TABLE.—*Bath Mineral Water Hospital.*—Statistical Results of Treatment of Disease, with Percentages.

		A.—Numbers Discharged at the several Ages.										B.—Percentage of Results of Treatment according to Age, for Males and Females separately.										C.—Percentages in proportion to Discharges for Males and Females separately and collectively.			Number of Cases Discharged.
		Males.					Females.					Males.					Females.					M.	F.	Total.	
		Result.	Under 20.	20 to 40.	40 to 60.	Over 60.	Under 20.	20 to 40.	40 to 60.	Over 60.	Under 20.	20 to 40.	40 to 60.	Over 60.	Under 20.	20 to 40.	40 to 60.	Over 60.	Per cent.	Per cent.	Per cent.	Totals.			
GOUT.	Cured	..	8	1	..	..	..	..	1	..	24.2	3.2	..	..	..	..	50	13.6	6.1	12.5	Males .... 66 Females .. 14				
	Much better.	..	25	25	1	..	..	2	4	1	75.7	80.6	..	..	66.6	44.4	50	77.2	50	72.5					
	Better	..	..	4	..	..	..	1	2	..	..	12.9	..	..	33.3	22.2	..	6.09	21.4	8.7					
	No better....	..	..	1	1	..	..	..	3	..	..	3.2	..	..	..	33.3	..	3.03	21.4	6.2					
	Total	..	33	31	2	..	3	9	2	..	..	..	..	..	..	..	..	..	..	..					
SCIATICA	Cured	..	3	4	2	..	..	..	..	..	36.5	13.2	66.6	..	..	..	..	21.4	..	19.5	Males .... 42 Females .. 4				
	Much better.	1	4	23	..	..	1	1	1	..	50	76.6	..	..	50	..	..	66.4	75	67.3					
	Better	..	..	2	1	..	..	..	..	..	..	6.6	33.3	..	..	..	..	7.1	..	6.5					
	No better....	..	1	1	..	..	1	..	..	..	12.5	3.3	..	..	50	..	..	4.7	25	6.5					
	Total	1	8	30	3	..	2	1	1	..	..	..	..	..	..	..	..	..	..	..					
LUMBAGO	Cured	..	1	..	..	..	..	..	..	..	33.3	..	..	..	..	..	..	16.6	..	10	Males .... 6 Females .. 4				
	Much better.	..	2	1	..	..	1	..	..	..	66.6	33.3	..	..	50	..	..	50	25	40					
	Better	..	..	1	..	..	1	1	..	..	..	33.3	..	..	50	50	..	16.6	50	30					
	No better....	..	..	1	..	..	..	1	..	..	..	33.3	..	..	..	50	..	16.6	25	20					
	Total	..	3	3	..	..	2	2	..	..	..	..	..	..	..	..	..	..	..	..					
HEMIPLEGIA	Cured	..	..	1	..	..	..	..	..	..	..	5.2	..	..	..	..	..	3.5	..	3.5	Males .... 28 Females .. 4				
	Much better.	..	1	5	..	..	1	..	..	..	16.6	26.3	..	..	..	..	..	21.4	..	21.4					
	Better	..	4	6	2	1	1	1	..	..	66.6	31.5	66.6	..	..	..	..	41.4	..	41.6					
	No better....	..	1	7	1	..	..	..	..	..	16.6	36	33.3	..	..	..	..	32.1	..	32.1					
	Total	..	6	19	3	2	1	1	..	..	..	..	..	..	..	..	..	..	..	..					
WASTING PALSY.....	Cured	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	Males .... 6 Females .. 1				
	Much better.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..					
	Better	..	3	1	..	..	..	..	..	..	75.0	50	..	..	..	..	..	66.6	..	57.1					
	No better....	..	1	1	..	..	1	..	..	..	25	50	..	..	..	..	..	33.3	..	42.8					
	Total	..	4	2	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..					
CHOREA	Cured	2	..	..	..	10	..	..	..	66.6	..	..	..	76.9	..	..	..	66.6	76.9	75	Males .... 3 Females .. 13				
	Much better.	1	..	..	..	1	..	..	..	33.3	..	..	..	7.6	..	..	..	33.3	7.6	12.5					
	Better	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..					
	No better....	..	..	..	..	2	..	..	..	..	..	..	..	15.3	..	..	..	15.3	..	12.5					
	Total	3	..	..	..	13	..	..	..	..	..	..	..	..	..	..	..	..	..	..					

When I contrast the percentage total (*vide* Table C) among males, and find that, under the comparative term "better", the percentage is 66.6, while under the positive term (if I may be a little ungrammatical) "no better" it is 33.3, I may be pardoned if I am somewhat sceptical of favourable results from this special treatment in this form of disease.

