions, and in fact disqualifying the patient from any active occupation, it was determined to saw through the upper part of the thigh-bone, in order to admit of rotation of the limb outwards. This was happily accomplished on March 17. Chloric ether, used at this time, narcotized the patient in five minutes; and he continued, with occasional applications of the sponge, in a state of total insensibility for ten minutes longer, during which time the operation lasted.

The first of these trials of chloric ether was in March, 1848; between that time and the month of May (when I mentioned the subject to the American Medical Association), the strong chloric ether was used in fifty cases with perfect success, so far as regards the narcotic influence, and without any unpleasant occurrence at the time or afterwards. The experience of that term has been confirmed by the observations of ten additional months, so that I now employ it almost exclusively.

It may be objected to the strong chloric ether, *first*, that it irritates the skin, as chloroform does; — *second*, that it causes nausea; — *third*, that it is, in fact, chloroform diluted with alcohol; — *fourth*, that, when chloric ether is administered by a wet sponge, the alcohol combines with the water in the sponge, and leaves chloroform to be inhaled.

In answer to the *first* objection, we should say that it is not necessary to use this ether in such way as to irritate the skin; also, that the skin is easily protected by a cloth, and by various contrivances, particularly by rubbing the face with an unctuous substance previously. *Second*, That the subsequent sickness, so far from being an objection, is an advantage; for, in patients who have experienced it, the lungs are relieved from congestion, and therefore recover from narcotism more rapidly. *Third*, The fact that it is chloroform diluted with alcohol does not form any objection to its use, since the chloroform is sufficiently diluted to render its inhalation safe. *Fourth*, The supposed decomposition of the

strong chloric ether, in consequence of the combination of its alcohol with the water in the moist sponge, may be obviated, by those who believe in such a combination, by administering the chloric ether on a handkerchief, towel, or other cloth not moistened. It is, however, probable that any portion of alcohol, which combines with the water of the moist sponge, being reduced to the state of rum, the exhalations would enter the lungs with the chloroform, and help to dilute its narcotic property.

It may be asked, whether chloric ether has any advantage over sulphuric. In my opinion, it has. It irritates the lungs less; its inhalation is more agreeable; and it never has produced headache in the operator and by-standers, as is the case in regard to many individuals from sulphuric ether. As to the narcotic power of the two articles, there seems to be but little difference.

The distinguished Mr. Lawrence is said to have used chloric ether in the summer of 1847, but whether that of commerce or the concentrated I am ignorant. The idea of using this agent was suggested to me by seeing the process of preparing the chloric ether of commerce and the chloroform by Mr. W. B. Little. Alcohol and chloride of lime being distilled together, the product of the distillation is the chloric ether of commerce; but a small quantity of the first product of distillation is much stronger than the aggregate. Taking therefore this

first product, I made trial of it, as before mentioned, and found it produced a satisfactory narcotic effect. Mr. Little has since improved the process, and prepares his chloric ether in the following manner, as he has kindly informed me by letter : —

“ Take the first run (that is, what passes first in distillation) when distilling chloroform, and re-distil from water containing an excess of lime, which gives a perfectly pure ‘chloric ether,’ free from chlorine or any other impurity. We furnished Dr. Warren with different samples, until he was satisfied with the strength, and since then have uniformly made it of the same quality. Our ‘concentrated chloric ether’ contains $33\frac{1}{3}$ per cent pure chloroform, the remainder being nearly absolute alcohol (containing but about 4 or 5 per cent of water).”*

After this article had been employed in a considerable number of cases, the subject was brought forward (not by me), as already stated, at the meeting of the American Medical Association, at Baltimore, in 1848. Having used it myself, I felt bound to give to the Association some account of its introduction, and of my reasons for using it. The President of the Association, Dr. A. H. Stevens, called on me to furnish a copy of the remarks I made, for

* I have been informed, that a chloric ether made in Philadelphia does not, when water is added, undergo the separation of chloroform, while that made here does. I have tried the experiment myself, and it has been tried by two of my friends, one a physician, the other a chemist ; and we have all found that chloroform does separate in both, on the admixture of water. The fact is, however, of no practical importance, since the chloric ether prepared as above answers the purpose.

publication in their proceedings. This I did not wish to do at that time, because a longer experience seemed necessary; and because the dangers of chloroform were not so fully established as to exclude the suspicion, that they might have arisen from a careless use of the article.

