

for the lower portion of the artery will afford a stream of blood at first small and weak, but as it finds no obstruction to its escape externally, increasing in size and strength after each hemorrhage. In this case we must control the current both above and below the wound; and if we rely on compression, this compression must be complete, so as to prevent any portion of blood passing along the artery, and be continued until the external wound has healed, until the areolar membrane and the lips of the wound in the artery have poured out lymph, and until this lymph has become fully organized, and formed a firm bond of union between the edges of the incision. We should also bear in mind that at times, where the wound in the artery has been small and in the line of the vessel, after the first gush of blood there has been nothing to call for surgical interference,—the wound had united firmly and rapidly. This fortunate event, although of rare occurrence, is, however, not to be despaired of; and to endeavour to promote this should be the great object with the surgeon.

ART. IV.—*On the Comparative Value and Properties of Ice and Chloroform as Anæsthetics; and the Surgical Cases in which each may be used respectively.* By CHARLES KIDD, M.D., Member of the Royal College of Surgeons, England; Member of the Surgical Society, Ireland, &c., &c.; Kingsland, London.

So much is now ascertained of the usefulness of ice as a local anæsthetic in surgical operations, we see it at length in private practice so often where chloroform is forbidden, that some comparative results of anæsthesia after ice, and anæsthesia after chloroform, must already have impressed themselves on every practitioner's mind. One of our chief surgical lecturers lately stated in London, in public, that the day was not far off when we should class chloroform as a discovery with the philosopher's stone, or any other fabled mythus of antiquity, so thoroughly would it have disappointed the world and be forgotten! I cannot say one shares in this conviction with any satisfaction: it may be so, but perhaps we shall have got something better than either ice or chloroform. We must make allowance, perhaps, for immature exaggerations on the part of the enthusiasts for ice on one side, of chloroform on the other. If the reader be not called on to entirely agree with the partisans of local anæsthesia, on the one hand, in their estimate of

benumbing cold as a preventive of pain and inflammation;
of ice as an antidote to that

“——— Macies, et nova februm
Terris incubuit cohors”——

that chloroform plague of my friend Dr. Arnott, the result of taking anæsthetics from the Americans;—if he find himself disagreeing also about ice being a specific for cancer, as urged by more than one of this school; much less will he be induced to give in his adhesion to the doctrine that chloroform is already going back to the alchemists, the very Mephistophiles of surgery, an institution or invention of our modern “table turning” times, of some invariably deadly kind, worse than the enchanted cup of Circe, and almost as bad as mesmerism. In avoiding one excess of exaggeration, it is to be feared we have had lately a tendency in this subject, after the classic maxim, to run into an excess of an opposite kind. Again, it is said that ice and chloroform are both equally dangerous, one leading to mortification of limbs and frost-bite, the other to syncope, asphyxia, convulsions, and death; quacks on every hand—and the term is used advisedly—who know very little, if anything, of chloroform, arguing with much lettered wisdom on these data, as they serve to disturb legitimate surgery.

The danger attending either ice or chloroform is not very great, if the proper use of these agents be understood. In the practice of medicine, it may be asked, are we not every day in the habit of using dangerous, nay, deadly agents, yet in this active danger consists their value. Need we refer at all to our own art for illustrations of this? Does any one travel one hundred miles in a railway, is he not in danger of his life? Actuaries tell us also the exact proportion of shipwrecks to ships, off the coast, in a month; but this does not prevent any one going in a railway or on the sea, as it should if the argument, one death in a thousand, against chloroform held good. An overdose of chloroform or of ice will kill with as much certainty as an overdose of opium, it is true: a fire also will kill, but if it were not fire it would not warm; opium also will kill, but if it were not opium it would not produce sleep. We have fallen here, in other words, on the time-honoured sophism of arguing against the use of chloroform from the abuse, whereas the real tendency of experience leads to a more extended but more cautious use of chloroform.