Chorea.—Sixteen cases of this disease were discharged from hospital during the year terminating May 1877. The records do not give any information as to their complications, or whether they were bilateral or unilateral. My own observations, founded on the cases which have been under my own care, would lead me to the conclusion that most of the cases have been bilateral, uncomplicated with cardiac or cerebro-spinal disease, though frequently associated with hysteria and sometimes with rheumatism. The table of statistics is a short one, as all the cases were under 20 and varied from 9 to 13 years of age. The small proportion of males to females is remarkable: three to thirteen. The percentage of results in this troublesome nervous affection is, I think, very favourable as regards those cured, amounting in females to 76.9 per cent. of females discharged, and in males to 66.6 per cent. of males total. The percentage of females cured in proportion to the total number discharged = 16 is 63.5, and the percentage of cured males and females collectively is seventy-five. The results of treatment of this affection by mineral tepid baths and waters was to me quite unexpected, and, had I not the opportunity of personal observation, I should have been sceptical. I can, however, vouch for the truth of these results as recorded on the patients leaving the hospital, nor have I remarked that choreic cases often apply for readmission. In those cases treated by myself, I have trusted entirely to the effect of the waters, and have not employed any supplementary treatment. It would be difficult to account for the *modus operandi* of the waters in cases of this disease. Of course, there is almost always functional cardiac disturbance.

[To be continued.]

DEATHS FROM ETHER.

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THE following analysis of the reports of deaths under ether is drawn up, not with the intention of comparing them with those under chloroform, it being assumed that the former has fully established itself as by far the safer anæsthetic, but with the object of gathering all the information they afford and learning, if possible, all the preventable dangers, so as to improve the results. If we are satisfied that, although the percentage of deaths from ether is apparently below that of deaths from chloroform, we can yet improve by experience, and help to raise still further, though in a small measure, the science of anæsthesia towards the high standard of perfect safety which we trust is its ultimate position, it is not enough that we read reports of fatal cases at the times they appear in our journals, but we must again and again recall them, place them side by side, compare them with one another, and so scrutinise their every feature with untiring zeal, that, if possible, we may trace certain marks running throughout them, and become so intimate with those marks as to be able to recognise their earliest appearance or prevent their appearance altogether.

In the BRITISH MEDICAL JOURNAL, *Lancet*, and *Medical Times and Gazette*, for the last ten years, there have been recorded one hundred and fifty-one deaths during the administration of anæsthetics. The following table shows the numbers recorded in each year.

In 1868	..	..	6 deaths.	In 1873	..	..	23 deaths.
" 1869	..	..	13 "	" 1874	..	..	11 "
" 1870	..	..	12 "	" 1875	..	..	16 "
" 1871	..	..	14 "	" 1876	..	..	18 "
" 1872	..	..	20 "	" 1877	..	..	18 "

For the mere purpose of statistics, these figures are perfectly useless because the journals have not been expected to be, nor have they claimed to be, authorities upon the numbers of deaths. Indeed, previously to the year 1872, there is abundant evidence to show that not only did they repeatedly speak of the deaths from anæsthetics without

reference to their number or individuality, but occasionally hint that many cases were allowed to pass away unnoticed or even unknown, except to those who were responsibly present. But about 1872, just previously to and especially after the time when our American brethren pressed ether upon our notice with strong recommendations, all three journals seemed to have commenced to enter into their pages, and even to solicit from all quarters, every individual record they could lay hold upon. Hence the apparent increase of fatal cases in the years 1872, 1873, etc., which, as was said at the time, must not be regarded as an evidence that such cases were increasing in number from carelessness on the part of the administrators, but is to be accounted for in the importance of recording them being more widely and more fully felt than ever. If, then, the deaths from anæsthetics have been more religiously recorded since 1872 for these general reasons, much more strictly would deaths under the administration of ether be reported for the additional reason of its being used *sub judice* by a cautious and almost sceptical profession. Still, even admitting that the above table includes, in the last five years, all or nearly all the deaths that have taken place in this country under the administration of ether, yet when we find them alone amounting to thirteen, though that number compares well with the number of deaths under chloroform, we feel that either we are not perfect in the art of its administration, or it is not the absolutely safe anæsthetic that we have been repeatedly told it is.

Let us examine the essential features of these thirteen deaths, together with five others that are reported in the same journals to have occurred in America, and compare the eighteen cases with each other.

1. A woman, aged 45, was to be operated upon for fatty tumour on the back, at the West London Hospital on February 18th, 1873. Chloroform was first given on lint, and the pulse becoming irregular, ether was substituted. It became full and regular again, but suddenly stopped, the face at the same time being "dusky red". The ether used was pure; its specific gravity 700. One ounce of it was given. It was administered on a sponge in the apex of a cone made of felt, the sponge having been previously wrung out in warm water. The *post mortem* examination revealed nothing to account for death; all the organs were fairly healthy, except both lungs being gorged with blood.

