

**A CLINICAL STUDY OF PNEUMONIA:**

WITH NOTES OF  
ONE HUNDRED CONSECUTIVE CASES OCCURRING  
IN HOSPITAL PRACTICE.\*

BY  
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PNEUMONIA constitutes one of the most formidable problems which confront the physician. The disease is upon the increase; nothing is known as regards its prevention; it involves a very heavy mortality; the treatment is a matter of much difficulty and anxiety. On all these grounds it calls for the best thought and study which we can devote to it.

The series of 100 consecutive cases here recorded were treated in my wards of the Royal Victoria Hospital, Belfast, in the years 1899-1913. They are recorded as they arose, without any selection. The deaths include 2 cases which were moribund on admission. Hospital mortality is everywhere somewhat high, inasmuch as, speaking generally, only cases of considerable severity seek admission; patients are in some cases only admitted when the disease has run its course for several days; and the number of children admitted to general hospitals is relatively small. All these factors have a bearing upon the mortality.

*I. Age.*

Age.	Cases.	Deaths.	Mortality.
			Per Cent.
Under 10 years ... ..	5	0	0
10-20 ... ..	17	0	0
20-30 ... ..	27	5	18.5
30-40* ... ..	18	3	16.5
40-50 ... ..	14	5	35.7
50-60 ... ..	13	3	23
60-70 ... ..	5	3	60
Over 70 ... ..	1	1	100

\* Under 40 years—67 cases 8 deaths; average mortality 11.94 per cent.

This table brings out clearly the dominating influence of age. Under 20 years there were 22 cases and no deaths. Under 40 there were 67 cases, with 8 deaths—average mortality, 11.94 per cent. After 40 the mortality rose rapidly. The fact that the mortality was higher in the ages 40 to 50 than in the ages 50 to 60 was probably a casual fluctuation. The general influence of advancing years is clear.

*II. Sex.*

Sex.	Cases.	Deaths.	Mortality.
			Per Cent.
Males ... ..	75	15	20
Females ... ..	25	5	20

The higher attack-rate in the male sex is in accord with general experience. The mortality was identical in the two sexes.

*III. Occupation.*

	Cases.	Deaths.	Mortality.
			Per Cent.
"Indoor" occupations ...	55	10	18.18
"Outdoor" occupations..	45	10	22.2

So far as these figures go, the influence of occupation upon the attack-rate and the mortality is not noteworthy.

Though Belfast is a great port, it is remarkable that only one sailor appears in the series, and he was a Hindu.

\* Read at a meeting of the Ulster Branch in Londonderry.

**HISTORY OF PATIENTS PRIOR TO THE ATTACK.**

*Alcoholism.*

There was a definite history of alcoholic excess in 17 cases—all males—of whom 4 died, 3 of these being over 40 years of age. This is a lower mortality in the alcoholic than might have been anticipated, especially in the light of the age law. Unacknowledged alcoholism was, no doubt, a factor in other cases—it is impossible to say how many.

*Previous Attacks of Pneumonia.*

In 18 cases there was a history of previous attacks, varying in time from thirty years to three months before admission. Of these only 2 died. One patient who had had two previous attacks recovered.

These statistics support the view that the prospects of a patient who has passed successfully through a previous attack of the disease are above the average.

*Wetting and Exposure.*

Only 6 patients attributed their attack to a wetting. Exposure is so common in patients of the hospital class that its influence as a causal factor cannot be determined with any accuracy. It has probably considerable influence.

*Pulmonary Tuberculosis.*

Twelve patients had a definite history of tubercle, and of these only one died. This tends to support the view that the prospects of phthisical patients in pneumonia are, on the whole, good. My experience in private practice confirms this view.

*Abnormal Histories.*

- 1 case followed immersion in the docks and proved fatal.
- 1 " " gas poisoning and also proved fatal.
- 1 " " ether administration—recovered.
- 2 cases were moribund on admission.
- 3 " occurred during attacks of bronchitis.
- 2 " had previously had acute rheumatism—1 died.

The absence of a history of influenza is noteworthy.