It has been recently suggested that in looking for the causes of death from chloroform, we have directed too much

attention to the source of life in the great nervous centres;—Romberg, with Dr. Marshall Hall, rather looking on that gossamer webwork of reflex nerves, so intricate and so wonderful, as in reality the proper nervous system, influenced by anæsthetic vapours, rather than what are popularly known as the large brain masses, thinking principle, or sensorium,—sensibility and pain, the great outlying roots or sources of consciousness, so to speak, being rather referred to, or *regulated* by, the soul or mind at the centre, than arising there. Chloroform, with true logical precision, may, in fact, be looked upon something in the light of any other physical agent, electricity, light, heat, cold, &c., as acting on the general nervous system through the blood. Much, if not all, of the danger of chloroform inhalation arises from going beyond mere anæsthesia, and by overdoses abolishing nervous motion as well as sensation; in fact, saturating the nerve matter and blood, so as to render one unfit to respond to the proper motor stimulus of the other. In some patients, from idiosyncrasy of frame, the larger dose, unguardedly administered, even produces all the phenomena of asphyxia or apoplexy, such as stertorous breathing, insensibility of the eyelids, &c., often abrogating also that complex reciprocal action of one distant part on another, which we cannot very often on the instant explain, but seen also in epilepsy, convulsions of children, hysteria, tetanus, &c. These are small or secondary matters, as it were, in the exhibition of chloroform, which in practice, however, come to be points of very great importance, and worth dwelling upon. We may, in fact, use chloroform vapour like the odours on the banks of wild thyme and other flowers of the fairy Titania, to allure sleep and banish pain, or illustrate with it all the deadly suffocating horrors of the upas tree. Any one who has seen a death from chloroform must be struck with its sudden somatic character, so like what we read of the upas tree suffocation. A very small per-centage of other vapours, such as carbonic oxide, mixed with atmospheric air, will, in the general phenomena, simulate chloroform, with this difference, that they end in undisguised asphyxia; the phenomena, for instance, caused by one of the oxides of nitrogen (laughing gas) are also in point. The dogs let into that celebrated asphyxiating grotto at Naples, as well as men sometimes taken up out of brewers' vats or foul sewers, all go to show that anæsthesia is not confined to ice or chloroform. A few years ago it made a great noise in England that ether, being inhaled, had killed asthmatic and other patients, yet nothing was made of the fact. In that singular old book, "*Burton's Anatomy of Melancholy*,"

it is stated that a ball of opium, when inhaled or smelled to, causes sleep; and pillows of opium, hops, and henbane, were much used among the Æsculapians of that period: yet all are now nearly forgotten.

It is well to remember that something like 15 or 14 per cent. of chloroform is generally considered the *maximum* which air respired by patients can contain of this agent; the law of the diffusion of gases of Professor Graham, no doubt, would settle the exact decimal, about which we are not now particular, the practical fact being that a proportion, a little over half, of this, even in animals, will cause death almost as certainly as the brewers' vat or a foul sewer: great care should be used, therefore, that chloroform does not get mixed up with heated air or hot sponges in surgical manipulation, as a larger percentage of vapour would be given off in excess. It does not seem generally advised by surgeons, except in the case of operations on children, to mix chloroform with any other fluid, such as spirits of wine, to dilute its powers; yet it is a matter very deserving of notice, as then it is quite conceivable we may make sure of the proper proportion of chloroform, *which should never exceed 5 per cent.* in the air respired. If we consult the safety of our patient, these facts cannot be repeated too often, till we are assured of the harmlessness of chloroform as an anæsthetic. In testing the activity of chloroform, the absence of the reflex action of the eyelids, in persons under its influence, is not, as recently urged amongst wounded soldiers in the Crimea, the *best* test of danger; it is, perhaps, the *last* test; and the French military surgeons, who have now used chloroform in tens of thousands of cases, have observed the more rational advice never to wait for this total abolishing of all sensibility, as bullets, balls, and fragments of shells, are best extracted in the *second* stage of chloroform inhalation. A very safe substitute for pure chloroform seems to offer in what is called "chloric ether," or a solution of chloroform in spirits of wine: chloric ether itself, as we might have theoretically expected, has no existence. In America, the birth-place of anæsthetics, a mixture of two parts of spirits of wine and one of chloroform is used under this name, a solution being thus obtained giving off 8 to 10 per cent. of chloroform. The proportion of chloroform necessary for particular patients, in other words, the doses of chloroform required in surgical operations, vary very much according to the age, nervous and muscular development, emotional excitement, &c., of each patient.