2. An old patient had a cancerous submaxillary gland successfully removed under ether. Shortly afterwards, confusion and stupidity were observed, which deepened into unconsciousness with local convulsive seizures, and death supervened forty hours after the operation. The *post mortem* examination showed nothing to account for the mental symptoms. The chest was not examined.

3. S. S., aged 62, was to be operated upon at the Women's Hospital, in Birmingham, for ovarian tumour. After about five drachms of ether had been administered, she became satisfactorily unconscious, but suddenly appeared to revive, opening her eyes, and passing urine; the pupils were largely dilated, and the pulse could not be felt. Some subjective efforts at respiration were made, but they ceased, and Silvester's method of artificial respiration and other means of resuscitation were adopted without avail. At the *post mortem* examination, the cavities of the heart were found to contain a small quantity of dark blood. The other organs were healthy, except the ovaries and uterus. The state of the lungs is not reported. The anæsthetic used was a mixture of McFarlane and Co.'s anhydrous ether, and Hearon, Squire, and Frances' bichloride of methylene.

4. David Newman, aged 14, had iridectomy performed for corneitis. Ether was given in a cone of spongio-piline. Before the operation was commenced, alarming symptoms presented themselves—great struggling, opisthotonos, and feeble pulse. The administration of ether was discontinued; the pulse improved, and the operation was performed. Afterwards, the pulse and breathing stopped altogether, and the patient died. The *post mortem* examination showed the right cavities of the heart to be full of dark fluid blood, the left nearly empty; and the lungs were congested with bright red blood.

5. An old man was etherised by Mr. McGill of Leeds in 1873, and operated upon for hernia. Wild delirium set in afterwards; the patient tore off the dressings, opened the wound, and tore out some of his intestines.

6. J. F., aged 16, was etherised for operation upon diseased bone in the hand on April 3rd, 1875. Four drachms of Robbins's ether were poured upon some lint in a folded towel. The patient inhaled it rapidly, with no cough and with very little struggling. In four minutes, he was ready for operation, when respiration suddenly ceased, the face became pale, the pupils dilated, and the pulse imperceptible. At the *post mortem* examination, the heart was found not to be weak, and the lungs not congested.

7. On June 23rd, 1875, a man was placed under ether at the Cancer Hospital, London. He was thin and pallid, yet moderately healthy. Partial insensibility was first obtained by nitrous oxide; then ether, of the *British Pharmacopæia*, and specific gravity .735, was given in a cone of lint covered with oiled silk. After a slight struggle, the patient got under its influence. In five minutes, the face became dusky, the respiration shallow, a gurgling sound in the throat was heard, and an effort was made to expel blood. The pulse, however, remained remarkably good. Breathing ceased, though Silvester's method was tried; and still the pulse kept beating for some minutes. At the *post mortem* examination, the *general* blood was found dark, fluid, and containing bubbles like those of air. The lungs were fully inflated and grey. The right auricle was collapsed, and the ventricle empty; the left ventricle nearly so. A clot of blood was found in the trachea.

8. A patient at the Homœopathic College, New York, was etherised for operation upon a necrosed jaw. The pulse was watched all the time by another physician. The face suddenly became blue and the respiration ceased.

9. The *Chicago Medical Journal and Examiner* related a case of the Charitable Eye and Ear Infirmary in Illinois. A man aged 74 was operated upon for cataract by Dr. Holmes. The patient inhaled the ether quietly till half a pound had been used; when a violent coughing commenced, which was followed by extreme lividity of the face and cessation of breathing. The ether was discontinued, and, by appropriate means, respiration was re-established. The lividity partially disappeared, and the action of the heart became stronger. Without any more ether, the operation was concluded. Again the patient ceased to breathe. The face became more livid and the pulse very weak till death ensued, in spite of renewed efforts to avert it.

10. The *Boston Medical and Surgical Journal* gave the particulars of a case in which Dr. Sinclair incised the os uteri for dysmenorrhœa. The patient had been a teacher. She was operated upon at a private hospital on July 19th, 1876. The ether was given on a towel; and, when the patient became unconscious, the doctors present, wishing to be engaged with the operation, entrusted the continuance of the etherisation to a female. When they turned their attention again to the patient's condition, the breath and the pulse were found to have ceased. At the *post mortem* examination, engorgement of the pulmonary artery was found.

11. On September 15th, 1876, a man aged 28 had his right leg amputated for compound fracture, at Guy's Hospital, by Mr. Howse. The house-surgeon began with chloroform; and, when the patient was completely under its influence, substituted ether. After the operation was finished, and as the effects of the ether were passing off, retching came on, and the pulse became feeble. *A little brandy was given.* Almost immediately afterwards, the patient began to vomit and became blue in the face. A large piece of undigested meat was removed from the back of the mouth; still no air entered the lungs; other pieces of food were removed from the entrance to the larynx with no better results. Tracheotomy was performed, and artificial respiration and other means were attempted; but the patient died. At the *post mortem* examination, the larynx and trachea were found full of partially digested food.

