An Address ON PNEUMONIA: ITS NATURE AND TREATMENT.

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THE subject of pneumonia, which I have chosen for this address, may appear to most of you threadbare, and it is one on which I have frequently lectured and written, but it is always possible to present an old subject in a new light. Moreover, a disease which kills more of His Majesty's lieges in this country than any other, with the single exception of tuberculosis, must always command the attention of thoughtful men. To-night I shall not weary you with any historical sketch, diagnostic problems, or symptomatology, with which I shall assume that you are all familiar; but I shall limit our attention to some points which I think worthy of the consideration of an intellectual audience. I have long held that pneumonia is, to a great extent, a preventable disease, and, in dealing with this ubiquitous affection, prevention must more largely rest with the general practitioner than with the medical officer of health. For the prevention and cure of this or any other disease we must have a good knowledge of its incidence, etiology, and proper treatment. It is to these topics that I shall devote your attention to-night.

INCIDENCE.

In 1909 the deaths from pneumonia in England and Wales considerably exceeded those from phthisis, the numbers being per 1,000 deaths, pneumonia 89, phthisis 74.6, and the rate per million living, pneumonia 1,290, phthisis 1,080. In 1911 the death-rate from pneumonia had fallen to 1,041 per million living, while the deaths from phthisis (including 22 per million of population from acute miliary tuberculosis) reached 1,084. This death-rate from phthisis of 1,084 per million persons amounted to 7.4 per cent. of the total death-rate, and was composed of the rate of 1,256 for males and 923 for females. It would seem as if the great fall in the death-rate from tuberculosis, which was very marked during the past fifty years, had been somewhat checked since the great outcry about the conquest of consumption began. In 1911 the deaths from all forms of tuberculosis in England and Wales were 53,120, against 51,317 in 1910. There is evidently still plenty of scope for those gentlemen who have done so much shouting and made so little progress.

The total deaths in England and Wales in 1911 from pneumonia were 21,582 males and 16,060 females; total, 37,642, which gives a death-rate per million persons of 1,041. There were also 14,391 deaths from pneumonia as a complication of other diseases, such as measles, whooping-cough, influenza, enteric fever, etc.

In the Registrar-General's report for 1911, Dr. Stevenson remarks on the mortality from pneumonia that, "apart from London, where it is high, there is a steady decrease from north to south in all classes of area and in both sexes, the position of Wales being intermediate between the North and the Midlands. The range of mortality is extreme, being four times as great for males in the county boroughs of the North as for females in the rural districts of the South, and not far from three times as great when persons of the same sex are compared. Even when comparison is restricted to the same class of area, in each case the mortality of the North is in no instance very much less than twice that of the South. No doubt this depends to some extent upon industrial conditions, but these can scarcely explain the great difference between the North and the Midlands. Evidently pneumonia is to a large extent a preventable disease, and the North of England has still much to learn with regard to its prevention. Statistics show pneumonia to be largely a disease of town life, as in all parts of the country mortality increases with urbanization, though the county boroughs of the South suffer less than the rural districts of the North."

The death-rates from pneumonia and phthisis in London are very heavy, being respectively 1,253 and 1,382 deaths per million persons living; these rates are high for the South, but there are many cities in the North of England and in Scotland where the death-rates from these diseases are much higher.

In dealing further with the incidence of this terrible disease I shall take Glasgow and Liverpool, with which cities I am fairly well acquainted. I am indebted to the reports of the Medical Officers of Health of Glasgow and Liverpool for much statistical information. In their reports for 1912, before we got greater Glasgow and greater Liverpool, the two cities were very similar in population, birth-rate, and death-rate, the only striking difference being in density of population, which was in Glasgow 60 persons to the acre and in Liverpool 45.2; the deaths from pneumonia were in Glasgow 1,378 and in Liverpool 1,469, which gave a respective death-rate per million persons living of 1,756 and 1,953.