Since that time, May, 1848, the fatal cases have more than doubled. The apprehensions, grounded on these occurrences, have led me to use, in preference to chloroform, the ethers, — either sulphuric or chloric, — and five times out of six the chloric, employing the former only for the purpose of comparison with the latter. I have never seen or heard of any accident from the use of chloric ether, which gave me reason for discontinuing it; and I think I can confidently recommend it to the profession, as more safe than chloroform, and more agreeable than sulphuric ether. Should any one, preferring chloroform to the ethers, feel disposed to employ this article in a diluted state, he might very properly add a certain portion of alcohol. I have used two parts of the purest alcohol with one part of chloroform; but have not sufficient experience of its effects to enable me to say, that these are the best proportions.

There are cases in which chloroform will have an advantage. We occasionally find instances of a want of susceptibility to the narcotic action. In such, after trying in vain the use of ether, the more powerful impressions of chloroform have been resorted to with good effect. I cannot say, however,

that this has occurred in my practice more than two or three times out of a great number of cases.

Chloroform, used externally, does not produce an anodyne effect, when employed on a surface of moderate extent, as for example a leg. It causes a slight cutaneous irritation, which sometimes relieves pain, and sometimes aggravates it. Taken internally, a fluid drachm of chloroform, diluted in two ounces of water, seems to have an anodyne influence. This dose may be repeated at intervals of an hour or less, two or three times.

Strong chloric ether, employed in very small doses, has much the same effect as spirits of nitrous and sulphuric ether. So far as regards its anodyne property, it does not answer for internal use, through the medium of the stomach, as well as chloroform.

To the questions contained in the letter at the beginning of this article, and to those which have been addressed to me from other quarters, I now reply in a few words by stating: — *1st*, That my confidence in the beneficial effects of ether, in surgical operations, is undiminished; but if I were compelled to substitute chloroform, I should do so with much anxiety. *2d*, Etherization is not, I think, employed so extensively as it was during the period of enthusiasm following the first inhalations of ether. The occurrence of fatal cases of chloroform has done much to cause a diminution of the use of ether, and the latter article has not been free from the charge

of pernicious consequences. No fatal case from its use has transpired, however, in this country, nor in Great Britain, so far as we know. One well-authenticated instance only has occurred in France.* The details of this case I am not able to give, further than to say, that the patient was a male, resident in Auxerre, about forty years of age, who underwent an operation for cancer of the breast, and died in ten minutes. 3*d*, Chloroform or ether is used in this part of the country in all capital operations, and I believe pretty generally in such operations in other parts. In parturition, also, the former is extensively employed here; but a considerable number of practitioners use it rarely, and only in cases of extreme suffering. The relief from pain is uniformly said to be great; but whether the patient does as well on the whole after this narcotism is a doubtful point with me, confiding as I do in the power of nature to render this process generally perfect without the aid of art. In surgical operations, there is every

* Dr. Snow, of London, one of the best writers on ether and chloroform, and a strong advocate for the latter, gives the following opinion on the supposed bad cases of ether in the "London Medical Gazette" for November, 1848, p. 841, note:—"I am aware that ether was thought by some to have caused death in two or three instances, in which the patient did not recover from the operation, but died two or three days afterwards; and, in one of these instances, a coroner's jury returned a verdict to that effect. But I believe the only instance on record in which the inhalation of ether was fatal was one that occurred in France (see "Gazette Medicale, 4 Mars," and "Med. Gaz." p. 432, last vol.); and, in that case, the inhalation was continued without intermission for ten minutes, although alarming symptoms were present nearly all the time; and it is probable that the result was owing as much to some defect in the inhaler, which limited the supply of air, as to the effect of ether."

possible evidence, that the chance of success is not diminished by etherization.