Pain, it need hardly be observed, as requiring either ice

or chloroform, is no respecter of persons, nor is there any medical greatness or superior skill in wishing patients unnecessary pain; even our wounded soldiers, the bravest men in the world, will wince more at the knives and saws of the operation-room than at the bayonets of the enemy; to deny them chloroform seems unphilosophic as regards pain, and not very full of meaning as regards surgery. Some of our greatest philosophers have been our greatest cowards on this point of physical pain: when Bossuet, for instance, one of the greatest men of his day, was told he had a disease requiring a surgeon, he became quite unmanned, and would not listen to the words, 'surgical operation;' D'Alembert, the friend of Newton, also another great man, refused to be operated on for stone, and no entreaty would induce him to undergo the pain of a single incision; even Sir H. Davy, in our own age, entertained some very singular ideas as to the nature of consciousness and organic life, believing sensibility remained in the dead body till chemical decomposition was far advanced, and would not for the universe permit a post-mortem examination of his body to be made, fearing the pain! What Dr. Hall in his memorable notice on chloroform in the Crimea may have intended by the surgeon's knife or pain being a stimulus during the shock and collapse of the system torn in pieces by fragments of a shell, or a soldier's arms or ears hewn to pieces by a sabre, is not easy to conceive; but this I know from observing at least a thousand operations during the past twelve months under chloroform, and having talked the matter over with many friends, such as Mr. Erichsen, Mr. Fergusson, Mr. Coulson, Mr. Birkett, Mr. Simon, Mr. Skey, &c., that their experience is directly opposed to that of Dr. Hall. We even still, perhaps, with all the valuable resources of chloroform and ice, allow too much pain in surgical operations; there is no peculiar surgical brilliancy, as we have just said, in inflicting pain on a sick fellow-creature. Our art, or the mission of the medical man, if anything at all, is as much to lessen pain as to lessen hemorrhage or fever; or do we sometimes imagine pain a non-existent quantity? or believe with one of the Germans, Schlegel, that pain is a metaphysical or subjective abstraction, existing only, as he thought, for the imaginary purpose of giving a zest to pleasure? pain merely serving to create transient overpowering impressions in the human mind, to make place for elevating emotions by contrast, which we call the sublime,—the terror of falling off a cliff into the sea, the fright of a thunder-storm, and so forth, according to Schlegel, being only ideal modifications of pain, but in reality a form of pleasure termed the sublime. A true philosophy of pain is very

much mixed up with the use of chloroform; metaphysical abstractions do not satisfy a man having his leg removed without chloroform. Shakespeare, more true to the world of every-day existence, and not analyzing the sublime or the subjective, gives us the pain and turmoil of human passions as making up even the entire sum of human every-day life, and when he wishes to give us a world free from pain and full of the "beautiful," he shuts out passion and pain by an anæsthetic of his own: the witching forgetfulness of Oberon, the fairies in their dreamy twilight scenes, amid their enchanted flowers and charms, giving us some singular analyses of sleep, and very animal emotions and consciousness; nay, almost anticipating the phenomena of chloroform inhalation.

We have, perhaps, two chief points in practice to observe as regards anæsthesia: the nature of the anæsthetic we use, and the peculiar constitution of our patient before using it. From some considerable observation of several thousands of operations on persons under the influence of chloroform, I think I may say that we did not formerly attend sufficiently to the various stages of chloroform inhalation, and to sufficient slowness in bringing the system under its effects. A minute, or two minutes (into which all the various stages were huddled together), was about the time originally allotted to the process, which is now extended to about ten or twelve minutes; it is done also more cautiously, and according to stages, the operator, as a general rule, watching the respiration, and pulse, and general sensibility of the surface. Some practitioners, with whom I am inclined to agree, advise the patient to be brought under the influence of chloroform in a darkened chamber, not in the streaming sunlight of the operating theatre—very much of the overdosing by chloroform (and it will be remembered we have had nearly one hundred deaths already from this agent), arising, they believe, from the increased quantity called for to dull the sensibility caused by the nervous alarm and noise of operating theatres. We lose sight, perhaps, even still too much of the analogy, if not identity, between ordinary sleep and the sleep of chloroform. It is true, according to the poetry of some psychological writers, that sleep will seal up the ship-boy's eyes, and rock his brain in the noise and rattle of the storm, or something of that stereotyped character; but this is not a normal condition, and, like the sleep of the traveller on Mont Blanc, is probably the result of the ship-boy's exhaustion and of habit. The sleep of apoplexy, so to call the coma of that disease, the sleep of narcotic poisoning by opium, not matters of habit, are neither very different from the sleep of

