REMARKS ON THE CONCLUSIONS OF THE REPORT OF THE ANÆSTHETICS COMMITTEE OF THE BRITISH MEDICAL ASSOCIATION.*

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[HAVING described the origin, in 1891, and the constitution of the Anæsthetics Committee which was formed "to investigate the clinical evidence with regard to the effects of anæsthetics upon the human subject, and especially the relative safety of the various anæsthetics, the best methods of administering them, and the best methods of restoring a patient in case of threatened death," Mr. Eastes stated that the anæsthetists throughout the kingdom who recorded their cases for the Committee in 1892, in books specially arranged for the purpose, returned 136 of the books with details of 25,920 cases from hospital and private practice. Each case in the record books was investigated by the Analysis Subcommittee, consisting of Dr. Buxton, Dr. Hewitt, Mr. Rowell, and Mr. Eastes, with Dr. C. Childs, the able Secretary of the whole Committee, in the earlier years; for which purpose the Subcommittee met over 300 times. Mr. Rowell was the zealous Secretary of the Subcommittee, which also received much aid from several industrious assistants. The report of the Subcommittee was submitted to the criticism of each member of the General Committee, of which Mr. Jonathan Hutchinson was Chairman, and which had Mr. T. Pridgin Teale as Chairman of its Executive Committee.] Mr. Eastes then proceeded as follows :

The 25,920 cases in the record books were first separated into two great divisions—the uncomplicated (A) and complicated (B) cases. Those anæsthetics that were most fre-

quently used appear in Table I, with the number of cases of the administration of each anæsthetic which were recorded.

The complicated cases, defined as cases "presenting unusual symptoms or sequelæ, referable wholly or in part to the anæsthetic," were further distributed in 4 sub-divisions, namely, cases with minor complications (Ba), cases of anxiety (Bβ), of danger (Bγ), or of death (Bδ). Of each of the complicated cases, over 800 in number, detailed accounts are given, and they form one of the most useful sections of the report. At the end of each case letters are appended which indicate the view of the Subcommittee as to the share in the causation of the unusual or dangerous symptoms of the case that was due to the anæsthetic or its method of administration, to the operation itself, or to the condition of the patient at the time of the administration.

Further, the details of every case, both in the complicated and uncomplicated divisions, were submitted to elaborate tabulation.

Records of the administration of 43 distinct anæsthetics, mixtures, or successions of anæsthetics administered in different ways were contained in the books. But, although the number are thus large, the administrations in over 21,000 cases were confined to chloroform, ether, gas and ether, A.C.E. mixture, and mixtures of chloroform and ether in various proportions; whilst nitrous oxide and the same gas with oxygen accounted for over 3,500 cases, leaving only about 1,200 cases to be distributed amongst the remaining 38 anæsthetics. From the very nature of the cases, therefore, the conclusions of the report frequently resolve themselves into various phases of the "chloroform *versus* ether" controversy. But, as the deductions are all drawn from actual cases, they possess a high value for practical anæsthetists.

It was only when the departure from the normal in any case was held to be due partly or entirely to the anæsthetic that the case was placed in the "complicated" division; for example, deaths attributed to surgical procedure, hæmorrhage, etc., occurred in 52 out of a total of 81 deaths in the record books, and were not held to warrant the classification of those cases as complicated.

MINOR COMPLICATIONS.

There were 389 cases of minor complications. They formed rather more than half of the complicated cases, and included phenomena, mostly trivial in character or degree, referred to

TABLE I.

No.	Anæsthetic.	Total Records.	Number of Cases in Division A.	Ratio of Division A to Total.	Number of Cases in Division B.	Ratio of Division B to Total.
1	Chloroform	13,393	12,955	96.730 per cent.	438	3.270 per cent.
2	Ether	4,595	4,455	96.953 "	140	3.047 "
3	"Gas and ether"	2,071	2,026	97.827 "	45	2.173 "
4	A.C.E. mixture	678	660	97.345 "	18	2.655 "
5	Mixtures of chloroform and ether	418	406	97.129 "	12	2.871 "
7	Chloroform followed by ether	208	196	94.230 "	12	5.770 "
8	Ether followed by chloroform	225	216	96.000 "	9	4.000 "
9	A.C.E. followed by ether	155	148	95.484 "	7	4.516 "
14	Chloroform followed by A.C.E. or by some similar mixture	275	270	98.182 "	5	1.818 "
28	Nitrous oxide	2,911	2,888	99.210 "	23	0.790 "
29	Nitrous oxide mixed with oxygen	597	596	99.832 "	1	0.168 "

TABLE II.