12. The *American Journal of Medical Science* for October 1876 reported a case of death after ether. The patient, nineteen years old, had contracted chest and lungs seriously restricted by adhesions, which bound them down in all directions. The ether was administered for twenty minutes. Death followed about two hours afterwards. At the *post mortem* examination, bronchial mucus, pulmonary and pleural serous effusion were found.

13. The *Boston Medical and Surgical Journal* reported another case of death under ether. It was of an old woman in whom cerebral hæmorrhage was afterwards found.

14. A man aged 69 was etherised by Clover's apparatus, for strangulated hernia, at the London Hospital. He commenced by inspiring only his own expired air for about thirty seconds; then he had the ether given in the proportion of from a quarter to a half for a minute. He struggled, and breathed the ether badly. The mouth-piece, therefore, was frequently removed from his face. The amount of ether was diminished, and, as his lips were blue, it was entirely discontinued. His breathing improved a little, but was not quite satisfactory. The pulse became weaker and weaker, and finally stopped; respiration, however, continuing for thirty seconds or more. At the *post mortem* examination, the heart was found flaccid, the left ventricle uncontracted, the lungs extremely emphysematous, the bronchi filled with mucopurulent matter, and other morbid changes were seen.

15. A patient, aged 56, had to be operated upon for a syphilitic caries of the leg at the East Suffolk Hospital. Bichloride of methylene was first administered; and, as the patient did not readily succumb,

methylated ether was substituted. The patient soon became unconscious; but, recovering unduly quickly, the bichloride of methylene was resumed. Great struggling and peculiar epileptiform convulsions ensued, followed by tonic spasm; this spasm relaxed; the breathing became stertorous; the pulse failed; and death supervened. There was no *post mortem* examination.

16. At the Moorfields Hospital, in August 1877, a very stout woman aged 46 was to be operated upon for cataract. A modification of Clover's apparatus was used. Forty minims of chloroform were added to the ether to prevent the choking sensation. The reporter of the case proceeds to say: "She had only breathed the mixture for one minute, when the face became livid, and could, therefore, hardly have been under the influence of the anæsthetic. The pulse and respiration continued fully four minutes after all anæsthetics had been discontinued." The anæsthetic had been applied on and off for some time after the first alarm. At the *post mortem* examination, the heart was found flaccid and empty; the mitral valve contracted; the walls in a state of fatty degeneration; the lungs emphysematous, and congested with blood.

17. Dr. Robert Saundby gave ether with Ormsby's inhaler to a case at Birmingham on October 4th, 1877. M. C., aged 35, had contracted knees. At 12.45 P.M., ether was commenced; only an ounce was used. There were no alarming incidents; very little stertor; no cyanosis; and the respirations were regular and full. Afterwards, the patient was carried out of the theatre across an open court for fifty yards, though well wrapped up. At 2.45 P.M., one hour and a half after leaving the theatre, the patient suddenly became alarmingly ill, cyanotic, and pulseless. *Râles* were heard over the chest. At 4.15 P.M., he died. At the *post mortem* examination, oedema was found in the membranes of the brain; no thrombus in the pulmonary artery; the heart was healthy, containing a little blood in the right auricle; the ventricles were contracted; the lungs were pale and oedematous; the other organs were healthy. The ether used was of the specific gravity 720.722.

18. At Lincoln, Miss S., aged 45, was etherised by Dr. Mitchinson for an operation upon a cancer of the breast. *Half-an-ounce of brandy was given first.* At three o'clock, pure sulphuric ether was administered by means of an inhaler, formed of a bag of muslin covered with a leather case, which had a valve at the apex and a larger one at the lower edge. The valves were open, and air was allowed free ingress and egress. Another doctor's finger was on the pulse of the patient all the time. Half-an-ounce having been poured into the inhaler, Dr. Mitchinson held it lightly over the patient's face. Immediately, she spoke as if half unconscious, and with two more inhalations became turgid about the face, and her hands pinched and white. There was no pulse. The tongue was dragged forward, and several forcible inspirations resulted. They, however, became less and less till 3.15, when she died. At the *post mortem* examination, the heart was found covered with fat; the right ventricle contained an ounce of fluid blood, the left was firmly contracted and empty; the muscular coat was one-twelfth of an inch thick. The base of the right lung contained a considerable quantity of fluid blood, and the base of the left a smaller quantity. There was cancerous deposit in both lungs.

Those of the above cases, which show, *primâ facie*, their causes and modes of death, may be at once taken out of the list, viz.:

No. 2, the old man, who, after the anæsthetic effects of ether had passed away, had not the strength to rally, but passed through the stages of confusion, stupidity, unconsciousness, and coma successively within two days.