chloroform, observing the same gradations, the same loss of consciousness, power of motion, &c.

We are obliged to shout in the ears and drag the body which is dead asleep from opium, up and down an apartment, to wake it *out* of such fatal sleep; yet we do the very same, as far as dragging the patient and the noise of the operation theatre, to get him *into* the sleep of chloroform.

Chloroform acts on the system evidently in a progressive way, and we have now probably arrived at four well-marked stages of chloroformization. If we watch an infant, in whom the muscular system and the cerebellum are not yet well developed, getting under the effects of chloroform, we notice the first faint struggles gradually becoming less and less, and ultimately the shrill crying and fright give place to a gentle sleep. We have here the *first* and *third* stages of chloroform well marked. In strong, muscular old men, on the contrary, as a general rule, it is all a struggle and plunge from first to last, the muscular system in them forming such a large portion of that connected with the brain as acted on by chloroform. This is, perhaps, the *second* stage well developed. In females, again, about to undergo what they conceive a formidable operation, for the removal of a breast or limb, where everything to them appears a world of anguish and mental anxiety as to their surviving such operation, the action of the chloroform may be observed to be almost confined to the emotional parts of the brain and intelligence, those parts most excited by the emotions thus brought into play. It is very interesting to remember that irritation, by surgical irritants and by chloroform, of the anterior and middle cerebral lobes (so much engaged in the emotions and intelligence) does not cause convulsive movement, but gives rise rather to manifestations of excited operations of the mind. We here go back again, so to speak, to the first and third stages, and the patient talks or sings, and recounts half her life, but suddenly falls off into the third stage of complete anæsthesia. Independently of the various proofs of the special function of the anterior lobes of the brain, derived from pathology, perhaps I might mention here the case of a child, often seen at St. Bartholomew's Hospital, in perfect health, but in whom the whole front of the forehead above the frontal sinuses is widely open, the result of a portion of the bones of the skull removed four years ago: the *dura mater* and brain pulsation are quite perceptible. This child has no convulsions if the parts be pressed, but gets immediately stupid. Chloroform would probably make her an idiot. Her memory and mere instinctive feelings of eating, or walking, or drinking, are good; but though twelve

years old, she is puzzled by any purely mental exercise; she cannot multiply twice three as six, but she recollects she was told so; memory seems to come after the fact. I believe this part of the brain is that first affected by chloroform in the form of a lethargy or drowsiness; contemporaneous, perhaps, with this change, however, another is also coming on, a specific irritation of the "*tubercula quadrigemina*." The limbs, as familiarly known, are thrust wildly apart, sometimes requiring great force to restrain them. I think one now and again remarks a curious similarity between this stage of chloroform irritation and a fit of hysteria. It is not at this second period that the fatal *fourth* stage, or fainting or syncope occurs or is to be feared, this second stage, in adult men, being generally looked upon rather as favourable than otherwise; it sometimes approaches the confines of epilepsy rather than hysteria; more generally consciousness is not yet abolished.

