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A GENERATION OF SURGERY.

BY WILLIAM ANDERSON,
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AN examination of the statistics of a large hospital through a period of twenty-five years, beginning with the rise of antiseptic surgery, cannot fail to give much information as to the progress of our art in its modern aspects. Such a review might of course be elaborated to an almost unlimited extent, but I have thought that the leading facts would be more easily brought within reach by confining the comparison of different years and terms of years to a few headings, and adding a few brief comments where necessary to explain or amplify the figures quoted.

It will be seen that the whole term, from 1873 to 1897 inclusive, comes within the scope of what may be called the antiseptic period. The earlier years were of course years of struggle against old-time habits and prejudices, against imperfect conception of the necessary technique of antisepsis, and especially against superfluous complications of practice which distracted the minds of surgeons from what now appear almost obvious applications of the grand principles. In the first half of our "generation," while the surgeon fortified with strong chemical bactericides every drop of fluid brought into contact with his hands, his instruments, or his patients, while

he performed his operations and dressings under an acrid mist of carbolic or thymol spray, he came into the field of action in a coat especially reserved for the purpose, and often teeming with dangerous organisms, and his assistants were allowed to wear the garments that did duty through all the stages of their daily work or play. The operating theatre, fairly well constructed and of modern date, was kept as clean as its materials and plan allowed ; but special operations, mostly those involving abdominal section, were for a long time relegated to a small and imperfectly ventilated ward, while many other operations of less importance took place in the bath-rooms attached to the main wards. The outcome being disappointing, great and radical reforms were introduced. The surgeon and his immediate assistants went to work with bare arms and protective aprons ; the spray boilers, once deemed so essential that the stoppage of the stream of vapour was held to justify the abandonment of all further antiseptic precautions, suddenly disappeared ; drainage, a forgotten lesson of the mediæval masters of surgery, which had been revived as an article of surgical salvation, sank into disuse when it was found that a perfect asepsis left no injurious exudations to drain. Soon chemical antiseptics began to disappear from the water used in the operation, and from the dressings employed after its conclusion, but were retained for the purification of the hands of the surgeon and his assistants, and for necessary irrigations. Then the portions of the patient's surface near the seat of operation were covered over with sterilised cloths to prevent direct or indirect infection of the wound ; and, lastly, a sterilised gown or overall replaced or supplemented the apron, and became *de rigueur* for every one assisting at the operation, an all-important step which quickly began to bear fruit. In spite of every precaution, however, a certain number of infections still occur, not frequent or dangerous infections like those of old days, but undesirable and discouraging, and a few surgeons are inclining to the belief that their own fingers and those of their aids represent the unwilling vehicle of contagion, the hand disinfection becoming more difficult as the number of operations increase ; for the skin, scrubbed almost daily with hard nail brushes and saturated with chemical solutions,

is apt to rebel and become roughened by detaching epidermic scales, or even reddened by erythematous rashes. A new departure, the latest towards the aseptic ideal, has already begun in Germany, America, and to a small extent in this country,—to shield the wound from danger of epidermic contact by operating in gloves; and it is perhaps in the adaptation of these to the needs of the surgeon that the latest and not the least valuable of our protective resources will be found.

To analyse the headings of our table. The number of surgical beds, excluding those in the special ophthalmic and gynaecological wards,* was 220 in 1873, increasing to 241 in 1879, and to 256 in 1896.

The *number of patients* treated during the year ranged from 1590 or 7 per bed in 1875, to 3700 or 14·4 per bed in 1897. This great increase, almost continuously progressive during the last twenty years, indicates the advancing value of the hospital work, and taken in association with the next item in the table, the reduction of the average stay of each patient from 36·6 to 23·5 days, shows that the surgical necessities of the patient have been relieved with constantly augmenting rapidity. It is true that the greater number passing through the hospital in the year may be in small part explained by the recent increase in the facilities for convalescent accommodation outside the hospital wards, but the fact still remains that the majority are cured more quickly in the later years than in the earlier.

The *general death-rate* in all cases shows like signs of progress. In the first quinquennial period ending 1877 it was 9 per cent., in the last 6·4 per cent., or a saving on the total average of patients during each year in the latter period of eighty-one lives. It must of course be borne in mind that, of the number of deaths occurring in the surgical wards of a hospital, many are unconnected with the question of treatment, since a proportion of cases, varying but not tending to diminish, are brought in beyond hope of relief, and enter the hospital only to die. Thus in 1886 no less than

* The surgery of the special ophthalmic and gynaecological wards is not included in the present summary.

thirty-five of the patients received for severe injuries died on the day of admission before anything could be done to save them, and a like source of possible misinterpretation is present every year in greater or less degree.