An attempt has been made to parallelize the unfavorable cases of ether with those of chloroform, with a view to determine the proper application of each of these to different cases. No such parallelism can be legitimately established. The fatal instances of chloroform, to whatever cause they may be imputed, are sudden, and are unequivocal sequels of chloroformization. Those of ether, on the contrary, are, with a single exception, lingering cases, subsequent indeed to the application of ether, but not immediately connected with it in time. The former mostly occurred within a few minutes of the administration, and none are considered as unquestionable poisonings by chloroform which have been prolonged an hour or more; while those alleged to be from ether, — varying in number from five to ten, according to the varying judgment of different persons, — have been prolonged to a number of days, during which, time enough elapsed to admit the intervention of various causes. There is therefore no good ground for the effort to specialize cases to which the application of chloroform and ether is relatively proper; ether is generally safe; chloroform cannot be said to be safe in any case. It has destroyed the feeble and the strong, the sick and the well, the young and the middle-aged; and no practitioner can be reasonably assured in his own mind, that it will not prove fatal the next time he employs it.

*Means of preventing and remedying the bad Effects
incident to the Chloroform Practice.*

First, To use chloric or sulphuric ether, for the purpose of producing narcotism in surgical operations, in preference to any other agent. *Second*, Not to use narcotism for trifling operations. *Third*, Where the operation is not very severe and prolonged, to produce only that degree of narcotic influence, which destroys the susceptibility to pain, without abolishing the intellectual functions. *Fourth*, To be careful that the patient does not get an exclusive inhalation of the narcotic vapor, but obtains with it a sufficient quantity of atmospheric air to carry on the oxygenation of the blood; and, when he is unpleasantly affected by the first impulse of this vapor, not to press it too harshly upon him. *Fifth*, When a powerful application is required, as in cases of the reduction of hip-dislocation, the patient should always be bled before etherization. It is very desirable, that a powerful narcotism should never be produced, without previous abstraction of blood, except in cases of great debility. *Sixth*, The respiration and pulse should be carefully watched, during the whole operation, by one in whom the operator can confide. *Seventh*, When the pulse intermits, and respiration is suspended, inhalation should not be continued. *Eighth*, The position of the body does not appear to exert a particularly unfavorable influence; of the fatal cases,

five occurred in the sitting posture, four in the horizontal, and one in a state of flexion forwards on a table. *Ninth*, Whenever etherization is to be accomplished, there should be a sufficient number of assistants present, to guard the patient if he should become violent. *Tenth*, To protect the face, a small towel is folded in a funnel-like shape, in the apex of which is placed a sponge, double the size of an egg, charged with an ounce of chloric ether; or the liquid may be poured directly on the interior of the cloth. *Eleventh*, Chloroform or ether should not be administered upon a full stomach, nor in cases of epilepsy, of active organic disease of the heart, of acute affection of the lungs, or in a hemorrhagic tendency of these organs. *Twelfth*, The fatal effects of chloroform, in almost every instance, have been produced by small quantities.

Some very judicious physicians and surgeons are of opinion, that the dose of chloroform should be exactly measured; and that, if this were rigidly and uniformly attended to, any calamitous consequence would be avoided. Should the use of chloroform be continued, this might be desirable; and the most exact apparatus for accomplishing this object is a small box, intended to receive the chloroform and the sponge or cloth containing it. To this box are appended two tubes, five or six inches in length, and fitted to the nostrils, through which alone inhalation should take place. In this way, the utmost precision may be attained.

The ethers, however, have the great advantage of

not requiring this extreme exactness of administration. A large sponge, imbued *ad libitum* with ether, we have seen employed in a great number of instances, and know that it has been employed by distinguished surgeons in whose judgment we have very great confidence. This profuse administration is not what we have recommended. A more sparing and precise exhibition seems better adapted to the power of the substance and the importance of the object, for the attainment of which it is given.

On the means of restoring the vital actions, when suspended by Chloroform or Ether.