To this succeeds the third stage, or that of general anæsthesia, or absence of feeling, beginning in the inferior half of the body first, or that more immediately under the influence of the *cauda equina*, and spinal nerves, subsequently engaging the superior or anterior segments of the nervous masses and brain, more particularly the *corpora striata* and *optic thalami*; these great centres of feeling and touch not any longer responding, as was their wont, to external impressions of pain or feeling: or, if we adopt the view of Romberg, there may be no special action of a centripetal kind—no specific action at all on one part of the nervous system more than another. But that the chloroform has now spread into all the capillaries, while the peripheral distribution of the nerves of feeling and touch, spread out over the skin and general surface of the head and upper extremities, diaphragm, &c., being far more complex about the fifth and seventh nerves and the head, a larger quantity of chloroform is required for them than that necessary to change the sensitiveness of the lower limbs,—the sensorium itself, as long since well supposed by Locke, becoming ultimately involved from want of ideas conveyed from the senses; in a word, all that part of the brain, conterminous with the *corpora striata* and centre of volition in the anterior masses of gray matter in the cord and "*locus niger*" with the vesicular matter of the *mesocephalon* and *medulla oblongata*, becomes anæsthetized in this state. It is idle to say that our patient in this state is not in the balance between life and death; a single dash of cold water or breath of fresh air, to keep the inward clockwork mechanism of the consensual system at work, may save him or its absence may destroy him; any excess of chloroform hastening him into

the fourth stage, or that of faintness and collapse. This state of syncope differs, however, from the *tabula rasa*, to use the words of Locke, which the brain represents in simple anæsthesia from the absence of ideas through the consciousness, and which may be recovered from as in ordinary sleep.

Chloroform has certain positive effects on the muscular system which should not be mistaken for mere involuntary action during anæsthesia, which may or may not be a negative result of the mere presence of chloroform in the capillaries. Chloroform, for instance, will tell simulated epilepsy among soldiers who wish to get out of the military service, from real epilepsy; one set of convulsions are replaced by anæsthesia and sleep, while the other convulsions are increased. Chloroform is also said to induce tetanus and hysteria; and in post-mortem researches of animals dying of chloroform, it is said the left side of the heart and aorta are always empty,—all these facts pointing to the marked specific action of chloroform on the muscular and motor system, quite distinct from its action on the sensitive tract of the cord.

If we might venture to systematize from the data afforded every year in practice, I would say, there are four well-marked stages of chloroform inhalation, and specific surgical operations adapted to each. In the *first* stage, simple consciousness is partly or wholly abolished: in this stage polypi of the nose may be removed; extirpation of the globe of the eye may be practised; hare-lip operations are easily performed; diseased bursæ from the knee, when not removed under the effects of ice, are conveniently cut out; and perhaps, trephining of the skull, when the patient is not already comatose, may be most safely executed;—any operation where in fact we wish merely to dull the over-anxiety and irritability of patients. In the *second*, or stage of convulsive excitement, so like hysteria, all midwifery cases, perhaps, should be conducted; the deligation of large arteries, if possible, should be accomplished, as the muscular and other landmarks for the knife are thrown into strong relief,—the sartorius and others about the thigh, for instance, in deligation of the femorals. In this stage, I think hernia cases might be operated on, more especially when the sac is not opened, as the seat of stricture especially, if muscular, is soon felt; and some of the best surgeons deny that chloroform in the third stage of anæsthesia is any advantage to the taxis. Rhino-plastic operations are better done in this stage, though the patient may plunge a good deal, as it is not safe to do them in the third stage. Syme's and Chopart's operations also on the foot, as the lower extremities are affected by chloro-

form earlier than the upper. All gun-shot wounds, perhaps, might be searched also, as the muscles assist in disengaging the ball; while on the other hand, catheters should not be passed in this stage, or perineal sections made, as Wilson's and other muscles of these parts are thrown into violent spasms, and the rectum or other parts might be wounded.

In the *third* stage, or that of complete anæsthesia, the reduction of old dislocations is, perhaps, best effected; excisions of joints and various amputations, lithotomy, perineal sections of various kinds, are also well performed, with the great majority of all other surgical operations not already specified.

In the *fourth* stage, not always reached, but always to be apprehended, the patient faints or swoons, I believe sometimes from the hemorrhage and "shock" of the operation, or sometimes from these, in conjunction with diseased or fatty heart. It is very unpleasant when this occurs in the middle of an operation; but it is a very strong argument for the substituting ice and local anæsthetics, where at all possible, for such a powerful agent as chloroform.

