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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.)

By RUTHERFORD ALCOCK, K.C.T., &c.

LECTURE XIX.

Relative periods of healing in the stumps, formed by the flap operation and by circular incision. Inferences from the facts. On the relative frequency of phlebitis and purulent depôts in the two operations. Conclusions founded on the comparison. Influence of short-cut ligatures, and of the application of torsion to the arteries. Observations on the objects to be kept in view in the putting up of stumps, and the means best adapted to attain them. On delayed dressing of stumps.

I HAVE but few additional observations to offer in reference to the influence and comparative value of union by first intention, and consecutively; but in order to conclude the parallel between the operation by flap and by circular incision, and prior to summing up the relative advantages and disadvantages of the two modes of operating, I will lay before you some facts, showing the period of healing in the stumps formed by each method.

ABSTRACT SHOWING AVERAGE PERIODS OF HEALING.

Primary Amputations.

In military hospitals:—

	Average Periods. Days.
Circular.	
Thigh	113
Leg	87
Shoulder-joint	41
Arm	105
Forearm	62
Average of the whole, 91 days.	
Flap.	
Thigh	153
Shoulder-joint	56
Arm	60
Average of the whole, 84½ days.	

No. 938.

Civil hospital, large proportion by circular incision:—

Flap.

Thigh	87
Leg	55
Shoulder-joint	32½
Average of the whole, 63 days.	

Intermediary Amputations.

Military hospital:—

Circular.

Thigh	108
Leg	60
Arm	93
Average of the whole, 101 days.	

Civil hospital, large proportion circular:—

Thigh	100
Leg	67½
Average of the whole, 78 days.	

Secondary Amputations.

Military hospital:—

Circular.

Thigh	88
Leg	69
Arm	72
Forearm	145
Average of the whole, 90 days.	

Flap.

Thigh	69
Leg	56
Average of the whole, 65 days.	

Civil hospital, large proportion circular:—

Thigh	104
Leg	54
Arm	18
Average of the whole, 70 days.	

Civil Hospitals, Amputations for Disease.

Thigh	50
Leg	53½
Arm	39
Forearm	14
Average of the whole, 48 days.	

The relative periods are given according to the site of amputations in military hospitals, in reference to the flap and circular operations. The results of circular operations for injuries and disease is also shown in civil hospitals; the facts for the latter being furnished by Dr. Hayward's "Statistics of Amputations," performed in the Massachusetts General Hospital from its establishment, and

therefore forming a complete series. The period of discharge is only given, but it is presumed that this is about the date of cure. The longest average period we find to be 101 days, and this in the *intermediary circular operations* of military hospitals; and the lowest is in the amputations *in the civil hospitals for chronic disease*, chiefly by the *circular incision*, and the term 48 days; whereas the primary amputations in the same hospital required an average period of 63 days to heal.

This statement comprises the first result deduced from the tabular abstract, to which I shall beg your serious attention, although not bearing on the immediate question of the influence of periods of healing in the stumps of two different modes of amputation. It has a more general bearing, and one of considerable importance: the result may be thus stated,—*the stumps which heal the most readily in the shortest period, by a considerable number of days, are those resulting from amputations PERFORMED FOR CHRONIC DISEASE.* You cannot fail to be struck by the strong confirmation which this fact, unexpectedly as it were, gives to the opinions sustained throughout these lectures; viz., that the system is in a more favourable state to bear the shock of an operation, and more capable of effecting the subsequent processes required for cure, in subjects who have been long accustomed to the air, the diet, and the limited exercise and comparative confinement of an hospital.

In persons, I would add, in whom the circulation has been lowered by previous disease, and, above all, who from these circumstances are not subjected to any sudden vicissitude and change in all their external relations, such as must occur by the transfer of a man to the wards of an hospital who receives an accident in rude health, we have already seen that in a civil hospital these are the cases in which there is invariably the least mortality. At the Massachusetts and Pennsylvanian hospitals, while the mortality in *primary amputations* was 1 in 3.9, in *amputations for disease* it was only 1 in 7.2½ one-half less.