First, When the pulse and respiration are suspended, the face should be dashed with cold water from a sponge. *Second*, A free passage of air to be directed to the patient's nostrils and mouth. *Third*, Inflation through one of the nostrils by an inflating tube, or, if this is not at hand, by the bellows; the opposite nostril and the mouth being closed, and the larynx pressed backwards to prevent the air from going into the stomach. *Fourth*, Forced movements of the chest, in imitation of respiration. *Fifth*, Friction of the chest, abdomen, and extremities. *Sixth*, Heat applied to the same parts. *Seventh*, The nostrils to be stimulated with the vapor of aqua ammoniæ. *Eighth*, The fauces irritated with a brush or quill-feather dipped in aqua ammoniæ. *Ninth*, The introduction of stimulating liquids into

the stomach by a gum-elastic tube. *Tenth*, The use of galvanism, if an apparatus can be immediately obtained. *Eleventh*, Inflation with oxygen gas of the nostrils and lungs. *Twelfth*, Inflation of the lungs through an aperture between the thyroid and cricoid cartilages. *Thirteenth*, A limited application of caustic ammonia to the region of the heart. *Fourteenth*, Convulsions to be treated by bleeding, vapor of ammonia, cold to the head: for the sudden production of the latter, evaporation of sulphuric ether answers well.

C O N C L U S I O N .

I hope it will not be thought presumptuous in me to propose the substitution of the ethers for an article which, although so deleterious to some individuals, has been and is still extensively used with safety on others. My apology must be found in the reflection, that, for more than a year before the introduction of chloroform, the ether-practice was carried on without any fatal result; that several fatal cases from chloroform occurred in a much shorter space of time than that above mentioned; and that a number of practitioners will feel absolutely compelled to abandon the employment of these anæsthetic agents, if chloroform be looked to as the principal. Moreover, the suggestion of a judicious friend will have its weight in forming this apology.

“Nor would it,” he writes, “alter my opinion of the wisdom of strongly urging the objections at this time, should longer experience show, that the disasters in the use of chloroform, during the year past, arose from peculiar coincidences; and that it is, in reality, as safe as the sulphuric ether. In so grave a matter, we should be willing to be proved over-cautious, rather than the contrary.”

P O S T S C R I P T.

While the preceding pages were in process of printing, new instances of the fatal consequences of the inhalation of chloroform presented themselves. Some of these cases are detailed with a minuteness which leaves us little to desire; others, on the contrary, are reported in so meagre a style as to allow us to remain in great obscurity. On the whole, however, though three of them are scarcely more than mentioned, yet, as we really believe that they are of the same character, and have equal importance with the others, we cannot pass over them in silence.

We shall present here five additional instances. The first, which we quote from the "Gaz. Med. de Paris" of January, 1849, is that of a patient who underwent the extraction of a tumor, not remarkable for its size, or for the danger of its situation. The patient never seemed to recover perfectly from the effects of the chloroform.

The second case occurred in the Hotel Dieu of Lyons, a medical establishment highly distinguished for its scientific character, and for the reputation of

the illustrious savans who actually discharge its duties. The details of this case are wanting; but they are spoken of by the editor of the "Gaz. Med. de Paris" as having been already published, and as of unquestionable authenticity.

The third case is said to have occurred at the Bicêtre, in September, 1848; but the details are not at hand.

The fourth case we take from the "London Lancet." The description was no doubt published before the details could be obtained: these we shall probably see hereafter.

The fifth case occurred at the Hotel Dieu, at Lyons, and is described with much care and minuteness.

I. — *Case of Death attributed to Chloroform, by M. Vanini.*

Copied into "Paris Med. Gazette," Feb. 17, 1849, from the "Gazzetta Medica Lombarda."

On Jan. 25, 1848, at the Hospital at Côme, was made the first trial of chloroform. Petronille F. a peasant woman of Alzate, aged thirty-six, having the aspect of fine health and flourishing nutrition, was put under the influence of chloroform, in order to undergo the removal of a sarcomatous tumor. The operation, very trifling in itself, was promptly performed, unattended with accident; nor was it indeed capable, under the circumstances, of compromising the life of a woman so healthy. She was

put to sleep by pouring about a drachm of chloroform on a sponge, which was applied to the nostrils. The effect, although tardy, was complete; but the consecutive phenomena were such as led the author to think that chloroform developed an action much more powerful, if not more rapid, than ether. In effect, the pain in the head, the dulness and stupidity of the mind, somnolency, giddiness, slowness and embarrassment of her pronunciation; in fine, all the symptoms which announce the state of cerebral congestion were prolonged for more than eight hours after the operation. Nor can we reasonably affirm, that, at the end of this time, all the phenomena were entirely dissipated; for the next day the pains in the head continued, with a feeling of fulness and of dulness, accompanied with a burning fever.

