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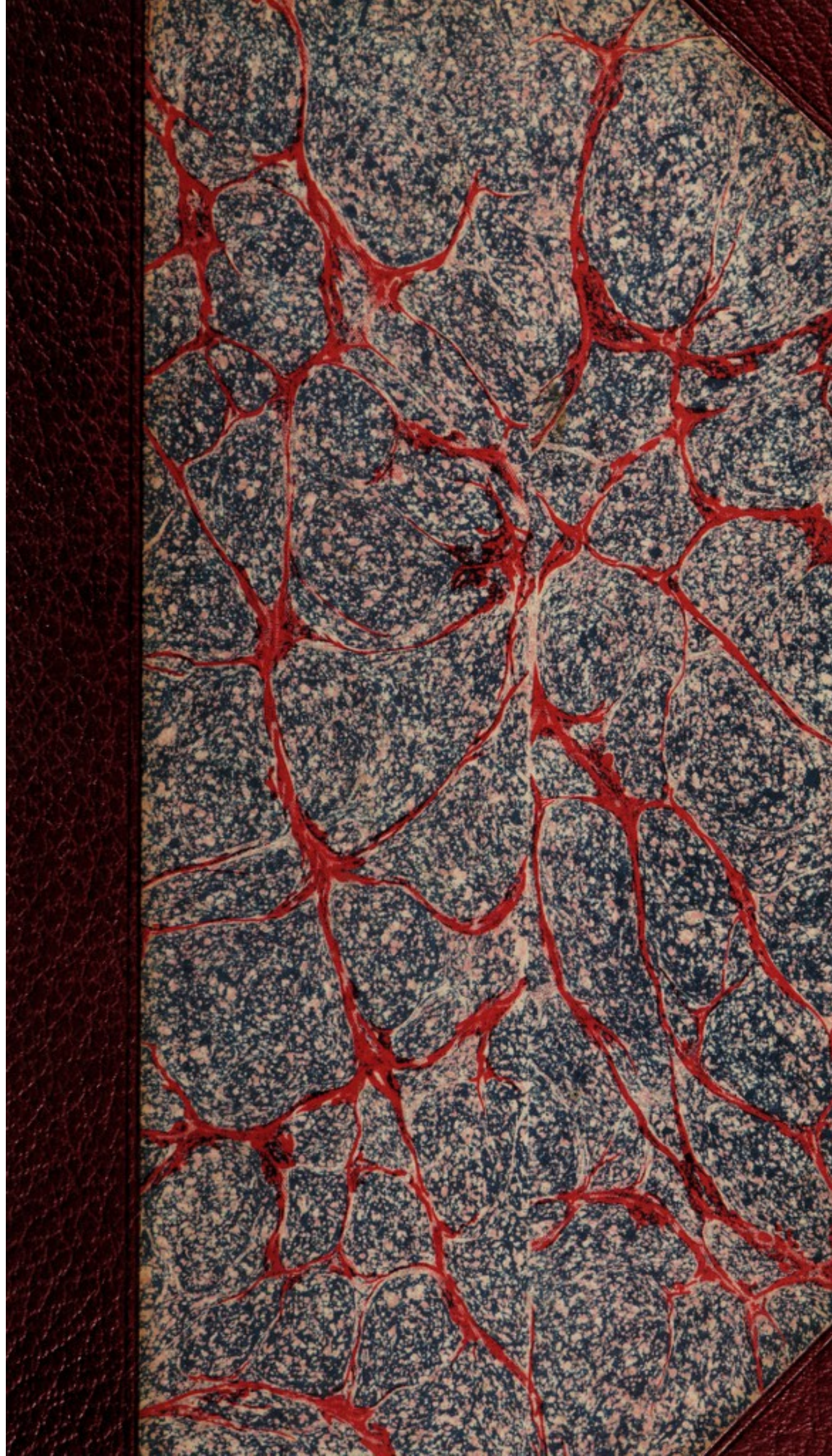
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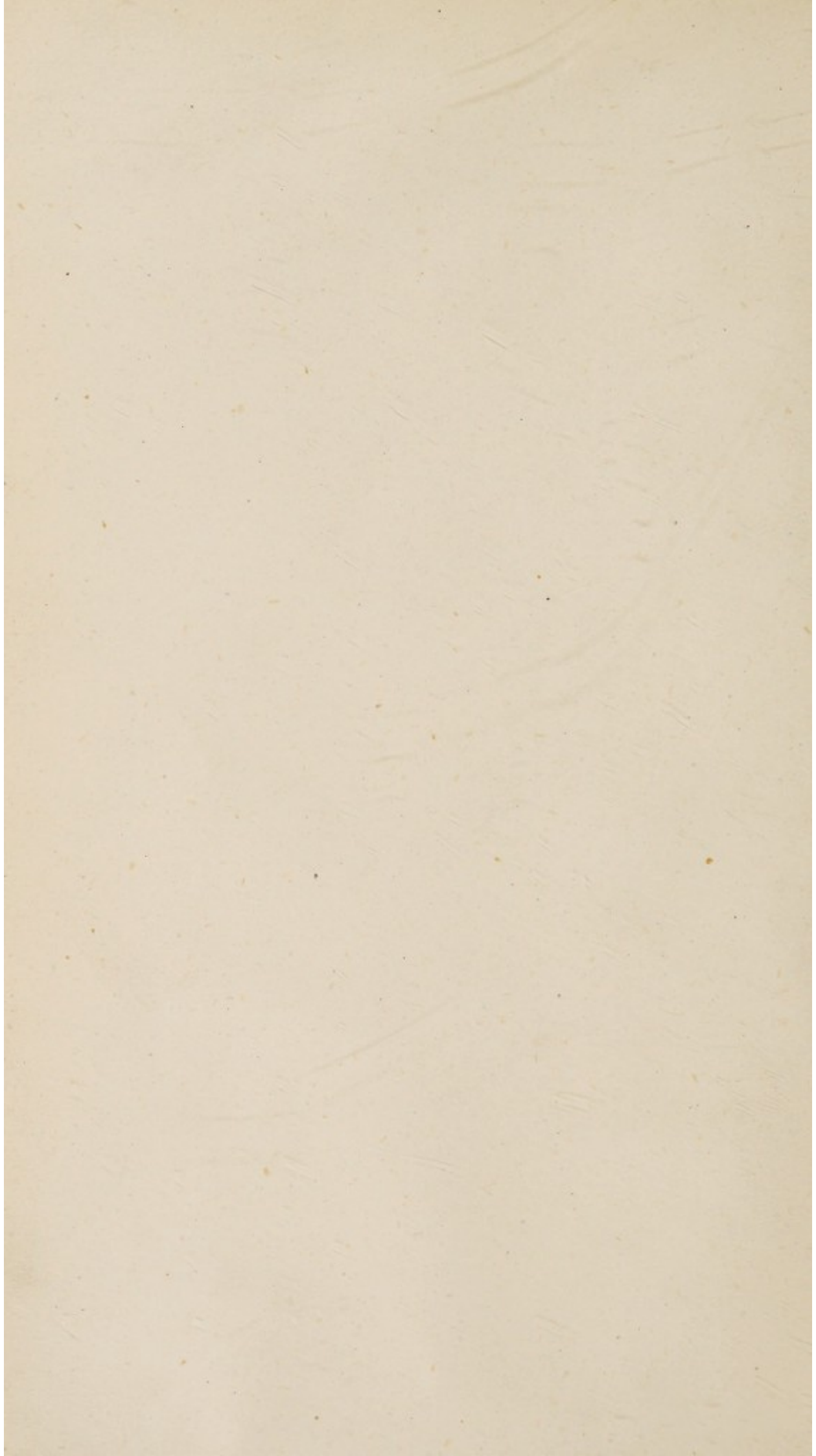