The *Injuries* have been separately recorded, as they represent a relatively fixed factor, the number in the first quinquennial term being nearly as great in proportion to the number of beds as in the last, and in the whole of the periods never varying largely. The death-rate of injuries, moreover, shows little change, but fluctuates between 11 per cent. in the first quinquennial period, and 9 per cent. in the fourth and fifth. It is perhaps in these cases that the changes in surgery are least effective, because so many of the fatal cases are placed almost outside the pale of surgery by the severity of the initial damage to the system.

We next come to the total number of *Operations*, and it is evident that the figures must be considered in the broadest possible light, since the operations in question range from what may be called operations of desperation, in which the hope is at best a forlorn one, to operations of expediency, in which the mortality is practically *nil*.

The most striking point in the table perhaps is the enormously great and progressive multiplication of operations during the last twenty-five years, the annual number ranging as it does from 322, or an average of 1.46 per bed, in 1873, to 2153, or 8.4 per bed, in 1897. This more than all shows the great increase in the amount of relief afforded by modern surgery as compared with the surgery of the past. The improvement in the mortality following operations is no less encouraging. In the first quinquennial period, before the technique of antiseptics had matured, the death-rate was no less than 17.6 per cent., while in the last it was reduced to 7.17 per cent., a difference of over 10 per cent.; and the reduction was almost uninterruptedly progressive. It will, of course, be seen that of the operations in recent years many have been operations of expediency which did not figure in the earlier years, and the mortality of which is almost nominal; but, on the other hand, there is an enormous increase in severe and desperate operations, the idea of which was scarcely entertained in the first period, when the annual average of

abdominal sections was only 6, as compared with 150 in 1897. Moreover it must be remembered that even such safe operations as the radical cure of hernia, the removal of tuberculous glands, and the excision of varicose veins, are safe only by reason of modern precautions against septic infections, and have, indeed, only won the confidence of surgeon and patient within the antiseptic period.

The cases of *Erysipelas* are tabulated to show the number arising within the walls of the hospital, and here the figures are far from gratifying, and call for serious consideration. It is true there is a diminution from an average of 45 in the first quinquennial period (or 2.54 per cent. of all the surgical cases admitted) to an average of 22 (0.66 per cent.) in the last; but the numbers have been fluctuating in the interval, and even our lowest figure, 17 cases in 1897, must be regarded as very unsatisfactory. The same may be said for our record of cases of *Pyæmia* developed in the wards. Here again the year's average of the last quinquennial period, 4.6, is a great reduction when compared with the 15.6 of the first period, but it is still too high.

The next section of the table offers a few selected groups of operations to guide our estimate of surgical progress and results. These might of course have been dealt with in a much more elaborate way, but the lesson to be derived from their study would perhaps have been less forcibly impressed.

The first on the list consists of *Amputations*. It is almost a belief amongst surgeons that amputations are becoming the rarest of operations, but our figures do not show this, since against a total yearly average of 54 for 220 beds in the first quinquennial period, we have an average of 55 for 247 beds in the last quinquennial period. There is, however, a great proportionate decrease in relation to the whole number of operations (from 15.47 per cent. to 3.25 per cent.).

The number of amputations for *injury* vary year by year, but the general average is not notably changed. The moderate reduction in the last five or six years may or may not mean that a certain number of limbs have been rescued from the extreme surgical resource by modern conservative treatment. That many individual cases are so delivered is

undoubted, but it is impossible to say how far these affect the statistics. The mortality, on the other hand, has diminished very materially since the first quinquennial period, when it was no less than 33·3 per cent. ; but it is somewhat curious that the best period was from 1883 to 1887, when the deaths were reduced to 8·12 per cent. ; and that they have risen to 14·56 per cent. since that time in face of the great improvement in all other directions in the later years. The explanation may be that there are good years and bad years in the admission of severe accidents, and that much larger statistics than ours would be required to minimise this source of variation ; but possibly it means that amputation is reserved for more severe cases than formerly, and that many injuries that would have been dealt with by amputation some years ago are now treated by less radical measures.