Dr. Chalmers points out that while the death-rate from all causes in Glasgow in 1912 was 177 per million population less than in 1911, the death-rate from pneumonia was 138 per million more. There was a great difference in the death-rate from this disease in different city wards per million persons living: In Blackfriars the rate was 2,989, in Calton 2,600, in Hutchenstown 2,511, in Mile End 2,237, in Kingston 2,214, in Cowcaddens 2,203, and in Broomielaw, 2,122. In the following wards a very low death-rate was recorded: In Dennistown 935, in Langside 716, in Pollokshields 624, in Park 583, and in Kelvin-side 519. In the wards with a high death-rate there was also a high birth-rate, but even of more importance to our present subject is the admirable paper by Dr. Chalmers on "The house as a contributory factor in the death-rate." The general death-rate, 1909-12, per 1,000 persons was in houses of one apartment 25.9, in two apartments 16.5, in three apartments 11.5, in four apartments and upwards 10.8. The reduction in the death-rate during the previous decennium was 20.8 per cent. in one apartment residences, 22.5 per cent. in two apartments, 16 per cent. in three apartments, and only 3.6 per cent. in four apartments and upwards. The proportion of children is greatest in the smallest houses, thus supporting his contention that the chief fall in the general death-rate during the decennium has been among children. In relation to pneumonia he shows that "at each age-period, almost without exception, the higher rates fell on the houses of one and two apartments. It would therefore seem to be a disease entirely of environment and climatic conditions, resembling in its behaviour, indeed, those of a more definitely infectious type. In infancy the rate for the larger houses is equal to two-thirds that of one apartment, but a greater interval separates the rates from bronchitis, and is probably related to the increasing air impurity in houses of smaller size." In this relation the following table is very instructive:

Table of the Death-rate of Male Children under 1 Year from Diseases of the Respiratory Organs.

	Pneumonia.	Bronchitis.	Other Diseases of Respiratory Organs.	All Diseases of Respiratory Organs.
1 apartment ...	21.46	13.35	4.95	39.76
2 apartments ...	21.05	11.54	2.92	35.51
3 apartments ...	15.56	6.67	4.44	26.67
4 apartments and upwards	14.42	5.61	—	20.03

Dr. Chalmers also shows from the experience of Glasgow "how rapidly fog and low temperature, when combined even for a short period, are disastrous alike to persons at both extremes of life."

The increase in the death-rate from pneumonia during recent years is, no doubt, partly due to a more correct certification of deaths, many of those formerly labelled "bronchitis," especially among children, being now more correctly designated pneumonia. But whatever the cause of the apparent increase, there can be no doubt that the death-rate from this disease is somewhat fearful. During 1912 there were in Glasgow 723 deaths from pneumonia

under 5 years of age, and 576 over 25 years. In Liverpool at these respective ages there were 738 and 629 deaths. In Glasgow during the same year and at the same ages there were 256 and 648 deaths from bronchitis, while in Liverpool the respective number of deaths were 375 and 1,022. From these statistics it would appear to me that correct death certification is rather more strictly carried out in Glasgow than in Liverpool. Both these diseases are very fatal at the extremes of life, and bronchitis especially so in old age, while pneumonia is the much more fatal of the two in middle life. In these two cities between the ages of 25 and 45 there were 377 deaths from pneumonia and only 115 from bronchitis.

Pneumonia occurs in all climes and is fairly common in many tropical countries. In this respect its incidence differs from that of bronchitis, which increases in frequency as we recede from the tropics. Hirsch says:

Although the *geographical position* cannot be shown to have much to do with differences in the diffusion of pneumonia over the globe, yet the amount of sickness depends very decidedly upon certain influences of *season and weather*.

In this insular climate the disease reaches its maximum about December and January, and is about twice as frequent in the winter and spring months as it is in the summer and autumn. On the other hand, according to Hirsch and Jürgensen, it reaches its maximum from February to May on the Continent of Europe and in America. Hirsch says:

We may with all confidence conclude from the very pronounced association of pneumonia, whether sporadic or epidemic, with winter and spring, that the origin of the malady is dependent on weather influences proper to those seasons, and more particularly upon sudden changes of temperature and considerable fluctuations in the proportion of moisture in the air. That conclusion finds support in the opinion expressed by many observers in all parts of the world, that the number of sporadic cases of pneumonia, as well as the extent and severity of its epidemics, is in direct proportion to the degree in which these influences, the changes in temperature in particular, make themselves felt, and that any exceptionally large number of cases of inflammation of the lungs at other seasons, more especially in summer, has coincided with the prevalence of the same meteorological conditions phenomenally at that season.

