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LECTURES ON AMPUTATION,

AND ON THE

Nature, Progress, and Terminations of the Injuries for which it is required.

(Delivered at Sydenham Coll. Med. School.)

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LECTURE XI.

Mortality of primary amputations. Influence of favourable or unfavourable external circumstances upon the results. Comparative mortality of primary, intermediary, and secondary amputations, under different circumstances. Average mortality in 664 primary and 654 secondary amputations for gunshot wounds. Comparison between the results of amputations in military and in civil hospitals, for their different classes of injuries. Result of amputations for chronic disease. Deductions from this view, and conclusions founded upon the series of facts herein stated.

Diseased Actions supervening on Primary Amputation under Favourable, Partially Unfavourable, and Unfavourable External and Collateral Circumstances.

IN the two last lectures I gave the results, and the leading facts connected with them, of the most fatal set of amputations I have had an opportunity of studying. To follow out the subject in a more general sense, as regards the results of primary amputation, and the modifications induced by the varying nature of external circumstances, I must beg attention to the three tables now laid before you—or rather two—for I have added the cases treated under *partially* unfavourable circumstances to those more unfavourably situated.

The distinction made in these tables between those cases amputated on the field and in hospital will be adverted to hereafter; for the present, it is necessary to consider them as one class. There is a total of 57 primary amputations for consideration; in three-fifths of which the operations were performed, and the cases treated, under circumstances more or less unfavourable. 17 of the latter class were of the March series, performed under no very unfavourable physical circumstances, but under depressing and highly-deleterious dynamic influences; to which, almost exclusively, those fatal effects, as I endeavoured to show you, might be attributed—as 15 of that number died, if we would now ascertain how far physical circumstances influence the result where there is no predominating moral or dynamic cause prevailing—we must separate the 17 from the 36 treated under more or less unfavourable circumstances, and consider the mortality and diseased actions supervening on the remaining 19: of which number 10 died—1 in 1.9; about 52 per cent.

10 *deaths occurred in* 19 *cases of primary amputation, performed under more or less unfavourable external circumstances.*

2 Died of cholera prevailing at the period.
  1 Arm, with wound of hip.
  1 Partial amputation of hand.
1 Tetanus (case of thigh torn off by cannon-shot).
3 Irritative fever (2 of thigh, 1 of arm).
1 Hectic, with severe wound of thigh above point of amputation.
1 Bilio-remittent fever, diseased stump (arm).
2 Febrile type not ascertained (shoulder and arm).

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10

These are the causes, chiefly as shown by the symptoms, for the records of the post-mortem examinations in many are either wanting or imperfect.

Many of these amputations, performed by myself, and other gentlemen of the medical staff, at the hospitals under my direction in Oporto, were treated under circumstances peculiarly harassing to the medical officer. The hospital crowded; cholera and a malignant fever, remittent and typhoid in character, generally prevailing.

The circumstances then were highly unpropitious, and the mortality is certainly great in proportion. Somewhat more than half—we may take as the average loss when

the physical and external circumstances are very unfavourable—but even when these are only moderately or temporarily unfavourable, if there be superadded dynamic and moral deleterious influences, then nearly the whole perish—15 out of 17, as we have already seen, or seven-eighths of the whole, die. If we glance at the review already given of all the circumstances attending the 500 wounded of the March series, it will be evident that no other adequate causes of a physical character existed to produce such a mortality.

In corroboration of this, let us turn to the 6 cases treated under partially unfavourable circumstances: the cases amputated of the 16th of March series were scarcely more unfavourably situated as regarded any physical circumstances, and yet the former gives only a mortality of one-sixth instead of seven-eighths. It may be observed, that 3 of the 6 were cannon-shot injuries—1 of the amputations of the thigh and 2 of the shoulder-joint.

Two of these cases were not only temporarily accommodated in a field hospital, hastily and very imperfectly organised, but in the second week transported from Irun to San Sebastian. But these 6 were all wounded after signal victories, and without much previous exposure to bad weather and distressing duty.

If we consider the character of the diseased actions causing the mortality, and compare those supervening on the March series of 15 with those carrying off 10, when physical unfavourable circumstances alone prevailed, or at least largely predominated, we are struck by *the difference in the proportion of the bilio-remittent fever:* in March, two-thirds of the whole died from it: in the 10 deaths, on the contrary, only 1, or one-tenth: here, too, there is no note of metastatic abscesses—purulent depôts or diseases of the viscera, affections largely predominating in the March cases—in all with 2 exceptions: tetanus removed 1 of the 10, and did not supervene in any of the 15 fatal cases. Cholera prevailing in the town, also carried off 2 of the 10.