The amputations for *disease* have also fluctuated in number year by year, and it cannot be said that they have shown much sign of diminution, but the mortality is decidedly lowered, although here again the figures of the last ten years are somewhat higher than those of the ten years before, 1878 to 1887, perhaps for the reason just suggested with regard to amputations for injury.

Amputations of the breast have increased in number from an annual average of 14 in the first quinquennial period to 40 in the last. How far this may indicate an increase in cancer it is impossible to say, but there is no doubt that it points to a steadily increasing confidence on the part of the public in the resources of the surgeon ; and that this confidence has been fairly earned is shown by the fact that against a mortality of 7 to 8 per cent. in the first ten years we find it now a little under 4 per cent., although the modern operations are of a far more extensive and radical kind than those practised in the earlier years. Our records show that the removal of the diseased lymphatic glands in carcinoma mammæ, never attempted in the first eight years of our surgical generation, rose into favour somewhat slowly, and did not become the rule until 1891, since which date it has been omitted only in exceptional cases and for special reasons. In future years the reward of our new-born thoroughness will be accurately measured by statistics based upon pro-

longed observations of large numbers of cases, and there is every reason to believe it will be found a rich one.

Our next heading, that of *Abdominal Sections* involving the opening of the peritoneal cavity through the abdominal wall, is perhaps the one of greatest interest. In looking at our table we see how slowly the surgeon overcame his dread of interfering with the peritoneum, and how well justified that dread was by the high mortality of the early years, amounting to no less than 72 per cent. in the small total of 29 operations, all ovariectomies, performed during the first quinquennial period from 1873 to 1877. In the second period, from 1878 to 1883, the number rose to 85, while the death-rate fell to the still excessive proportion of 53 per cent. ; and the list of operations embraced such more advanced procedures as excision of the pylorus, gastrostomy, and removal of uterine fibroids. Some progress was made in the third period from 1883 to 1887, when the number rose to 123, and the percentage of deaths fell to 40·6, while the sphere of operative enterprise was greatly widened, including many gastric, enteric, and uterine and other operations, and two successful cases of suture of ruptured bladder. In the next period the numbers rose slightly, and the mortality rose also ; but in the last period, from 1893 to 1897, during which the technique of antiseptic and aseptic precautions underwent great development, the total number of cases reached 500, with a mortality of 33 per cent., and included almost every known form of abdominal surgery outside those of the special gynæcological department (not comprised in our table). This mortality is still high, but many of the operations were almost heroic measures, and on closer examination it will be found that few of the deaths were attributable to the operation itself, while in many of the cases ultimately fatal the immediate effect of the surgical intervention had been one of relief to suffering, and of some extension of the term of life. In the Reports of next year I hope to offer an analysis of this section for the last quinquennial period.

The table of *Renal Operations* speaks for itself. The first nephrectomy was performed in 1882, with a fatal result. In the five years from 1883 to 1887 the total only reaches the small figure of 11, with a mortality of over 36 per cent.

In the next period the number rose to 29, and the death-rate fell to 24 per cent.; while in the last five years, to 1897, the number was 51, the mortality remaining nearly the same (23·5 per cent.).

The heading of *Lumbar Colotomy* is introduced chiefly to show that there is an absolute increase in the number of operations in the last period, 1893 to 1897, as compared with the first two periods, 1873 to 1882, notwithstanding that the ground occupied by this method of opening the intestine is now disputed by abdominal colotomy, and that both forms are superseded in many cases by the more radical plan of excision of the disease. The mortality, very high down to 1887, has since fallen to 27 per cent. The abdominal colotomies are at present included with the other abdominal sections.

The tables of *Perinæal* and *Supra-pubic Lithotomy* require little comment. The latter operation does not appear on our record till 1886, while the former practically disappears in the last quinquennial period.

The operations for *strangulated hernia* will be seen to have risen in number from an annual average of 20 in the first period to 50 in the last, the increase being probably due in greater part to the disuse of prolonged taxis and other measures devised in former times to avoid the risk of a cutting operation. The mortality has fallen from 50 per cent. in the first period to 20·7 per cent. in the last, an improvement which may be partly assigned to better antiseptic methods, and partly to the avoidance of delays in undertaking the operation. In the last fifteen years a radical cure has formed an almost invariable part of the operation.