Nos. 3 and 15, the ether being in the one case mixed with, and in the other replaced by, bichloride of methylene.

No. 5, in which Robbins's ether was used; for Dr. Richardson says it is not pure ether, but a mixture of amyl hydride and anhydrous ether; it is useful in producing local anæsthesia by the spray-machine for which it is manufactured, being of a low boiling point and specific gravity; and it is directly dangerous when inhaled.

No. 11, in which the trachea was found filled with food.

Nos. 12 and 14, where previous pulmonary trouble was just aggravated by means of the ether.

Nine cases still remain, in which ether appeared to play no secondary part, nor even to be assisted by any untoward condition or circumstance; and the question immediately follows: What killed these patients? They who admit that, although ether is safer than chloroform, it is not absolutely safe, answer "asphyxia"; whilst all others, including those who assert the absolute safety of ether, give no answer at all.

It may be an advantage to draw up the essential particulars of these nine cases in a table, so that we may the more readily compare them altogether, and consider the following points.

- A. The important facts reported in these cases.
- B. The probable conclusions deduced from the facts.
- C. A theory explaining the facts and the deductions.
- D. The best method of the administration of ether.

Table of Nine Cases of Death under Ether.

No.	Kind of Ether.	Instrument used.	Quantity used.	First alarming Symptoms.	Time between commencement of alarm & death.
1	Pure; sp. gr. .700	Warmed sponge in felt cone	One ounce	Face dusky red; pulse stopped	Query? **
4	" "	Spongio-piline cone	" "	Opisthotonos, & pulse feeble	The operation performed in the interval
7	B.P.; sp. gr. .735	Lint cone covered with oiled silk	The inhalations during 5 minutes	Face dusky; respiration shallow; pulse good	Some length of time
8	" "	" "	" "	Face blue; respiration ceased; (pulse good?)	Ditto ditto
9	" "	" "	" "	Face livid; respiration ceased; pulse weak	The operation performed in the interval
10	" "	Towel	lb. ss. on a towel; part lost in air	" "	" "
16	" "	Modified Clover's	Inhalations during 1 minute	Face livid; respiration & pulse continued	Four minutes
17	Sp. gr. .720-2	Ormsby's inhaler	One ounce	Face cyanotic; pulseless; râles	From 2.45 P.M. to 4.15 P.M.
18	Sulphurised	Leather case with valves	Half an ounce, but only three inhalations	Face turgid; pulseless	From 3.0 P.M. to 3.15 P.M.

"Post Mortem" Appearances.

No.	The Lungs.	The Heart.	Other Organs.
1	Gorged with blood	" "	All healthy
4	Congested with bright red blood	Right side full of dark fluid blood; left side empty	
7	Trachea contained a clot of blood	Right auricle collapsed; ventricle empty; left nearly so	
8	" "	" "	Healthy
9	" "	" "	
10	Pulmonary artery engorged	" "	
16	Emphysematous and congested	Flaccid; fatty walls; mitral valve contracted	Cancerous deposits
17	Pale and oedematous	Right auricle contained a little blood	
18	Bases contained considerable quantity of blood	Right side contained one ounce of dark blood, left empty; walls a twelfth of an inch thick	

** In the spaces of those cases where the double asterisks are placed, the reports gave no details to put in. Nos 8 and 9 being shortly reported from American journals, many of their details are wanting.

A. The important facts.—They are easily recognised in looking over the table of the nine cases.

1. Ether was inhaled in various yet limited quantities, from three inhalations of it up to as many as would consume half-a-pound on a towel; and then produced the symptoms ending in death. It was diluted with various quantities of atmospheric air, and given in various methods.

2. The face was reported to be "dusky", "blue", "dusky red", "livid", "cyanotic", or "turgid" in seven of the nine cases, and never said to be "white" or "pale"; in the other two, the colour is not reported at all.

3. In seven cases, the heart did not cease till some time had expired after the commencement of the alarming symptoms, and after the ether had been discontinued; the intervals varying from four minutes to three hours. In those of which the notes were comprehensive, we read that the pulse remained feeble, weak, or good for a longer or shorter length of time after the ether had been discontinued, or after the alarm had been taken; in the other two cases, no certainty on that point can be gathered.

4. The lungs were reported to have been gorged with blood in five cases and the pulmonary artery in the sixth. In another, the trachea contained a clot of blood; and, of the remaining three, two cases were not reported at all; and one case only (No. 17), in which the patient died three hours after the ether-inhalation was over, were the lungs altogether "pale", and even then they were "oedematous".

B. Two Deductions seem to follow from these facts.

1. The fatal effects of ether do not depend upon any directly poisonous property of its own.

2. These cases died by "asphyxia".

Is not the former deduction indicated by the facts that the quantities

of ether given in these cases were various and often small, and the proportions of its mixture with air as well as the methods of its administration also various? And is it not further borne out by the experience of so many cases in which ether has been given in large quantities with the smallest possible amount of atmospheric air, and still the patients have to all appearances been perfectly safe?