Thus the difference observable in the nature of the supervening actions causing death, is not less remarkable than the difference in mortality; both circumstances pointing clearly to some predominating influence in the one not existing in the other—that influence was one of vital character—moral and dynamic—totally independent of the mode of operation—system of treatment, or any physical and more material circumstances to which attention is usually and chiefly directed, and hitherto almost exclusively considered, as accounting for any differences in the progress and results of amputations. The conclusion is inevitable, thus founded upon a large number of facts and observations, and most important; viz., *That there are two classes of causes materially influencing the development and character of diseased actions supervening in primary amputations,* and consequently the mortality of such operations: the one moral and dynamic by far the most fatal and difficult to combat, subtile in its characters, not easy to trace even in the progress of its actions, and for which medicine or surgical art can provide no remedy, rarely succeeding even in temporarily arresting its progress, or modifying its results. The second are physical, more obvious in character, depending upon many appreciable circumstances—the mode of operation, the time, the medical treatment, the diet, air and other circumstances—which scarcely need enumeration; for it is precisely to these, as obvious influences, that attention is usually and exclusively paid in forming a prognosis, and deciding upon the therapeutic and surgical measures to be adopted: whereas these should bear a direct relation to both classes of influences, and moral and dynamic powers be brought to bear upon each case, combating, by contrary characters and tendencies, all that is deleterious. For reasons connected with this class of causes, amputations, under such influences, must ever be more fatal in hospitals than in private life, where every act of kindness and whisper of hope—every tie of affection binding man to his kindred and to life itself for their sake, when often not for his own, are most valuable aids to recovery, and directly tend to diminish the mortality after operation.

We have now to consider the influence of favourable circumstances, or rather the nature and progress of the supervening actions under such conditions—what is the relative mortality and its causes.

In 21 amputations contained in the annexed table, performed either on the field or in hospital within twenty-four hours, 4 died; 1 in 5: 3 were of the thigh, and 1 of the arm. The causes of death were as follows:—

3 of the thigh out of 9 primarily amputated; 1 in 3.

1 Fractured femur; irritative fever; no organic or recent disease, *although bone denuded near extremity; the stump was healthily united, in nearly its whole extent.*

1 Tibia into knee-joint; febrile action only occasionally, very moderate, and of no definite type; extensive necrosis involving whole of femur; appetite good, and slept at night, twenty-four hours before his death; hepatisation; adhesions and vomicæ of lungs; liver greatly enlarged; mesenteric glands diseased.

1 Tibia; *bilio-remittent fever;* phlebitis; pus in saphena vein, as far as its junction with the femoral, and in that vein also; liver pale, other viscera healthy; abscess along the course of artery and vein.

1 Arm; hand crushed and comminuted by grape-shot; great local inflammation;

tenderness and swelling up to shoulder; sloughy stump; coats of artery and vein thickened; clot in vein to axilla; no particular morbid appearances elsewhere; but a large collection of pus (and no other evidence of disease) in left knee-joint.

Let me remark here, that while we saw affections of the viscera, purulent depôts, &c. largely predominating in the March series, they did not appear at all in the second set of cases. Here, again, we have them thus:—

In 15	cases of primary amputation, under predominating, deleterious, dynamic, and moral influences, and temporarily unfavourable external or physical circumstances, purulent depôts, and affections of viscera, took place in.....	13
In 10	cases treated under unfavourable, physical, collateral circumstances	0
In 4	cases under favourable, physical, and collateral circumstances	3
29		16

From this statement it may be fairly concluded, that the mere physical and external conditions under which primary amputation is performed, and subsequently treated, *exercise little or no direct influence upon the development of this peculiar class of complications, supervening after amputation;* and, moreover, that they are probably dependent upon a dynamic order of causes, acting chiefly through the nervous system, some change possibly taking place in the character, quantity, and force of the *vis nervosa,* directed to particular organs or parts of the body. This, of course, I give only as a conjecture, which may seem, in some degree, justified by the facts—the latter being distinct—important, and offering valuable matter for consideration.

The mortality in the 21 cases, 1 in 5.2, seems more considerable than it has generally been stated to be in similar cases under similar circumstances; but, first, we have to observe, that 13 of these amputations were either of the thigh, or at the shoulder-joint; and that although in 9 of the thigh 3 died, or one-third, that in the remaining 12, in which are included 4 at the shoulder-joint and 4 cannon-shot injuries, only 1 died—a rate of mortality exceedingly low.

The result, such as it is, certainly is not equal to some averages that have been put forth, while it is greater than others; those performed after the battle of Thoulouse, for instance. I can only give and vouch for the accuracy of the facts which have fallen under my own observation; at the same time that I can also vouch for all these amputations, with one exception, having been performed *secundum artem,* and the majority on young and healthy men, without unnecessary delay, and with a moderate loss of venous blood, and scarcely any arterial, during operation. That in addition, there was the most anxious care devoted to the after-treatment, for which there were all necessary means and appliances; and the patients were placed in an airy, large, and well-organised hospital. Thus, it is difficult to conceive amputations, under any circumstances, on service, more favourably situated for recovery.

I have never seen greater success. On my return to the Peninsula, in 1835, the first 8 amputations I performed, both secondary and primary, all recovered; and 2 of the former, were cases of fractured femur, and the patients in an almost hopeless state. After this several of my amputations died in succession, although apparently more favourable cases for recovery than some of the more successful series; and thus, whether in my own operations, or those of others under my observation, I have ever seen the results to be. The average recoveries in any series of cases above 20 in number, has not been greater than 5 out of 6, or 6 out of 7, when there has been a fair proportion of lower extremities. In the series under consideration, although only 1 died in 12 (exclusive of amputation of the thigh), yet when these are added, the success is reduced below the average I have stated, and the mortality is 1 in 5.2.