There are various affections which are said to be incompatible with the application or use of chloroform in surgical practice. Modern surgeons who have studied the dangers and advantages of chloroform with patient and particular care, among other contra-indications, refer especially to the following circumstances:—1. Diseases of the spinal column of a serious or organic kind as interfering with the reflex functions of parts not under the control of the will or ordinary sensibility and beyond our power, always suggest caution in the use of chloroform, if such diseases of a nervous character do not entirely contra-indicate its exhibition. 2. An unusual difficulty of benumbing sensibility, or the fact of a patient remaining passive to the influence of chloroform, must also be looked upon with very great caution, if not suspicion, as the cumulative doses of chloroform in one part of the body will do mischief in another part when least expected. I cannot say this agrees with ordinary experience in English hospitals, as I have seen patients obliged to be removed off the operating table, as no amount of chloroform seemed to affect them; others used almost ounces before an old dislocation, perhaps, was reduced; while in one or two cases—one especially at Guy's, another at St. George's Hospital—the woman was dead almost as if killed by lightning after a few inhalations indeed. 3. Various lesions of the vascular system, such as atheromatous deposit in arteries, or fatty degeneration of the internal fibres of the heart itself, it need scarcely be observed, have also been forcibly

urged as causes of death during the use of chloroform; when we remember, however, that the first effect of chloroform is usually to excite the muscular system and quicken the pulse, it will be readily seen that the action of this agent as an anæsthetic, is not, as might be conceived *a priori*, to depress the heart: a general impression now prevails that too much emphasis has been laid on this single sign or symptom as a contra-indication to the use of chloroform. 4. It has been lately urged that the existence of hysteria in a patient is sure to lead to death, if such a patient be placed under chloroform. 5. Great caution also is necessary that a patient shall not have a full stomach at the time of an operation under the influence of chloroform, as impeding the involuntary action to the diaphragm. 6. Excess of one of the most marked of the reflex functions connected with the generative system, to which it is not necessary further to allude, has also been pointed out by continental surgeons, as weakening the spine and reflex system generally, and if suspected in patients, should prevent them using chloroform. My friend, Dr. Snow, lost a patient once in whom there was a feeble intermittent pulse; and this liability to faint, with our experiences, now make men more cautious of such cases. A suggestion has been made in operations about the head and neck, to defer tying the ligatures in arteries, as in deligation of the carotid, till after the effects of the chloroform shall have passed away, the danger being too great, perhaps, of a stoppage of all sensibility at one side of the brain, suddenly added to the altered sensibility from anæsthesia of the general nervous system. In one case of death from chloroform, a man operated on at the Ophthalmic Hospital for extirpation of the eyeball, or, rather, about to be operated on, one is almost afraid to think that there was sufficient cause for death, if it could have been suspected, as with some other contra-indications, there was very general œdema of the brain substance. During the first four minutes of inhaling the chloroform vapour, nothing unusual occurred in this case; the pulse rather increased in fulness and volume, as it usually does. The familiar sign of excitement next followed; but it was suddenly observed the eyes were fixed and staring, the arms quite rigid (irritation of the brain substance?), the face was contorted, respiration stertorous, and after a few sighing efforts at respiration, and one or two gasps, the man was dead. Any ligature of arteries here would have obviously destroyed the little irritability of the brain which remained after the first stage of the etherization. It has been rather urged, as we have just said, not with-

out reason, to open a vein in such an emergency, and thus relieve the congestion and insensibility of the parts about the base of the brain and larger sinuses. It is singular how opinions vary as to the cause of death: one section of observers saying by asphyxia; another, by syncope. I believe *both* are right. In France and Germany it is believed by syncope, because they never push chloroform to the state of asphyxia. In London we say asphyxia; but asphyxia AND syncope, in the proportions of 4 and 6 in every 10 deaths, is nearer the truth.