Since these lectures commenced, Dr. Laurie, of Glasgow, has given to the profession a valuable contribution on the results of amputation. If you refer to his paper you will find equally strong evidence from a totally different quarter. In 77 cases of primary amputation at the Glasgow Infirmary, 39 died, giving a mortality of 1 in 2: in the upper extremity 1 in 3.1, and in the lower 1 in 1.4; while in the same locality, and during the same period, 153 were amputated for disease, and the mortality was only 1 in 4.3, or less than half the proportionate number of deaths in primary amputations for injuries: in the upper extremity 1 in 5.7, in the lower 1 in 4.1. Indeed, the secondary amputations in the same hospital, where not only disease, but the *previous shock of an injury*, had been sustained, are only in the

upper extremity slightly more fatal. The mortality stands thus:—On the whole number 1 to 1.7, and in the upper extremity 1 in 2.4, in the lower 1 in 1.5.

To this it might be urged, that this happier result is not to be accounted for by assuming the system to be in a state nearer to health after the long existence of a local chronic disease than immediately after the receipt of an injury, but that in the latter cases the patients undergo two shocks instead of one. I not only grant the fact, but admit the previous shock to be a chief cause of difference. By why does this previous shock of the injury give rise to such difference? Because the first shock makes a deleterious impression upon the nervous centres, disturbing alike the sensorial and vital functions; thus removing the patient at once *from the state of health*, which the advocates for the surpassing excellence of primary amputation vainly and erroneously maintain to exist for twenty-four hours after the shock of the injury. In other words, they maintain that a man continues for some time after he suffers a violent shock in a healthy state, because he was so an hour before! And not only this, but that he is in a better state to suffer a second shock immediately after a first than at any subsequent period! On this I join issue with them; and facts show that there are states of the system more capable of bearing the shock of an operation than a few hours after a man in rude health has received an incurable injury. Each day since surgeons have partially recovered from the Macedonian phalanx of figures brought against secondary amputations by the medical officers of the army in the beginning of this century, and began to observe and inquire for themselves, facts have accumulated, and are daily accumulating, entirely subversive of the *doctrines* by which the value of primary amputations has hitherto been upheld.

It is sufficiently remarkable that nearly all the facts elicited, by a careful analysis of cases of amputation, whatever may be the more immediate object for which it is undertaken, tend to confirm the truth of an opinion sustained by the most eminent of the profession in the last century, and scouted as utterly untenable by the surgeons of the present day. Some, indeed, are now beginning to inquire into and to call in question the truth of the doctrine, which holds not only that the operation is most likely to be successful immediately after the injury has been received, *but that it is so because at such period the system is in the best state, by the short interval which has elapsed from the time when the patient was in perfect health, to meet the second shock of an operation*, and to avert its worst consequences.

The amputations for disease healing the most promptly, we find next in order of healing, are the circular primary amputations in civil hospitals, and the flap secondary in mili-

tary hospitals, which average in their periods of cicatrization within two days of each other, 63 and 65 days being the respective dates. Secondary amputations by circular incision average in civil hospitals 70 days. Thus the most favourable result of the primary amputations only shows the healing process completed two days earlier than a similar class of secondary amputations. If the system be in so healthy a state in the period for primary amputations, and in so bad a state in the period for secondary, how happens it that the stumps of secondary amputations, often including partially diseased tissues, heal as rapidly? or, rather, how does it come to pass that the stumps of primary amputations do not heal in half the period, and at least as early as the stumps of amputations for long standing chronic disease? Are not these results convincing proofs that the advocates of primary amputation, *par excellence*, in their eagerness to prove they were right in their conclusions, and that their antagonists were not only wrong in some of their practical conclusions, but in all their reasoning, have erroneously defined the state of the system in both periods, giving an undisturbed and healthy character to the vital actions in the first period they do not possess, and attributing to the secondary period diseased tendencies and actions that do not necessarily exist?