Having now very conscientiously given the results of my own experience on this subject, it may be interesting and instructive to compare it with the results of the next most recent experience in amputations for gunshot wounds—such as the results in the action of Navarino—the "glorious days" of July—when the patients were placed indubitably under most favourable circumstances, with all that the skill of the best French surgeons could accomplish for their cure; and any other series that may be attainable. Lastly, a comparison must be instituted between the result of amputations for the injuries of civil life, performed and treated in civil hospitals; all of which cases must also be considered as under the most favourable circumstances. If we commence with the more remote series of amputations first, we find from the records of the American, Egyptian, and Peninsular wars, occurring at the close of the last and beginning of the present century, extending through a period of some five-and-twenty years, that the following were the chief results bequeathed by the respective medical staffs for the guidance of the profession:—

Mr. Guthrie gives a return of the amputations (exclusive of the shoulder-joint), performed during the period of six months, occupied by the transit of the British army from Portugal to Bayonne, and collected by Sir James M'Gregor.

Operations on the field, 291; died 24. 160 remained "under cure;" but these are considered (perhaps not without liability to error) to be recovered. There is a mortality,

then, of only 1 in 12; the mortality in the lower extremities, it is true, is more—1 in 6¾; 19 in 128; 66 remaining under cure.

In subsequent amputations, equally exclusive of shoulder-joint cases, in 551 cases there were 265 deaths, with 116 still under cure; giving a mortality of very nearly one-half, independent of any deaths that might occur during the remainder of the treatment.

As regards the *secondary* amputations, this is nearly the result (a little less favourable) which I have recorded from the hospitals under my direction in the same country. In my returns, however, I included shoulder-joint cases. Thus, in 51 amputations performed after the first 48 hours, 26 died.

If, however, I were to select those which, as I shall point out hereafter, ought alone to be termed *secondary* amputations (implying, as the term is held to do, a period of selection), then in 25 cases the mortality was 9; a fraction beyond a third, 2.7.

M. Percy reports that, after the action of Newbourg, he performed 92 primary amputations, and 86 were cured; the mortality not amounting to 1 in 15: the proportion of upper extremities not stated.

Of 60 wounded, who underwent primary amputation after the naval action of Jan. 1, 1794, only 8 died; 1 in 7.5.

After the battle of Thoulouse, Mr. Guthrie again reports, and to the accuracy of this series I would attach more faith, since Mr. G. could not have the power of vouching for the perfect accuracy of the larger series already quoted, that of 48 primary amputations, 10 died; which brings the mortality down to 1 in 4.8. Only 7 of the 48 were of the arm, the rest thigh and leg: how many of the former is not stated.

The secondary operations give for result 21 deaths in 52; 1 in 1.5; between one-half and one-third: the superior extremity giving a mortality of one-fifth, and the thigh of one-half.

At the attack of New Orleans, in 45 primary amputations, 7 died; 1 in 6.4: in 7 secondary, 5 died; 1 in 1.4.

M. del Signore, a surgeon of the Egyptian army, tells us, that of the wounded resulting from the battle of Navarino, in 31 primary amputations he lost only 1; and in 38 amputated during the twelve following days (all therefore *intermediary*) he lost 13, or one-third only.

In the revolution of 1831, it is reported by M. Velpeau, that about ("*environ*") 100 amputations were performed at 10 civil hospitals in Paris; that the primary were nearly all successful; the secondary fatal in the majority: a statement which, if valued by the definite and precise data furnished, will be found to be worth nothing, unless conclusions be drawn from it, and it might then become worse than useless, and prove mischievous.

Dr. Burke, in an official report, states, that in 80 primary amputations performed at Bhurtpore, in Upper India, all recovered!

Several Collected Returns of the Results of Amputations in Egypt, America, France, and the Peninsula, in the Wars which took place in Different Armies and Ships from 1780 *to* 1840.

From what Battles resulting, and by whom Reported.	Primary.	Died.	Average Mortality.	Secondary.	Died	Average Mortality.	
Baron Percy, at Newbourg.....	92	6	15.3				
Baron Larrey	14	2	7.				
New Orleans	45	7	6.4	7	5	1.2	
Naval Action of June 1, 1794	60	8	7.5				
After the Battle of Aboukir.....	11	0	..	3	3	1.	
Battle of Camperdown; Dr. Wright, flag-ship Venerable :—							
Upper Extremity	7	..					
Lower do., 3 double amputations	8	..					
Various Ships: — Bombardment of Algiers :—							
Upper Extremity 2.5	28	7	4.	2	2	1.	
Lower ditto	29	15	1.9				
British Peninsular Army, in 6 months :							
Upper Extremity 12.1	163	5	32.6	296	116	2.5	2.0
Lower ditto	128	19	6.7	255	149	1.7	
Thoulouse—Mr. Guthrie's Report :—							
Upper Extremity 4.8	7	1	7.	16	4	4.	2.4
Lower ditto	41	9	4.5	37	18	2.0	
Navarino—M. de Signore.....	31	1	31.	38	13	2.8	
	664	80	8.3	654	310	2.1	