That conclusion is still further borne out by the fact that in those northern regions (Russia, Sweden, Denmark, Germany, England, North of France, and the Northern States of the American Union) where the most sudden and severe changes of temperature fall in the spring, the largest number of cases is met with in the spring also; while in the warmer and sub-tropical countries (Italy, islands of the Mediterranean, Spain and Portugal, Greece, Algiers, Southern States of the Union, Chili and Peru), which are subject to these meteorological influences for the most part in winter, it is winter that represents the proper season of pneumonia. One other fact deserves to be noticed here—namely, that those tracts of country, especially in the tropics, which are highly favoured in their climate, or in the steadiness of the temperature from day to day (Egypt, many parts of India, including Bengal and the plain of Burma, California, etc.), are subject to pneumonia to a comparatively slight extent.

It is much less prevalent in the country than in town, and less among those who lead an outdoor life than among those whose occupations confine them to close, ill-ventilated and insanitary buildings. It is rarely nowadays contracted at sea, though I have seen it develop there. In former ages there were many epidemics of pneumonia in the navy, barracks, gaols, workhouses, asylums, etc. None of the Polar expeditions seem to have suffered from it. Exposure to cold, especially damp cold, seems to lead to catarrhal affections rather than to true pneumonia; sudden variations of temperature may so depress the resisting powers as to become a markedly predisposing cause of the disease. It has been correctly asserted that exposure during sleep increases the predisposition to this disease, and this is no doubt due to the lessened control of the nervous system. This applies more especially to the aged and young, whose resisting powers are easily enfeebled; consumptives and others who can keep the furnace burning within, readily withstand the cold air in their bedrooms, though draughts of cold damp air may easily induce catarrhal conditions. Frequent draughts of alcohol are, in my opinion, a much more important predisposing cause than any draught of cold air, and this may to some extent account for its greater prevalence among men than among women. A high barometric pressure is inimical to the origin of pneumonia, and is of advantage in the treatment of the disease.

A cold foggy atmosphere saturated with moisture is very deleterious.

RACE.

Hirsch says:

While the immigrants from northern latitudes to sub-tropical or equatorial regions enjoy a comparative immunity from inflammation of the lungs, the natives of the tropics and most of the negroes are subject to the malady in quite a peculiar degree, not merely when they go to live in colder regions, but also within the countries of their birth. I am unable to say how far this fact is to be explained on the ground of a predisposition (congenital or acquired) in the coloured races, particularly in the negroes; or whether in their case also the wretched state in which they live, and their notorious carelessness in exposing themselves to the weather, may not be to some extent the decisive thing.

There has been a good deal of agitation about the excessive death-rates from phthisis and pneumonia among the negroes engaged in mining work on the Rand. On the other hand, the Chinese when thus engaged were very healthy, the death-rate from all causes being only 12 per 1,000 living, while the general death-rate of the negro population was often as high as 40 or 50.

There is no race exempt from this disease, though some seem much more liable to it than others, and in the same race the difference in individual immunity is often very marked.

SEX.

While the incidence is less among women, the percentage mortality among those affected is quite as great as, if not greater than, among men, and this is perhaps due to the lesser vital capacity of females. This disparity in the mortality between the sexes occurs at all ages, and is a markedly contributing cause of the excess in the female over that of the male population.

AGE.

There is no age exempt from pneumonia; statistics show that it is most common and most fatal during the first two years of life, and even at this early period of life the incidence and mortality is greatest among males. The disease is very prevalent and fatal up to the age of 5; after this the incidence and mortality are low till 25 or 30. There is then a gradual increase both in the incidence and mortality up to the age of 65 years, but in old age the occurrence and mortality are not so great as from bronchitis. It frequently attacks those of strong constitution, but rarely when they are in good health, while the weak and debilitated are very prone to the disease.

ETIOLOGY.