The sleeplessness and headach at night, induced very often by chloroform, and sometimes so embarrassing after surgical operations—so embarrassing, indeed, as to make some hospital surgeons disapprove of chloroform altogether, and adopt ice as an anæsthetic, are caused by this congestion of the sinuses of the brain; pure air and some gentle stimulus, however, seldom fail to act as useful antidotes. Chloroform acts more safely on the young than the old; or as it might, perhaps, be otherwise explained, in the very old we have a smaller stock of irritability to work with, and once extinguished by chloroform it is not easily restored; in the old, too, there is more organic diseases of various kinds latent in the system than in the young. I have seen Dr. Snow, however, use chloroform in cases of hemiplegia, &c., in operating for stone, with the greatest safety; where patients of this kind, however, are in impending danger, if the tongue be pulled out with a forceps, cold water dashed, and, perhaps, ammonia *not* used, they quickly come about again. It is curious, many of the deaths occur as the patient is *about* to be brought fully under its action.

The activity or value of chloroform, as regards the lower animals, is very instructive, and would seem to be, popularly speaking, in proportion to the development of the respiratory and circulatory systems—in other words, in proportion to the complexity or non-complexity of the reflex and general spinal system of nerves.

Birds, for instance, are much easier affected by chloroform than lizards or snakes; in birds, it need hardly be observed, almost the entire frame, with the cavities of the long bones, are engaged in respiration; the optic ganglia, the analogues of the tubercula quadrigemina, are wonderfully developed. In lizards, on the other hand, and in snakes, the irritant action of chloroform on their large spinal cords and muscular and reflex systems is more marked; the latter creatures, though torpid previously, are roused up by chloroform; like fishes, these creatures breathe chiefly by gills, their brains are less developed than those of birds, but their spinal system is, perhaps, more complete. The

posterior half of the spinal cord, as a general rule, in all animals, is the part first anæsthetized, or, in other words, perhaps the complex arrangements of the nerves about the head, as remarked already, require a larger quantity of chloroform, or resist it longer.

A practical lesson of caution arises from this, that we should observe care in using chloroform in patients where we have to suspect *ramollissement* of any of the spinal nervous centres, as we cannot gauge the quantity of chloroform. A previous tendency to epilepsy also is equally dangerous, or anything wrong with the consensual group of actions. A stethoscope should always be run across the chest, and percussion also tried. We should be apprehensive of danger where disease of the restiform bodies exists, though the cerebellum, something like a helm to direct the motions of the ship, is not a part obviously affected by chloroform, nor connected very closely with the cerebrum. The emotions of joy or fear must not be forgotten in our estimate of the effects of chloroform; none of us, in these war times, pretend to know fear; let an omnibus in the street crush any one's leg against another omnibus, and we feel palpitation of the heart and fear; it is purely through its nervous connexions, and probably through the sympathetic, that this influence of mental emotion is conveyed. A severe fright, or a severe burn from a fire, may even stop the action of the heart altogether. In chloroform, in a word, as Cullen said of typhus, we must "obviate the tendency to death;" but it is clear, before striving to obviate this tendency, we must know, in some shape or another, in which direction the tendency lies,—this can only be known by an acquaintance with our patient's constitution. Electricity along the phrenic nerve is said to restore the lower animals when labouring under impending death from excess of chloroform; fresh air received into the lungs will be found, however, the best antidote; but, unfortunately, the patient in extreme danger, and this is too often forgotten, is not breathing at all, so that he does not receive the ammonia generally given him to smell (and very objectionable it is) into his lungs; the spark that supplied the internal respiratory or phrenic is gone out; dashing cold water to wake up the *external* respiratory nerve and trifacial is our last resource; this, with suddenly opening all the windows and doors of the apartment, generally succeeds.

Chloroform does not seem to produce its effects as a mere sedative, by the reaction of a simple stimulus,—like as the reaction of a walk up Mount Blanc produces sleep, as ingeniously but erroneously put forth in a series of lectures at the Polytechnic Institution lately in London,—as patients generally kick out, like giants of the Brocken, wide awake, though they are, to all