From the table of many complete series, we see how great may be the variation between one series and another. The average mortality on the whole primary amputations is 1 in 8.3; in secondary amputations, 1 in 2.1. If the upper extremities be taken singly, the disproportion is still greater, for then the mortality in primary amputations is only 1 in 15.7; whereas in secondary it is still nearly as great as before—1 in 2.5. The lower extremities, taken singly, approach more nearly to each other in mortality; in primary amputations, it is 1 in 4.7; in secondary, 1 in 1.7: thus the value of primary amputations is shown to be less as applied to the lower than to the upper extremity. The lowest average loss in any one of these distinct series of primary operations is 1 in 31, or about 3 per cent., that of M. del Signore's; the next, Baron Percy's series, 1 in 15, between 6 and 7 per cent.; the next, the Peninsular army, 1 in 12, between 8 and 9 per cent; several series at 1 in 6 or 7, about 16 per cent; while the greatest mortality is in the series from the bombardment of Algiers, where it is to be presumed the great majority were cannon-shot injuries, the mortality is 1 in 2.5, or 38 per cent. The greatest mortality after this is in the series of Thoulouse, 1 in 4.8, or 20.8 per cent. The mortality in secondary amputations varies from 34 per cent., that being the lowest average: thus the lowest average mortality of secondary amputations just reaches the highest from primary, in these series. If from gunshot injuries we proceed to the injuries of civil life, and, finally, to the diseases for which amputation is performed, we shall find amputation no longer presents the same results. The materials for comparison, unfortunately, are not equally abundant, and civil surgeons would seem to take less interest in the question connected with such operations. Drs. Norris and Hayward, of the Pennsylvania and Massachusets Hospitals, have led the way to a careful registry of operations, and I sincerely trust that it may become more general in our large institutions; and in the "Medical Gazette" of Dec. 4, 1840, Dr. Laurie, of Glasgow, has made excellent use of the materials at his disposal; although these, unfortunately, are not in the perfect and complete form necessary to ensure accuracy in the results.

M. Gendrin, in 1835, in his thesis, gave the result of 60 amputations in Paris.

		Died.	Mortality.
24	For chronic disease...	9...	1 in 2.6
11	Secondary amputations for injuries of civil life	7...	1 in 1.5
8	Primary amputations for ditto	7...	1 in 1.1
43		23	1 in 1.8

20 Amputations performed in hospital in 1834, on children for chronic affections —all recovered.

In the Annales of Heidelberg, 1834, tome i., partie i., there is a statistical detail of the Clinique de Chelius, comprehending all the operations performed in the space of four years, from 1830 to 1834.

In 29 amputations of superior or inferior extremities, 2 only died, 1 in 14.5.

In the Parisian hospitals generally, the estimated mortality on their amputations, as it has been stated by various persons who devoted some attention to the subject, is from one-half to one-third.

Dupuytren, in his "Leçons Orales," vol. iv., gives 29 cases, and a mortality of 1 in 3.

Roux gives the same result without stating numbers.

Hypolite Larrey—"*Sanson de la Reunion des Plaies*"—gives 57; mortality 1 in 6.

"Dubois Memoires et Observations sur la Reunion," gives 28; mortality 1 in 9.

But I turn to the most interesting, and, at the same time, the most complete series of facts furnished during the last few years, namely, those published by Drs. Norris and Hayward, of Boston and Philadelphia. These tables include *the whole of the amputations* performed in each hospital during a series of years, the cases obviously placed under the most favourable circumstances.

In the table of injuries, it will be seen I have contrasted the results of several series of the amputations, at certain different periods, performed in the military hospitals under my direction in Portugal and Spain, where 55 died in 109.* But as the only fair comparison between the mortality of amputations after gunshot wounds and after the injuries of civil life, is to place both under similar external and collateral circumstances; and the latter being placed under the most favourable circumstances for efficient and successful treatment, I have subjoined a second series of numbers, showing the relative mortality in cases treated under favourable conditions in a military hospital. The total result then stands thus:—In 54 cases (exclusive of partial amputations of hands and feet) 15 died, giving a mortality of 1 in 3.6. The result thus appears nearly the same in the civil and military hospitals, the latter having the advantage by a fraction. According to this table, it may be observed that the mortality in amputations after injuries is nearly double that which took place after operation for chronic disease. Dr. Laurie gives as the comparative mortality of primary amputations and those for disease in the infirmary at Glasgow, in primary, 1 to 1; for disease, 1 to 2.75.

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* See Table V., p. 435.

AMPUTATIONS FOR INJURIES IN CIVIL HOSPITALS.

Primary.

	Deaths.	Relative Mortality.	
12 of thigh.....	7.....	1 in 1.7	Lower extremity, 1 in 3.2
14 of leg.....	1.....	1 in 14.	
7 arm and shoulder..	3.....	1 in 2.3	Upper extremity, 1 in 5.6
10 forearm.....	0.....	0 ..	
43	11	1 in 3.9	

Intermediary.

Dr. Hayward's return alone enabling these to be distinguished.

4 thigh.....	3.....	1.3
7 leg.....	4.....	1.7
Upper extremity....	0.....	0
11	7	1 in 1.5

Secondary.

6 thigh.....	0.....	0
8 leg.....	4.....	1 in 2.
5 arm.....	0.....	0
6 forearm.....	1.....	1 in 6.
25	5	1 in 5.

AMPUTATIONS FOR DISEASES.

28 thigh.....	5.....	5.6
20 leg.....	3.....	6.6
10 upper extremity...	0.....	0
58	8	1 in 7.2

137 total of amputations in the two civil hospitals ; died, 31.—Mortality, 1 in 4.4.