*Mode of Onset.*

- 47 cases gave a history of one severe prolonged rigor.
- 1 case had two rigors.
- 1 " had three rigors.
- 1 " had several rigors.
- 1 " had "shivered for six hours."
- 1 " had "shivered for three days"!
- 48 cases gave no history of rigor.

Early prostration was marked in nearly every case. Only 2 cases remained at work after the initial rigor.

**SYMPTOMS.**

Most cases presented the typical pneumonic syndrome, but—

- (a) 5 cases were admitted as "abdominals"—namely, 3 as "colic"; 1 as enteric fever; 1 as subphrenic abscess. All these patients recovered.
- (b) 13 cases had persistent vomiting; all recovered.
- (c) 17 cases had albuminuria in considerable amount; of these 6 died—mortality, 35.3 per cent.
- (d) 7 cases had valvular disease of the heart; of these only 1 died—mortality, 14.3 per cent.
- (e) 3 cases had marked delirium; all died.
- (f) 1 case had practically no symptoms. In elderly patients the onset of pneumonia may be quite insidious.
- (g) A tinge of yellow in the conjunctiva was common, but marked jaundice hardly occurred.

*Relation of Temperature to Mortality.*

Maximum Temperature.	Cases.	Deaths.	Mortality.
Exceeded 105° F. ... ..	1	1	100.0
104°-105° F. ... ..	10	3	30.0
103°-104° F. ... ..	39	7	18.0
102°-103° F. ... ..	27	5	18.5
101°-102° F. ... ..	7	4	57.1
Under 101° F. ... ..	16	1	6.25

The most noteworthy feature of this table is the high mortality in cases where the maximum temperature ranged from 101° to 102° F. A low temperature in pneumonia may indicate imperfect reaction, and is common in

the elderly and in the alcoholic. It may also indicate a mild attack. A smart pyrexia is not unfavourable.

*Lung Involvement.*

	Cases.	Deaths.	Mortality.
(a) Double pneumonia ...	13	7	Per Cent. 54.0
(b) Right base ...	40	8	20.0
(c) Left base ...	31	2	6.4
(d) Right apex ...	5	1	20.0
(e) Left apex ...	3	0	0.0
(f) All right lung ...	4	1	25.0
(g) All left lung ...	4	1	25.0

These figures emphasize the deadliness of double pneumonia. They show a heavier mortality in right than in left pneumonias. They run counter to the view which has sometimes been maintained, that apical is more serious than basal pneumonia. In my cases, upon the whole, the contrary was the case. The moderate mortality in cases where an entire lung was involved is worthy of note.

*Complications.*

The complications recorded as having been present were as follows:

Pleurisy ...	8 cases.
Empyema ...	3 "
Pulmonary fibrosis ...	4 "
Pharyngeal abscess ...	1 case.
Gangrene of lung ...	1 "
Pharyngeal abscess ...	1 "
Unilateral spasm ...	1 "

No case of abscess of the lung was recorded. One patient developed aortic reflux during the attack. No clear case of malignant endocarditis occurred in the series, though its presence was more than once suspected. No patient, not previously tuberculous, developed phthisis as the result of his illness. Pleurisy was only noted as a complication where it was a prominent feature. No case of meningitis occurred. The small proportion of cases of empyema is noteworthy.

*Course of the Disease.*

Definite crisis, 52 cases—namely:

On the 3rd day ...	8 cases.
" 5th " ...	19 "
" 7th " ...	19 "
" 9th " ...	3 "
" 11th " ...	3 "

It is curious how this table supports the old medical tradition that the crisis usually occurs upon the uneven numbers. A termination by lysis was recorded in 34 per cent. of cases.

Average duration of patients' stay in hospital: Uncomplicated cases, 23 days.

*PATHOLOGY.*

The pneumococcus was found to be practically constant in the sputum.