Pneumonia—both croupous pneumonia and broncho-pneumonia—is an infective process for the most part due to the pneumococcus of Fraenkel, though many other micro-organisms play an important part in its causation, such as the influenza bacillus, staphylococci, streptococci, the *Bacillus typhosus*, the plague bacillus, and practically all the pathogenic bacteria. Since 1890 the prevalence of influenza has led to a varying increase in the number of cases of pneumonia. Here the inflammatory mischief is of a low congestive type and often rapidly fatal; but the bacillus of Pfeiffer does not seem to lead to the marked consolidation of the lung which takes place in cases associated with the pneumococcus of Fraenkel. However, in these cases there is not infrequently a mixed infection. The pneumococcus usually exists as a harmless organism in the mouth and upper air passages. What, then, are the predisposing causes which give rise to its cultured malignancy in the air cells, causing a serious disease, which, as we have seen, occurs in all climes and at all ages?

There can be no doubt that the pneumococcus, either alone or in association with other pathogenic organisms, is the chief cause of pneumonia or pneumonic fever in the vast majority of cases, but in the present day no one will contend that it is the only cause of the very large and varied class of diseases which, according to our present classification, we group under the generic head of "pneumonia." Many of the cases differ very widely in their general characters, even apart from the predisposition or special constitution of the individual affected, and have very little in common except that they all involve an inflammation, more or less, of the lung. Who can view a true croupous or fibrinous pneumonia,

involving perhaps the whole of one lung, without much more nervous disturbance than that of sleeplessness, and a case of pleuro-pneumonia limited to the apex of one lung, and associated with wild and noisy delirium, without coming to the conclusion that there is at least a difference in the virulence of the toxin in the two cases?

The pneumococcus is often sparsely disseminated in the expectoration, while staphylococci and streptococci may be found in much greater profusion. I have recorded a severe case of pneumonia associated with phlegmonous erysipelas and abscesses in the leg; streptococci were found in the purulent discharge, and both the patient's lungs and leg were cured by antistreptococcus serum. In another very severe case of pneumonia with mixed infection, in a young lady, which I published in 1900, an abscess was apparently forming in the lung, and streptococci were found in the serum obtained from the focus by an exploring needle; she was cured by a few injections of antistreptococcus serum.

In surgical practice cases of pneumonia are not at all uncommon, and are generally ascribed to draughts from the window, whereas, the true cause may be some infective pyaemic organism. In operations in the mouth and throat pneumonia is especially frequent. In my opinion, when possible, no operation should be undertaken in this region until a careful examination of the flora of the mouth and throat has been made for pathogenic organisms and a suitable vaccine administered. Very many years ago my friend, Mr. Paul, in his cases of operation for cancer of the tongue and floor of the mouth, adopted my suggestion of placing the patient for some days before the operation on a mixture containing calcium chloride and administering three doses of antistreptococcus serum; since then he has had no pneumonia in such cases. More recently I wanted him to try a vaccine as a preventive measure, but he avowed that he was quite satisfied with his present procedure, as he has not had a single failure.

The pneumococcus is often present in the mouth and upper air passages even in health as a harmless saprophyte, but in these low septic pneumonias of which I am speaking I do not think that it is often the principal offending organism. Pneumonia is often associated with influenza, typhus, typhoid, diphtheria, measles, anthrax, glanders, pneumonic plague, and other infectious diseases, and in such cases the pneumonitis most probably owes its origin to the micro-organism of the primary disease, though in certain cases the pneumococcus may be also in action. An inflammatory process in the lungs or elsewhere may be started by a great variety of micro-organisms, but a true croupous pneumonia starting and ending abruptly is due to the pneumococcus. I have seen pneumonia occur as a sequel to carbolic acid taken with suicidal intent. Again, we have the so-called ether pneumonia—probably a true pneumonia—and the hypostatic pneumonias associated with many debilitating diseases. We have also seen that in 1911 there were 14,391 terminal pneumonias in England and Wales. I have no doubt that in the future all these varied types, which we now classify under the generic head of "pneumonia," will be arranged in proper classes; in fact, we have now got lobar pneumonia, broncho-pneumonia, and pleuro-pneumonia, and in our treatment of individual cases we are largely influenced by our knowledge of their nature and causes. Perhaps our classification does not matter very much so long as we recognize the true nature of each individual case, and recollect that it is the patient rather than his disease which we have got to treat.

I have reckoned that the incidence of pneumonia affects at least 1 per cent. of the population of Glasgow and Liverpool each year. It may, of course, be looked upon as a good racial disease, as it kills the weaklings, and, as a rule, causes no permanent injury to the survivors. But, unfortunately, it does much more, and cuts off a large number of both sexes, more especially the male sex, in the prime of life. It is often very appalling to see the breadwinner of a large family cut off in the vigour of manhood after a few days' illness.

