

A point which may become of great interest and importance is, whether other agents cannot be combined with the ether; for instance, laudanum where the pains are dangerously violent; or tincture of ergot where they are insufficient. In one of Dr. Simpson's cases, the patient inhaled a volatile solution of ergot. The pains, which had previously been languid, almost immediately became strongly expulsive, and the child was born in a quarter of an hour. The woman had been in labour from forty to fifty hours.

In conclusion, I would state it as my opinion, that with perfectly pure ether, carefully administered by skilful persons, and with good apparatus, and especially by one containing an appendage with a supply of oxygen, the operation not being commenced until efficient etherization is produced, the employment of ether is not only justifiable, but promises to be instrumental in materially diminishing the dangers of operative midwifery. Probably, in natural cases it will be both sufficient and safer to carry the etherization only to the second stage, in which partial consciousness remains, but sensation is abolished; and towards the end, when the pains are ordinarily intolerable, to induce perfect narcotism. From the results which I have already obtained, it is my intention to continue the use of this valuable agent, and I do not hesitate to state my belief, that future experience will fully confirm my present opinion.

John-street, Bedford-row, April, 1847.

### OBSERVATIONS AND EXPERIMENTS ON THE DIRECT ACTION OF ETHER ON THE BLOOD.

By JAMES H. PRING, M.D., Weston-super-mare.

In the state of uncertainty which at present characterizes the opinion of the profession respecting the propriety of having recourse to the novel employment of ether as a means of suppressing pain during parturition, and the performance of surgical operations, it is hoped that the facts which form the subject of the following communication may contribute to divest the question of some of the sources of ambiguity in which it is still involved.

The altered condition of the arterial blood, resulting from the inhalation of ether, has been pointed out by several of the French physiologists, who found that a dark and fluid state of the blood was produced in animals subjected to the process termed "etherization," and a similar result has been repeatedly observed by surgeons in this country, whilst operating on patients under the influence of ether, the arterial blood lost during the operation having exhibited the change of character above mentioned.

Considering, however, the important influence which the change in question must necessarily exert on the animal economy, it seems surprising that it has not yet been made the subject of more special investigation. It is true that M. Amussat, in his experiments on the lower animals, purposely continued until a fatal result ensued, does not hesitate to ascribe the cause of death to the altered state of the blood, and that Mr. Adams, of the London Hospital, however questionable may be his mode of explaining the rationale of the subject, nevertheless refers the peculiar effect of the ether to its influence primarily on the arterial blood, yet I am not aware that any satisfactory attempt has hitherto been made to ascertain the mode in which the altered state of the blood is brought about,\*—whether it is owing solely to the direct action of the ether on the blood; or whether it may not rather depend—as has, I believe, been suggested—upon the deficiency of the usual amount of oxygen, in consequence of the substitution of a considerable proportion of the vapour of ether, in place of the normal supply of atmospheric air; whether the effect produced is in any way determined or modified by vitality; or whether it is independent of this influence, and occurs equally in blood removed from the body, and is therefore to be regarded as a chemical rather than a vital change. On these, and some similar questions, it has appeared to me desirable that we should have some more certain information than that at present possessed; and it was with a view, in some measure, to supply this desideratum, that I was induced to try the effect of the direct admixture of ether with arterial blood, when removed from the body.

For this purpose I collected in two separate two-ounce bottles, some arterial blood, as it was flowing fresh from a

\* Since the above was written, the observations of M. Robin, in relation to this subject, as reported in THE LANCET of April 17th, have come under my notice. The views, however, of M. Robin, and the conclusions he arrives at, appear, as will hereafter be shown, so different from those forming the subject of the present communication; as to render any material alteration of the above remark unnecessary.

divided vessel in a sheep. In one of the bottles, a small quantity of pure washed ether\* had been previously introduced, whilst the other, being employed merely as a standard of comparison, contained only atmospheric air, and as soon as each bottle became about half full of blood, it was immediately closed hermetically. On comparing the two bottles after the lapse of two or three minutes, the blood in that containing the ether was found to be almost black, and in some measure fluid, the coagulium formed being at the same time of a much softer consistence than usual. In the second bottle, that in which no ether was introduced, the blood at this time exhibited itself as a firm and uniform coagulium, retaining all its florid arterial character. This experiment, made some weeks since, has subsequently been varied, as opportunity has been afforded, and the following may be taken as a brief summary of the results arrived at. Oxygen gas introduced into the vessel containing ether, does not in any way prevent the peculiar action of the ether on arterial blood, nor does the subsequent transmission of oxygen gas through the darkened etherized blood restore to it either its arterial colour, or the power of coagulating; though it seems probable that the cause of the failure of the oxygen in displaying its usual agency on the blood in this instance, may be attributable to the presence of some free ether still remaining in the vessel. Ether poured on fresh arterial blood produces the same results as where it is first introduced into the vessel in which the blood is subsequently to be received, and in each instance the effect is increased by agitation of the vessel. Arterial blood collected in a vessel containing ether was found to become darker and more fluid than when collected in a vessel containing carbonic acid gas.