Some cases might be quoted, such as those which caused men like Dr. Joy Jeffreys to affirm the belief of American surgery that ether is absolutely safe; but one will suffice. Mr. Furneaux Jordan related a case in which the ether was pushed to an extreme degree, on account of the marked and uncontrollable tremor of the muscles rendering the operation doubly difficult. The anaesthetiser, Mr. Priestley Smith, when requested by Mr. Jordan to give the patient more ether, remarked "that the man was as much under the influence of ether as it was possible to effect".

The second conclusion, that asphyxia was the mode of death, is, to my mind, irresistible from the dusky face, the shallow respiration, the interval between the commencement of the alarming symptoms and death, the engorged lungs, and other signs reported in most of the cases.

C. A Theory explaining these facts and reconciling these conclusions.—The intense cold produced by the ether under certain circumstances causes the small blood-vessels of the lungs to contract, and so offer such degree of resistance to the right ventricle of the heart as to stop it, if it be weak or wearied, and embarrass it, if it be strong; and, by watching the symptoms from this point of view, we are likely to be able to cope with the dangers as they may arise, or even (may we hope?) to prevent their occurrence entirely.

Assuming that the deductions under the head B are logically based upon known facts, we are driven into a corner out of which only such a theory as this can help us.

The asphyxia by which these deaths occur cannot be said to be brought on by any interference with the nerves or nerve-centres directly concerned in respiratory movements, *i.e.*, by paralysis of respiratory muscles, like the asphyxia from carbonic dioxide poisoning; nor, on the other hand, by any mechanical interference with the air-passages, as the asphyxia from hanging or drowning; but must be from interference with the chemical process of the aëration of the blood in the air-cells and blood-vessels surrounding them. This interference is not due to the want of oxygen, because *none* of these cases show that oxygen was absent; but most of them show the reverse, pure atmospheric air having been breathed for some time before death. It must, then, be the result of the insufficiency of the circulatory action of the blood in the capillary vessels of the lungs to do their share in carrying on respiration. What obstructs this circulation? It cannot be that the blood is poisoned with ether; for, in one case (No. 18), three inhalations only had been taken, and, in another (No. 16), the ether had been administered for one minute only. It must be from some property of ether which comes into action in certain circumstances; and, when we call to mind its power of producing intense cold under some conditions, we venture to inquire into the likelihood of that property being the cause of asphyxia. Suppose it to be true. Ether, in its administration, becomes a vapour by absorbing a fixed amount of heat from surrounding media, generally the atmosphere, and, in that condition, is inhaled into the larger bronchial tubes and then becomes mixed with the residual air in the smaller tubes and alveolar spaces. From them it is absorbed into, and dissolved by, the blood, becoming a fluid again virtually in that act, and therefore giving off a certain amount of latent heat. This heat diffuses itself through the body as well as the ether, and probably much faster, the latter having to be pushed on to other parts by the continued addition of more ether behind. This process goes on as long as ether is added. When its administration is discontinued or interrupted for any reason, and pure air allowed to enter the lungs, the current of osmosis between the blood in the capillaries of the lungs and the contents of the air-cells is reversed. The ether, having now to change from the state of fluid to that of vapour again, reabsorbs the amount of heat it gave off on its entrance into the blood. If the air which has just entered the lungs be warm, the abstraction of heat for the re-evaporation of the ether will not be felt by the lungs, though it is sudden and local; but, if, on the other hand, that fresh air be cold, whether on account of its passing through or close to an ice-cold instrument, rendered so by the action of the ether, or from the room being cold, or from the patient having been put into a cold place, though well wrapped up, the amount of heat required suddenly by the ether on its returning to the atmosphere will be more; and the lung-tissue, not having stored up the heat, the ether brought to it will, upon this sudden demand, become so cold as to cause a violent contraction of its arterioles. Such an amount of obstruction, from this

contraction of a large number of vessels, without anastomoses or diverticula, resists the right side of the heart; that, unless the latter has an immense margin of strength, failure in its function is the result, and the patient dies in a space of time varying with the amount of resistance and the amount of strength the right ventricle possesses. If the death were rapid, there would be engorgement of the main branches of the pulmonary artery and the right side of the heart. But the heart may be able to overcome this obstruction; then the capillaries of the lungs become engorged, the chemical process in respiration becomes impeded, and the *vis à fronte* more or less lost. Here is another and, perhaps, greater resistance to the heart, and the latter, wearied out now, might fail. In this case, death would be more delayed than in the former; the pulse might be felt to become more and more feeble. Afterwards the lungs would be found engorged with blood, and the right side of the heart might be full of dark blood or the reverse.