intents and purposes, partly insensible and asleep—,patients are rather as if in a nightmare or state of somnambulism, they have told me. They heard the surgeon's saw sawing the bone in an amputation, but they remarked no pain,—how unlike natural sleep, but how like nightmare! A red hot cauterizing iron carried round a man's ankle or shoulder, blazing red and smoking, gives him a sense of something rubbing the limb, but not the sense of red hot iron. Sometimes the scene is a little ludicrous; indeed, as a general rule, patients do not believe their legs or arms are off at all, so completely together are the stimulus and sedative action and abolishment of consciousness, and so quickly does every thing pass. The late Marquis of Anglesey used to feel his leg buried at Waterloo, and used chloroform to make him forget it. I have known a patient satisfied in the same way, on the other hand, in his own mind, for a long time after chloroform, that his leg was still on, and not taken out at the hip-joint! "It's all very well," he said, "but I feel the limb just as it was a month ago, and when all them there bandages are off, I'm sure to see it again,—not a wink on me, sir, I assure you." "But it is off long ago." "Ah, you won't persuade me to that; don't I feel it, as usual, bad at night and better towards morning,—the frost, too, pinches it above a bit, I assure you." Sailors, in general, are very demonstrative on this point that their legs are not off; one poor fellow, after an operation under chloroform in one of the chief hospitals in London recently, and after the part cut off had run the gauntlet of two or three microscopes, cut up, in fact, into as many little bits as there were clinical pupils, thought himself only in the middle of so much dead bones and surgeons when he woke up, something, perhaps, like Sinbad buried with his dead wife, or a new kind of nightmare; he was satisfied for a while, however, after all was over, that the amputation was only beginning. "The patient is now to be taken away," said the surgeon to the nurses and assistants, "and let him have a little wine if faint." "Avast! heave to, mates; better luck the next time; though 't isn't cut off, by George, I am ready to pay all the expenses." And the poor fellow went off under full canvass in the arms of the gate porters, with his purse in his hand, confidentially assuring every body, for some hours after, that he "didn't mind a £5 note, but off that there larboard limb should come." Another patient, last month, would not believe his leg was off high up near the hip, and pulled out all the ligatures "to try," and nearly died of secondary hemorrhage and necrosis of the bone. All this singularly well shows what slaves we all are to simple consciousness.

It has been objected to chloroform by divines (and the mo-

ral argument with some persons outweighs a thousand others) that we ought not to use chloroform, as we trifle with man's consciousness, or self-identity; but from the mode in which we have just explained the operation of chloroform on the capillaries and peripheral parts of the nervous system, its action is, like ice, not necessarily on the sensorium at first. The sensorium is like the sun-dial, with clouds obstructing the sun. An hour is blotted out of this sailor's existence by chloroform; he leaves the theatre as he came in: no impressions have been sent to the sensorium by the consciousness, yet both are again as perfect as before the operation.

Where a distinct contra-indication to chloroform exists—such as a tendency to epilepsy, hysteria, fatty heart, &c.—ice will be found a most valuable substitute; indeed, in evulsion of toe-nails, opening abscesses or whitlows, amputating fingers, in the operation for strangulated hernia, in all fatty tumours, hare-lip, staphylophary, cancer of the lip, diseased breast, &c., it is doubtful if ice should not be the rule rather than chloroform. The method of using it is very simple, and consists chiefly in mixing equal parts of pounded ice and common salt in a small muslin bag, and carrying this to and fro across the part to be operated on for two or three minutes. I have seen bad effects from keeping it twenty minutes, as is sometimes done, as the parts seem entirely killed, and no reaction sets in, very troublesome sloughing arising, in place of healing by the first intention. The period of the application of the ice should be timed by a watch, and never allowed to exceed five minutes. The part usually becomes white or blanched, and congealed; the patient also feels a tingling, as if a mustard sinapism were placed over the part. In London ice is as easily procured at the fishmongers' shops as salt; but in rural districts it may not be so readily purchased. In such cases some of the artificial modes of freezing might be adopted.

Where, on the contrary, chloroform is preferred to ice, we should pay attention, as already indicated, to the various stages of chloroform intoxication, and the different operations adapted to each; we should be ever on our guard against the sudden effects of an overdose precipitating the last stage, or that of asphyxia. Chloroform should not be used by unskilful persons, as deaths under such circumstances help to bring it into unmerited disrepute; its exhibition, in scientific hands, being comparatively safe, as well shown in the Crimean campaign of the year lately terminated.