The common sulphuric and nitric spirits of ether of the shops, when mixed with arterial blood, produce, apparently, the same effects as are obtained with the washed ether.

Of these experiments, which, believing them to be new, I have thought it worth while to communicate, the first appears to be the only one deserving more particular attention. From this experiment alone, the questions formerly proposed will be found, in great measure, to have received their solution, whilst a more attentive consideration of it will assist us in drawing some practical conclusions in reference to the novel use to which ether is now applied.

We learn from this experiment that the state of the blood observed in etherized patients does not depend merely upon the absence of the normal amount of oxygen in the lungs, nor upon any impediment which the process of etherization, with the apparatus employed, &c., may offer to the due elimination and disengagement of the carbonic acid from the lungs; neither does the ether act, as stated by M. Robin, simply by "preventing the transformation of venous into arterial blood," since it is shown, in this experiment, not only "to oppose the arterialization of the blood," for the reasons assigned by M. Robin, but actually to deprive arterial blood of the oxygen already combined with it.

The conclusion, therefore, is inevitable, that the change produced in the blood is independent of any vital agency, and hence must be regarded as of a purely chemical nature, dependent, in all probability, on the affinity which ether has for oxygen—a property which the high temperature to which it is exposed when taken into the lungs would have the effect of augmenting in a remarkable degree, so as to favour its rapid absorption of oxygen from the oxygenized constituents of the blood.

It seems scarcely necessary to do more than advert to this changed condition of the blood, in order to indicate the true source through which an explanation of the physiological effects of ether must be sought. "Physiology," says Liebig, "has sufficiently decisive grounds for the opinion, that every motion, every manifestation of force, is the result of a transformation of the structure or of its substance; that every conception, every mental affection, is followed by changes in the chemical nature of the secreted fluids; that every thought, every sensation, is accompanied by a change in the composition of the substance of the brain." And again:—"The change of matter, the manifestation of mechanical force, and the absorption of oxygen, are, in the animal body, so closely connected with each other, that we may consider the amount of motion, and the quantity of living tissue transformed, as proportional to the quantity of oxygen inspired and consumed

\* Should the use of the liquid ether in these experiments be objected to as affording no sufficient ground of analogy with the process as ordinarily employed, it must be remembered that a similar state of the blood to that here described is, in many cases, undoubtedly found to result from the process of etherization, whilst it is presumed that no very marked differences of effect would be likely to ensue from the employment of the ether in a condensed, instead of in a more rarefied, form.

in a given time by an animal." If, then, these views are correct, as it is now pretty generally admitted that they are, can it any longer be a matter of surprise, that sensibility, in common with the other vital manifestations, should, according to circumstances, be variously modified, or even altogether suppressed, by a process which not only arrests at its very source the necessary absorption of oxygen by the blood, but has the property, further, of depriving the arterial blood of the supply of oxygen of which it is already in possession.

The experiments made by M. Serres, by which he showed that a sponge dipped in ether, and placed in contact with the crural nerve of a rabbit, had the effect of abolishing sensibility in the nerve at the part in immediate contact with the ether, and in all the ramifications of the nerve below that point; but that sensibility remained unimpaired in the portion of the nerve above the point of contact of the ether, may seem to militate against the view just advanced, which ascribes the physiological effect of the ether to its chemical action primarily on the blood in the lungs. The discrepancy, however, seems more apparent than real, since it is most probable, that as general insensibility results from the action of the ether on the blood in the lungs, so particular or local insensibility may result from the like changes, produced by the direct chemical action of the ether on the blood circulating in the minute vessels, by which the nerve subjected to the experiment was supplied; though it is possible, that in this instance some chemical action may also have been exerted on the nervous substance itself.

As regards the practical conclusions to be drawn from a consideration of the experiments now detailed, it is obvious that where there is any tendency to passive hæmorrhage, the condition of the blood produced by ether must tend remarkably to favour its occurrence. In preference to the new employment of ether in obstetric practice, I feel it unnecessary, after the able manner in which this part of the subject has been treated by Dr. W. Tyler Smith, to offer any observations of my own.

With respect to the use to which the vapour of ether has been applied in operative surgery, I am aware that any remarks which may tend to discourage its employment may at once be met by an appeal to the numerous instances in which it has been resorted to with success. That some cases, however, owe their fatal issue to the employment of ether seems now no less certain—a fact of sufficient significance to require no comment in order to guide the judicious practitioner in his decision as to the eligibility of having recourse to this new agency.

It was formerly a principle in operative surgery, that previously to submitting to an operation, the patient should undergo a suitable preparatory treatment; and we find Mr. Abernethy stating, that "as operations are injurious, so we ought not to perform them, if it can be avoided, where the constitution is much disordered." Whether such a state of the blood as that caused by etherization can occur without giving rise to any corresponding degree of constitutional disorder, or whether the production of such a condition of the blood can be regarded as a salutary preparation for an operation, are questions that must be left to the decision of those surgeons who may still deem it prudent to make etherization the prelude to the use of the knife.