*Seasonal Influence.*

The attack-rate, as is shown in the following table, was

*Influence of Season upon Attack-rate and Mortality.*

Month.	Cases.	Deaths.	Mortality.
January ...	11	3	Per Cent. 27.2
February ...	16	3	18.7
March ...	9	1	11.1
April ...	14	3	21.4
May ...	12	2	16.7
June ...	8	1	12.5
July ...	3	0	0
August ...	4	0	0
September ...	5	2	40
October ...	4	1	25
November ...	7	2	28.5
December ...	7	2	28.5

much higher in the months November to May than in the months May to November. The mortality shows some curious fluctuations in the monthly averages, but is, upon the whole, higher in the months of greater prevalence of the disease.

*Comparative Virulence of the Disease in Different Years.*

There is evidence that the disease varies much in intensity in different years. The following table is instructive from this point of view:

Year.	Cases.	Deaths.	Mortality.
1899 ...	3	0	Per Cent. 0
1900 ...	2	0	0
1901 ...	1	1	100
1902 ...	4	0	0
1903 ...	12	1	8.3
1904 ...	3	1	33.3
1905 ...	3	1	33.3
1906 ...	9	3	33.3
1907 ...	-	3	33.3
19'8 ...	8	0	0
1909 ...	10	2	20
1910 ...	8	0	0
1911 ...	14	5	35.7
1912 ...	7	0	0
1913 ...	7	3	43

Thus in six years out of fifteen the mortality was nil, while in seven years it was over 30 per cent. This can hardly have been a matter of chance. We must assume variations in the intensity of the virus of the disease. I cannot trace any connexion between varying rates of mortality and the meteorological characteristics of the different years. None of the years in the record were specifically "influenza years."

*MORTALITY.*

The general mortality was 20 per cent., or, omitting, as we may fairly do, two cases which were moribund on admission, 18 per cent. This is roughly the average mortality of the disease in general practice, including all ages and every degree of severity, but hospital statistics, which are usually less favourable, often show a much higher figure. Osler's mortality in his clinic at the Johns Hopkins Hospital was 30.4 per cent., or, excluding some cases of terminal pneumonia, 26.4 per cent. Goodhart had 25 deaths in 120 cases. At the Presbyterian Hospital, Philadelphia, the mortality was 28.7 per cent.; at the Montreal General Hospital, 20.4 per cent.; at the Boston City Hospital, 29.1 per cent. On the other hand, Fraenkel at the Hamburg Hospital had a mortality of 19.2 per cent., and Powell at the Middlesex Hospital a mortality of 17 per cent.

*PROGNOSIS.*

The prognosis is determined mainly by the following factors, namely:

- (a) The patient's age; this dominates the outlook.
- (b) The amount of lung involved. Double pneumonia is very deadly.
- (c) The general character of the symptoms. Marked cerebral involvement is very serious. Very high temperatures are grave, while abnormally low temperatures may indicate either a mild attack or deficient reaction. The latter is common in the aged and alcoholic. Slight febrile albuminuria has little weight, but signs of marked renal congestion are serious.
- (d) The nature of the complications. Gangrene and abscess of the lung are very serious. Pericarditis, of which curiously there is no record in any of my series of 100 cases, but which is not extremely rare, is a grave complication, and malignant endocarditis carries with it an almost certainly fatal issue. Meningitis is another rare complication which usually involves death. The good

record of my cases with endocarditis—7 cases with 1 death—is somewhat surprising.

#### DIAGNOSIS.

The diagnosis of pneumonia is usually obvious, yet mistakes are common, and not always due to carelessness on the part of the practitioner. In a small minority of cases the diagnosis is really difficult. Mistakes arise in the following ways:

1. Because the physical signs may be entirely latent for one, two, three, or more days. It is not very rare for a patient to have a typical seizure and to present all the typical symptoms while the most careful exploration of the chest fails to yield any definite signs. The sudden onset, the initial rigor, the sharp pyrexia, the urgent dyspnoea, and the rapid prostration should suffice to put us on our guard in such cases.

2. Because the early symptoms may be mainly cerebral—namely, intense headache, convulsions, delirium, excitement, or coma. The unwary practitioner is apt to diagnose these cases as meningitis or acute mania, but movements of the alae nasi, the temperature, the burning skin, and the signs in the chest make a correct diagnosis easy.

3. Because abdominal symptoms may be prominent at the outset, especially abdominal pain. Five instances of this unfortunate error are recorded in my series, three cases being mistaken for "colic," one for enteric fever, and one for subphrenic abscess. But this by no means exhausts the category of abdominal conditions which have been confused with pneumonia. Perforation of the stomach or bowel, appendicitis, peritonitis, and even acute pancreatitis have been wrongly diagnosed and laparotomies needlessly performed. These mistakes are easily avoided by attention to the history, the mode of onset, the temperature, the dyspnoea, and the physical signs in the chest.

4. Because certain of the specific fevers have occasionally a pneumonic onset. I have seen several cases of enteric fever which began with pneumonic symptoms and signs and where the diagnosis at first was difficult. But if we are on our guard we need not fall into error. Some of the characteristic signs of enteric will soon appear. An enlarged spleen, a suspicious spot or two, a significant course of the temperature, or Widal's reaction, may give us the necessary hint. In some countries, in the presence of an untypical pneumonia, our thoughts should turn to plague.

I will not occupy your time by a discussion of the differentiation of pneumonia from pleurisy, bronchopneumonia, or pneumonic phthisis. Every textbook on medicine does full justice to such matters.

#### TREATMENT.

It remains to speak of treatment. I shall first indicate my own methods and then deal with two or three controversial points.

I treat pneumonia as an acute general infection, with special impact upon the lungs, inducing a very intense type of toxæmia, and involving special danger from the side of the heart. Everything that tends to conserve the patient's strength and remove sources of irritation receives attention. Our system of ventilation at the Royal Victoria Hospital, which changes the air seven times in each hour, secures an abundant supply of pure air. Only milk is allowed—three pints in the twenty-four hours—any excess of nourishment being regarded as likely to remain unabsorbed, and to distend the stomach, and embarrass the heart. A light warm poultice, frequently renewed, is applied to the chest, care being taken not to embarrass the respiratory movements, and after the third or fourth day this is replaced by a jacket of cotton-wool. In the hope of diminishing the toxæmia the skin, bowels, and kidneys are gently stimulated, all remedies which might tend to depress the heart being avoided. If the patient is in great pain or very restless a hypodermic of morphine or a few grains of Dover's powder are administered.

In the presence of any signs of circulatory weakness strychnine is given hypodermically, and ammonia and digitalis, and sometimes caffeine, by the mouth. Alcohol is used sparingly, and only in the more serious cases and in moderate or small quantity. Of the 100 cases in my series, only 39 received any alcohol. Brandy was the usual stimulant, and the amount seldom exceeded three or

four ounces. In the presence of unusual dyspnoea or cyanosis oxygen is administered, the gas being passed through alcohol. Tepid sponging is vigorously practised in every case, and cold sponging when the indications seem to point to its use. Antipyretics or expectorant drugs are not administered.

Bleeding was not employed in any of this series of cases, though I have had some small experience of that procedure elsewhere. For the relief of persistent insomnia paraldehyde, bromides, and morphine are sparingly used. The various complications, when they arise, are treated upon the usual lines. After the crisis all special medication is suspended, the patient is allowed a liberal diet, and some tonic is administered. Alcohol is always stopped at this stage, unless there are serious complications.

The above represents a comparatively simple therapy, and I am persuaded that fussy and meddling treatment in pneumonia does more harm than good.

In conclusion, let me deal briefly with some controversial points. I have never used icebags or ice poultices to the chest in pneumonia, and I can furnish no evidence as to their value. This method of treatment does not appear to be gaining favour. There seems to be some danger that it might depress the heart. As clots are found *post mortem* in the right heart in many fatal cases of pneumonia, I tried the administration of citrates and citric acid in a few cases some years ago, but I could not satisfy myself that this line of treatment presented any advantage. I have made a limited trial of serum treatment, but have not felt encouraged to persevere with this method. On theoretical grounds pneumonia seems a particularly unpromising field for vaccine therapy. We may yet get an efficient serum, but up to the present no such remedy appears to be available.

I have seen bleeding employed in a few cases, and there is no doubt that the removal of a few ounces of blood tends to relieve the labouring right heart, and to mitigate the dyspnoea. But I have no wish to see this long-discarded method reintroduced into general favour. If applied without great discrimination, it is quite capable of turning the frail balance against a patient at the critical juncture. We should need some definite statistics to prove the efficacy of venesection before adopting it as a common expedient. Textbooks give the practice a sort of qualified benediction, but cautious practitioners are shy of it at the bedside.

The value of alcohol in pneumonia is a vexed question. I incline to its use in moderate quantity in severe cases, and in the presence of circulatory weakness, especially in patients who are no longer young and who have been accustomed to it in health. In mild attacks, in most young patients, and where the pulse is good, it is better withheld. It should certainly not be given in any routine fashion or in the excessive quantities which were at one time in vogue. If we may often be in doubt as to the wisdom of prescribing alcohol, we can generally tell without much difficulty whether, when given, it is proving of service. The effect upon the pulse, the nervous system, the skin, the urine, and upon sleep are the chief points which should guide us in this matter.

Among the errors to be avoided in the treatment of pneumonia we might signalize the following: Neglect of thorough ventilation; forgetfulness of the fact that any local applications which impede the free movements of the chest are likely to do harm; the use of expectorants which are probably inert; the excessive employment of strychnine and cardiac tonics in the absence of signs of circulatory weakness; too much timidity in the use of sedatives in the early days of the disease; too much nourishment; too free exhibition of alcohol.

In the treatment of unresolved pneumonias every case must be dealt with according to its special indications. Counter-irritation is usually employed, and fibrolysin and the  $x$  rays are recommended. Our main reliance, however, will probably be upon general tonic and hygienic measures and change of air. Mountain air is often useful.

To sum up, we should treat pneumonia on the lines of the acute general infections, remembering the intensity of the toxæmia, its self-limitation and relatively brief duration, its tendency to depress the heart and cause circulatory failure, the increase of the fibrin elements in the

blood, the importance of a fortifying line of treatment and of avoiding all depressing measures.

The problem of specific treatment still awaits solution.

(I have to acknowledge the valuable assistance of my house-physician, Dr. Turkington, in preparing the data for this paper.)

## A Lecture ON RADIUM IN THE TREATMENT OF MALIGNANT DISEASE.

DELIVERED AT THE CANCER HOSPITAL, BROMPTON.

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THE action of radium on human tissues was accidentally discovered by Bécquerel in 1901. He carried a quantity of unprotected radium in one of his pockets for a time. A fortnight later a burn appeared on the skin. This accident quickly led to a number of experimental exposures, first on animals and later on human subjects. Wickham of Paris experimented largely with the new agent, and there is no doubt that the medical profession is greatly indebted to this pioneer in radium-therapy, both for the valuable work he has carried out himself, and for having stimulated others to work on the subject.

Remarkable success followed the use of radium on superficial lesions of the skin; naevi, keloid, lupus, rodent ulcer, and, later, epithelioma, have yielded to its curative power.

### METHODS OF APPLICATION.

The emanation may be used for inhalation alone or mixed with oxygen, by injection, or, after its deposition upon metals, in glass tubes or on agar pads.

Inhalation has had up to the present no practical value in the treatment of malignant disease. The emanation may be injected into tissues in a saline solution. The solution takes up a very small percentage of the active gas, and is therefore hardly applicable for the type of case we are usually called upon to treat.

The deposition of the active principles upon metals, etc., opens up a large field of usefulness, and it is possible that in the future we may be able to make good use of this method in selected cases.

Experiments are being carried on by Mr. Phillips, the honorary physicist to the hospital, on the absorption power of petroleum, and we hope to get a fairly large percentage of the emanation taken up by petroleum, giving us a very active preparation which may be useful both for internal administration and for injection into the tissues; by the former method it is hoped that we shall be able to introduce into the system a large quantity of radio-active matter. We cannot expect to influence cancer and similar disease, but Dr. Bellingham Smith has shown that radium emanation in whatever form it is used is rapidly eliminated by the respiratory organs, so that a future field of usefulness for radium may lie in the treatment of respiratory diseases (phthisis, asthma, chronic bronchitis, etc.).

The deposit of emanation upon flat surfaces (pads of agar-agar) and their application to the surface of a growth and ionization of the particles into the deeper structures by the aid of a galvanic current may prove to be a useful method.

Flat applicators containing the radium in a varnish are useful in the treatment of rodent ulcer, superficial epithelioma, recurrent nodules of cancer, etc. It is chiefly the beta rays which are employed by this method.

Radium contained in metal tubes which act as filters, of the necessary thickness, may be used for particular purposes, and several tubes may be arranged around a growth.

Tubes may be inserted into the various cavities of the body (mouth, oesophagus, etc.). In treating a stricture of the oesophagus, a preliminary x-ray examination is necessary to locate the stricture and to give some idea of the

extent of the malignant growth. A bismuth cachet is swallowed by the patient, and when screened may be seen passing down the oesophagus. Should there be obstruction, the cachet will be found in the stricture. The exact situation of the obstruction can be determined before the radium tube is passed into it. Later, a radiograph will help us to ascertain if the tube occupies the correct position necessary to influence the growth.

Radium tubes may be buried in the substance of a tumour for a time determined beforehand. It is important that the tubes shall be well surrounded by the growth in order to get the maximum effect of the radiations upon the new growth; the tubes should be placed at equal distances from one another to ensure an equal distribution of the radiations.

### ACTION OF RADIUM UPON TUMOUR CELLS.

The action of radium on tumour cells is not purely caustic, though caustic effects can readily be produced if the exposure is too prolonged or the filtration is insufficient. In some growths we deliberately make use of the caustic action to produce necrosis of the mass, in the hope that when the slough separates the normal tissues will fill in the resulting ulcer.

Occasionally enlarged glands are reduced in size with hardly any skin reaction; nothing more than a slight erythema may be produced even after repeated exposures to the same area of skin, yet the enlarged glands situated at a much deeper level slowly diminish in size.

Malignant indurated ulcers will rapidly break down and heal under the action of radium.

The degree of action induced is dependent upon the method of application. The various degrees of tissue change depend upon the filtration employed and the length of the exposure. Thus, if necrosis of the growth is necessary, a thin filter would be used and a long exposure given. Here we are making use of the beta ray almost entirely. Should it be necessary to act on a deeper structure and at the same time protect the skin from such action, a thick filter of platinum or lead is used. Two millimetres of platinum or four of lead are sufficient to cut off all but the hardest of the beta rays, while the gamma ray is unaltered. The filters containing the radium are enclosed in a rubber tube to prevent the secondary radiation induced in the platinum by the radium rays from damaging the superficial structures. If the exposure be long, further protection can be secured by using an inch or more of lint or gamgee tissue.

In this way we can control the exposure so that we get nearly the pure gamma-ray effect. This enables us to get an action upon the deep-seated parts.

It has been claimed that radium possesses a "selective action" on cancer cells. While admitting that it undoubtedly appears to act on such cells, the word "selective" is badly used. Radium exercises an action on all living cells in a varying degree according to the resistance of the particular cell in question. Thus, young actively growing cells are more readily influenced than mature cells. The cells of a new growth approximate in structure and power of resistance to the actively growing cells of a tissue. In this way it is conceivable that the cancer cell is influenced should it at the time of exposure be attacked comparatively early in its life-cycle. Should the cancer cells be of a stronger or more vigorous type, it is conceivable that the action of the radium may be stimulating, and instead of a decrease in vigour of a particular cell we may find an increase in activity, and a consequent increase in the size of a tumour. It is a fact that some cases of cancer increase in size at a quicker rate after radium has been applied. Some types of cancer are more amenable to radium treatment than others.

In addition to the action upon the cancer cell itself, radium acts upon all the tissues composing the growth and surrounding structures unequally. There is a general stimulation of the healthy tissues as a result of radium treatment so long as the exposure is not excessive. If it should be excessive the action is apt to produce a caustic and ulcerative effect, which leads to local death of the tumour and a portion of the tissues around it. This may sometimes be desirable.

When the effect upon the healthy tissues is confined to stimulation, we expect to find an increase of fibrous tissue formation which shuts off the cancer tissue from its blood