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L E C T U R E S

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 IV.

Observations in detail on the nature, progress, and frequency of diseased actions supervening on complicated injuries, which either destroy life by their development, or render amputation necessary as the sole means of safety.—Analysis of causes of death in cases not amputated.

IN the preceding lectures I have directed attention chiefly to general results and conditions. It is now time to follow out the subject in its details. In doing this, I find myself compelled to confine my remarks to the Table of Gunshot Wounds produced in the last lecture, for to none of the statistical reports heretofore published are attached the explanations necessary for the full appreciation and development of the results. Indeed, as I have elsewhere observed, this subject has not hitherto been investigated in the comprehensive spirit, and with the care which its importance demands.

The tables to which reference will chiefly be made, in speaking of the results of cases not amputated, are Nos. I. and II. The first gives the progress and results of 131 cases of fractures, complete and partial, in which the articulations were not involved, and primary amputation not performed.

The second furnishes similar information respecting injuries involving the articulations, this being the distinctive difference between the two classes. The numbers in this table of cases in which primary amputation was not performed, are 61; the two combined, therefore, give a total of 192.

Other returns will be found necessary to illustrate this subject, to which I shall hereafter direct your attention, giving the results

No. 904.

of the same series of cases, but differently grouped and classified.

The Tables Nos. I. and II. present for consideration fatal disease, supervening in 20 cases of injuries to joints treated without amputation, and 18 cases of fractures not implicating the articulations—total of fatal cases, 38.

In Nos. III. and IV. we see supervening diseases necessitating subsequent or secondary amputations in 21 cases of injuries to joints, and in 31 cases of fracture without such complication, giving a total of 52 cases requiring amputation during the progress of treatment.

We have, therefore, to examine the nature and relative frequency of the supervening actions which rendered amputation necessary in 52 cases, and of those which caused death in 38—total 90.

The number of amputations here recorded are derived from a larger series than the deaths, in cases under treatment. In order, therefore, to determine the relative frequency, we must refer to the smaller classes contained in Nos. I. and II., where the amputations, the deaths, and the number treated, refer each and all to the same series, and are strictly correct in reference to each other.

The supervening actions causing these two disastrous results, amputation or death, are here presented in sufficient number to allow fair averages and practical conclusions to be drawn; but could I succeed in one of the objects I have in view, and draw the attention of the profession, and especially surgeons of large hospitals, to the subject, in a very few years conclusions might be drawn from thousands, instead of hundreds; which, extensive as my opportunities for observation have been, is all I, or, indeed, any single individual, can hope in many years to offer as the result of his own experience. The majority of the surgeons of the present day, I am well convinced, are not only generally unacquainted with the actual results of operations on a large scale, but are unprepared, and, to a certain extent, reluctant to receive the evidence which such a study furnishes. Judging from a very partial view of the subject, forming their opinions from vague data and loose recollections, I have reason to believe that even among those who operate the best and

the most frequently, a true statistical table of the operations which pass under their observation in the course of any three or five years, and their results, would surprise, if not startle, them; I am quite certain it would present much valuable matter for reflection, and new, as it would be interesting and practically important.

The true proportion of these supervening actions is shown thus in Nos. I. and II. :—

In fractures not involving articulations, the number is	131	Proportion.
Number of supervening actions causing death	18—7.277	
Ditto, causing secondary ampts.	23—5.695	
Total of unfavourable results of treatment	41—3.065	
In injuries involving joints the number of cases is.....	61	
Number of supervening actions causing death without amput.	20—3.050	
Number causing subsequent amputations	16—3.812	
Total of unfavourable results during treatment..	36—1.695	

In both these statements, partial fractures, and cases where the joints were only secondarily affected by the extension of diseased actions, are included—2 in 38 died of the partial fractures, and this class of injuries gave rise to no amputations. So in Table II., in reference to cases of joints secondarily involved, in 5, 2 died, or 1 in 7.500, and the supervening actions necessitated 2 amputations; total of disastrous results, 4; proportion, 1 in 3.750.