No.	Anæsthetic.	Percentage of Complicated Cases (B).	Number in the Sub-division Ba.	Ratio of Ba to whole of Division B.	Ratio of Ba to A and B Combined (that is, to Total Cases).
1	Chloroform	3.270	198	45.205 per cent.	1.478 per cent.
2	Ether	3.047	96	68.571 "	2.089 "
3	"Gas and ether"	2.173	31	68.800 "	1.497 "
4	A.C.E. mixture	2.655	11	61.100 "	1.622 "
5	Mixtures of chloroform and ether	2.871	3	25.000 "	0.718 "
7	Chloroform followed by ether	5.770	6	50.000 "	2.885 "
8	Ether followed by chloroform	4.000	1	11.100 "	0.400 "
9	A.C.E. followed by ether	4.516	7	100.000 "	4.516 "
14	Chloroform followed by A.C.E. or by some similar mixture	1.818	2	40.000 "	0.727 "
28	Nitrous oxide	0.790	21	91.304 "	0.721 "
29	Nitrous oxide mixed with oxygen	0.168	1	100.000 "	0.168 "

* From a paper read before the Society of Anæsthetists on February 15th, 1901.

the respiratory, circulatory, and nervous and muscular systems, and to abnormalities such as micturition, defæcation, and vomiting lasting over twenty-four hours. The number of minor complications under the anæsthetics most frequently used are set forth in Table II, p. 441.

Of the total complications under ether, gas and ether, and A.C.E., about two-thirds were minor complications; whereas under chloroform and mixtures of chloroform and ether the complicated cases were more often of a more serious character.

CASES OF ANXIETY.

These numbered 162, of which 148 occurred under the first five anæsthetics; their numbers are here set forth:

Number and Name of Anæsthetic.	Total Number of Complicated Cases (B).	Number of Cases of Anxiety (B β).	Ratio of B β to the whole of Division B.	Ratio of B β to A and B Combined (that is, to Total Cases).
			Per cent.	Per cent.
1. Chloroform ...	438	102	23.28	0.76
2. Ether	140	30	21.42	0.65
3. Gas and ether ...	45	7	15.5	0.34
4. A.C.E. mixture...	18	4	22.2	0.59
5. Mixtures of chloroform and ether	12	5	41.6	1.19

The phenomena exhibited by the cases placed in this group were similar to, though more pronounced than, those occurring in the previous group; they also required definite remedial measures. Of 100 complicated cases under ether, gas and ether, and A.C.E., 90, 84, and 83 respectively were placed in the two subdivisions just reviewed, and in none of these apparently was life threatened; but under chloroform, and mixtures of chloroform and ether, fewer than 69 and 67 respectively of 100 complicated cases were placed in these less serious subdivisions. In other words, the complications under chloroform, and mixtures of chloroform and ether, were more frequently of a dangerous character.

CASES OF DANGER.

These were divided into two subdivisions—those that recovered, 153; and those that died, 29. Of the former, 140 occurred under the first five anæsthetics. Their symptoms were urgent, “immediately threatening life, and included such conditions as failure, or impending failure, of respiration or circulation, or both, during or after the administration.”

Number and Name of Anæsthetic.	Total Number of Complicated Cases (B).	Number of Cases of Danger that Recovered (By).	Ratio of By to the whole of Division B.	Ratio of By to A and B Combined (that is, to Total Cases).
			Per cent.	Per cent.
1. Chloroform ...	438	120	27.4	0.89
2. Ether	140	8	5.7	0.17
3. Gas and ether ...	45	6	13.3	0.29
4. A.C.E. mixture...	18	3	16.6	0.44
5. Mixtures of chloroform and ether	12	3	25.0	0.71

This table shows that under ether, gas and ether, and A.C.E., the proportion of complicated cases classed as cases of danger was, especially under ether alone, very far below the proportion of cases so classified under chloroform and mixtures of chloroform and ether.

DEATH DUE PARTLY OR ENTIRELY TO THE ANÆSTHETIC.

There were 29 such cases, of which 26 occurred under the first 5 anæsthetics.

Number and Name of Anæsthetic.	Total Number of Complicated Cases (B.)	Number of Deaths γ (B δ).	Ratio of B δ to the whole of Division B.	Ratio of B δ to A and B Combined (that is, to Total Cases).
			Per cent.	Per cent.
1. Chloroform ...	438	18	4.11	0.13
2. Ether	140	6	4.28	0.13
3. Gas and ether ...	45	1	2.2	0.04
4. A.C.E. mixture...	18	0	0.0	0.00
5. Mixtures of chloroform and ether	12	1	8.3	0.24

In the next table are found the cases of danger (including deaths) considered to be due entirely to the anæsthetic. The figures of this table are printed at page 123 of the report, though they are not there tabulated.

No. of Anæsthetic.	Total Cases (A and B together.)	Cases of Danger.		Total Cases of Danger (By and B δ).	Ratio of Danger Cases (By and B δ) to Total Administrations (A and B).
		By (Recovered).	B δ (Died).		
1* ...	13,393	75	3	78	0.582
2 ...	4,595	3	0	3	0.065
3 ...	2,071	2	0	2	0.096
4* ...	678	1	0	1	0.147
5* ...	418	2	0	2	0.478
6* ...	59	1	0	1	1.694
7 ...	208	1	0	1	0.480
8* ...	225	4	1	5	2.2
9 ...	155	0	0	0	0.000
14* ...	275	1	0	1	0.36

Of the 10 anæsthetics 6 (marked thus*) belong to the “chloroform group;” they exhibited 88 cases of danger (including 4 deaths), and gave a “danger-rate” of 0.58 per cent. The remaining 4 anæsthetics belonging to the “ether group,” had 6 cases of danger, but without a death, and their “danger-rate” was 0.085 per cent. In other words, in 1,176 cases of the “ether group” there was an average of 1 case of danger, due entirely to the anæsthetic; whilst in the same number of cases of the “chloroform group” there were, at least, 6 cases of danger caused solely by the anæsthetic.