Notwithstanding the prevalence and widespread nature of this disease, there are very many individuals fairly immune, but even these become susceptible when their resisting power is lowered from any cause. The domestic fowl is fairly immune to anthrax, but when its normal

temperature is lowered it becomes readily susceptible; a similar readiness to develop this disease occurs in the adult white rat when it is over-fatigued. I look upon the immunity to pneumonia which numerous human beings possess as a very relative term, and therefore those who possess such immunity should not ruthlessly destroy it.

Alcohol is a strong predisposing factor, a factor which not only increases the incidence of the disease, but also immeasurably lowers the resisting power of the individual, and so increases the mortality-rate. On the other hand, it must be said that gouty individuals who eat well and drink moderately, or perhaps rather freely, are not particularly prone to the disease, and the mortality in their cases is low. An excessive amount of lime salts in the blood and tissues greatly increases the resisting power of the individual, and so both lessens the incidence and the mortality. A lay friend of mine maintains that the general death-rate is lower in districts supplied with hard water than in those where the water is soft. This is not a point which I have myself studied, but it might be worthy of the attention of Glasgow and Liverpool, where the water is exceptionally soft. Personally I am not inclined to recommend this method of preventing disease strongly except within well-defined lines, as in escaping Scylla you might fall into Charybdis.

PREVENTION.

The way to prevent pneumonia is to increase the resisting power of the individual; hence you should encourage temperance or even total abstinence, and the avoidance of all debilitating agencies, such as undue exposure, over-fatigue, work in an insanitary, stagnant, moist atmosphere. There should be an abundant supply of fresh, moving air night and day; the body temperature should be maintained by a proper supply of food, and there should be suitable external clothing to assist the regulative mechanism of the body in maintaining and distributing the heat which it has generated. A fever patient may be packed in ice so long as the temperature is high, but if this treatment be continued after the temperature has fallen to normal you quickly get congestion and oedema of the lungs.

A corpulent individual is not particularly prone to the disease, but a fat, flabby man, perhaps with a heart infiltrated with fat, and who gets out of breath on the slightest exertion, has a very poor chance when he develops an attack of pneumonia. People should be encouraged to develop muscle rather than fat by plenty of outdoor exercise.

Any septic condition of the mouth increases the virulence of the pathogenic organisms, and so a foul-mouthed individual is usually a greater danger to himself than to others. The mouth should always be kept perfectly clean and as aseptic as possible, and the teeth in good order. The nasal passages and throat should be kept clean with some simple oily preparation, such as pure liquid paraffin, as they are frequently the paths of infection for pneumonia, rheumatic fever, influenza, diphtheria, and cerebro-spinal fever. As many of the micro-organisms which induce pneumonia may be introduced by other paths than the respiratory passages, all sources of pulmonary infection should be obviated. A cool bath each morning and physical exercises improve the vitality and general resisting powers of the individual. Leonard Hill has recently shown that the depressing effects of crowded rooms are more due to the stillness and moisture of the atmosphere than to the carbonic acid; hence the air should be kept moving, and the drier it is the better. I have seen a case of bronchitis almost drowned in his own secretions rapidly cured by raising the temperature of his bedroom and drying the atmosphere.

Pneumococcal and influenzal vaccines, introduced by Sir Almroth Wright, act not merely as curative but also as preventive agents by establishing an artificial immunity. In apoplexy and hemiplegia the patient frequently succumbs to an attack of pneumonia, and this can be obviated by a proper vaccine and by keeping the mouth clean. Many of the terminal pneumonias might be thus prevented. After a severe chill, or prolonged exposure and fatigue, the individual should have a warm bath, be put to bed in a warm room, and have warm liquid nourishment; whisky and hot water is a favourite remedy, but a bowl of hot gruel or a cup of hot coffee would have a more beneficial effect.

TREATMENT.

A common cause of the high mortality from pneumonia is the lack of proper early treatment, often owing to the fact that some medical men take two or three days to diagnose the disease and then call it congestion of the lungs, and treat it cavalierly as a matter of no great importance for fear of frightening the patient, until the unfortunate individual is too ill to be frightened by anything. In my opinion, if pneumonia were early recognized and properly treated, the mortality would be greatly lessened.