The thorax and abdomen, being slowly and attentively examined, manifested no symptoms of pain, or signs of lesion, with the exception of a slight cough, which the patient said she had already had habitually. The wound resulting from the operation had a pale and greasy appearance.

The chief surgeon of the Hospital, suspecting a latent inflammation of some of the viscera, prescribed bleeding, which diminished the fever and the pain in the head.

At the visit on the morning of the 27th, the patient was tranquil. Four hours after mid-day, she was seized with irregular and prolonged chills. At nine in the evening, she died suddenly.

AUTOPSY.—The membranes of the brain were in a state of abnormal turgescence. The cerebral hemispheres exhibited their ordinary consistence. All the vessels of the interior of the encephalon were gorged with blood. The cutting of the cerebral pulp exhibited numerous bloody points. The marrow was softer in the lumbar region than elsewhere. Its coverings were slightly injected.

The lungs were filled with blood, and softened. There was some bloody serum in the pleura. The heart was normal as to size, but flaccid, and without blood in its cavities.

No morbid appearance was exhibited in the abdomen, if we except a bloody suffusion of the spleen, which was softened, like a bladder full of a blackish, fluid pulp.

The kidneys were softened, and natural as to form and size.

REMARKS.—This case, attributed to chloroform by M. Vanini, does not come in exactly the same class with those we have considered as normal cases of poisoning by chloroform, because the death did not take place under the immediate influence of this agent. That the patient did actually die from the effects of chloroform, there seems little reason to doubt, since she never revived fully from its first effect, and did not experience any other symptom sufficient to explain the cause of death. The morbid appearances correspond nearly with those of other chloroform cases:—the same dark color of the blood, congestion of the lungs, flaccidity of the heart,

but a greater degree of congestion of the brain. The last-named circumstance is attributable to the comparative slowness of death in this case. The lungs, so far as we can judge from the statement, were more congested than usual; and the gradual accumulation of blood, constituting this congestion, would also be a natural consequence of the slowness of the morbid changes.

II. — At the Hotel Dieu of Lyons, Charles Desnoyers, aged twenty-two; of scrofulous habit, affected with white swelling of the left wrist. Chloroformization with an apparatus during five minutes. Transcurrent cauterization of the joint. Death at the commencement of the operation.

III. — An instance reported by J. Guérin as having taken place at the Bicêtre, in Sept. 1848. A man suffering from a lesion of the thigh. Chloroformization; coxo-femoral disarticulation. Death before the end of the operation.

IV. — A death from chloroform is reported in the "London Lancet," Jan. 6, 1849, page 25, as follows: —

"The 'Glasgow Herald' states, that recently a young gentleman returned from Australia, to visit his relatives in the neighborhood of Govan (a town about four miles from Glasgow). Before leaving the colony, he met with a slight accident in the foot, which, being perhaps neglected during the pas-

sage home, caused the great toe-nail to grow into the flesh. To remove the pain and inconvenience, the gentleman resolved to submit to an operation, which a respectable surgeon in Govan was employed to perform on Tuesday last. Preparatory to doing so, the surgeon resolved to make use of chloroform; but the patient, after inhaling the gas, almost instantly expired."

V. — *Case of Death from Chloroform at the Hotel Dieu of Lyons.*

Reported by M. le Doct. Barrier. "Paris Gaz. Med." No. 7, Feb. 17, 1849, page 115.

To the Editor of the "Union Medicale."

Mr. Editor, — Whilst the discussion of chloroform is still pending at the National Academy of Medicine, I believe it my duty to publish, without delay, a case of chloroform-inhalation followed by death, which I have just had the pain of witnessing at the Hotel Dieu of Lyons. Hitherto an avowed partisan of chloroform, I do not now know whether I shall decide to continue or abandon the use of it.

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J. Verrier, aged seventeen, of lymphatic temperament and good constitution, entered the Hotel Dieu of Lyons, Jan. 24, 1849. He bears on his limbs the scars of scrofulous ulcers, which he attributes to the labors of his trade, that of a miner. He comes to the Hospital for a disease of the middle finger of the right hand, consisting of a complete necrosis

of the first phalanx, with suppuration, fistulæ, and fungosities of the two joints, of which this bone makes a part. The affection not being curable without an operation, the 31st of January is appointed for it. The intention is to amputate the finger, and to cut out as much as is necessary of the metacarpal bone.