	Primary.				Secondary.			
	No.	Died.	Mortality.		No.	Died.	Mortality.	
Mr. Guthrie's series, at Thoulouse :—								
Upper Extremity	7	1	·7.	9.5	16	4	1 in 4.	4.6
Mr. Alcock's series in Spain and Portugal ditto	12	1	12.		12	2	6.	
Mr. Guthrie's at Thoulouse :—								
Lower Extremity	41	9	4.5	4.7	37	18	2.	2.
Mr. Alcock's ditto.....	21	4	5.2		21	10	2.1	
	81	15	5.4		86	34	2.5	
Messrs. Hayward and Norris's Amputations for Injuries received into Civil Hospitals :—								
Upper Extremity	17	3	5.6		11	1	11.	
Lower ditto	26	8	3.2		25	11	2.2	
	43	11	3.9		36	12	3.	
Messrs. Hayward and Norris's Amputations for Chronic Disease :								
Upper Extremity	10	..	..					
Lower ditto	48	8	6.					
	58	8	7.2					

But the result in the hospitals under my charge is much below the average success, as relates to primary amputations (though greater in the secondary), than that of the table of collected returns of several actions already shown to you. If we take the whole number of primary and secondary as representing a fair average, even of cases treated under the most favourable circumstances, then compared with amputations for injuries in civil life in which the mortality is 1 in 3.4, with those in war, in which it is 3.3, there is only a minute fractional difference. This, however, may not be quite just; for although looking to the different series, and observing in nearly all the highly-favourable results of their primary amputations, I doubt not the majority have been treated under advantageous circumstances, yet some may not have been so situated; and, moreover, the proportionate numbers of secondary and primary amputations should be alike. The statistical results of amputations also depend so much, first, upon the relative proportion of secondary, intermediary, and primary amputations; and, secondly, of upper and lower extremity; that where all are classed under one head *a great source of fallacy may exist.*

If we may assume these two civil hospitals, however, to give a fair average for the operations and injuries of civil life, and Mr. Guthrie's at Thoulouse, or my own series, as an equally fair ratio in military life where cases are not under peculiarly disadvantageous circumstances, we have all the means of comparison at hand.

I do not feel authorised in giving Dr. Laurie's series as a fair standard, for the reason, that he expressly states some of the journals of cases from which the whole have been selected are altogether wanting. I have already explained how fatal to the accuracy of any average must be the omission of a single case; how much more an indefinite and unknown number! The incompleteness of the materials is the more to be regretted from the accurate spirit of analysis which distinguishes Dr. Laurie's paper, and the abundance of valuable detail accompanying his facts. Had his materials been equal in value to the ability and philosophic mode of handling them, Dr. Laurie's paper would unquestionably have been the most valuable yet published on the subject of amputations—their results and effects.

I would premise, before drawing inferences from the facts stated, that as I have taken neither extreme in the "collection of returns," but selected the series at Thoulouse, which, under all the circumstances, gives the best guarantee of accuracy, together with sufficient information connected with them; and, finally, my own, when no very unfavourable circumstances were existing, in which a medium result is also shown, though somewhat more favourable than that of the series at Thoulouse; we have the means fairly chosen for arriving at a very close approximation to the truth in relation to the *comparative results of amputation in civil and military hospital practice.*

To what conclusions do the facts brought forward in the last analytical and numerical statement naturally and legitimately lead? I believe they will be found to be not less novel than important.

Civil Hospitals.

1. Amputations for chronic disease are more successful than primary for injuries, by as large a proportion as 1 death in 7.2 compared with 1 in 3.9.

2. In a still greater degree are they more successful than the secondary amputations (including intermediary) for injuries, the relative mortality being as 1 in 7.2 to 1 in 3.

Thus in civil hospitals the success resulting from amputations is stated in the following order:—1. Amputations for chronic disease. 2. Primary amputations for injury. 3. Secondary amputations.

Comparing these with the results of amputation in military hospitals, when no peculiarly disadvantageous conditions interfere with the progress of the cases, although inevitably some must exist not experienced in civil life, we find, as a total result, that primary amputations are not so fatal in military hospitals, the difference being as 1 in 5.4 compared with 1 in 3.9; and although both upper and lower extremities amputated for gunshot injuries present a favourable difference, yet is this most signal in the upper extremity, 1 in 9.5, and 1 in 5.6, being the relative proportion of mortality in military and civil hospitals; while in the lower extremity, 1 in 4.7, and 1 in 3.2, express the difference. Yet when amputations are performed for chronic disease, the balance is turned in favour of the civil hospitals, these only lose in total result 1 in 7.2, or 1 in 6. in the lower extremity, and no death in 10 of the upper; whereas the mortality in the military hospitals for gunshot injuries, as above stated, is 1 in 5.4; a superiority which seems, so far as the number allow us to judge, about equal in both upper and lower extremities. Secondary amputations in military hospitals are less successful than in civil, the difference being as 1 in 2.5 to 1 in 3: of course they fall far below the successful results of amputations for chronic disease, which give a mortality of only 1 in 7.2.

It is remarkable that in military hospitals in each of the series taken as affording a fair standard, the amputations of the lower extremity are one-half more fatal than the upper, whether primary or secondary, in relation merely to the extremity operated upon; while, again, in both upper and lower the secondary are about one-half more fatal than the primary. This law or average seems no longer to hold, however, if we pass on to the amputations for injuries in civil life. The

disproportion between the success of the upper and lower extremity is by no means so great in primary amputations, being only as 5.6 to 3.2; and in secondary amputations it is much greater, being as 11 to 2.2. Again, there is not the same relative proportion between the primary and secondary amputations taken as a whole, instead of a difference of 5.4 to 2.5 in civil hospitals, it is reduced to 1 in 3.9, and 1 in 3.