This is probably the chief lesson taught by the report, namely, that chloroform, alone or in combination, caused in the reported cases a danger-rate sixfold higher than the danger-rate produced by ether. Or, contrasting chloroform alone with ether alone, chloroform had, in the opinion of the Subcommittee, a danger-rate in the recorded cases under the two anæsthetics, which were nearly 18,000 in number, more than eight times higher than the danger-rate of ether.

Had the report emphasised only this single conclusion I do not consider the time given to the investigation would have been wasted. But there is a second part of the report in which the influence of various factors upon the phenomena of anæsthesia is considered. To obtain the data necessary for this portion of the inquiry every case in the record books, whether complicated or not, was rigidly analysed and tabulated under some 12 or 13 distinct headings by the Subcommittee. The results thus obtained are interesting, and in some instances seem to furnish answers to problems that before were undetermined. Let us take them *seriatim*.

TIME OF YEAR.

The tendency for cases of complication and danger to arise was rather greater in the winter than in the rest of the year, especially under ether. This latter fact may possibly be due to the circumstance that bronchitis is far more prevalent after

ether than after chloroform (as we shall presently see) and that bronchitis usually flourishes when the thermometer is low.

TIME OF DAY.

For about 15 operations taking place between 6 A.M. and 6 P.M., one only was performed in the other half of the day, and that was usually an operation of emergency. Elaborate tables accompany this section, but it must be remembered, as the report states, "that the differences in the complication-rates and danger-rates given in the tables may be explained by other influences than the time of day."

SEX.

The conclusions of this section of the report are definite and worthy of study. The percentage of complications under all anæsthetics together was greater in males than in females, in the ratio of 1.477 to 1; whilst the percentage of danger cases was still higher in males than in females, in the ratio of 1.687 to 1. The rates varied with different anæsthetics. Thus, under chloroform the danger-rate was greater for males than for females, in the proportion of 2.071 to 1; and under A.C.E., in the ratio of 1.519 to 1. But under ether and gas and ether, these proportions were about reversed. Thus, under ether the danger-rate was less for males than females in the proportion of 0.621 to 1; and under gas and ether in the proportion of 0.589 to 1.

The frequency with which cases of danger occurred was as follows:—

1. In males:	With chloroform,	once in every	68 administrations	
	" ether,	"	" 406	"
	" gas and ether,	"	" 488	"
	" A.C.E.,	"	" 171	"
2. In females:	" chloroform,	"	" 141	"
	" ether,	"	" 251	"
	" gas and ether,	"	" 287	"
	" A.C.E. mixture,	"	" 260	"

But, whilst such was the frequency of cases of danger—that is, far less with males than with females under ether—yet minor complications were notably more frequent with males than with females even under ether.

AGE.

The age period "11 to 15" years had the lowest complication-rates and danger-rates under all anæsthetics taken together; from this age onwards there was a steady rise for each decennial period until the age of 50 in the complication-rate and until 80 in the danger-rate. Under chloroform the percentage of danger cases in the first 10 years of age was distinctly higher than in the second and third decennial periods. The administrations to children under 1 month were only 36, but of these no fewer than 3 were cases of danger. With ether the percentages of danger cases were far lower than with chloroform, the highest being in the "50 to 60" and "60 to 70" age periods. Under gas and ether the "20 to 30" and "60 to 70" periods had the highest danger percentages.

The following chart shows the percentages of cases of danger (including death) for the different age periods in connection with anæsthetics 1, 2, and 3.

GENERAL CONDITION OF PATIENT.

Where possible every case was classed in one of three conditions of health—"good," "not good," and "very bad." In patients in "good" health the frequency of cases of danger was:

With chloroform, once in every 133 administrations.
With ether, once in every 654 administrations.
With gas and ether, once in every 834 administrations.

And, contrasting the figures for the anæsthetics of the "chloroform group" with those for the "ether group" (as before), it appears that the danger-rate under the former group in patients in good condition was five times higher than in similar patients under the ether group.

In patients in Condition 2—"not good"—the percentage of danger-rates was, under chloroform, still double those under ether, and under the "chloroform group" as 19 to 14 under the "ether group."

In patients in "very bad" health the danger-rate under chloroform remained double that under ether, but that under the "chloroform group" was very little above that under the "ether group." The danger-rate increased quickly as the general condition of the patients deteriorated; but, at the same time the relative dangers under chloroform and under ether became more equal.

PATHOLOGICAL STATES.

There was an "increased liability to the occurrence of complications and dangers in patients suffering from emphysema, shock and collapse, alcoholism, affections of the heart generally, emaciation, empyema, bronchitis, valvular diseases of the heart and anæmia; and symptoms of danger were particularly prone to arise under chloroform in emphysema, shock and collapse, alcoholism, affections of the heart generally, valvular disease of the heart, and empyema. Further, when complications arose in such conditions as shock and collapse, emphysema, and alcoholism, they exhibited a markedly increased percentage of cases of danger; while in patients suffering from malignant disease and febrile conditions the complications were unusually free from danger. Lastly, in patients suffering from pyrexia, tuberculosis, and pulmonary phthisis (especially the latter), anæsthesia was more than usually free from complications or dangers. The remarkable diminution of the chloroform danger-rate in a large number of cases of tuberculosis, and especially in phthisis, deserves attention."

DURATION OF ADMINISTRATION.

In uncomplicated cases the average duration of each administration under chloroform was 22.748 minutes; under ether it was 26.993 minutes; under gas and ether, 26.2 minutes; and under A.C.E., 22.129 minutes. The averages of chloroform and A.C.E. were similar, as were also those of ether and gas and ether.

Under chloroform the "complication-rate" increased with the longer duration of the administration, but the danger-rate was the highest in the early stages of administration. In fact, 12 of the 16 fatal cases judged by the Subcommittee to be due entirely or in part to the anæsthetic—12 of these 16 cases had died within 20 minutes of the commencement of the administration, and 3 of the other 4 fatal cases were those of patients who survived the operation, but died subsequently from "after-effects." Thus 12 of these 13 cases in which death occurred "on the table" terminated in less than 22 minutes. Also, the average duration of administration prior to the onset of the dangerous symptoms in the 118 cases classified as cases of danger, and of which 102 recovered whilst 16 died, was only 20.85 minutes. But the average duration of administration in the 117 cases in which minor complications occurred exceeded 36 minutes. Thus, "the highest 'minor complication' rate was observed in the longest administrations; in other words, the longer the cases lasted the greater was the chance of some minor complication occurring. Secondly, cases of danger, not ending fatally, occurred with about equal frequency in the various duration periods up to 60 minutes." Lastly, "in no instance was the incidence of non-fatal 'danger' noted as occurring after 60 minutes from the commencement of chloroform administration."

Under ether, as with chloroform, the highest complication-rates occurred in cases lasting over 30 minutes, but the highest danger-rate was also in the cases in which the administration lasted beyond 30 minutes. The complication-rate was less than half the complication-rate under chloroform; but the danger-rate under ether was only one-sixth of the danger-rate under chloroform. To summarise, "under all

the four principal anæsthetics the onset of dangerous or fatal symptoms occurred, as a rule, in the early stages of anæsthesia; whereas the complications of the later stages of prolonged anæsthesia were generally instances of 'minor complications' or of 'anxiety,' and were very rarely cases of 'danger,' either non-fatal or fatal."

THE OPERATION.

As regarded the operation the most striking fact was that both the complication and danger-rates were determined in larger measure by a surgical factor, such as shock from hæmorrhage, interference with important structures, etc., than by the anæsthetic. The difference in the complication and danger-rates for amputations of different degrees of severity, and the high rates for excisions of the hip-joint, operations upon the thyroid, and excisions of the rectum exemplified this fact; while the low complication and danger-rates for amputations of the foot or toe, for orthopædic operations, operations on abscesses, glands, or bone, and "minor operations" afforded corroborative evidence. The danger-rates were high for operations for strangulated hernia, those involving the pleura or lung, excisions of the eyeball, operations on the testicle and kidney, abdominal operations, and operations involving the upper air passages. In all these operations, with the exception of strangulated hernia, and in major amputations and excisions, and in operations for ruptured perineum, the danger-rates under chloroform were high. Also in 525 operations for circumcision, under chloroform, the large majority of the cases being children, the danger-rate was as high as 1.25 per cent. The danger-rates under chloroform were low in "minor operations generally, operations for dislocation or fracture, orthopædic operations, minor amputations, operations for strangulated hernia (not in operations for herniæ other than strangulated, be it noted), and operations on the vulva or vagina. Ovariectomy and hysterectomy together, although showing one of the highest complication-rates, were comparatively free from danger."

The cases of danger under ether were none for the majority of operations, but the number of cases was limited. The danger-rate in operations for strangulated hernia exceeded 11 per cent., and operations for hæmorrhoids and major amputations showed noticeably high danger-rates. With respect to this point the Subcommittee points out that as ether was often selected for use in conditions of exhaustion and collapse, the danger-rate for this anæsthetic was influenced thereby. This fact helps to explain the high danger-rate in strangulated hernia under ether. It is noteworthy, however, that in the 124 cases of strangulated hernia in which chloroform was employed there was only 1 case of danger.

Under gas and ether there was an increased danger-rate for abdominal and rectal operations, whilst there was no case of danger with most of the major operations under this anæsthetic.

SOURCES OF ANÆSTHETICS.

Only one paragraph from this section of the report need be quoted; but this will doubtless come as a surprise to many. It is the following: "Comparing 'pure,' 'methylated,' and other chloroforms, no evidence is afforded of one kind being safer than another."

METHODS OF ADMINISTRATION.

As to chloroform, the towel was the most frequently used method, and it also showed the highest complication and danger-rates; at the same time, of 65 danger cases occurring under this method only 5 died. There was a striking diminution in both the complication and danger-rates in the cases in which lint was employed; but of the 23 cases of danger occurring when lint was used no fewer than 7 ended fatally. With Junker's apparatus there was a low complication-rate, and an absence of "danger" from the 422 cases recorded under this heading. But in the "combined methods" there were 3 danger cases recorded, and all 3 happened whilst Junker's apparatus was in use; further, one of the 3 was a death.

The recorded cases of ether administration were 445, and in over 4,000 of these, including 13 "danger" cases, Clover's inhaler was used. There were 6 deaths among these 13 danger cases; but in 2 of them death followed (from

apoplexy and uræmia respectively) some days after the operation.

Gas and ether was usually given with Clover's or Ormsby's apparatus; and under the considerations mentioned in the report (page 93) the complication and danger-rates were not very different under the two methods.

With A.C.E. mixture the more "open" methods of towel, lint, and Skinner's mask gave far lower complication and danger-rates than the "mask and sponge" or Clover's ether apparatus.

QUANTITY OF ANÆSTHETICS USED.

For chloroform Junker's apparatus was the most economical, as it used on the average in 334 cases 1 ounce in 86.12 minutes; whilst with the towel chloroform was used most rapidly. In 3,195 cases of this latter method the average time for using 1 ounce was 45.05 minutes. So many factors, often necessarily unknown—such as the temperature of the air, the personal equations of patient and administrator, the duration of the administration—obviously affected the quantity used, that the Subcommittee was unable to arrive at conclusions of practical value. The statistics showed, however, that "a slow induction of anæsthesia was not necessarily safe."

With ether the average rate of use was 1 ounce in 12.85 minutes; but the Subcommittee concluded that "the evaporation rate of ether appears to have little bearing upon the incidence of complications and dangers, of which the determining cause was rather a variable factor, such as the condition of the patient, than the administration of ether alone."

REPEATED ADMINISTRATIONS.

In 26 cases of chloroform administration in which complications occurred, and 3 of which proved fatal, chloroform had been previously administered with safety. In 4 of the ether cases with complications, there had been a previous safe employment of that anæsthetic, but not one of those 4 cases was a case of danger.

PHENOMENA DURING NARCOSIS.

In the uncomplicated division some phenomena were regarded as incidental to the administration, and as not necessarily rendering the case a "complicated" one. The frequency of these phenomena varied much with the different anæsthetics. Struggling and rigidity occurred more frequently in ether and A.C.E. cases than in gas and ether or chloroform cases. Excitement was noticed under ether twice as often as under chloroform, or gas and ether. Secretion of mucus occurred most frequently under gas and ether and ether, least often under chloroform; cough most frequently under ether, less so under gas and ether, rarely under chloroform; lividity oftenest under gas and ether, least with chloroform. But vomiting was distinctly more common with chloroform than with ether, gas and ether, or A.C.E.

In complicated cases the chief phenomena were those connected with the respiratory, circulatory, alimentary, and nervous and muscular systems. Of the respiratory phenomena, many of those of minor degree, such as embarrassed or difficult breathing, dyspnoea, and "spasm of glottis," were more frequent under ether than under chloroform; but shallow breathing occurred oftenest under chloroform. Moreover, cessation of respiration was observed 4 times oftener under chloroform than under ether, and in the proportion of 10 cases in the "chloroform group" to 4 cases in the "ether group" (*vide supra*).

Circulatory phenomena, of all degrees of severity from mere feebleness of pulse to actual cessation of cardiac action, were far more common under chloroform than under ether, and those of a grave nature occurred more than 5 times oftener under the "chloroform group" of anæsthetics than under those of the "ether group."

Simple vomiting occurred in complicated cases under chloroform with more than twice the relative frequency with which it happened under ether, whilst with A.C.E. the relative frequency was even greater. The phenomenon "retching and vomiting" (which of itself was not, as above mentioned, regarded as a "complication") was yet frequently associated with complications. The phenomenon doubtless bore a causal relation to the onset of complications.

Muscular phenomena, such as violence, struggling, move-

ment, or excitement, were in the complicated cases almost as frequent relatively under chloroform as under ether, thus contrasting with the figures in the uncomplicated class. Of the 30 tabulated cases under chloroform 12 were cases of danger, 5 of them terminating fatally, whereas of the 11 ether cases not a single one was a case of danger. Thus under chloroform there appeared to be a connection between muscular phenomena and the occurrence of dangerous symptoms. In 14 cases a "fit," or "epileptiform" or "convulsive" seizure was noted; 11 times under chloroform and once each under ether, gas and ether, and a mixture of chloroform and ether.