The day having arrived, after being assured that the patient otherwise enjoys good health, and has taken no aliment, he is placed upon a bed, and put under the influence of chloroform, which he had desired, and which inspired him with no apprehensions. The phial containing the anæsthetic agent is the same that has been used, but a moment previous, to put a young girl to sleep, in whose case all had passed off regularly. As usual, a compress of very thin texture is drawn over the face, leaving free passage for the air; and chloroform is dropped, with many intervals, on the part corresponding to the nasal aperture. Two assistants, very familiar with the administration of chloroform, are entrusted with this, and, at the same time, with the exploration of the pulse at the wrist. The operator overlooked and directed the labor of his assistants. After four or five minutes, the patient still feels and speaks. Hardly another minute has elapsed when the patient pronounces some words, and manifests slight agitation. In all, about six or eight grammes (from one to two drachms) of chloroform are absorbed; or, rather, this is the quantity dropped on the compress, and evaporation has necessarily exhausted the

greater part of it. The pulse continues with perfect regularity, as it regards the rhythm and force of its motions. All at once, the patient hastily raises his body, and moves his limbs, which escape from the assistants; but they promptly seize them again, and replace the sick man in his position. This movement has lasted certainly not more than a quarter of a minute, yet one of the assistants immediately announces that the pulse at the wrist has ceased to beat. The handkerchief is taken away. The face has surprisingly altered. The action of the heart has altogether ceased. There is no longer any pulse or any sound in the region of the heart. Respiration still continues; but it becomes irregular, feeble, slow, and at last stops entirely in the space of about half a minute.

At the first signal given, energetic measures are directed against the accidents, the gravity of which is immediately perceived. A little ammonia upon a cloth is immediately applied to the nasal aperture. A large quantity is poured upon the thorax and abdomen, which are forcibly rubbed. The same substance is employed to irritate, if possible, the most sensitive parts of the integuments, as the lips and the genital mucous membrane. Mustard is applied. His head is inclined over the edge of the bed. Finally, an attempt was made to restore respiration by pressing alternately upon the abdomen and the chest. After two or three minutes, respiration returns, and even has a certain fulness; but the pulse is not again aroused. The frictions are

persisted in. Respiration is again slackened, and ceases a second time. The hopes that had been raised vanished. Air is blown into the mouth, and even into the larynx, a probe being introduced through the aperture of the glottis; because, while blowing into the mouth, it was perceived that the air passed into the stomach. The cauterizing irons having been put into the fire at the commencement of the accidents, the surgeon cauterized powerfully the precordial, epigastric, and prelaryngeal regions. The pulse does not revive. Still every conceivable effort to restore the patient to life is continued for over half an hour. These efforts are useless.

The **AUTOPSY** could not be made till seventy-two hours after death. The weather being sufficiently cold, the body does not exhibit any marks of decomposition. There is still a decided rigidity of the limbs. The features show no particular alteration. A careful examination is made of all the organs.

The *stomach* contains about forty-five grammes of a thick fluid; the color of lees of wine, but not at all resembling any alimentary liquid. It is distended with gasses, and also the rest of the digestive canal. With this exception, it is healthy. The *liver* and *spleen* are a little congested.

The *heart*. — Size normal, flaccid, empty of air and blood. The walls of the ventricles are moistened by a thin froth, very red, giving one the idea of a little blood that has been beaten by the fleshy pillars of the heart. The *venæ cavæ* and *vena porta* are distended with black fluid blood, very copious.

Over the Eustachian valve is found a fibrinous clot of blood, of little consistency, weighing four or five grammes, being all that is met with in the cavities of the heart and great vessels. Moreover, these cavities are opened with sufficient attention to render it certain that there was no accumulation, in any observable quantity, of any aeriform fluid.

The *lungs* are very much contracted on the opening of the thorax. They exhibit a very decided dark slate-colored appearance. A section of the lungs exhibits the same tint. With this exception, the tissue is healthy. The larynx and trachea show no lesion. The brain is unaltered. The sinuses and the dura mater contain a considerable quantity of black uncoagulated blood.