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## ON INFANTILE SPASM OF THE WINDPIPE.

ILLUSTRATED BY CASES.

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I AM induced to offer some observations on this complaint, on two accounts; the first, that to some practitioners it seems an unusual one, many with whom I have spoken on the subject never having met with an instance of it in their practice; whilst with others there is a strong difference of opinion as to its primary cause, and consequently as to its treatment.

It is not my intention to enter fully into all the details connected with the disease, but more especially to consider the two points above alluded to; and I shall endeavour to be as concise as the subject will allow of.

Until within the last few years, the subject seems to have been rarely described by authors, and not at least to have been inserted in the different works which professed to treat on the "General Practice of Physic." Dr. Simpson, in 1761, and Dr. Millar, in 1769, described it under the name of infantile asthma, although Hamilton, John Clarke, and Gooch, at an after period, thought it either to be little known, or, as two

of them imagined, not to have been regularly described. This, at least, proves how little it had excited the attention of the profession generally.\*

The different terms under which it is found in the authors who allude to it are, infantile asthma, bastard croup, cerebral croup, child crowing, laryngeal asthma; Dr. John Clarke described it under the title of "A peculiar species of convulsion in infant children." The most common appellation at the present time is, unfortunately, I think, that proposed by Dr. Mason Good, and afterwards adopted in the voluminous work of Dr. Hugh Ley—viz., laryngismus stridulus. On being questioned by the parents or relations of an infant attacked by this peculiar complaint as to its name, I am sure that every practitioner must feel a difficulty in giving this sonorous reply; and, for my own part, I have seldom done so without being requested to write down the name, so that they might both understand and recollect it. A far better term is that used by Dr. Marsh, who, in a paper in the *Dublin Hospital Reports*, vol. v., terms it "Spasm of the glottis;" and in the following observations I shall adopt it, modifying it slightly, by using the common appellation of that tube of which the glottis forms a part, and terming it spasm of the windpipe. From the effects produced, it might also not inappropriately be called infantile spasmodic asphyxia, for in fatal cases the death of the child appears to be caused fully as much by asphyxia, owing to continued closure of the air tubes, as if the throat were compressed tightly by a ligature, or the child submerged in water for the same period of time.

*Description.*—The spasmodic stricture of the windpipe varies of course much in its intensity and duration; in some cases being but momentary, in others continuing for a minute nearly, and occasionally, when not altogether fatal, it is just within the limits of the period of suffocation. In the first case, a slight catching of the breath is alone noticed, and passed over as of no consequence. It is this affection, in a slight degree, which is perceived when a young child is injudiciously and rapidly tossed up and down by the nurse for some time. In the next degree, it is attended with a peculiar crowing sound, like the prolonged inspiration of whooping-cough, the child suffering for the moment, apparently, with a sensation of constriction about the throat, which, together with the attendant fright, occasions a fit of crying afterwards. Should the affection proceed to a greater extent, either from neglect of precautionary treatment, or from the persistence of the primary cause in spite of it, the symptoms take on a much more alarming form. Temporary asphyxia occurs, the face becomes either livid or ashy pale, the body is rigid, the head thrown back; the child is motionless, after struggling for a time, and the friends are uncertain whether life still remains or not, until respiration is at length reëstablished feebly, and the infant gradually recovers from the paroxysm. There is not, afterwards, necessarily, either cough or difficulty in respiring, unless another paroxysm supervenes, but occasionally both may be present.

This I regard as a case of simple asphyxia; the shrill, squeaking sound attending the first struggles of the child, something like the crowing of a cock, is the result of the attempt to inspire through the narrow chink of the partially-closed glottis.

But not unfrequently, though not necessarily as part of the disorder, there is a complication of another equally serious symptom—convulsion, rendering the attack much more dangerous. This general convulsion may be the effect either of the same irritable state of the intestinal canal, and of the nervous system, which we know so frequently results from dentition, or it may be caused by the state of the cerebral system which results from the asphyxia itself, as in common cases of that state, when produced by noxious gases, drowning, or hanging, the same convulsive action often occurs. This tendency to convulsions is generally evidenced by the drawing in of the thumbs across the palms of the hands, accompanied frequently by a spastic contraction of the toes.

The complaint is found to attack the most robust and apparently healthy children, as well as those of more delicate conformation and health. The paroxysms may be slight, and speedily relieved, or they may continue, at intervals of uncertain nature, during several months.

*Age when attacked.*—The period of dentition seems to be the boundary as to the liability to these attacks. The peculiarly irritable state of the nervous system during this time

\* Dr. Underwood—whose valuable "Treatise on the Diseases of Children," with the practical additions of its three respective editors, is so well known to the profession—does not apparently describe the disease from his own knowledge, but gives the account "of a gentleman of great respectability and experience, by whom it was regarded as a spasm of the stomach, lungs, or other vital parts."—*New Edition*, 1846, p. 180.