Take the conclusions founded on these statistical results, so far as they go (I readily grant that they require confirmation by larger numbers, and in repeated series, carefully analysed); and until they are shown to be reversed by series better entitled to confidence, bear these results in mind, and the

inferences to which they lead. In reference to the influence of the two modes of amputation, as shown by their relative periods of healing, the only comparison here established is between the flap and circular of primary and secondary operations in military hospitals; and in both, the flap has the advantage. In secondary operations the advantage is considerable; the average period of healing in flap being 65 days, in circular 90. In primary the range is only from 84½ to 91 days. In civil hospitals, for the injuries of civil life, the circular exhibits a considerable advantage over both, the average being 63 days: but there are no flap operations, under similar circumstances, with which to compare this latter result.

I confess the relative number of flap operations is not sufficiently great to satisfy me of the unvarying average. In the case I related in the last lecture, where one limb was amputated by flap, and the other leg of the same patient by circular incision, the flap did not heal until ten days later than the stump of the opposite limb. A *dépôt* of matter in the face of the stump, however, retarded the final cure of the flap operation.

VI. ON THE RELATIVE FREQUENCY OF PHLEBITIS AND PURULENT DÉPÔTS, IN THE FLAP AND CIRCULAR OPERATIONS.

This may be considered as the most important question comprised in the whole range of facts we have selected for comparison. It must, first, be determined, whether any influence is exercised by this difference of mode of operation; and, secondly, if any, what is the nature and proportion? On comparing, we find that in

Primary Amputations.

By Circular Incision.

By Flap.

20 deaths, of which 6 were marked by phlebitis or secondary inflammations and *dépôts* 1 in 3.3. 10 deaths, of which 6 were similarly attended. Proportion, 1 in 1.6.

Intermediary Amputations.

17 " 4 were marked by these diseased actions. Proportion, 1 in 4.2. 0 "

Secondary Amputations.

$\frac{6}{43}$ " $\frac{0}{10}$ 1 in 4.3 " $\frac{3}{13}$ " $\frac{0}{6}$ 1 in 2.1

In a total of 43 deaths, phlebitis, secondary inflammations and abscesses were ascertained in 10—1 in 4.3—and suspected in 4.

In 13 deaths by flap operation, 6 presented these diseases; 1 in 2.1.

The comparison is confined to the primary operations, and the numbers are small: how far, therefore, the proportion may be depended upon is open to discussion.

No one who has devoted much attention to the statistics of disease can fail to be fully conscious how necessary it is that numbers (under somewhat similar circumstances, too)

should be large, in order to establish a correct average. There is enough, however, in this disproportion to make the subject one of interest and worthy of further inquiry. If it should prove to be correct that the flap operations are more liable to such supervening diseases, the most fatal in the whole train, this would go far to counterbalance any advantage which its warmest advocates have ever produced in its favour, and probably, in the series under consideration, it account for the greater mortality in the flap operations.

The truth is not to be disguised, that the rapidity with which this mode of amputation is performed has something of *éclat* and brilliancy, which captivates both surgeon and spectator; albeit surgeons know that it certainly does not require either more skill or dexterity. Its *simplicity*, on the contrary, is one of its *ad captandum* advantages. As for rapidity, it may be allowed to have *some* advantage, but much less than is generally asserted; for, after all, either operation in dexterous hands is the work of a few seconds. With myself, the only time I am aware that the steps of the circular operation on the thigh was timed while I was operating, it proved to have occupied 90 seconds, and some accidental delay occurred in the assistant fixing the retractor. If that be the longest period, and the shortest consumed by the flap operation may fairly be assumed as extending to 50 seconds, it is after all, then, a question in the operations, where the shock is greatest (excepting hip-joint) of 40 seconds. I doubt whether this, in the generality of cases, can exercise either a real or perceptible influence, certainly not sufficient to counterbalance any palpable disadvantage.

In considering the two modes of operation, both of which, as has been stated, I have myself extensively practised, all the facts have been given which came under my notice. Some of the results in the series I have selected for illustration, for instance those regarding secondary hæmorrhages, proved contrary to the general impressions I had received in practice; so with reference to the relative periods of healing; the last in reference to the supervention of some of the worst forms of diseases incident to amputation—those more especially termed by some “secondary inflammations,” have alone confirmed any opinions I had insensibly acquired.

That a larger surface is exposed, and that the fibres are divided in an oblique manner, so as to prevent in a great measure their contracting into smaller space, as in the circular, I must contend, notwithstanding all a distinguished operator and advocate for the superiority of the flap operation has urged to the contrary. I am thoroughly satisfied, by the most careful observation, and by frequent comparison, that a more extensive injury is inflicted by the flap than by the circular operation. There are certain circumstances, however, and certain sites, where I have generally been in the habit of preferring the former; and I still recommend it, bearing in mind, nevertheless, the inferences from facts previously stated, in reference to the influence of site, external circumstances, &c., viz. :—

1. Where the patient is so exceedingly debilitated that even a few seconds may be judged of importance.

2. Where the patient is much emaciated, and the operation is to be performed a short distance below the knee, or where the pa-

tient purposes wearing a cork leg, the soft cushion thus preserved being an advantage.

3. When there has been laceration or wounds of the part so as to interfere with the circular line of incision, or where, by the flap, in some instances, a greater length of limb (when that may appear to be an object) can be saved.

4. For the operation at the hip-joint, which is thus, in an important degree, rendered more expeditious.

As to site, at the lower third of the leg and the forearm it is peculiarly applicable. In the upper third of the leg with a large calf—in the arm or the thigh, I think the circular operation simpler as regards all the subsequent progress, nearly as expeditious, and more satisfactory in its result.

At the shoulder-joint an oval incision or the flap I use indifferently; the flap, perhaps, forms a better cushion, composed in great part of the deltoid, to fill in the cavity made by removing the head of the bone; by a modified circular incision, on the other hand, a much simpler wound is left to heal. These nearly counterbalance each other.

Before I conclude, let me add a few remarks in relation to different modes of securing arteries and putting up stumps.

Influence of Short-cut Ligatures and Torsion.

I tried these methods in several cases of amputation both by flap and circular incision. In reference to the short-cut ligatures, I found that whenever a stump rapidly healed there was generally some disagreeable after consequence in the shape of an abscess, or a sinus, which would not heal until a piece of ligature was removed upon some occasion with the dressing: I do not believe they are ever absorbed whatever their material, neither are they likely to lie innocuous; they invariably, I believe, act as foreign and irritating bodies, which nature more or less quickly endeavours to throw off.

I have seen torsion adopted in a considerable number of amputations, chiefly under the direction of M. de Lannay, my colleague, with the French division in Portugal. Once when hospital gangrene prevailed, it bore this severe test in all the amputations (performed in the French hospital) resulting from the wounded of a sortie, amounting to about twelve (so far as my memory serves me), including thigh and shoulder-joint. There was only secondary hæmorrhage in one instance, and that not fatal. It is somewhat less certain, however, than the ligature, particularly for the smaller arteries; and, according to my views of union by first intention in stumps, I regard the improvement it was intended to effect as trifling in extent, and even doubtful in its character; it has never been very generally adopted, and I think, in all probability, it never will. The short-cut ligatures and the torsion of arteries were two methods proposed with the sole view of *facili-*

tating immediate union: the first protracts the ultimate cure; and the second exercises such trifling influence on the attainment of the object in view, even that it has not been held to warrant, or to compensate for, any additional insecurity, which, to a certain extent, results. These observations apply equally to flap and to circular amputations. With these remarks, many of them rather thrown out as hints and guides for observation than as well-established conclusions or ascertained truths, I conclude the parallel of facts attending the different modes of amputation and their corresponding results.

I have only a few words to add on the "putting up" of the stump, as it is technically described. Mr. Liston, and some other surgeons in different parts of the kingdom, have for some time adopted an innovation on the plan more usually followed; viz., by merely securing the arteries, and allowing the stump to remain undressed for a few hours. I believe the chief grounds for this novel practice (independent of the rapid disappearance of the patient from the operating table, which, in these days of railway speed, I must believe is not without its influence), are, first, that it diminishes the liability to secondary hæmorrhage; and, secondly, that the parts are brought into contact after all sanious oozing has escaped, and any immediate swelling has taken place: so that from neither of these causes is there any liability of subsequent displacement or necessity from the staining and hardening of the dressings to remove them entirely on the third or fourth day.

In reference to the liability of secondary hæmorrhage, inasmuch as more time is given for bleeding to commence after the patient has recovered from the depression of the operation, it is possible that some advantage may be gained. But if, when the principal vessels are tied, the surgeon will sacrifice a little of his *amour propre* and desire for *éclat* to the safety and comfort of his patient, and make pressure on the face of the stump for a few minutes with a sponge dipped in cold water until all oozing cease, which, unless some small vessel *require ligature*, very soon takes place, and then put up the stump lightly with two or three strips of isinglass plaster (by far the best and most clearly adhesive in use), I will undertake to guarantee that under these circumstances the liability to secondary hæmorrhage will not prove to be greater than by the other plan. The amount of suffering saved to the patient by bringing the surfaces and edges in contact and apposition, *before* they have become swelled, more or less inflamed, and exquisitely tender, will be so great and important, that were I certain the liability to secondary hæmorrhage was actually increased, I still should not hesitate in recommending this plan in preference, as being the lesser of two evils. In my own operations, as in all per-

formed under my inspection, I have not, with the above conviction, made any trial of this surgical version of the "*medicine expectante*" of our French brethren; but I have not condemned without satisfying myself by personal observation that the pain, excitement, and disturbance occasioned by this delayed dressing, almost necessarily performed in the evening, when the patient would be otherwise tranquillised and inclined to sleep, is calculated to produce the most unfavourable effect upon the progress and issue of the case, and in this respect far outweighs all the advantages its advocates have ever put forth in its favour, even were these really as many and as important as they are represented to be.

The directions I would give for the putting up a stump subsequent to the tying of the vessels and cold sponging to stop the oozing, and in addition to those already indicated in considering the relative value of primary and secondary union, are few and simple, and with these I shall conclude.

The objects to be attained in the dressing of a stump are to cover the bone, bring the edges and surfaces in apposition, prevent the retraction of the muscles and integuments, leave the stump cool, and its edges open to inspection, without disturbing the whole or any effective part of the apparatus by which these objects are attained.

The first object is obtained by the integuments being brought down by the gentle traction of the two hands of an assistant applied from above downwards to the edge of the stump, while a few turns of a soft elastic bandage are applied, commencing on the limb above, or round the trunk, and brought within two inches of the incision. This object is further facilitated by taking care not to support the stump in bed with its face to the ceiling, nor to allow the patient to cock it up after the same fashion, which they are exceedingly prone to do if the amputation be of the thigh; the obvious effect of which is to protrude the bone either through the integuments or the face of the stump.

The second object is already rendered easy in the operation by circular incision especially, by the previous steps; generally all that is required are two or three one-and-a-half inch strips of isinglass silk, passed from the lower to the upper surface, while the operator draws the edges of the two flaps gently in apposition, leaving between each strip an interval to allow a ready exit to the discharge, and you are thus enabled, without disturbing the limb, at all times to inspect the line of incision, and judge of the process set up within. Three will generally suffice for a large limb, and a couple of narrower ones for the arm. A strip should never be carried in a *straight line over the end of the bone*, the pressure being calculated to produce inflammation, and even ulceration in the soft parts over the sharp edge of its extremity. One