A few years ago a young friend was dangerously ill in the South of England with one of the worst attacks of typhoid fever I have ever seen, and his condition was not improved by the fact that he had been treated as a case of influenza for the first ten or twelve days of his illness. I was with him many days and nights, and one night he almost succumbed to an attack of acute pulmonary cedema; there was just a flicker of consciousness left, his breathing had almost ceased, except for a few short, shallow gasps, and a nurse was kept busy wiping away the frothy fluid which welled out of his mouth. By continually shouting at him to breathe, mechanical stimulation of his respiration, and the free administration of atropine he pulled round. Three days afterwards, on a Sunday, he showed signs of a commencing pneumonia which I thought was pneumococcal from its somewhat abrupt onset in the middle of the fever. I wired for some pneumococcal vaccine, took a swab from his throat, with which I returned home that night, and told the medical attendant that he would have my report by wire in the morning, before the vaccine could arrive. I found pneumococci, and the patient had several doses of vaccine, which contributed to his recovery.

The treatment of pneumonia was the battlefield of contending schools of thought for the greater part of the last century, and yet the death-rate has not materially decreased. In some respects our forefathers had the advantage over us in that they agreed to bleed, starve, or stimulate their patients; but now we have arrived at the "do as you please" period, so that there is no uniformity. The excessive blood-letting in the early part of last century led to a revulsion in favour of the expectant and supporting treatment of Hughes Bennett and the non-interference of Skoda and Diel. Yet it is highly probable that the mortality during the active period of adult life was not greater under the antiphlogistic treatment than it is in the present day. In the presence of a disease with a high mortality neither the public nor the profession were content to do nothing, and then followed the very pernicious system of Todd, who dosed his patients with huge quantities of alcohol, a practice which, in a somewhat modified form, has been perpetuated, I regret to say, to the present day. Then came the antipyretic treatment, which, as carried out by Jürgensen, von Ziemssen, Liebermeister, and others, had definite objects in view, and was attended by a fair measure of success, but it involved too much trouble ever to become popular in this country.

There are many men who have no hesitation in prescribing such noxious drugs as phenacetin, antifebrin, antipyrin, and other coal-tar products made in Germany, who would never dream of undertaking the trouble of administering the German cold bath.

We have recently had the antiseptic treatment of pneumonia, which is as irrational as any which preceded it. The idea of attacking the pneumococcus is very self-satisfying to young physicians, but I would strongly dissuade you against any such frontal attack, because the chances are 1,000 to 1 that you will not succeed; but, on the other hand, you may succeed in killing your patient. The great curse of all these systems is that the treatment is directed to the disease rather than to the patient. It is far more rational to try to increase the resisting powers of the individual, or to protect him against the ravages of the pneumococci or other pathogenic organisms and their toxins. The pneumococcal vaccine of Sir Almroth Wright is extremely valuable if used in the early stage of the disease. I rarely use more than 20 millions, and I have the dose repeated the following or second day, as deemed advisable.

A good leucocytosis in the early stage of the disease is a favourable omen, but it is not necessarily so in a late stage, when there is purulent infiltration. When there is

a defective leucocytosis, the formation of a fixation abscess has been highly extolled; but I prefer a very old remedy—the application of a large fly-blister. My friend the late Sir Mitchell Banks used to tell about an enormously big, fat, plethoric man, over 20 st. in weight, he thought was dying from pneumonia; the late James Long was called in, and he literally covered the man's back with a great quantity of liquor epispasticus which he laid on with a large paint brush; the following morning Banks found the man sitting up in bed reading the newspaper, and he made a good and rapid recovery. Sir Mitchell Banks was not an authority on pneumonia, so I give this case with all reservations as to the diagnosis, but there is no doubt in my mind that this old remedy is too much neglected in the present day, especially where there is a poor leucocytosis.

THE CAUSES OF DEATH IN PNEUMONIA.

In treatment our chief object is to cure our patients—to restore them to the *statu quo ante*. In dealing with an acute and self-limited disease like pneumonia we must always recognize the fact that a large proportion of cases get well without treatment, under any treatment, and in spite of treatment, so that in, say, 75 per cent. of our cases we must not take too much credit for any line of treatment which we adopt. