SOME STATISTICS OF PNEUMONIA,
WITH ESPECIAL REFERENCE TO THE
RELATIONS OF DELIRIUM AND TEMPERATURE.
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THE following statistical tables have been drawn up from an investigation of the cases of pneumonia recorded in the University College Hospital case books during the past twelve years. I am indebted to Sir William Jenner, Dr. Russell Reynolds, Dr. Wilson Fox, Dr. Sydney Ringer, Dr. Charlton Bastian, and Dr. F. T. Roberts for permission to make use of cases that had been under their care.

The plan that I have pursued has been to make a concise abstract of the cases, paying every attention to the notes on the temperature and state of the nervous system. From these abstracts a table, not here presented, was constructed, and its various factors have been carried through a kind of permutation and combination, the results of which processes are here recorded. I have in a few places ventured on some suggestions, and notably in connection with the unexplained circumstance that delirium is so frequent with pneumonia of the upper lobes of the lungs.

TABLE I *gives age and sex of all the cases.*

AGE. Years.		Male.		Female.		Total.		Percentage.
1—10	...	41	...	14	...	55	...	27·5
11—20	...	24	...	17	...	41	...	20·5
21—30	...	30	...	16	...	46	...	23·0
31—40	...	21	...	6	...	27	...	13·5
41—50	...	16	...	4	...	20	...	10·0
51—60	...	6	...	2	...	8	...	4·0
61—70	...	1	...	1	...	2	...	1·0
		<u>139</u>		<u>60</u>		<u>199</u>		

TABLE II, *showing site of lung affected and the sex of all the cases.*

	RIGHT LUNG.				LEFT LUNG.				BOTH LUNGS.	
	Upper lobe.		Lower lobe.		Upper lobe.		Upper lobe.			
Male	...	9	...	59	...	4	...	47	...	20
Female	...	2	...	26	...	4	...	15	...	13

The right lung alone was the seat of pneumonia in 96 cases, or a percentage of about 48. Bleuler gives the percentage at 52. The left lung alone was affected 70 times, or 35 per cent. Bleuler gives 32 per cent. There was double pneumonia 33 times, or 16 per cent., which also agrees with Bleuler.

TABLE III, *showing the number of cases according to age, sex, and site of pneumonia.*

RIGHT LUNG.					LEFT LUNG.					BOTH LUNGS.																			
Male.					Female.					Male.					Female.					Male.					Female.				
1—10	...	16	...	5	...	21	...	5	...	3	...	4	...	11—20	...	12	...	6	...	10	...	5	...	4	...	4			
21—30	...	17	...	7	...	6	...	5	...	5	...	3	...	31—40	...	9	...	1	...	8	...	2	...	5	...	2			
41—50	...	10	...	3	...	4	...	1	...	2	...	—	...	51—60	...	5	...	1	...	1	...	1	...	—	...	—			
61—70	...	—	...	1	...	1	...	—	...	—	...	—	...	—	...	—	...	1	...	1	...	—	...	—	...	—			
<hr/>					<hr/>					<hr/>					<hr/>					<hr/>					<hr/>				
69					24					51					19					19					13				
<hr/>					<hr/>					<hr/>					<hr/>					<hr/>					<hr/>				
93					70					32																			

Fallacies of statistics.—No one can be more aware of the fallacies of statistics than I am. To reject statistics altogether, though perhaps the most logical proceeding, appears to me to be unadvisable. That statistics have introduced many false facts into medicine I do not doubt, but I cannot but believe that we have also benefited by them.

The statistics which are here presented seem to me to be suggestive rather than positively instructive, and will serve the purpose more of indicating lines of future study than of laying down fresh propositions. At the same time, as a solid contribution to our collection of facts concerning pneumonia, the author submits that this paper must necessarily possess some value in and of itself.

The apparent discrepancies in numbers is to be explained by bearing in mind that all the cases were not always available for every table.

The cases are all cases of *lobar* pneumonia. The majority of the cases are *simple* ones of *primary* pneumonia. A few cases are interspersed in which there were marked complications, or in which acute pneumonia supervened on another disease. I have retained these cases for comparison and with a view to their throwing light on the symptoms in primary pneumonia.

From the total number of cases, 199, we subtract the following (17) in which the pneumonia was not the only disease :

1. Case 54, man, aged 23, pneumonia of the whole of the right lung complicated by pleurisy and acute Bright's disease, fatal.
2. Case 55, woman, aged 37, pneumonia of left lower lobe, mitral disease, recovery.
3. Case 84, man, aged 20, pneumonia of right lung, complicated by peritonitis, death.
4. Case 121, delirium tremens, man, aged 27, Bright's disease, fatal.

5. Case 128, man, aged 36, right base affected, Bright's disease, recovery.

6. Case 129, female, aged 16, double pneumonia, rheumatic fever, recovery.

7. Case 158, female, aged 15, rheumatism, double pneumonia, fatal.

8. Case 189, male, aged 62, complicated by pericarditis, pleuro-pneumonia of left lower lobe, fatal.

In these 8 cases delirium was present.

9. Case 2, female, aged 42, left lower lobe pneumonic, mitral disease, death.

10. Case 4, female, aged 19, double pneumonia, Bright's disease, death.

11. Case 32, infant, lethargic, aged 1, pericarditis, left lung pneumonic, fatal.

12. Case 35, male, aged 11, lethargic, left lower lobe pneumonic, rheumatic fever, recovery.

13. Case 64, male, aged 6, right lower lobe pneumonic, meningitis, mental dulness, death.

14. Case 75, male, aged 50, left lower lobe pneumonic, pericarditis, fatal.

15. Case 101, female, aged 29, mitral disease, double pleuro-pneumonia, recovery.

16. Case 102, female, aged 29, rheumatic fever, mitral disease, right lower lobe pneumonic, recovery.

17. Case 188, male, aged 55, right lower lobe pneumonic, pericarditis, death.

The above 9 cases had no delirium.

Of 182 cases of primary pneumonia there were 56 in which delirium was present, or a percentage of 30.

Heinze ('Archiv der Heilkunde,' 1868, p. 49) has studied the relations of marked mental symptoms to the temperature in pneumonia and has arrived at the conclusion that the mere pyrexia had little or nothing to say in the matter. My investigations tend in the same direction. But the consideration cannot be lost sight of that prolonged pyrexia and high transitory fever must

exercise some direct and indirect deteriorating influence on the grey matter of the brain and spinal cord, and must therefore predispose to delirium and other signs of exhaustion of the nervous matter.¹

Of 17 available cases sometimes (4) the delirium coincided with the greatest rise in temperature; rarely (2) it preceded the acme of fever, and most frequently (11) the delirium came on with the fall of temperature.

Heinze draws attention to the much greater frequency of delirium, or rather, marked mental change in pneumonia of the upper lobe of the lung. Of 317 cases the upper lobes were involved 117 times; the lower lobes were alone affected 200 times. Of the 98 cases showing delirium, 47 were cases of pneumonia of the upper lobe and 51 of the lower lobe. The contrast is made more striking by a detailed statement of the facts (*loc. cit.*, p. 57).

I think it safest and least liable to error if a comparison be made between cases which affect the upper lobe alone and those which affect the lower lobe alone.

Thus, of 25 available cases in which the upper lobes were alone diseased, I find that 12 are reported as delirious, or a percentage of 48, which is 7 per cent. higher than Heinze's estimate. When the lower lobe was alone involved in 110 available cases, I find that there was delirium 28 times, or a percentage of 25·5. These results are practically identical with those of Heinze.

Liebermeister believes that one of the reasons for the above difference is to be found in the longer duration of pneumonia of the upper lobe. Heinze adduces evidence to show that this conclusion does not hold good. My notes so far as they go support the contention of Heinze.

Thus, in Case 8, the onset was on November 6th, and the fever had disappeared by the 13th; the temperature was frequently 105°; the unconsciousness lasted till the

¹ See a paper by author on "Reflex Actions, &c.," 'The Lancet,' vol. ii 1885.

9th; there was some "after" fever on the night of the 13th, which had ceased by the 15th; the temperature remained quite normal after the 23rd. Case 9 began on March 12th and ended on the 19th; no mention was made of delirium.

Case 58, the man had suffered from epilepsy; it was a fatal case of pneumonia of the right apex which began on July 30th and ended on August 9th. Case 69 lasted only seven days (August 1st to 8th). Case 78 began on May 9th and terminated on May 17th. Case 129 began on May 22nd and ended on May 29th. Case 130 lasted from August 22nd till August 30th. Case 140 commenced on February 9th and ended fatally on February 13th.

In several other instances there are no notes to fix the date of onset, but the course and height of the fever on admission and attendant circumstances would lead one to suppose that the duration was not abnormally long. Further, the temperature of cases of pneumonia of the upper lobe alone does not appear to be higher than in pneumonia of the lower lobe. And though my notes show that the temperature was generally high and sustained in cases of pneumonia of the upper lobe, yet a comparison of the number of cases according to site of disease and temperature gives no certain indication that there is any remarkable difference in the degree of pyrexia in pneumonia of the upper as contrasted with that of the lower lobe.

Heinze brings forward some figures to show that the rate of mortality in pneumonia of the upper lobe is higher than in pneumonia of the lower lobe. Taking again only those cases in which the disease was confined to the upper or the lower lobe my statistics give the following results:—Five deaths in 25 cases of pneumonia of the upper lobe alone, and ten deaths in 110 cases of pneumonia of the lower lobe alone, or a percentage of about 20 in the former and 10 in the latter. The numbers are small, but the difference is great. Of the 12 cases of delirium with pneumonia of the upper lobe, but 2

proved fatal (16·6 per cent.) ; of the 28 cases of delirium with pneumonia of the lower lobe, 4 proved fatal (14·3 per cent.). The difference here is not nearly so great as that given by Heinze, whose numbers are 34 per cent. and 21·5 per cent. respectively. This author seeks for a satisfactory explanation of the greater frequency with which delirium occurs in pneumonia of the upper lobes and finds none. He examines the age, sex, drinking habits, month of the year of all the cases of delirium, and all to no purpose.

After a careful survey of the statistics that I have collected, I have arrived at the following position :

The determination of delirium in any particular case probably depends on at least several factors or elements in the case. The age of the patient probably has some influence, but I think not much, except in this way. Delirium is disorder of the intellectual faculties and inextricably mixed up with the functions which are engaged in the process of speech. Infants, therefore, are incapable of delirium in the ordinary sense of the term, for the reason that they are not in possession of the organised elements on which intellectual actions depend. But that the mental or cerebral functions are greatly disturbed in infants a glance at the collected facts readily proves. A little consideration will show also that sex can have but little to say in the matter.

Previous habits and social conditions probably play some share in the production of delirium. Some of the most powerful causes are alcohol, tea, and tobacco. The prolonged and excessive use of these articles of consumption probably deteriorates considerably the structures on which intellectual processes depend.

Unquestionably a neuropathic disposition, however brought about, would be a potent element in the causation of delirium.

Is there anything special in the nature of pneumonia which tends to produce delirium ? I do not think so. I do not think that pneumonia is associated in any way

with the production of any substance which has "deliriant" properties like belladonna.

That some cases of delirium in pneumonia may be dependent on the absorption into the circulation of an autogenetic alkaloid is possible. But the action of alkaloids formed in the tissues in pneumonia (such as have been found by MM. Villiers, Lepine, and Guérin) is unknown.

But one more suggestion I have to make in connection with the greater frequency of delirium in pneumonia of the upper lobes. I make the suggestion that the proximity of the intense inflammation to important and extensive nervous structures in the neck is an element in the explanation. An intense process like lobar pneumonia must influence by radiation the structures in its vicinity. There are the brachial plexus and the cervical sympathetic nerves. The cervical sympathetic watches over the calibre of the arteries supplying the head. I suppose that the arteries supplying the brain are under the dominion of its influence.

Let it be imagined that pneumonia of the apex is capable by its action on the cervical sympathetic of interfering with the supply of blood to the brain. An impairment in the cerebral blood supply, whether as hyperæmia or in the direction of anæmia, must damage or tend to damage the nervous tissues on which cerebral functions are dependent.

Phthisis is well known to be associated with a hopeful state of mind. Phthisis is most frequent at the apices of the lungs. All cases of phthisis are not in a state of hope. Does the difference depend on the site of the lesion? I merely make suggestions, and am fully aware that I am on unsafe ground. Abdominal disease is, as a rule, associated with mental depression. I hardly like to write the following crude attempt at an explanation, as it is open to so many logical objections. Disease of the apices of the lungs irritates the sympathetic and causes hyperæmia of the brain; joyfulness and hopefulness are

said to be associated with increased supply of blood to the brain. Abdominal disease irritates the abdominal sympathetic, opens the floodgates of the abdominal vessels, and drains blood away from all parts of the body, including the brain. A deficient supply of blood to the brain is said to go with mental depression and apathy.

It would be very interesting and might be very instructive if we had some accurate information concerning the relations of delirium to the collective amount of sleep which the patient enjoyed.

TABLE IV *shows the number of cases of delirium at different temperatures (the highest recorded temperature in each case).*

Temp.	98°	99°	100°	101°	102°	103°	104°	105°	+
No. of cases ...	—	—	2	2	6	11	26	9	

TABLE V *shows the number of cases without delirium at different temperatures.*

Temp.	98°	99°	100°	101°	102°	103°	104°	105°	106°	+
No. of cases...	3	1	7	12	19	27	34	14	2	

A comparison of these tables appears to show that the number of cases with delirium is largest at the temperature of 104° and 105°. This comparison is rendered more apparent by Table VI, which contrasts nearly equal numbers of cases with and without delirium.

TABLE VI.

Temp.	98°	99°	100°	101°	102°	103°	104°	105°	106°	+
No. of cases with delirium	—	—	2	2	6	11	26	9	—	
No. of cases without delirium...	1·5	1·5	3·5	6	9·5	13·5	17·0	7	1	

It would seem, therefore, that the temperature does exercise some, though probably small, influence.

Of the 199 cases there were 42 deaths=about 20 per cent.

TABLE VII.—*Fatal cases with delirium.*

There was 1 fatal case when the highest temperature recorded was 100° +					
„	1	„	„	„	101° +
„	were 4	„	cases	„	102° +
„	5	„	„	„	103° +
„	7	„	„	„	104° +
„	was 1	„	case	„	105° +

TABLE VIII.—*Fatal cases without delirium.*

There were 2 fatal cases when the highest recorded temperature was 100° +					
„	was 1	„	case	„	101° +
„	were 3	„	cases	„	102° +
„	2	„	„	„	103° +
„	7	„	„	„	104° +
„	4	„	„	„	105° +
„	3 ¹	„	„	„	106° +

From an examination of these tables it seems clear that the presence or absence of delirium exerts no influence on the mortality. A temperature above 105°, whilst not necessarily causing delirium, seems to be of grave significance; the three fatal cases at this temperature were infants, who are incapable of delirium in the ordinary sense of the term.

TABLE IX.—*Number of cases of delirium with recovery at different temperatures.*

Temperature	100° +	101° +	102° +	103° +	104° +	105° +
No. of cases	1	1	3	10	21	9

TABLE X.—*Number of cases without delirium with recovery at different temperatures.*

Temperature...	-100° +	100° +	101° +	102° +	103° +	104° +	105° +
No. of cases ...	4	7	10	18	28	29	14

¹ Case 32, male infant, aged 1 year, highest temperature 106·2°; left lung pneumonic; the child was lethargic.

Case 140, male infant, 9 months, highest temperature 106·8°; right apex pneumonic.

Case 132, female infant, 10 months, temperature 107·2°; double pneumonia.

TABLE XI, *showing the age, highest temperature, and number of Cases of delirium in pneumonia.*

Temp.	AGE.						
	1-10	11-20	21-30	31-40	41-50	51-60	Above.
100°+ ...	—	...	1	...	—	...	1
101°+ ...	—	...	1	...	1	...	—
102°+ ...	—	2	2	1	1	...	—
103°+ ...	—	4	2	6	1	1	...
104°+ ...	2	7	9	6	1	2	...
105°+ ...	1	...	3	2	...	2	...
106°+ ...	1	1	...	...	...	...	...

From this table we may state that the third decade, when the temperature goes beyond 104°, seems to be most fertile in the production of delirium. Such a statement is open to several fallacies, and probably means but very little: for an examination of other tables and statistics shows that this period of life and this degree of fever probably yield the greatest number of cases of pneumonia.

The right lung was affected 69 times without delirium, and of these cases 11 proved fatal. The left lung was involved 50 times without delirium, and 7 proved fatal. Both lungs were affected 17 times without delirium, and of these 5 ended in death.

There were 27 cases in which the right lung was affected and the patients were delirious, a fatal termination taking place 9 times. The left lung was affected in 20 cases, delirium being present, and 2 of these died.

Sixteen times the pneumonia was double and the patients delirious; 8 of these succumbed.

The fatal cases of double pneumonia associated with delirium consisted of 2 males in the second decade and 1 female; 1 male and 1 female in the third decade, 1 female in the fourth, and 1 male in the fifth.

Four of these cases were uncomplicated double pneumonia, 1 was complicated with rheumatism, another with slight empyema, another with Bright's disease and delirium tremens. In one of the uncomplicated cases the delirium

was of violent character, with a falling temperature, and in another case of violent delirium the highest temperature recorded was but $102\cdot6^{\circ}$.

Of the 2 fatal cases of pneumonia of the left lung associated with delirium 1 occurred in the fourth and the other in the seventh decade. Of the 9 fatal cases of pneumonia of the right lung associated with delirium 2 occurred in the second decade of life, 3 in the third, 1 in the fourth, 1 in the fifth, and 2 in the sixth.

(For report of the discussion on this paper, see 'Proceedings of the Royal Medical and Chirurgical Society,' New Series, vol. ii, p. 127.)