In order to throw light on the relative frequency of primary circulatory failure, or primary respiratory failure, in "danger" cases (including "death"), the Subcommittee framed a table which shows that the largest proportion of instances of primary circulatory failure occurred when chloroform alone or in mixture was employed. There was a single case of primary circulatory failure under ether, in which sudden depression occurred ten minutes after the withdrawal of the ether.

THE MOVING OF PATIENTS AND THE INFLUENCE OF POSTURE.

In 2 cases of death under chloroform, in 1 under ether, and in a case of danger under chloroform followed by A.C.E., the symptoms of danger were noticed directly after the patients had been moved. In a danger case under A.C.E. the symptoms of danger were noticed after the patient was sat up in a chair and "a few stumps had been removed." In one case of laminectomy under chloroform the dangerous symptoms were attributed to the prone position. On the other hand, a boy aged 16 who took chloroform whilst his head and shoulders were well raised, had failure of pulse which improved when the head and shoulders were lowered.

AFTER-EFFECTS.

Vomiting was most common after ether, next after A.C.E., next after gas and ether, least after chloroform. But this order was exactly reversed in the case of prolonged vomiting, which occurred most frequently after chloroform, next after gas and ether, next after A.C.E., and rarely after ether.

Faintness, shock, or collapse as after-effects were noted under the "chloroform group" of anæsthetics in the proportion of 69 cases to 41 under the "ether group," notwithstanding that in many instances ether was evidently selected on account of the feeble condition of the patient.

Bronchitis following anæsthetics was not common, but it occurred about once in 400 administrations of ether to once in 3,300 cases in which chloroform was used. "The fact that in bronchitic patients ether is usually avoided further emphasises the enormous difference in the rates of occurrence of bronchitis after ether and chloroform respectively.

Uræmia succeeded ether administration in two patients, and terminated fatally in each case. One patient was known to have chronic Bright's disease, and died after 10 days; the other patient died 30 hours after ovariectomy, but no note was made as to the condition of the urine before the operation.

As to the average duration of administrations in uncomplicated cases, in which the above after-effects were noted, they were distinctly longer in the cases which displayed after-vomiting than in cases with no bad after-effects; whilst in cases in which after-sickness was severe and prolonged the average duration of administration had also been considerably prolonged. Also in the cases which were followed by "shock and collapse" the average durations of administration had been more than twice those in cases in which the after-effects were recorded as either "nil" or "good." But in all these cases the feeble condition of the patient or the gravity of the operation, or both factors combined, were held to account for the after-effects; hence the classification of the cases in the "uncomplicated" division.

TREATMENT OF COMPLICATIONS.

The simpler procedures, such as temporary or entire discontinuance of the anæsthetic, "opening the mouth," "pushing forward the jaw," were evidently imperfectly recorded. Of the more elaborate measures adopted in grave emergencies, such as artificial respiration, change of anæ-

thetic, hypodermic injection of ether, inversion, enema of brandy, administration of amyl nitrite, and intermittent compression of precordium, detailed tables appear in the report; but the Subcommittee considered the evidence before it as unfortunately insufficient to warrant any definite pronouncements as to the relative value of the remedial measures employed by the observers.

DEATHS IN CONNECTION WITH THE USE OF ANÆSTHETICS.

Of the 18 chloroform deaths 3 were considered to have been due entirely to the anæsthetic, and 4 to the anæsthetic principally and the patient's condition secondarily. In the others the patient's condition and the operation were held to be more or less contributory factors, together with the anæsthetic, to the fatal termination. Of the 6 ether deaths not one was considered to be due entirely to the anæsthetic. In the case of death under gas and ether, and that under the mixture of chloroform and ether the patient's condition chiefly contributed to the fatality. In the case under anæsthetic 8 (ether followed by chloroform) the death was considered to have been entirely due to the chloroform. In the case after ether, followed for the greater part of the operation by A.C.E., the death from broncho-pneumonia was referred by the recorder entirely to the anæsthetic.

The Subcommittee felt justified in reporting that "the foregoing facts emphasise the conclusion that danger to life under the use of chloroform is greater than when other anæsthetics are employed."

Besides the 29 deaths caused entirely or partly by the anæsthetic, there were in the record books 52 other deaths regarded by the Subcommittee as in no degree due to the anæsthetic.

SHOCK AND COLLAPSE.

In a paragraph dealing with this subject particular reference is made to several cases, especially those illustrating reflex shock; and the Subcommittee concluded "that reflex shock of a more or less fatal character does occur even when a patient is under the influence of an anæsthetic." But that "the small number of cases of reflex phenomena in the record books appears to warrant the assumption that the anæsthetic is in itself protective."

INCOMPLETE ANÆSTHESIA.

The Subcommittee was of opinion that "when anæsthesia was undoubtedly incomplete, complications were more frequent than when it was unquestionably complete." In the books of three observers, particularly, evidence of incomplete anæsthesia was frequently found, and in all three books the complication-rates were very high. It is important, therefore, that complete anæsthesia should be established before surgical procedures are commenced, and the requisite degree of anæsthesia maintained during the remaining stages of the operation; also attempts should not be made to arouse the patient, as by flipping with a towel, at the conclusion of the operation. Unfortunately, the evidence shows that, "In many instances the importance of regulating the depth of the narcosis to the requirements of the operation and the general state of the patient was not appreciated" by the administrators.

APPENDICES.

Three appendices are attached to the report. In the first are particulars of 26 cases of death recorded in the press in 1892, but not reported in the record books. Of these cases, 21 were under chloroform, 2 under ether, 1 under A.C.E., 1 under chloroform followed by ether, and 1 under chloroform followed by A.C.E.

The second appendix is a report from Professor Ramsay respecting the examination of several samples of chloroform. In it he states that chloroform, as delivered from the makers, is, so far as his experience goes, a pure article, and that it develops impurity on keeping; that chloroform exposed to daylight and sunlight develops carbon oxychloride; that it is impossible to respire such chloroform, which instantly causes choking; that this is the only impurity which he believes to exist in chloroform; and that it may be removed by distillation from quicklime or by the placing of slaked lime in the chloroform.

The third appendix is a report from Surgeon-Lieutenant-Colonel Edward Lawrie respecting 1,521 administrations of

chloroform at the Afzulgunj Hospital, Hyderabad, with apparently only one case of danger, and an average rate of administration of one ounce of chloroform in 6.6 minutes, as against one ounce in 54.7 minutes, the mean average rate of use in the 9,279 cases analysed by the Subcommittee. This point alone shows the vast difference existing between the practice of chloroformists in this country and that of those who act under Colonel Lawrie's supervision at Hyderabad.

The final conclusions of the Committee contain some weighty pronouncements, drawn entirely from the actual facts and figures contributed by the observers, and are so important and so admirably summarise the lessons to be drawn from the report, that they cannot with advantage be curtailed. They are stated in the following terms:

CONCLUSIONS.

Relative Safety of the Various Anæsthetics.

I. The relative safety of the various anæsthetics may be gathered from the statistical tables in the report. When only those cases of danger which were held to be due entirely to the anæsthetic are considered, the following instructive figures are obtained, further emphasising the danger of chloroform as contrasted with ether.

Cases of danger (including deaths) considered to be due entirely to the anæsthetic:

Under chloroform, 78, giving a danger-rate of 0.582 per cent.

Under the A.C.E. mixture, 1, giving a danger-rate of 0.147 per cent.

Under mixtures of chloroform and ether, 2, giving a danger-rate of 0.478 per cent.

Under the A.C.E. mixture followed by chloroform, 1, giving a danger-rate of 1.694 per cent.

Under chloroform preceded by ether, 5, giving a danger-rate of 2.2 per cent.

Under chloroform followed by mixtures of alcohol, chloroform, and ether, 1, giving a danger-rate of 0.36 per cent.

Under ether, 3, giving a danger-rate of 0.065 per cent.

Under "gas and ether," 2, giving a danger-rate of 0.480 per cent.

Under ether preceded by chloroform, 1, giving a danger-rate of 0.480 per cent.

Under ether preceded by the A.C.E. mixture, 0.

Under the chloroform group of anæsthetics (addition of the first six headings above), 88, giving a danger-rate of 0.584 per cent.

Under the ether group of anæsthetics (addition of the last four headings above), 6, giving a danger-rate of 0.085 per cent.

II. Although (excluding nitrous oxide) ether may be accepted as the safest routine agent, certain circumstances determined by the state of the patient, the nature of the operation, etc., may render the use of some other anæsthetic or combination of anæsthetics both safer and easier.

The Best Methods of Administration.

III. No method of administration of chloroform is free from danger, but an examination of the complicated cases appears to show that the occurrence of danger depends largely upon the administrator who employs any particular method.

IV. No conclusion from the evidence before the Committee as to the best method of administration of ether and "gas and ether" is possible.

V. The data warrant the conclusion that the A.C.E. mixture should not be given from a closed inhaler—for example, Clover's. This conclusion applies to all mixtures containing chloroform (*vide* anæsthetic No. 5, p. 94).

VI. As regards the rate of use of the various anæsthetics, no conclusions other than those in the section on "Quantity of Anæsthetic Used," p. 94, can be offered.

Best Methods of Restoration.

VII. The Subcommittee are unable from the material at their disposal to draw any conclusion upon this point.

Clinical Evidence regarding Anæsthetics Generally.

VIII. Anæsthetics are more commonly associated with complications and dangers in males than in females.

IX. Excluding infancy, and taking anæsthetics collectively, the complications and dangers of anæsthesia increase *pari passu* with advancing age.

X. Anæsthetics are notably more dangerous in proportion as the gravity of the patient's state increases. (The conclusions arrived at in the Section on "Pathological States," p. 76, are extremely instructive, and should be referred to in this connection.)