The *radical cure of non-strangulated hernia* begins in 1882, if we omit from consideration the occasional adoption of now abandoned methods. In the periods from 1883 to 1887 the total number of operations for this purpose amount only to 29, with a death-rate of 13·8 per cent. In the last period, from 1893 to 1897, the total has reached the noble proportions of 696, and the mortality has sunk to 1·86 per cent.

The last three headings, *Operations for Varicose Veins* and *Varicocele*, and the *Excision of Tuberculous Glands*, show a

great increase in recent years. In the first decade the vein operations were few in number, and mostly by ligature. Excision prevailed in the third quinquennial period, and numbers increased, although the yearly average for varicose veins was then only 8.4, and that for varicocele only 14. In the fourth and last periods the yearly numbers have steadily advanced, reaching in 1897, 80 for varicose veins, and 83 for varicocele, the latter number including, however, a proportion of subcutaneous ligatures. The excision of tuberculous glands may be considered to have begun in 1882, but the operations were very few until 1890. In the last quinquennial period they reached an annual average of 73, the mortality throughout being nominal (0.27 per cent. from 1893 to 1897). It is remarkable that these operations, although often very extensive, necessitating prolonged dissections, frequently dealing with parts already infected with pyogenic organisms, and performed upon patients of weakly physique, have been amongst the most successful in surgery.

Many other recent developments of our art might have been included in this table, such as brain surgery, ear surgery, the surgery of the spinal cord and of the thorax, and the suture of fractured patellæ and olecranon, but it did not seem desirable to extend the list too far. The figures, stated as they are without reservation, speak well for the modern progress of surgery, and show that that progress is mainly attributable to our growing comprehension of the surgical significance of bacteriological research. They show also that there is still much to do; but although we may never hope to reach finality in surgery, we are making rapid strides in the best direction.

In conclusion I must not omit to thank my colleagues, Mr. Croft, Mr. Makins, and Mr. Abbott, for valuable assistance in tracing the progress of antiseptic details during the periods under consideration.

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Summary of Surgical Reports from 1873 to 1897 (Cases in Ophthalmic and Gynecological Wards Excluded).