REMARKS. — The phenomena in this case accord with those of the other fatal cases. The lungs were dark-colored, and their contraction showed that there was no great accumulation of blood, as there is in most cases of asphyxia. The heart was, as in every case we have noted, empty and very flaccid, as if it had been suddenly deprived of its *vis insita*, or organic power, by a deleterious agent. No air was detected in its cavities or in the blood-vessels. The brain was unchanged, exhibiting of course nothing which would lead us to believe, that death had been produced by an organic lesion of this viscus. The blood, so far as it is mentioned, — and this has only been done incidentally, — was found in a fluid and dark-colored state, such as would result from the action

of a poison. The morbid appearances in other organs are not of a character to lead us to believe, that they had any material influence in causing death.

We are therefore led to the conclusion, that the fatal result is not to be attributed to simple asphyxia, to accumulation in the heart or in the brain; but that it may be ascribed to an undiscoverable toxic action received by the lungs, and thence conveyed to the nervous centres.

The administration of chloroform seems to have been judiciously conducted, admitting, in its full extent, the fact that the cloth or compress, by which the chloroform was applied, was, as stated, of a thin and open texture. No case can more clearly show the dangers of chloroform.

Summary of Case I., p. 54.

NAME. — Petronille F. aged thirty-six years.

DATE. — Jan. 25, 1848.

DISEASE. — Sarcomatous tumor.

PREVIOUS USE. — None.

TIME OF INHALATION. — Between five and six minutes.

MODE. — From a sponge.

QUANTITY CONSUMED. — About a drachm.

POSTURE. — Recumbent.

LAPSE OF TIME TILL DEATH. — About fifty hours.

SYMPTOMS. — Pain in head; dulness and stupidity of mind; somnolency; giddiness; slowness and embarrassment of pronunciation; all symptoms of cerebral congestion, lasting more than eight hours; not then entirely disappearing, but some fever present; death in about fifty hours, sudden.

MORBID APPEARANCES:

Brain. — Membranes turgid; cerebral hemispheres of ordinary consistence; all internal vessels greatly gorged; puncta vasculosa many; spinal marrow softer than natural in lumbar region; its coverings slightly injected.

Heart. — Normal in size; flaccid; no blood in cavities.

Lungs. — Filled with blood and softened; bloody serum in pleura.

Spleen. — Softened, like a bladder full of a blackish fluid pulp.

Kidneys. — Softened ; natural in form and size.

Summary of Case V., p. 58.

NAME. — J. Verrier, aged seventeen years.

DATE. — Jan. 31, 1849.

DISEASE. — Necrosis of first phalanx of right hand, with fistulæ, fungosities, &c. of the two joints.

PREVIOUS USE. — None.

TIME OF INHALATION. — Between five and six minutes.

MODE. — From a thin compress drawn over the face, and chloroform dropped at nasal apertures, with many intervals.

QUANTITY CONSUMED. — Between one and two drachms.

POSTURE. — Recumbent.

LAPSE OF TIME TILL DEATH. — Between five and six minutes.

SYMPTOMS. — In four minutes, feels and speaks ; in five, slight agitation, and speaks ; pulse perfectly regular ; at once, he hastily raises his body, and moves his limbs ; pulse at wrist ceases ; heart ceased its action ; no pulse, or sound in region of heart ; respiration irregular, feeble, slow, then stops in about a minute.

MORBID APPEARANCES :

Brain. — Unaltered ; sinuses and dura mater contain a quantity of black uncoagulated blood.

Heart. — Size normal ; flaccid ; empty of air and blood ; walls of ventricles moistened by thin froth, very red ; vena cava and porta distended with black fluid blood, very copious ; small fibrinous clot over Eustachian valve ; no other in cavities of heart or great vessels.

Lungs. — Much contracted on opening of thorax ; dark slate-colored appearance ; same tint on section ; otherwise healthy.

Stomach. — About a couple of ounces of thick fluid, like lees of wine ; not like alimentary liquid ; distended with gasses, like rest of the canal ; otherwise healthy.

Liver and spleen a little congested.