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ANÆSTHESIA IN SURGERY:
DOES IT
INCREASE OR DECREASE THE MORTALITY
ATTENDANT UPON SURGICAL OPERATIONS?

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ANÆSTHESIA IN SURGERY.

“ Why dost thou whet thy knife so earnestly ?

 Shylock must be merciful.

On what compulsion *must* I ? Tell me that.”

Shakspeare's Merchant of Venice.

STATISTICAL INQUIRY INTO THE RESULTS OF ANÆSTHESIA IN AMPUTATIONS.

IN two papers on Etherization in Surgery, published in the *Monthly Journal of Medical Science* for September and November 1847, I took occasion to discuss various points connected with the subject, and more particularly dwelt upon the necessity of having recourse to the evidence of a large collection of statistics as the only proper and legitimate method of determining the fact, whether the previous superinduction of artificial anæsthesia increased, decreased, or altered in any way the mortality attendant upon surgical operations. During the intervening period, various circumstances and engagements have intervened to delay the publication of the following inquiry, the results of which were laid at length before the Medico-Chirurgical Society of Edinburgh in July last.—(See *Monthly Journal* for October 1847, p. 302.) From that time up to November, I continued to receive additional returns, all of which have been embodied in the Tables, pp. 7, 8, and 9.

Shortly after etherization began to be employed in surgery, its alleged beneficial or baneful effects were keenly discussed among the members of the profession ; and principally, or entirely, upon the results of individual or isolated cases. Some eagerly and stoutly doubted, *in toto*, the possibility of making operations painless ; and many who admitted its possibility, denied altogether its propriety, on the alleged ground of its increasing the general subsequent dangers of the patient, inducing a variety of alleged morbid states and lesions, and adding, on the whole, to the fatality of operative surgery.

Amidst the many conflicting and contradictory assertions that were uttered on these points, I became convinced that there was only one method of arriving at the truth, viz., by instituting a statistical investigation upon as large a scale as possible into the results of the practice, and thus ascertaining whether, out of an extensive series of operations performed with and without etherization, the mortality was greater or was less when the patients were operated on in a narcotized and anæsthetic state, than when they were operated on in a waking and æsthetic state.