It is difficult to resist such evidence, so distinctly proving that while secondary amputations are more favourable in civil than military hospitals, the primary are much less so. Into the causes of this difference I must not enter here, but defer it for another lecture. Dr. Laurie's statistics, so far as we may venture to take the result strongly, confirm a similar view.

By all that has been published on the subject, I am led to believe that the amputations of all classes in the Parisian hospitals have a much higher average mortality. In the 43, however, given by M. Gendrin, it is worthy of remark, that great as is the mortality, it is least in the amputations for chronic disease, the *primary* being the most fatal.

We have seen that primary amputations in military hospitals, where they seem indubitably most successful, under unfavourable circumstances, will give a mortality of one-half; and if to these more general and physical conditions a moral or dynamic influence of a deleterious character be superadded, 88 per cent. may perish; while a general average success in civil hospitals is very low. *Primary amputation, therefore, is an operation under which the system becomes highly susceptible of supervening actions fatal to life.*

The proportionate mortality in fractures, under similar circumstances, undergoing treatment, and not amputated, treated in the hospitals under my charge during one year, was 13 in 43, or 1 in 3.3; of secondary amputations, 13 in 15, or 1 in 1.1. In fractures not amputated under such circumstances the mortality is least; but it must be remembered that this number represents only the most favourable cases, the whole of the amputations having been performed on those who probably, without an exception, would have died if left to take their course.

Dr. Laurie states, on the result of 40 compound fractures of civil life, where no amputation was performed, that 17 died, a mortality of 1 in 1.3, less than half; and he shows that when the attempt to save fails, secondary are less fatal than primary amputations; thus again reversing the results of military hospitals.

The small number saved under unfavourable circumstances, especially with the addition of depressing and deleterious dynamic influences, after both primary and secondary amputations, does not, it seems to me, lead legitimately to the conclusion, as Dr. Laurie would infer, *that more would be saved* if no amputation were performed; but it shows forcibly how little we have reasonably to hope under such adverse circumstances, *when the shock of an operation has to be superadded to the worst kinds of injuries.*

I hold this statement to be the more important, that surgeons, whether in public or private life, are less likely to be disposed to publish a series of cases with unfortunate results, however the circumstances of the cases may exonerate them from any blame or discredit.

I am much inclined to believe that a very erroneous idea is generally entertained in consequence, *as to the degree of success generally to be expected after amputation,* and especially after primary amputations. As the surgeons who have written since Bilguer, Le Conte, and Faure, have had it at heart to prove the dangers of *delay*, we have been favoured with very full information on the mortality of secondary amputations; nay, the *usual* loss has been by this means greatly exaggerated. But has there been the same zeal, in furnishing series of primary amputations for publication, to select those that gave results strongly contradicting the current of general opinion? Have we not rather been eagerly furnished with extraordinarily successful series? while, when a contrary result has taken place, it has been attributed to some peculiar influence or cause, by which such results could not be deemed to bear *justly* upon the question of success in primary amputations, and the series, therefore, not brought forward!

I am led to this conclusion, because, although the very question of the superiority of deferred amputation was only entertained because the *primary* were *so notoriously fatal,* yet since that period when Bilguer, Le Faure, and others wrote, we have seen nothing but series after series of the most astonishing success, and not one where the results contradicted the prevailing opinions!

And still further am I confirmed in this impression, by seeing a general feeling of doubt pervading men's minds as to the reality of a success, and of the relative rates of mortality between primary and secondary, so long held to be established.

The papers of Messrs. Hayward and Norris, in America; M. Gendrin and others in France; Dr. Laurie, of Glasgow; are but the indications of a general opinion, that practice continued through a succession of years, *does not bear out the very flourishing statistics* so long current, and so generally received, as to bear down all opposition, and for a time even to silence doubt, and its offspring inquiry.

Throughout the series of cases which have occurred under my own observation, when the circumstances have been highly unfavourable, the consequences have seemed to *fall more heavily on the primary than the secondary,* not only reducing the favourable balance

which may be generally observed, but actually giving the advantage to the secondary, while the intermediate amputations perish entirely. Thus, under unfavourable circumstances—

In 30 primary.... 24 died....1 in 1.2
In 13 intermediary 13 .....1 to 1.
In 4 secondary .. 3 .....1 to 1.2

The true secondary and the primary are thus equal in the mortality—the whole of the intermediary were lost. If we take the result of all amputations subsequent to the first twenty-four hours, then the primary obtains a trifling advantage, and not otherwise.

The proportion is very different under favourable conditions—

In 21 primary .... 4 died, or 1 in 5.2
In 20 secondary .. 6 ..... 1 in 3.3
In 13 intermediary 5 ..... 1 in 2.6

The important conclusion, therefore, to which I feel authorised in calling your attention, is, that in proportion as the circumstances are favourable, is the preponderance of success in primary over all subsequent amputations, but that as these become highly unfavourable that preponderance is less ; and the secondary are even occasionally less fatal—the intermediary being the most so.