XI. Danger to life is especially likely to be incurred in early periods of the administration of anæsthetics, while the tendency to less grave complications increases directly with the duration of anæsthesia.

XII. The tendency for complications, dangerous and otherwise, to occur, increases *pari passu* with the gravity of the operation.

Clinical Evidence regarding Chloroform.

XIII. Chloroform is about twice as dangerous in males as in females.

XIV. Chloroform is most dangerous during early infancy and after 30 years of age; least so from 10 to 30 years of age.

XV. In conditions of good health chloroform is very much more dangerous than other anæsthetics. In grave conditions chloroform still remains the least safe anæsthetic, but the disparity between it and other anæsthetics is far less marked than in health.

XVI. When danger occurs under chloroform, whatever its exact nature may be, there is abundant evidence that in a large proportion of cases the symptoms that are observed are those of primary circulatory failure.

XVII. Imperfect anæsthesia is the cause of a large number of cases of danger under chloroform.

XVIII. Vomiting during anæsthesia, which may lead to danger, seems to be more frequent under chloroform than under other anæsthetics.

XIX. Struggling is very much more frequent in the complicated cases under chloroform than in the uncomplicated, and this phenomenon must therefore be regarded as a source of grave danger under chloroform.

XX. The tendency for circulatory complications to appear increases directly with the relative amount of chloroform in the anæsthetic employed.

XXI. While vomiting is more common after administration of ether, severe and prolonged vomiting is more common when chloroform has been used.

XXII. Circulatory depression following anæsthetics is more common after chloroform than after ether.

XXIII. While the respiratory complications of anæsthesia as a whole are of equal frequency under the ether and chloroform groups respectively, yet those that occur under ether are mostly of a trifling and transitory nature, while those that occur under chloroform are more grave and persistent.

Clinical Evidence Regarding Ether.

XXIV. Under ether the complications of anæsthesia are more frequent with males than with females, but with the former they are generally slight, ether being rather more dangerous with females than with males.

XXV. Ether, where employed throughout or preceded by nitrous oxide gas or by the A.C.E. mixture, is singularly free from danger in healthy patients.

XXVI. Minor troubles in administration due to laryngeal irritation and increased secretion are more common under ether and "gas and ether" than under chloroform and its mixtures.

XXVII. Struggling occurs more frequently with ether when given alone than with other anæsthetics, but it rarely leads to danger.

XXVIII. After-vomiting is more common with ether than with other anæsthetics, but it is usually transient.

XXIX. Bronchitis is much more common as an after-effect of ether than of chloroform.

XXX. With "gas and ether," as with ether, dangers are more common in females, although complications are more frequent in males.

Clinical Evidence regarding Mixtures and Successions of Anæsthetics.

XXXI. The A.C.E. mixture in most of the statistical tables holds an intermediate position between chloroform and ether.

XXXII. The A.C.E. mixture is more dangerous in males than in females, but not to such a marked degree as is chloroform.

XXXIII. The administration of ether antecedent to chloroform does not abolish the possibility of chloroform dangers.

XXXIV. The various mixtures and successions of anæsthetics were recorded too infrequently to justify definite conclusions.

General Conclusion.

XXXV. From the evidence before the Subcommittee they are convinced that by far the most important factor in the safe administration of anæsthetics is the experience which has been acquired by the administrator.

In many cases the anæsthetisation completely transcends the operation in gravity and importance, and to ensure success, particularly in these cases, it is absolutely essential that an anæsthetist of large experience should conduct the administration.

As to this final recommendation it may be possible to act upon it in hospitals and big towns; but practitioners everywhere must in emergencies be prepared to administer anæsthetics. No one, therefore, should be allowed to qualify until he or she has shown proficiency in this very important branch of medical work.

There are many other lessons to be learned from this report, which all who are interested in anæsthetics should study.

A LADY INTERNE OF THE PARIS HOSPITALS.—In the list of candidates for the post of *interne* of the Paris hospitals who have been successful in the recent examination there occurs the name of Mlle. Marthe Francillon-Rouville, who gained the fifty-second place among more than 600 competitors. The lady is, according to the *Progrès Médical*, the first French woman who has obtained the much-coveted title of *interne des hôpitaux*.

AN EXHIBITION OF MARINE HYGIENE.—A congress of marine hygiene will be held this summer at Ostend. An international exhibition of marine hygiene and appliances for the saving of life at sea will be held on the occasion under the auspices of the Communal Administration. The King of the Belgians has accepted the title of High Protector of the exhibition. Further information may be obtained from the General Secretary, Rue des Sœurs Blanches, No 18, Ostend.

THE UNIVERSITY OF MOSCOW.—From an official report recently published it appears that the total number of students at the end of 1900 was 4,228, of whom 1,140 belonged to the Faculty of Medicine. The teaching staff of the Faculty consists of 44 professors, with a number of *Privat-docenten*, demonstrators, and prosectors. During 1900 the degree of Doctor was conferred on 10, and the diploma of District Medical Officer on 200 candidates.