But a strong heart might be supposed to overcome even this second resistance; then the engorged capillaries would throw out a quantity of serum into the air-cells and the surrounding tissues; that in the air-cells becoming frothy and being expectorated; that in the tissues, perhaps, after some time becoming reabsorbed, or possibly causing so much difficulty in the acts of respiration as to constitute the last straw and break the camel's back by offering such embarrassment to the exhausted heart that the patient at last succumbs.

D. The Best Method of the Administration of Ether.—My own experience consists principally in having administered anaesthetics for Mr. Pridgin Teale's cases in private, with very few exceptions, during the last year and a half. In those cases, except with very young children, ether has nearly always been administered. At first, we used the sponge, covered with mackintosh; then the American framework, with the bandage weaved in it; next, Clover's larger apparatus; lastly, Clover's smaller and more recent inhaler. I have also used Ormsby's inhaler a few times.

In my opinion, Clover's smaller inhaler is the best. It is made by Meyer and Meltzer, Great Portland Street. It is composed of an ether chamber and water chamber, together in a circular vessel, a bag that can be detached, and a face piece, which likewise can be detached, and which rotates, when fixed to the vessel, for the purpose of regulating the amount of ether-vapour. It has no valves, or sponge; and costs between £3 and £4.

It possesses the following advantages.

1. There is no struggling or resistance on the part of the patient, however terrified or prejudiced he may be; the ether being invariably breathed with comfort, and in many cases with even a sense of pleasure.
2. The amount of ether-vapour can be carefully regulated to a nicety without lifting the machine from the patient's face, and, consequently, it is easy to keep a patient on the very borderland of insensibility for any length of time.
3. The ether being economised, and not being dissipated into the surrounding atmosphere, there is not only a better chance of fresh air if needed for the patient, but there is more comfort to the operator and his assistants, and especially to the anaesthetiser, who, with other contrivances, often inhales a large share of the vapour himself, and in consequence suffers many a headache. There is also a considerable saving of ether; an ounce and a half usually being sufficient for half an hour, when formerly eight, nine, or more ounces were used.
4. There is none of that bronchial mucus which gave, with other instruments, so much trouble at the time of inhalation, and which was often followed by bronchitis, and in some instances by death.
5. When consciousness has so far returned that the patient can recognise, and even speak sensibly, the sensibility to pain is still so numb that an operation may be concluded, sutures put in, and dressings applied, without the slightest sign of pain from the patient.
6. The comfort to the patient, silencing his resistance and calming his mind, the ease with which the anaesthetiser can administer and regulate the ether without the distraction caused by the patient's struggles, or the etherised atmosphere, or the repeated application to an ether-bottle for fresh supplies, and the equable temperature at which the ether-vapour can be kept, combine together to ensure the greater safety to the patient.

The following are the details of the method of administering ether with the abovementioned machine which I have adopted, keeping in view and acting upon the theory spoken of under the division C of this paper; and Mr. Teale expresses himself well satisfied with the practical results that continue uninterruptedly under his observation.

1. Never allow any solid food, milk, or spirits to enter the patient's stomach for six hours beforehand.
2. See that the room is well warmed.
3. Detach the bag and face-piece from the metal vessel of the

machine; warm the vessel by placing it in a basin of hot water an inch deep; pour an ounce and a half of methylated ether, specific gravity 714, into the ether-chamber; put the face-piece to the vessel, and rotate it so that the indicator points to "no ether". Let the patient breathe through the vessel without the bag into the air, so that he gets only a flavour of the ether; his nervousness and fear will by this means be soon allayed, and confidence gained. Avoid giving him the choking sensation until he becomes numb to the ether; by giving him the ether slowly at first, imperceptibly and gradually increasing it, the bag being placed to the vessel, and so stealing over his sensitiveness until he is quite "numb". Then proceed rapidly to full ether, without any atmospheric air; watch the respiration closely. If it be at all embarrassed, give one breath of fresh air, and resume the ether, at first weak, but increase it as before. He will soon be under its influence; then reduce the proportion of ether by the regulator, so as to keep him just beyond the boundary line of sensibility; give him one breath of fresh air occasionally. Continue to watch the respirations closely. After the operation, do not place the patient suddenly into a cold room or passage, even if he be warmly clothed.

CLINICAL MEMORANDA.

APPARENT GLYCOSURIA AS A RESULT OF THE ADMINISTRATION OF SALICYLIC ACID.

WHEN visiting a case of acute rheumatism in Guy's Hospital, which I was treating with salicylate of soda, I was told that that morning the urine (which was free from sugar on admission) gave a distinct reaction with copper. Next time I examined it myself, and found a more abundant precipitate. The specific gravity was somewhat high, but the quantity was not increased, and there were no other symptoms of diabetes. The reaction disappeared after a few days, when the drug was given less frequently; and, though a slight relapse led to its being again administered every two hours, the presence of sugar was not again noted.