You are aware that since John Hunter's time it has been laboriously and perseveringly argued, that the body is in the best state for an amputation, the nearer the subject may be to a state of rude health. Admitting this were true, which is more than doubtful, the advocates of such doctrine jump to the conclusion that a man is nearer a state favourable to the endurance of the shock of an operation, immediately after the first shock of an injury, than at any other more distant period. For my part, I think it would be difficult to find a patient in a state more remote from health, or his system less capable of any vigorous healthy action, than immediately after the shock, moral and physical, supervening upon a gunshot wound crushing and splintering through the bone of a limb, disturbing the equilibrium of the circulation—altering the direction, the character, and quantity or energy of the nervous influence conveyed to all the more important organs, certainly more or less disturbing the functions of all.

If the statements to which I allude did not involve some grievous error, how is it that in two civil hospitals, with every opportunity of bringing the relative value of operations to a fair test, unbiassed by changing or unfavourable external conditions, so much larger a proportion of amputations should recover in amputations for chronic disease, than when performed immediately after the receipt of an injury? nay, that those performed for injuries at a period of selection, when inflammation and fever (the immediate products of the shock) have subsided, should still present a more favourable result? Yet by reference to No. V. it will be seen the relative proportionate mortality, as enumerated, stands thus (taking into account some intermediary amputations in one of the series, probably included under the head secondary amputations) for chronic disease, 1 in 7.2; secondary, 1 in 5.0 ; primary, 1 in 3.9.

It is true, that under ordinary circumstances on military service, primary amputations are more successful than secondary ; but why? The diseased actions from gunshot injuries shatter the powers and irritate the system to such a degree, exposed, as the cases are, to many unfavourable conditions, *as fractures* (to which patients are not exposed in civil hospitals), many of which conditions or causes of death are escaped in their worst form by the *removal of the shattered limb* ; then the diseased condition developed in particular organs, or throughout the system, is often such as to place a patient in a *still worse* condition, at any more remote period, for the shock of an operation, and subsequent reparative processes, than immediately after the first shock of the injury. Less of this takes place in civil life, and therefore the differences between the results of the two, as observed in military hospitals, is often not only materially diminished in civil life, but the balance turned on the other side. And the average success of amputations for chronic disease is more favourable than any amputation for injury, because the system suffers, and has only to struggle against the *consequences of one shock instead of two.* The approximation of two shocks near to each other is a great evil, and a source of imminent danger; and considering for the moment merely the result and effect of amputation, there is less of danger from it when the period intervening is increased; but in such intervening time we cannot guarantee the patient against the development of actions either fatal, or leading to a state still more unfavourable to any healthy reparative process than when the injury is first received.

It is impossible, with these facts before us, to deny that primary amputations prove, by their results, that the body is *not in* the best state for successful issue immediately after the first shock of an injury; and that those who have laboured under chronic disease, if the constitution has not entirely given way, are, upon the whole, better able to endure the shock of amputation—that at all events the shock of the operation, quickly added to that of the injury, is *more fatal to life* than the shock of an amputation upon a state of chronic disease. This granted, it is easy to understand how cases selected from those patients who survive beyond the inflammatory stage, without serious organic lesion, or continued destructive febrile action (*and many such cases there are*), do actually present a more favourable condition for the success of amputation, than those operated upon within the first twenty-four hours of the receipt of a violent injury.

No. XVI.—*Primary Amputations on the Field and in Hospital under Favourable Circumstances.*

Site and Cause of Injury.	On Field.			In Hospital.			General Result.			Mortality.
	Cured.	Died.	Total.	Cured.	Died.	Total.	Cured.	Died.	Total.	
Knee .... Cannon	1	..	1	..	..	..	1	..	1	9—3,1 in 3
Knee .... Musket	2	1	3	1	..	1	3	1	4	
Femur .....Musket	2	1	3	..	..	..	2	1	3	
Tibia and Fibula..Musket..	1	..	1	..	1	1	1	1	2	
Shoulder.. Cannon	1	..	1	..	..	..	1	..	1	12.
Shoulder.. Musket	3	..	3	..	..	..	3	..	3	
Elbow .... Cannon	1	..	1	..	..	..	1	..	1	
Elbow .... Musket	2	..	2	..	..	..	2	..	2	
Humerus.. Cannon	1	..	1	..	..	..	1	..	1	
Humerus.. Musket	2	..	2	..	..	..	2	..	2	
Radius and Ulna..Cannon..	..	1	1	..	..	..	..	1	1	
Total	16	3	19	1	1	2	17	4	21	5.2
Total unfavourable	3	12	15	3	12	15	6	24	30	1.2
Ditto partially unfavourable.	4	1	5	1	..	1	5	1	6	6.
GENERAL TOTAL	23	16	39	5	13	18	28	29	57	1.9

No. XVII.—*Results of Primary Amputations—On the Field (within 8 Hours); in Hospital from 8 to 48 Hours.*—External Circumstances Unfavourable.

Site and Nature of Injury.	On Field.			In Hospital.			General Results of both.			
	Cured.	Died.	Total.	Cured.	Died.	Total.	Cured.	Died.	Total.	
Knee .....Musket..	..	1	1	1	2	3	1	3	4	1.1
Femur .....Cannon..	..	1	1	..	..	..	..	1	1	
Femur .....Musket..	..	2	2	..	..	..	..	2	2	
Ankle .....Cannon..	..	1	1	..	..	..	..	1	1	1.2
Tibia and Fibula.....Musket..	..	..	..	..	4	4	..	4	4	
Humerus .....Musket..	1	2	3	2	4	6	3	6	9	
Shoulder .....Musket..	1	..	1	..	1	1	1	1	2	
Elbow .....Musket..	..	4	4	..	..	..	..	4	4	
Wrist .....Cannon..	..	1	1	..	..	..	..	1	1	
Radius and Ulna.....Musket..	1	..	1	..	1	1	1	1	2	
Total.....	3	12	15	3	12	15	6	24	30	1.2
External Circumstances Partially Unfavourable.										
Femur .....Cannon..	..	1	1	..	..	..	..	1	1	
Ankle .....Cannon..	..	..	..	1	..	1	1	..	1	
Tibia and Fibula .....Musket..	1	..	1	..	..	..	1	..	1	
Shoulder ..... Cannon..	1	..	1	..	..	..	1	..	1	
Shoulder ..... Musket..	2	..	2	..	..	..	2	..	2	
	4	1	5	1	..	1	5	1	6	6.
Total.....	7	13	20	4	12	16	11	25	36	1.4

All that can possibly be urged, if we would reason fairly upon the facts, is this, that, although the quick supervention of two shocks to the system produces a highly deleterious action, unfavourable to the success of any operation, yet when the consequences of the first shock of the injury are allowed time fully to develop their action, where a shattered limb also exists, to irritate and exhaust all the powers and external circumstances, as in military service, are more or less unfavourable, a still worse state is often the result, independent of the many deaths which follow before the first violence of such actions subsides. Therefore, by primary amputation, is there much saving of life; and in military hospitals a greater amount of success is obtained than after the febrile and inflammatory actions have subsided, although not usually so great as we observe in amputations performed for chronic disease, where the inflammatory disposition is less, and only one shock is experienced, that of the operation.

REMARKS ON APOPLECTIC AFFECTIONS.

By William Mac Intyre, M.D.

(Continued from p. 186.)

Of all the causes which immediately determine the apoplectic attack, in its sudden and strong form, the most common, undoubtedly, is *extravasation of blood*. This is generally associated with, and, often, dependent on the diseased conditions of the membranes, and the state of vascular turgescence already noticed. Meningeal hæmorrhage is sometimes found to take place from the superficial vessels, forming a layer of greater or less extent on the surface of the hemispheres; sometimes from the vessels of the choroid plexus, in which case the coagulum will be met with in the ventricles. It is not always possible to trace it to its precise origin; but in the more extensive extravasations, its source may be detected in rupture or ulceration of one of the principal arteries, veins, or sinuses.

More frequently, however, the hæmorrhage is the result of some previous disease, either of the vessels themselves, or of the proper substance of the brain. The morbid alteration of the structure of the vessels has been long known to be owing to a deposition of bony or earthy matter between the coats of the arteries, depriving them of their distensile property, and rendering them easily lacerable. To this condition of the vessels, usually the result of advanced years, and to consequent imperfect circulation, Dr. Abercrombie and others are disposed to attribute *ramollissement*, or *softening* of the brain, when it occurs in the old and feeble. This peculiar degeneration or conversion of a portion of the cerebral structure into a soft pulpy mass, devoid of cohesion, is often met with in connection with apoplectic effusions, of which it is probably the frequent source, those parts most liable to this morbid change—namely the hemispheres, corpora striata and optic thalami—being the most usual seats of the extravasation. The blood effused in such cases may remain confined in a distinct cavity, or, when proceeding from the rupture o a considerable vessel, may find its way by laceration of the cerebral texture to the surface of the hemispheres, the base of the cranium, or into the ventricles. When a disruption of the brain to this extent takes place the effect is usually overwhelming, and the attack speedily mortal; while it would appear that when the extravasation is of a more limited extent, the disease is less strongly marked, slower in its progress, and attended or followed by paralytic symptoms, but, in general, eventually fatal; and, after death, we find the effused blood in the state of coagulum lodged in a defined cavity and partially absorbed.

The existence of the apoplectic clot and cell was known to the older writers on morbid anatomy; and they were described and delineated by Dr. Bailie in his celebrated work, and afterwards by Dr. Hooper in his "Morbid Anatomy of the Human Brain." In the "Sepulchretum,"* Bonetus relates, in his diffuse but not uninteresting way, the case of a carpenter's wife, aged 47, who recovered, under active treatment, from an attack of the strong apoplexy, and, after the lapse of five years, was seized with a second which proved speedily fatal. On opening the head, there were found considerable vascular congestion, and recent sanguineous extravasation to a great amount into the ventricles and into the substance of the right thalamus opticus, with manifest evidences of previous disease of the brain and its vessels. In searching for the cause of the first attack, by carefully slicing away the brain, Bonetus came upon a half-closed cell or small cavern (cavernulam conniventem) situated in the posterior part of the right hemisphere, over the lateral ventricle. It was difficultly cut into, of an oblong shape, and capable of holding a nutmeg, but contained only a small quantity of clear fluid. A second cavity was cut into in the side of the same hemisphere, also containing a little serum; and under the corpus striatum a third was discovered, the walls of which were agglutinated, but easily separated. All of them, as well as the neighbouring cerebral tissue, were of a dark brown or yellowish colour, of membranaceous consistence and with difficulty divided—the callosity and cicatrisation appearing to have been

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* Lib. I., sect. 2, obs. 12, de apoplexia post quinquennium recurrente fortissima a sanguine extravasata.