or two sutures may occasionally be required; but, as a general rule, never employ them if a little adaptation of the bandage above and strips of adhesive silk will effect the object. Remember that if you have to use force, whether by strapping or suture, to bring the edges together, your labour will be all in vain, and the inflammation of the limb and general irritation in the system induced by your thus binding the parts together by means of strong compression and stretching, will endanger the patient, and contribute to defeat your real object. No wound, such as is inflicted by the amputating knife, can take place without subsequent local action and swelling; to render this inevitable enlargement of parts difficult or nearly impossible, can only tend to excite a more violent effort on the part of nature to effect these necessary changes: hence more blood is sent to the part; increased action of the heart is induced to overcome the resistance; pain and tension quickly supervene, the ligatures ulcerate through; and unless the injudicious constriction and confinement of the parts be removed, a violent inflammatory and febrile action is developed, involving alike the stump and the system, and leading to the worst consequences. The retraction of the stump is prevented by the equable compression of the roller above, and by the position of the patient's body and the stump, relaxing all the muscles proceeding from the trunk to the limb; and a cold lotion to the stump tends to repress any exuberant local action in the wound, and is generally soothing to the patient.

These objects kept steadily in view, and the means I have indicated judiciously adopted, the chances of secondary hæmorrhage are exceedingly remote, unless from any of the diseased actions which I have in a former lecture described, and which may subsequently be developed. The stump is thus placed under the most favourable circumstances for the progress of those actions required for the union of the divided surfaces, and the final adhesion and cicatrization of the edges.

And here, gentlemen, I had originally contemplated concluding these lectures. I have, however, been insensibly led further than I had at first deemed necessary, but without assistance from the labours of others; I not only had to present you with some of the leading results of amputation at different periods, but to furnish materials which no where else, so far as I know, were to be found, by which you should be enabled to compare the progress and results of various kinds and degrees of injury, when their course was uninterrupted by amputation, and the modifying influence of collateral circumstances and dynamic conditions upon injuries treated to the end, and upon amputations performed at each of the three defined periods. The analogies and differences brought out by this means were

calculated to throw considerable light on the questions discussed in these lectures.

I commenced in fine with the intention of communicating *results*; but in order to carry your conviction with me, and to enable you to appreciate the grounds for opinions often at variance with those generally received, and yet of considerable practical importance, I found myself under the necessity of laying before you all the steps of an inquiry which had led to such conclusions, and furnishing the whole of the materials required for their construction.

I have thus been led into such varied and extensive details, that I feel were I to conclude with the present lecture I should leave the task I proposed to myself imperfect, or at least in some degree without the fruit I wished the lectures to bear.

I have yet, therefore, in conclusion, to give you a faithful summary of the more important results of our inquiry, and of the principles of practice to which they lead. This will form the subject of the next and concluding lecture.

RESEARCHES
INTO THE
PATHOLOGY, PHYSICAL SIGNS,
AND
TREATMENT
OF
VALVULAR DISEASES OF THE
HEART, &c.

By THOMAS MOORE, Esq., M.R.C.S., late
Secretary to the Dublin Medico-Chirurgical Society.

(Continued from p. 632.)

CASE 4.—Permanent patency of the auriculo-ventricular apertures, from dilatation and the inefficiency of the valves to close them, caused by shortening, thickening, and retraction of their structures, with fibrous growths on their surfaces; two circumscribed true aneurisms of the parietes of the left ventricle; vascularity, thickening and pulpy softening of lining membrane of aorta; steatomatous depositions; pulmonary valves healthy, those of aorta slightly altered; first sound of heart completely masked by a loud, rough, sawing murmur; second sound audible, not possessing its usual clearness; œdema of lungs; disease of liver.

Description of a canal, leading from the third ventricle of the brain, upwards and backwards, beneath the "iter a tertio ad quartum ventriculum," and the floor of the fourth ventricle, and terminating at the superior part of the posterior surface of the spinal column.

A woman (A. Pettit) advanced in years, the mother of four children, was brought into