A few days later, another patient taking salicylate of soda for rheumatism was found to have a trace of sugar in his urine. I then suspected its source, and the ward-clerk, Mr. Charles Wood, undertook to examine the urine of all the patients in the hospital who happened to be taking salicylic acid in the form of the soda or ammonia salt. In sixteen out of eighteen cases, the copper was reduced. I have myself tested the urine in other patients for whom I had prescribed salicin or salicylates for rheumatism, urticaria, or common colds, and have never failed to find more or less reaction with the copper-test. The specific gravity was usually not raised, and there was no polyuria or other symptom of diabetes. The reaction disappeared when the drug was no longer taken, and its effect was the same in healthy persons.

An alkaline salicylate is probably decomposed in the circulation into the corresponding carbonate and nascent salicylic acid, and this is partly or entirely excreted in the urine in the form of salicyluric acid. Salicin, it is well known, is excreted as salicyl hydride. Since excess of uric acid will itself reduce copper salts like grape-sugar, and it is possible that salicyluric acid is the reducing agent, salicin, heated with dilute mineral acids, takes up water and forms saligenin and glucose; and I find that, whereas salicylic acid and salicin have no reducing action on copper in an alkaline solution, they exert it when previously acidulated with acetic or mineral acids or when added to acid urine.

I hope to pursue the inquiry further, but thought it well, in this preliminary communication, to call attention to the fact, as one of clinical interest, that the ordinary test for sugar in the urine acts as I have described in persons taking salicylic acid, whether this be due to glycosuria or some other cause. I may add that in every case perchloride of iron produced its characteristic reaction in the urine.

P. H. PYE-SMITH, M.D.

NOTES ON A CASE OF SEVERE INFANTILE CONVULSIONS.

ON February 2nd, I was called in to see an infant twelve days old, and that weighed six pounds two days after birth. She was suddenly seized with violent contraction of nearly every muscle in her body, the head being violently jerked backwards and forwards; the face was alternately red and livid; respiration was very irregular and laborious; the features were fearfully distorted; and there was involuntary discharge of fæces and urine. These symptoms had gone on more or less for three hours without a decided intermission. On endeavouring to

find a cause, I could not. The bowels had acted regularly up to the attack; the remains of the umbilical cord were normal; the appetite was not impaired; and the child had had nothing but her mother's milk since birth. The sister died from convulsions when about twelve months old. I ordered the usual remedies, such as cold to the head, the feet to be placed in hot mustard and water, etc.; but they were of no avail, the symptoms being as persistent as before. I gave the infant an inhalation of equal parts of chloroform and ether, producing complete insensibility, which I kept up for twenty-five minutes, the chaplain christening the child during the administration of the anæsthetic. The inhalation being discontinued, the convulsions were replaced by apparently a sound natural sleep, lasting upwards of three hours and a half, after which some slight muscular twitchings were observed. I then administered two grains of chloral-hydrate, which had the desired soporific effect. The infant awoke up bright and cheerful, without a sign or symptom of muscular twitching, and has remained in perfect health up to the present time.

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THE DETECTION OF SUGAR IN URINE.

THE employment of the fermentation-test for the detection of sugar in the urine is, I am afraid, not so frequently used as it should be. This arises from some little difficulty in the manipulation. To obviate this, I have devised a simple and inexpensive apparatus, which is very easy to use, and gives trustworthy results. It consists of a couple of ounce-and-a-half vials, with their corks, and an empty used sardine tin. The lid of the tin is bent at right angles with its cavity, and affords a support to the two vials, an elastic band or two being used to retain

them in their proper vertical position, while the cavity of the tin receives a portion of the urine under examination sufficient to cover the inverted ends of the bottles, thus forming an extemporaneous pneumatic trough, allowing the whole concern to be put in any situation where the required temperature can be maintained. The vials are two of the ordinary "long series" ounce-and-a-half size. The corks are of unequal length, and each has a triangular notch, about one-twelfth of an inch deep, cut through the entire length of one of its sides. This constitutes the whole of the mechanism. In using, the bottles are to be filled to the very brim with the suspected urine. To the vial which takes the longer cork, a little yeast is to be added; the cork is then forced in level with the neck of the bottle. The notch in the cork allows the superfluous urine to escape. The bottle can then be inverted without a particle of air entering, and placed mouth downwards in the stratum of urine contained in the hollow of the tin. The other bottle is to be treated in the same way; but no yeast is to be put in it, and it is to be placed side by side with the other. The bottle containing the yeast is recognised by its longer cork; and if sugar be present, at a sufficient temperature fermentation soon commences. Gas is evolved, and is retained in the upper part of the bottle, while an equal bulk of urine is expelled through the slit in the cork. The bottle with the shorter cork having no ferment added to its contents, remains full and