	1873	1874	1875	1876	1877	Per cent. general period.	1878	1879	1880	1881	1882	Second general period.	1883	1884	1885	1886	1887	Third general period.	1888	1889	1890	1891	1892	Fourth general period.	1893	1894	1895	1896	1897	Fifth general period.		
Number of surgical beds	220	220	220	220	220	220	220	241	241	241	241	235	241	241	241	241	241	241	241	241	241	241	241	241	241	241	241	241	241	241	247	
Number of patients treated throughout	1846	1758	1590	1745	1801	1706	1850	1908	2237	2094	2200	2058	2272	2370	2248	2380	2337	2323	2337	2228	2231	2412	2700	2383	2916	3142	3305	3447	3700	3314		
Average duration of stay in days	43.3	34	35	35.5	35.4	34.6	36	40	32	37	30.3	35	30.9	35.5	30.4	30.7	33.0	30.48	33.91	31.6	29.5	29.12	29.12	30.45	25.25	23	27.7	22.6	20	25.1		
Death-rate % in all cases	9.18	9.5	10.4	7.74	8.56	9.07%	7.78	6.4	6.0	6.9	7.54	6.92%	7.74	7	7.3	7.3	7.41	7.35%	7.5	7.21	6.4	7.2	8.24	7.31%	7.13	6.01	5.79	7.11	6.03	6.41%		
Number of injuries	558	587	570	635	712	612	528	615	805	911	837	754	861	918	929	680	819	819	838	700	740	809	779	794	932	901	816	772	787	842		
Death-rate % of injuries	9.67	12.26	13.15	9.45	11.8	11.20%	13.68	9.43	7.51	7.79	7.58	9.0%	9.17	7.3	7.85	7.11	7.82	7.85%	9.18	9.96	6.98	9.14	9.88	9%	9.22	8.43	8.09	11.14	9.63	9.9%		
Total number of operations	322	332	291	380	419	369	431	531	589	665	618	575	637	470	622	755	812	671	686	769	791	975	1108	866	1250	1376	1718	1947	2153	1680		
Death-rate % of operations	18.95	20.78	22.34	12.36	13.06	17.6%	17.87	8.00	9.01	9.77	11.50	10.55%	9.9	6.80	7.87	9.93	9.48	8.8%	10.5	8.66	19.4	8	8.21	8.14%	7.92	6.39	6.75	7.8	7	7.12%		
Cases of erysipelas arising in the hospital	51	75	40	21	39	45	14	41	38	35	30	33	92	65	31	20	51	52	41	22	16	14	20	23	33	17	23	21	17	22		
Cases of pyemia arising in the hospital	16	13	15	12	22	15.6	8	6	...	2	5	4.2	7	7	7	6	3	6	5	3	...	...	5	2.6	5	4	3	5	6	4.6
SPECIAL GROUPS OF OPERATIONS.																																
Amputations for injury	19	24	24	35	26	28	16	24	42	59	32	33	29	46	29	39	26	32	27	30	21	31	15	27	25	25	11	16	26	21		
Amputations for disease	15	29	27	29	32	26	25	31	25	32	48	32	39	42	35	66	42	41	30	29	22	53	42	33	33	28	40	33	38	31		
Breast amputations	11	10	9	13	28	14	16	21	30	34	25	25	23	25	23	29	27	25	35	32	31	27	31	31	35	34	42	47	43	40		
Excisions and arthroplasties of large joints	39	27	36	34	34	34	56	48	37	21	29	37	14	39	37	36	34	27	39	56	31	43	62	41	77	68	85	63	74	48		
Abdominal sections of all kinds involving peritoneal cavity (herniotomies excepted)	7	8	5	6	3	6	13	10	21	14	27	17	23	24	29	27	29	24.5	15	37	24	26	33	27	36	53	102	154	155	109		
Renal operations	1	2	1	...	1	4	5	
Uterine extirpation	1	3	3	2	1	1.8	2	...	3	5	2	2.4	3	6	5	5	7	
Cases of perineal lithotomy	2	7	6	7	3	5	6	6	6	2	2	4.4	8	4	2	2	3	
Cases of supra-pubic lithotomy
Operations for strangulated hernia	14	16	23	16	30	20	24	20	28	33	26	26.2	31	29	27	35	26	37	33	45	24	37	52	39	43	51	58	49	47	50		
Operations for radical cure of some strangulated hernia	
Operations for varicose veins	4	2	10	1	5	4.1	3	3	1	2	3	2.4	8	4	5	11	15	8.4	9	11	26	37	41	25	57	67	42	49	80	61		
Operations for varicocele	8	2	6	2	3	4	4	2	2	1	5	2.8	9	12	16	17	15	14	20	18	34	32	46	30	48	46	72	69	83	64		
Excision of tuberculous glands	...	...	...	...	...	...	...	...	...	...	0	1.2	5	...	...	5	9	3.8	4	13	29	50	39	27	44	51	80	115	73	72

Chiefly carbolic oil dressings. Hand sprays of carbolic solution for dressings and operations. Operations performed in coats reserved for the purpose; assistants in ordinary attire. Hands washed in carbolic acid solution.

Pure Listerian treatment with carbolic lotion and gauze. Operations and dressings under spray. Drainage in nearly all cases. Hands and instruments washed in carbolic acid solution. Operating coats still worn, sometimes supplemented by washable slippers.

Operating coats dressed by some surgeons, but still retained by others until nearly the end of this period. Operations under carbolic acid beyond spray. Carbolic acid usually used as an antiseptic lotion. Iodoform gauze and salicylic wool (the latter largely employed); much iodoform powder. Drainage generally used. Dressings brought down from wards in open baskets.

Macintosh aprons worn by surgeons and house surgeons during the whole of this term; dresses in shift dresses. Drainage-tubes practically disused from about 1890. Spray discontinued suddenly in the same year, both for operations and dressings. All operations in theatre from 1889; before this many operations were performed in the bath-rooms, and abdominal operations in a special small ward. Perchloride of mercury was used for hands and irrigations from about 1886 in place of carbolic acid, and double cyanide dressings were introduced about the same time.

General antiseptic precautions continued, but with increasing attention to technique. Theatres remodelled 1893. Instrument man (a porter) then replaced by theatre sisters. Instruments boiled every time of use and kept on glass shelves. Scrubber introduced, and aseptic dressings and methods began in the same year. Agents used by all engaged in operations, except anaesthetists; iodoform for surgeons and parts of the patient's surface adjacent to the seat of operation covered with sterilized cloths. Sterilized covers for surgeons, dresses, anaesthetists, and all others and nurses in theatre introduced after the end of this period—in 1898.