If the complete fractures not implicating joints, and the fractures primarily involving the articulation, be compared, the results are somewhat different from those already stated :—

Number of cases : complete fractures not involving joints.....	93	Proportion.
Of these there died, without amputation	16—5.812	
Underwent secondary amputat.	23—4.043	
Total of unfavourable results	39—2.387	
Number of cases primarily involving joints.....	44	
Of these there died, without amputation	18—2.444	
Amputated during treatment..	14—3.142	
Total of unfavourable results	32—1.375	

In this view, as might be anticipated, both classes become more disastrous, but the disproportion between the two is much diminished. The injuries to joints are still the most fatal to life and limb; but instead of the relative numbers standing thus :—

FRACTURES.		INJURIES TO JOINTS.
Deaths and Amput.	3.065	Deaths and Amput.
	3.065	1.695
They are as, 2.387 to		1.375

These results show how necessary are the distinctions, carried throughout the tables, between injuries affecting the joints directly and primarily, or only secondarily, and in fractures between the complete and partial. I direct attention to these circumstances as peculiarly illustrative of one of the sources of fallacy so liable to creep into statistical statements of the results of disease or injury; that is to say, where cases, apparently similar, but really essentially different, may carelessly be classed together.

It is worthy of remark, that the proportions between the two classes of injury not only differ in the gross results of each, but in the proportion of supervening actions causing the two results—amputation and death—during the progress of treatment without operation.

Thus, if we exclude partial fractures, and injuries which only secondarily implicate the joints, we find,—

In complete fractures, the deaths are in the proportion of	1 in 5.812
Ditto, the amputations during treatment.....	1 in 4.043
Total proportion of both unfavourable results	1 in 2.387
In joint injuries, the deaths are in the proportion of.....	1 in 2.444
Ditto, the amputations during treatment.....	1 in 3.142
Total proportion of both unfavourable results.....	1 in 1.375

The proportion of amputations to the number of deaths in joint injuries is considerably increased, and in the two classes of injuries the proportion of both is reversed. It will be seen by the tabular statement (A), taking both classes, and all the cases of partial fracture and joints secondarily involved, that the combined results, as regards amputation and death, are wonderfully equal, nearly a fifth require amputation, and a small fraction more than a fifth die under treatment and unamputated.

Thus the frequency and the gravity, to a certain extent, of the diseased actions supervening upon each class of injury, may be determined. The nature and progress of these supervening diseases producing such results we have now to consider; and it will be desirable to show, first, the nature of those morbid actions in each of the classes which cause death during treatment, where amputation has not been interposed; and, secondly, the nature of those which render amputation necessary.

In taking into consideration only such supervening actions as prove causes of mortality, without reference to many slighter, which, nevertheless, may place the patient in some jeopardy of life or limb, I do not believe that the omission will be found of any practical importance.

Those diseases which prove causes of am-

(A)—Statement of Disastrous Effects of Complicated Injuries to the Extremities, showing the Relative Proportions.

	Proportion to Cases treated.	Partial Fractures of Joints secondarily affected, excluded.
Proportion of supervening actions, causing death in cases reserved for treatment, no subsequent amputation being performed. Class complicated fractures, complete and partial, <i>not involving joints</i>	18 in 131 = 7.277	16 in 93 or 5.812
Fractures implicating joints	20 in 61 or 3.05	18 in 44 or 2.444
Deaths in the two classes	38 in 192 or 5.050	34 in 137 or 4.029
Supervening actions, causing amputation during treatment. Fractures not implicating joints	23 in 131 or 5.695	23 in 93 or 4.043
Cases of fracture involving joints.....	16 in 61 or 4.0	14 in 44 or 3.142
Amputations in the two classes.....	39 in 192 or 4.922	37 in 137 or 3.702
Total of disastrous effects in both classes		
Amputations	39 in 192 or 4.923	37 in 137 or 3.702
Deaths in cases not amputated	38 in 192 or 5.052	34 in 137 or 4.029
Total	77 in 192 or 2.498	71 in 137 or 1.939

* * These numbers are, of course, exclusive of cases which underwent primary amputation.

putation, or causes of death, are, in truth, the only effects which need, at present at all events, fix our attention.

I have given these supervening actions in two separate columns, that any difference and distinction, as regards the nature of the injury, may be seen at a glance. Their proportionate frequency of occurrence has already been shown.

The average terms of development for the different diseases are not very strikingly different. The fevers in both classes are, on the contrary, remarkably identical in their duration. If we take merely the average, although in each class there is considerable individual variety, as much as from 8 days to 160.

In the irregular or accidental complicating actions, the average term of development is shorter in fractures not implicating joints.

In reference to these actions generally, the most striking result is the great disproportion of what I have termed "irregular or accidental complicating actions"—more than one-half of the deaths in the injuries of joints are caused by them, whereas in fractures little more than a fourth.

Referring to the Returns I. and II., it will be seen that the supervening actions cause death in 38 cases out of 131, during treatment adopted, either with a view to save the limb, or to conduct the patient to a state or period favourable for operation.

In complicated fractures not involving joints.
18 in 131: average term of development
— of fatal actions, 38 days.

12 Febrile: term of development, 45½ days.
6 Irregular and accidental
— complications 25½
18

In similar fractures involving joints.
20 deaths in 61 cases: term of development of fatal actions, 40 days.
9 Febrile actions: term of development 41 days.
11 Irregular and accidental.... 39
—
20

This is the result of the first or most general classification of causes of mortality from the supervening actions during treatment. We may fairly conclude from these data, that severe injuries involving the articulations are more prone to develop those fatal actions, which may in some sense be termed as above, "accidental and irregular complications;" while patients with injuries equally severe, but not involving the joints, are more generally destroyed by the full development of febrile action.

There are several circumstances, however, connected with these two classes of injuries, requiring more detail, and offering features of interest both in a pathological and statistical point of view. Thus,

In 18 fatal cases of fracture, not involving joints, average term of development. 38 days.	
	Term of Development. Days.
In 12 febrile actions predominant,	
6 were hectic	41
2 with gangrenous action of limb	44—39
2 with diarrhoea and cough...	33
1 dyspnoea two days before death	16
2 hectic simply	35—80
4 Bilio-remittent.....	56
1 with cough	18
1 purulent deposits in lungs ..	35
1 enlarged liver and ulcerated mucous membrane of intestines	160
1 pain of side, spasms, and retention of urine.....	10
1 continued fever, with effusion of chest and abscesses of liver	29
1 distinctive character not defined, period uncertain.	
12	
5 irregular and accidental actions ..	25
2 by shock (cannon-shot).....	1
1 hæmorrhage and gangrene....	84
1 complicated wound, purulent cavity of wounded side of chest	34
1 tetanus	7
1 at end of three years, probably worn out with necrosis, but cause not accurately known.	
In 20 severe fractures implicating joints, average term	40
9 febrile actions predominant, average	41
4 hectic with diarrhoea	47—27
Cavities not examined in two	48—42
1 bilio-remittent, with enlarged liver	33
1 aguish type, with dyspnoea....	66
1 irritative	8
2 fever of undefined character.	
1 great constitutional, cerebral, and epigastric derangement, with large abscesses in limb	72
1 with great disorganisation of limb; no other disease traced	25
11 irregular and accidental complicating actions, average	39
1 with gangrene of leg	10
1 secondary hæmorrhage, right lung gorged with blood	34
2 exhausted with several wounds	58
2 trismus.	
1 purulent deposits and lung congested	48
1 tetanus, in great measure disappearing, but fatal impression left on nervous system .	27
1 shock, within 24 hours.	
1 angina pectoris.....	120
1 gangrenous and erysipelatous action with anasarca and serous effusion of chest	100
2 causes not ascertained.	

We may now proceed with our inquiry into the *nature* of these supervening actions, and any distinctive differences that may exist in the two classes of injury.

1. Febrile Actions.

These, which form two-thirds of the causes of mortality in fracture, do not amount to one-half in the injuries of joints; independent of this difference in the proportions, there is also some difference of type. In gunshot fractures, not implicating the articulations, the classification of fevers into distinct types is more easy; they are more defined and regular in their characters. The same tendency observed in fractures involving the articulations, to induce a large proportion "of irregular and complicating actions," is observed to prevail in the fevers. Instead of a half being of one defined form, the hectic, one-third remittent, one-twelfth continued, and but one of no very distinctive type, we find in the class of joint injuries, that although nearly one-half of the much smaller proportion of fevers are hectic, yet that the remaining five are of so many different kinds, exceedingly difficult to reduce to any classification, and attended with excessive local and general disturbance. The irritative and intermittent are present; two forms not observed in the opposite column; the remittent appears only in a single instance.

In the class of *fractures* only, there are signs of organic disease in the chest or abdomen in six, or one-half of the whole number; three of these verified by examination. In the injuries involving joints but two such cases occur, not a fourth of the whole.

In the class of "irregular actions," one-fifth present this complication in *fractures*. In joint injuries, more than one-third of the whole, although one of these was rather functional derangement than organic; another only amounted to a state of congestion; and a third consisted in an effusion into the cavities, general anasarca prevailing in a patient worn out by wasting discharge from an incurable fracture; the one of purulent deposits forming one-eleventh of the whole, corresponding with the one-fifth of the opposite column.

Of the whole twenty fatal cases of injuries to joints, seven—more than one-third—present this singular complication.

In reference to this it must be observed, that there is a wide difference in the two classes between the gravity of these affections. In fractures, three were cases of purulent deposits, whereas only one presented disease in this stage among the cases of injuries to joints.

It seems from this result that injuries to joints are either less prone to excite these purulent diseased actions, or that the affections of the viscera are of less gravity when they do supervene.

This assumption is further borne out by

reference to the average duration of this disease. In joint injuries the average term of development is sixty-seven days: in fractures only forty-one. This is the more remarkable in relation to these peculiar diseased actions, because it reverses the general rule which is applicable to them as a whole.

The most natural explanation of this result will probably be found in the fact, that the diseased actions attending injuries to joints expend much of their disastrous violence upon the limb itself, and less upon other and more distant parts. This view seems to me to receive confirmation from the result already shown; viz., that the "accidental or irregular" complications in this class are far more numerous; and it may be further seen, by reference to the detailed statement of these cases, that the greatest violence is generally developed locally; and when involving distant structures or the viscera, it appears in many instances to occur, rather by the extension of local disease, than by any more remote sympathy with a local irritation.

2. *Irregular or Accidental supervening Actions.*

Independent of the proportionate number of irregular and supervening actions (in which the febrile action does not appear to be the one predominant) in the two classes of injury, there is no essential difference in their characters. Shock, gangrene, secondary hæmorrhage, tetanus—these play the chief part in both classes.

Having by this brief analysis shown where-in consist the differences and resemblances between the supervening actions causing death by their development in the two classes of injury: these cases may now, with advantage, be considered collectively, as severe injuries of the extremities, with fracture more or less complicated. The following, then, are the results.

In 192 cases submitted to treatment, supervening diseases caused death in 38. The whole series of cases, originally 235 in number, having previously been cleared of 43 of the worst cases by primary amputation.

In 21 of these fever was the predominant action—more than half.

		Average Term of Development.
10 Hectic, with various complications.....	1 in 3.210	41 days.
5 Remittent, complicated with affections of lungs or liver chiefly	1 in 7.078	51
1 Continued fever } with compli- { 29 days } 1 Intermittent } cations { 66 } 1 Irritative } { 8 }	1 in 12.012	34
3 Character undefined	1 in 12.012	43
Average term of development of fevers.....		44½

In 14 irregular and accidental complicating actions predominating—near one-third.

	Proportion.	Average Term of Fatal Development.
3 Shock	1 in 12.666	1 day.
3 Tetanus, with complications.....	1 in 12.666	27½
3 Exhaustion from complicating wounds	1 in 12.666	16
2 Hæmorrhage, with complications	1 in 19.000	59
2 Gangrene, ditto	1 in 19.000	55
1 Angina pectoris	1 in 38.000	120
Average term of fatal development		46½

3 Cause unascertained.

In the fevers it may be seen hectic largely preponderate; remittent next; and lastly, those of undefined character. Shock and tetanus among the irregular actions, as both marking a deleterious impression upon the nervous system, may be said to be those which predominate under that head.

In the febrile affections, when hectic symptoms and characters predominate, there is seldom any other complication than that of diarrhœa. The remittent form, closely, indeed, resembling that which Mr. Arnott has described* as distinctive of phlebitis, is certainly very frequently complicated by some organic lesion; the lungs and liver are the

organs most frequently implicated, and the disease affecting them is chiefly of a suppurative character. Fevers which, by their leading symptoms, may be classed as continued, intermittent, and irritative, are generally unaccompanied by organic disease. In the three cases, however, included in the analysis, two are complicated by disease of chest or liver. Fevers, the character of which are undefined by any leading characteristics, seldom present organic lesion.

The average term for the full development of these various febrile affections, and their complicating processes on to their termination in death, is 44½ days.

The number of both classes of injuries, where any organic lesion accompanied the

* Medico-Chirurgical Transactions, vol. xv.

development of fevers, stands thus:—In twenty-one febrile, five presented disease of viscera, and four might be suspected from symptoms, but the cavities were not examined; two had gangrenous limbs. The rest gave no indication of disease beyond that of fever.

In fatal cases from irregular diseased actions, five presented disease of lungs or liver, two of the number marked by purulent deposits.

Taking the whole series of cases where life was lost during treatment by the fatal development of supervening actions, febrile, or irregular and accidental, such as gangrene, tetanus, secondary hæmorrhage, &c., it may be assumed as correct, that the majority of the 38 cases ended fatally by actions, leaving no trace of structural or physical lesions, but by impressions on the nervous system, and the blood disordering the circulation and deranging the vital functions.

I shall offer some observations, in a future lecture, upon those secondary diseases of remote parts chiefly affecting the lungs or liver, and accompanied by a more or less peculiar febrile action, according to different conditions. I shall also call your attention more particularly, hereafter, to the dynamic forces called into deleterious action, and producing fatal results without traceable lesion of structure, as also to other circumstances which modify the character and gravity of these supervening affections. Before we proceed, however, to the consideration of this part of the subject, it will be well to show the influence of certain *physical* influences, easy of appreciation and sufficiently palpable in their effects.

1. In reference to the injury, its seat and degree.
2. In relation to the external and collateral circumstances of a physical nature chiefly, prevailing during treatment.

For the full development of these subjects of inquiry, it will be necessary to lay before you series of cases, somewhat differently grouped and classified from those already presented in the comprehensive tabular returns from No. I. to V., inclusive. These, exemplifying the influence of the above conditions, and the reflections arising from the considerations, will form the subject of the next lecture.

VACCINATION OF THE PRINCESS ROYAL.

The Princess Royal was vaccinated by Mr. Blagden, in the presence of Sir James Clark and Dr. Locock, on Monday, Dec. 21. We trust that this royal example will have its proper effect upon those who are unfortunate enough to entertain a prejudice against this simple but truly important operation.

MEDICAL JURISPRUDENCE.

INQUESTS IN MIDDLESEX, HELD BEFORE MR. WAKLEY, M.P.

ALLEGED DEATHS FROM EXCESSIVE BLOOD-LETTING BY VENESECTIION.

CASE I.—ST. MARYLEBONE.

JOHN SHEARS, a robust, florid-looking man, aged forty-three years, died on the 23rd of November, 1840; and his widow complained to the constable of St. Marylebone, that the cause of his death was excessive bleeding from the arm on Nov. 21st, under the treatment of an inexperienced practitioner, who had seen him soon after he had fallen in a fit, in a shop where he was working as a carpenter. The allegation, upon some preliminary inquiry, was found not to be groundless, and the warrant for an inquest to be held on the body, in Great Titchfield-street, on the 26th of November was issued, when

Joseph Sawtell stated that the deceased seemed perfectly well on that morning, until, just after beginning to work, his employer, Mr. Clark, observing that he was proceeding unsatisfactorily about it, told him to "gather up his tools and go home, for he had engaged him as a good workman, whereas he saw that he knew nothing about his business, and was no carpenter at all." On receiving half-a-crown for his wages, deceased said it was not enough; and while Mr. Clark was in the act of tendering him a shilling more, he turned pale and fell, speechless, and insensible for a time, breathing heavily until his neckerchief was loosed. In falling, his head struck the edge of a door, and received a deep wound, three inches long, from which blood enough flowed to soak through a thick mat on the floor. He was picked up, and subsequently carried home, a short distance only, in a chair; the wound open. Before leaving the shop he slightly recovered from the shock, and expressed much agony at some pain, now and then putting his hand to his head.

His wife sent for a "doctor" at once, and in twenty minutes one arrived from a shop which had no name over the door. Expressions of agony (or convulsive motions) were continued by the deceased, who was then abruptly asked "how he was," with the addition that he "must have been drinking again." His pulse was felt, and preparations made for venesection; and tape and a wash-hand basin were supplied for the operation, as the patient sat on the edge of the bed, whence he presently sank to the floor, from the impossibility of holding him up, on ac-