The first difficulty to be encountered in such an inquiry was the difficulty of obtaining a proper field and standard for the proposed comparison. But *first* of all it was evident that the comparison, whatever it might be, could only be properly instituted between patients operated on in public hospitals, with and without etherization. For we had nowhere published, nor did it seem possible to obtain, any adequate comparative returns of the results of operations from the surgical practice of private practitioners. Besides, hospital returns were preferable in this respect, that there existed on the whole, every where, undoubtedly a far greater uniformity between the hygienic and other collateral circumstances of patients operated on in hospital than in private practice. *Secondly*, however, it was further evident, that in seeking and fixing upon a criterion by which we could compare the statistical results of surgical operations formerly performed without ether, with those now performed upon etherized patients, it was improper and impossible to institute the comparison between *all* operations and reports of operations in hospitals; for the severity and danger of the operations performed in, and reported from, different hospitals, differed immensely in their nature, and consequently in their results. In order, therefore, to obtain the primary requisite for a correct statistical inquiry—of having data of a *similar* kind and character for the proposed testing and comparison—it was necessary to select and contrast the results of some *one* operation without ether, with the results of the same one operation with ether. With this view I selected the larger amputations of the limbs as the fittest field on which to conduct the proposed investigation; and I restricted myself to hospital amputations of the thigh, leg, arm, and fore-arm, on account of their being every where performed in almost the same manner, for the same causes, under the same circumstances, and on the same class of subjects; and because there already existed extensive published researches, by Phillips, Lawrie, and Malgaigne, into their absolute mortality, when performed under ordinary circumstances and without anæsthesia, to aid us in satisfactorily determining the nature of the results of the new practice of operating upon patients in an anæsthetic state.

Having thus fixed upon the mode of inquiry, I proceeded to apply for returns from all the surgical hospitals of Great Britain and Ireland that I could hear of, as likely to have employed etherization in amputations. And I feel it quite impossible to return thanks, in

any adequate terms, for the very great politeness and kindness with which my inquiries were answered on all hands.¹ In some hospitals ether had not been tried, and I was consequently furnished with no data; in others in which it was used, my correspondents were quite at issue about its propriety; many were doubtful; some expressed themselves strongly against it; others strongly for it. But I was principally anxious to obtain the total results, believing that *they* would decide the question far more certainly than any individual experience or individual opinion could. In Table No. I (see p. 7

¹ In my letter of application I stated, that "the effects, whether favourable or unfavourable, of etherization upon the ultimate recoveries of patients from surgical operations, is still a matter of much doubt and uncertainty. We have as yet had no proper collection of data to ascertain whether the mortality of operations has been increased or not by patients being placed under the influence of ether at the period of their performance. In order to determine as far as possible this important point, I have been induced to undertake the statistical investigation of the results of the larger amputations in cases where ether inhalation was employed at the time of operation. Amputations have been selected for this purpose in preference to other operations, because they are, under all common circumstances, nearly and every where alike, and because the general average mortality accompanying most of the greater amputations is already known from the inquiries of Phillips, Lawrie, and others, and thus a ready standard of comparison afforded us. You would, therefore, oblige me by filling up the following table with any results, however few in number, of amputations in which ether was used in your hospital. I especially wish to know *all* the deaths as well as all the recoveries in these operations; and by thus collating, on the whole, a large body of statistical data, I hope to be able to arrive at some interesting general results."

Copy of Form of Table sent.—"Results of Amputations performed upon Patients in an Etherized State in the ——— Hospital."

Seat of Amputation.	<i>Primary or for Injury.</i>		<i>Secondary or for Disease.</i>	
	Total No. of Cases.	Total No. of Deaths.	Total No. of Cases.	Total No. of Deaths.
Amputation of Thigh				
Amputation of Leg				
Amputation of Arm.....				
Amputation of Fore-Arm...				
Total.....				

It may be proper to remark, that in answer to the returns I had the results of twenty-four amputations of the fore-arm sent me, which are not included in the subsequent remarks in the text. Out of these twenty-four amputations ten were primary, with one death, and fourteen secondary, with two deaths. I have omitted them in the text in consequence of finding that Mr Phillips, in his standard of amputations, confines his returns to those of the thigh, leg, and arm, and does not include those of the fore-arm.

and 8), these results are given in a detailed form, with the names of the gentlemen who kindly reported each return to me.¹

GENERAL MORTALITY OF AMPUTATIONS OF THE THIGH, LEG, AND ARM, WITHOUT ETHERIZATION.

Before attempting to determine whether the results in these ether amputations (Table, No. I.) are, or are not favourable to the adoption of Anæsthesia in Surgery, let me in the first place state the results of the previous investigations that have been published by Phillips, Lawrie, and Malgaigne, relating to the mortality of these same amputations, when the same operations were performed without ether. In the year 1837, Mr Benjamin Phillips brought before the Royal Medico-Chirurgical Society of London, a communication² on the results of amputation of the thigh, leg, and arm, in different countries. From the collection of cases which he laid before the society, Mr Phillips concluded that the general mortality of these larger amputations amounted to 23 deaths in the 100 operations. The correctness, however, of his conclusions was called in question by the publishing committee of the society, on the idea that the alleged mortality was too great, and he was recommended to investigate the subject more fully before proceeding to publish his observations. Further inquiry served only to satisfy him that his previous results were understated rather than overstated.

Subsequently, in 1844, Mr Phillips published a table of a still more extensive series of cases.³ This collection, however, includes the results of private as well as of hospital practice. "They are (says Mr Phillips) the whole, so far as I know, of the cases of amputation recorded in the periodical literature of this and other countries during the present century. I by no means (Mr Phillips adds) think that the results furnished by such data will fairly represent the mortality. I believe it will be *understated*, because successful cases are more likely than unsuccessful ones to find their way into print."

The table (No. II. p. 9), extracted from Mr Phillips' second paper, shows in a summary way the results which he obtained from these sources.

¹ In No. 49 of the Table the name of the hospital is not mentioned, as my correspondent unfortunately omitted to date his return. The Paris hospital returns of twenty-two cases (No. 40) are distributed according to the standard of Malgaigne; Dr Burguières, in a note to me, having stated that he was unable to give the exact number of these amputations which were respectively primary and secondary.

² Observations on the Results of Amputations in different Countries. Medical Gazette, Vol. XXII. 1837-8.—P. 457.

³ Medical Gazette, Vol. XXXIII. 1843-44.—P. 804.

TABLE SHOWING, IN DETAIL, THE NUMBER OF INDIVIDUAL AMPUTATIONS AND THEIR RESULTS, IN DIFFERENT HOSPITALS, UPON 302 PATIENTS UNDER ETHERIZATION, *continued*.

No.	Name of Hospital.	Name of Reporter.	Amputation of Thigh.				Amputation of Leg.				Amputation of Arm.				TOTAL CASES.			
			Primary.		Secondary.		Primary.		Secondary.		Primary.		Secondary.		Cases.	Deaths.	Cases.	Deaths.
			Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.				
25	Brought forward,	Mr Hey,	6	5	45	12	14	2	33	4	7	0	12	5	27	7	90	21
26	Leeds Infirmary,	Mr Curling,	1	0	4	0	1	0	1	0	1	0	—	—	1	0	1	0
27	London Hospital,	Mr Haig,	2	1	6	3	3	2	4	1	2	1	1	0	6	3	11	4
28	London, St Bartholomew's Hospital,	Mr Liston & Mr Cadge,	2	1	5	0	—	—	5	1	—	—	1	1	2	1	11	2
29	London, University College Hospital,	Mr Fergusson,	—	—	1	0	—	—	1	0	—	—	—	0	—	—	2	0
30	London, King's College Hospital,	Dr Snow,	—	—	12	2	1	0	7	0	—	—	1	0	—	—	20	2
31	London, St George's Hospital,	Mr Shaw,	—	—	5	0	1	0	1	1	—	—	1	0	1	0	7	1
32	London, Middlesex Hospital,	Mr Avery,	1	0	2	1	—	—	—	—	—	—	1	0	1	0	3	1
33	London, Charing-Cross Hospital,	Dr Bird,	2	0	4	0	—	—	1	0	—	—	1	0	—	—	6	0
34	London, Westminster Hospital,	Mr Paget,	—	—	3	2	—	—	4	3	—	—	2	1	2	0	1	0
35	Leicester Infirmary,	Dr Bainbrigge,	—	—	1	0	—	—	—	—	—	—	—	—	—	—	1	0
36	Liverpool Northern Hospital,	Mr Morris,	—	—	2	1	—	—	—	—	—	—	2	1	2	0	9	6
37	Liverpool Southern Hospital,	Dr Reid,	—	—	3	1	1	0	—	—	1	0	1	0	—	—	2	0
38	Manchester Royal Infirmary,	Mr Greenhow,	—	—	2	1	2	2	2	1	1	0	—	—	3	2	4	2
39	Newcastle Infirmary,	Mr Wright,	—	—	3	0	1	0	1	0	1	1	—	—	2	1	4	0
40	Nottingham General Hospital,	Dr Burguières,	3	2	7	2	3	1	5	2	2	2	2	1	8	4	14	5
41	Paris Hospitals,	Dr McFarlane,	4	2	1	0	3	1	1	0	1	0	—	—	4	1	1	0
42	Perth Infirmary,	Mr Parson,	1	0	3	0	3	1	1	0	—	—	—	—	5	1	4	0
43	Sussex County Hospital,	Mr Turner,	—	—	2	0	—	—	2	0	—	—	—	—	—	—	4	0
44	Staffordshire, North Infirmary,	Mr Jackson,	—	—	3	0	—	—	3	0	—	—	—	0	—	—	7	2
45	Sheffield General Infirmary,	Mr Young,	—	—	4	2	—	—	2	0	—	—	2	—	—	—	7	0
46	Salisbury Infirmary,	Mr Rayner,	—	—	3	0	—	—	2	0	—	—	—	—	—	—	2	0
47	Stockport Infirmary,	Mr Wickham,	—	—	3	0	—	—	4	0	—	—	2	0	—	—	5	0
48	Winchester County Hospital,	Mr Sheppard,	1	1	4	0	1	0	—	—	2	1	—	—	3	2	8	0
49	Worcester Infirmary,	Mr Stocker,	1	0	1	0	—	—	—	—	—	—	—	—	2	0	1	0
	Total,		24	12	121	25	32	9	81	13	17	4	27	8	73	25	229	46

No. II.—*Table of the Mortality of 1369 cases of Amputation of the Thigh, Leg and Arm.*

Seat of Amputation.	PRIMARY.			SECONDARY.		
	No. of Cases.	No. of Deaths.	Per Centage of Deaths.	No. of Cases.	No. of Deaths.	Per Centage of Deaths.
Thigh,	245	176	72	415	87	21
Leg,	204	88	43	231	61	27
Arm,	164	49	29	110	26	24
TOTAL,	613	313	51	756	174	23

In the year 1840, Dr Lawrie of Glasgow published an excellent paper¹ on the results of amputations, with tables showing the rate of mortality from amputation in the Glasgow hospital, from the period of its foundation in 1794 down to 1839. Dr Lawrie's inquiries yielded an average mortality greater than that of Mr Phillips, being as high as 36 per cent. The following table, made from data in Mr Lawrie's paper, contains the results of amputation of the thigh, leg, and arm in the Glasgow hospital.

No. III.—*Table of the Mortality of 242 Amputations of the Thigh, Leg, and Arm in the Glasgow Hospital from 1794 to 1839.*

Seat of Amputation.	PRIMARY.			SECONDARY.		
	No. of Cases.	No. of Deaths.	Per Centage of Deaths.	No. of Cases.	No. of Deaths.	Per Centage of Deaths.
Thigh,	35	27	77	92	19	20
Leg,	27	18	66	35	12	34
Arm,	36	18	50	17	3	17
TOTAL,	98	63	64	144	34	23

In 1842, a valuable series of papers on the statistics of amputations was published by Professor Malgaigne in the *Archives Générales de Médecine*, his data being derived from the reports of the Parisian hospitals. In these papers, Malgaigne enters largely upon the subject of the mortality of amputations. The following table,

¹ On the Results of Amputations. Medical Gazette, Vol. XXVII. 1841, p. 394.

compiled from data in his returns,¹ exhibits a mortality still higher than that of the Glasgow hospital.

No. IV.—*Table of the Mortality of 484 Amputations of the Thigh, Leg, and Arm, in the Parisian Hospitals, from 1836 to 1841.*

Seat of Amputation.	PRIMARY.			SECONDARY.		
	No. of Cases.	No. of Deaths.	Per Centage of Deaths.	No. of Cases.	No. of Deaths.	Per Centage of Deaths.
Thigh,	48	34	70	153	92	60
Leg,	80	51	63	112	55	49
Arm	30	17	56	61	24	39
TOTAL,	158	102	64	326	171	52

These three tables of large collections of cases by Phillips, Lawrie, and Malgaigne, may be properly considered as giving a correct idea of the general mortality of these amputations in hospital practice, and may be used with justice as subjects of comparison with any series of cases similar to them in the whole series of circumstances, except that one whose influence upon the results is to be decided. After, however, I began to collect the results and mortality of the same amputations upon patients in an etherized state from various British and other hospitals, it was objected to the inquiry that it would be unsatisfactory in two respects, viz. that the amputations compared were possibly performed in different classes of hospitals, and at dates so different that I did not consider in my investigation the changes and improvements which might possibly have been introduced into the very methods of operating.

In order, then, at once to enlarge the basis of data for comparison, and to obtain a series of cases still more exactly similar to the collection of ether amputations which I was making, I procured from various British hospitals, through the kindness of different correspondents, and from published data, returns of the latest amputations that had been performed in them immediately previous to the introduction of etherization. These returns are given in detail in the opposite page (p. 11). All of the operations have been performed within the eight years, from 1839 to 1846 inclusive. By having this collection of cases as an additional standard, I hoped to avoid all cavil on the ground of any supposed difference in the time, and other collateral circumstances, in which the compared operations were performed.

The data in the following table, No. V. (p. 11), when condensed into the tabular form, afford the results in table, No. VI. (p. 12.)

¹ Archives Générales de Médecine, Vol. LVIII. 1842, p. 40.

NO. V.—TABLE SHOWING, IN DETAIL, THE RESULTS OF 618 AMPUTATIONS, IN 30 DIFFERENT BRITISH HOSPITALS, IMMEDIATELY BEFORE THE INTRODUCTION OF ETHERIZATION.

No.	Name of Hospital.	Date of the Observations.	Name of Reporter.	Amputation of Thigh.				Amputation of Leg.				Amputation of Arm.				TOTAL CASES.			
				Primary.		Secondary.		Primary.		Secondary.		Primary.		Secondary.		Primary.		Secondary.	
				Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
1	Aberdeen Royal Infirmary,	1841-1846	Dr Macintosh,	5	3	7	2	5	2	15	4	5	0	5	0	15	5	27	6
2	Bristol, St Peter's Hospital,	1844-1846	Dr Rogers,	—	—	3	0	—	—	—	—	—	—	—	—	—	—	3	0
3	Bristol Infirmary,	1845-1846	Mr Morgan,	1	0	17	2	2	0	12	1	3	0	1	0	6	0	30	3
4	Bristol General Hospital,	1846	Mr Mason,	—	—	2	1	—	—	—	—	—	—	—	—	—	—	2	1
5	Berks Royal Hospital,	1840-1845	Mr May,	7	5	5	0	3	0	—	—	1	0	1	0	13	5	6	0
6	Cork Northern Infirmary,	1845-1846	Dr Bullen,	1	0	2	1	—	—	3	0	—	—	—	—	1	0	5	1
7	Cumberland Infirmary,	1845-1846	Mr Page,	—	—	4	1	—	—	2	0	2	0	—	—	2	0	6	1
8	Dumfries Infirmary,	1842-1846	Mr Borthwick,	—	—	6	1	—	—	2	0	1	1	—	—	—	—	9	2
9	Derbyshire General Infirmary,	1845-1846	Mr Fox,	—	—	5	2	—	—	6	0	—	—	—	—	—	—	11	2
10	Dundee Infirmary,	1844-1846	Dr Monro,	1	0	2	0	1	1	4	0	3	0	—	—	5	1	6	0
11	Edinburgh Royal Infirmary,	1840-1845	Dr Peacock,	8	8	35	13	4	3	12	2	5	4	2	1	17	15	49	16
12	Elgin Infirmary,	1844-1846	Dr Paul,	—	—	8	2	1	1	1	0	—	—	—	—	1	1	9	2
13	Glasgow Hospital,	1840-1844	Dr King,	11	10	14	6	14	5	6	1	7	4	—	—	32	19	20	7
14	Glasgow Hospital,	1844-1846	Dr Orr,	10	3	22	8	17	5	13	4	12	3	11	5	39	11	46	17
15	Hull General Infirmary,	1846	Mr Craven,	—	—	2	0	3	0	—	—	2	0	—	—	5	0	2	0
16	Inverness Infirmary,	1845-1846	Dr Manford,	1	1	—	—	—	—	—	—	1	0	—	—	2	1	—	—
17	Ipswich Infirmary,	1845-1846	Dr Durrant,	—	—	6	0	1	0	—	—	3	0	—	—	4	0	6	0
18	London, St Bartholomew's Hos.,	1846	Mr Haig,	2	1	7	2	3	0	4	1	3	0	3	0	8	1	14	3
19	London University College Hos.,	1841-1846	Mr Cadge,	5	3	16	7	1	1	15	2	1	0	7	1	7	4	38	10
20	Leicester Infirmary,	1845-1846	Mr Paget,	2	0	3	1	1	0	4	0	3	0	2	0	6	0	9	1
21	Liverpool Northern Hospital,	1845-1846	Dr Bainbrigge,	5	3	8	4	4	1	6	2	2	0	2	0	11	4	14	6
22	Liverpool Southern Hospital,	1846	Mr Morris,	1	1	—	—	2	1	—	—	—	—	—	—	3	2	1	0
23	Newcastle Infirmary,	1840-1846	Mr Benson,	7	3	10	2	8	2	10	3	10	2	2	0	25	7	22	5
24	Perth Hospital,	—1847	Dr McFarlane,	—	—	13	5	—	—	7	2	—	—	2	1	—	—	22	8
25	Sussex County Hospital,	1844-1846	Mr Parson,	2	2	2	2	2	1	3	0	3	1	1	0	7	4	6	2
26	Salisbury Infirmary,	1845-1846	Mr Young,	2	0	3	0	3	2	3	1	1	0	1	0	6	2	7	1
27	Stockport Infirmary,	1845-1846	Mr Rayner,	2	2	2	0	—	—	1	0	2	0	—	—	4	2	3	0
28	Sheffield Infirmary,	1845-1846	Mr Jackson,	—	—	1	0	3	0	—	—	—	—	—	—	3	0	1	0
29	Worcester Infirmary,	—1846	Mr Sheppard,	—	—	5	0	1	0	3	0	4	2	1	0	5	2	9	0
30	York County Hospital,	1845-1846	Mr Hey,	—	—	1	0	1	1	3	0	2	1	1	1	3	2	5	1
	Total,			73	45	211	62	80	26	135	23	77	17	42	10	230	88	388	95

No. VI.—*Table of the Mortality of 618 Amputations of the Thigh, Leg, and Arm, without Etherization, performed during the last few years in 30 British Hospitals.*

Seat of Amputation.	PRIMARY.			SECONDARY.		
	No. of Cases	No. of Deaths.	Per Centage of Deaths.	No. of Cases.	No. of Deaths.	Per Centage of Deaths.
Thigh,	73	45	63	211	62	29
Leg,	80	26	32	135	23	17
Arm,	77	17	22	42	10	24
TOTAL,	230	88	38	388	95	24

GENERAL MORTALITY OF AMPUTATIONS OF THE THIGH, LEG, AND ARM UPON PATIENTS IN AN ETHERIZED STATE.

In the preceding lengthened Table, No. I. (p. 7), I have given from forty-nine different hospitals the detailed reports of 302 amputations of the thigh, leg, and arm. When these 302 amputations are reduced into a tabular form, similar to those which I have used for stating the data of similar amputations without ether, they present the following results:—

No. VII.—*Table of the Mortality of 302 Amputations of the Thigh, Leg, and Arm, under Etherization.*

Seat of the Amputation.	PRIMARY.			SECONDARY.		
	No. of Cases.	No. of Deaths.	Per Centage of Deaths.	No. of Cases.	No. of Deaths.	Per Centage of Deaths.
Thigh	24	12	50	121	25	20
Leg	32	9	28	81	13	16
Arm	17	4	23	27	8	29
TOTAL	73	25	34	229	46	20

I shall now proceed to contrast these results with the results of the same operations in the same class of hospitals, and when performed upon patients not in an etherized state.

Before doing so, however, let me observe in passing, that the data I have adduced in Tables No. I. and V., have been objected to on the ground that they are collected from too many different hospitals, and too many different sources. But, on the contrary, I believe all our highest statistical authorities will hold that this very circumstance renders them more, instead of less trustworthy. Professor Chomel of Paris, after pointing out the first requisite for a successful statistical

comparison of therapeutic or other results—viz., a sufficient similarity between the number of collated cases—adds, as the second condition, “that the data be numerous, collected at different times, in different places, and, if possible, by several observers. It is easily seen (he adds) that the results of a number of facts too limited, collected in a short space of time, in a single place, and by a single observer, however exact as regards that individual series of data, may yet be very different from, or even the reverse of conclusions drawn from a larger series, and one collected under various circumstances.”¹

COMPARISON OF THE MORTALITY FOLLOWING THE LARGER AMPUTATIONS OF THE LIMBS, 1. WITHOUT, AND 2. WITH ETHERIZATION.

The major amputations of the limbs, including those of the thigh, leg, and arm, are generally fatal in hospital practice in the proportion of about 1 in every 2 or 3 operated upon. In the Parisian hospitals, the fatality, according to Malgaigne, amounts to upwards of 1 in 2. In Glasgow, it is $2\frac{1}{2}$. In British hospitals, I found that under these amputations 1 in $3\frac{1}{2}$ died. The same operations, performed in the same hospitals, and upon the same class of patients, in an anæsthetic state, present a mortality of 23 in 100, or 1 in 4, only. The following table shows the amount of the individual cases, and the per centage of deaths in different collections, with the corresponding proportion of deaths in those operated on in an etherized state.

No. VIII.—*Table of the Mortality of Amputation of the Thigh, Leg, and Arm.*

Reporter.	No. of Cases.	No. of Deaths.	Per Centage of Deaths.
Parisian Hospitals—Malgaigne,...	484	273	57 in 100
Glasgow Hospital—Lawrie,.....	242	97	40 in 100
General Collection—Phillips,.....	1369	487	35 in 100
British Hospitals—Simpson,.....	618	183	29 in 100
<i>Upon Patients in an Etherized } State,.....</i>	302	71	23 in 100

The evidence which the preceding table affords in favour of the greater safety of amputation with ether than without it, is sufficiently strong and striking. While 23 in 100 died under the amputations named, when the operations were performed upon patients in an anæsthetic state; 29 in every 100 died under the same amputations in the same hospitals when the patients were not etherized;—in the Glasgow hospital as many as 40 in 100 died; and in Paris, as many as 57 per cent. In other words, out of every 100 persons submitted to amputations of the thigh, leg, or arm, the lives of 6 were, by the employment of etherization, saved above the average number of the same operations in British hospitals;—17 lives in each 100 were saved, if we take the Glasgow returns as a standard of comparison; the average mortality was, under ether, less by 34 in every 100 cases

¹ Bulletin de l'Acad. Roy. de Médecine. Seance du Mai 2, 1837.

than that which was found by Malgaigne to accompany the same operations in the Parisian hospitals.

But probably, to most minds, this comparison would be rendered more clear and simple, if we took not a class of operations, but a single operation as a standard and medium of comparison. For this purpose, let us select amputation of the thigh as the *individual* operation regarding which we possess the largest series of observations.¹

COMPARISON OF THE MORTALITY FOLLOWING AMPUTATION OF THE THIGH, 1. WITHOUT, AND 2. WITH ETHERIZATION.

There are few or none of the operations deemed justifiable in surgery, that are more fearfully fatal in their results than amputation of the thigh. "The stern evidence (says Mr Syme) of hospital statistics shows, that the average frequency of death is not less than from 60 to 70 per cent;"² or above 1 in every 2 operated on die. Out of 987 cases of amputation of the thigh collated by Mr Phillips, 435 proved fatal; or 44 in every 100 were lost.³ "On referring (observes Mr Curling) to a table of amputations in the hospitals of London, performed from 1837 to 1843, collected with care by a private society to which I have the honour of belonging (the Medical Society of Observation), I find 134 cases of amputation of the thigh and leg, of which 55 were fatal, giving a mortality of 41 per cent."⁴ Out of 201 amputations of the thigh performed in the Parisian hospitals, and reported by Malgaigne, 126 ended fatally. In the Edinburgh Infirmary 21 died out of 43. Dr Lawrie found the mortality attendant upon this operation in the Glasgow hospital to amount to 46 deaths in 127 cases. In the collection of cases from 30 different British hospitals which I have published in table No. V., 284 cases of amputation of the thigh are reported; 107 out of these 284 operations proved fatal. On the contrary, I have collated 145 cases in which the same operation has been performed during the past year in British hospitals upon patients in an etherized state. Out of

¹ One objection may be urged against the comparison of the results of a single operation, with or without etherization, that I am now about to institute, on the ground, viz.—that the number of cases (145) is too limited to afford a result that is perfectly decisive. I am perfectly willing to admit the justice of this remark in a statistical point of view, and to hold this part (and indeed the whole of the present inquiry) as, so far, the commencement and nucleus merely of a more full and lengthened investigation by other hands. At the same time, I have, during the course of the inquiry, had the conviction impressed upon me, that future results will more and more confirm those that I have here stated in the text, and be still more in favour of etherization; for no small number of the operations reported to me were, in the first periods of the new practice, doubtlessly performed upon patients in whom the anæsthesia was by no means entire and complete, in consequence of imperfection in the forms of apparatus, in their management, in the dose given, &c.; and, I believe, that as the profession becomes more accomplished and certain in the use of such measures, the resulting effects will become proportionally happier and more favourable.

² Monthly Journal for May 1845, p. 337. ³ Medical Gazette for 1844, p. 805

⁴ Address to the Hunterian Society of London, 1848, p. 31.

these 145 cases of amputation of the thigh, only 37 proved fatal. Or, in other words, the fatality was not greater than 1 in every 4 operated on when the patients were previously etherized. It was as high as 1 in every 2 or 3 operated upon when the patients were not previously etherized. The following table presents these results in a more clear form:—

No. IX—*Table of the Mortality of Amputation of the Thigh.*

Name of Reporter.	No. of Cases.	No. of Deaths.	Per Centage of Deaths.
Parisian Hospitals—Malgaigne,	201	126	62 in 100
Edinburgh Hospital—Peacock,	43	21	49 in 100
General Collection—Phillips,	987	435	44 in 100
Glasgow Hospital—Lawrie,	127	46	36 in 100
British Hospitals—Simpson,	284	107	38 in 100
<i>Upon Patients in an Etherized State,.....</i> }	145	37	25 in 100

The preceding figures speak in a language much more emphatic than any mere words that I could employ in favour of anæsthesia, not only as a means of preserving surgical patients from pain, but as a means also of preserving them from death. Between even the lowest mortality in the table without ether, 36 in 100, and the rate of mortality with it, 25 in 100, there is the difference of 11 per cent. That is to say, according to this standard, out of every 100 patients submitted to amputation of the thigh without anæsthesia, 11 more would die from the operation than if the same 100 patients were submitted to the same operation in a state of anæsthesia. And if the condition of anæsthesia effects thus a saving of 11 lives in every 100 amputations of the thigh;—then out of every 1000 such operations the lives of 110 patients would be preserved by the use of antipathic means.

If we compare these results with the standard of Mr Phillips, the contrast is still more startling. Out of 987 amputations of the thigh collected by him, 435 proved fatal; or 44 in the 100. Out of 145 amputations of the thigh under anæsthesia, 37 proved fatal, or 25 in the 100. According to this comparison, the amount of persons saved from death in amputation of the thigh by the patients being rendered anæsthetic during the operation, amounts to 19 lives in every 100 operations performed.

In conclusion, let me add, that when etherization first began to be employed in surgical operations, it was eagerly argued that its adoption produced a greater tendency to primary and secondary hemorrhagy, to imperfect union of the wounds, to pneumonia, &c. If my space had permitted, it was my intention to show, from the analysis of the three hundred cases of amputation reported to me, that these various allegations were foundationless and imaginary,¹—that

¹ Some of my correspondents, who expressed the strongest opinions in regard to the reality of these supposed evil consequences, have, I know, now abandoned such opinions as utterly untenable.

such consequences were not so frequent after amputations with ether as after amputations previously performed without it,—that as the casualties were reduced in number, so were also the attendant accidents and complications.¹ But I believe such proof to be at the present day superfluous, as few or none now maintain such opinions. When writing to me as early as in June last on this subject, the late lamented Mr Liston stated what all the subsequent experience of our ablest surgeons here and in London has confirmed. “The ether (says he) produces no bad effect, as far as I can see. There is no change in the blood, nor in the vessels, or muscles. The recoveries are, at least, quite as good as before it was employed.” An excellent surgical pathologist (Mr Curling, surgeon to the London Hospital)² has more recently afforded still stronger testimony to the same effect. “I have carefully watched (says he) the progress of cases, after operations of various kinds performed upon patients in a state of anæsthesia, and I can with confidence declare that, so far as my present experience has reached, the constitutional symptoms have been milder, and the cases have proceeded more satisfactorily, than after operations in which no means had been taken to prevent pain. Several of my surgical friends can fully confirm this statement.”

I have also avoided entering into the theoretical question,—How does anæsthesia render severe operations less fatal and dangerous in their consequences? I have already shown (*Journal* for September, p. 164) that the endurance of severe pain is in itself depressing and destructive; and apparently the anæsthetic state saves the patient from this suffering and its effects; as well as saves him, in some degree, from the shock of the operation and its consequences. When writing, in 1839, on the subjects of pain and shock, and on certain states connected with or produced by wounds or injuries, Professor Burns of Glasgow offered some remarks bearing directly on the present subject, and which are more valuable as they were written without any theory, and without any prospect of such a state as he speaks of being capable of being artificially induced. I shall quote them in his own words:—“The mere lopping off of the member, by the immediate abridgement of the quantity of living body, the instant loss of so large a portion, which was formerly acting along with the system, is productive of serious evil to it, from the sympathy which universally prevails. But if the *nervous system become in part torpid, so as to prevent this sympathy*, or to be incapable of maintaining it, the loss of a member, or what is, in one respect, the same, the loss of its connexion with the system, and its failure in power, and action, and sensibility, may not have the same bad effect.”—*Principles of Surgery*, Vol. I. p. 493.

¹ In my communication to the Medico-Chirurgical Society, in June last, I went over this ground at some length.

² Address to the Hunterian Society of London, 1848, p. 23.

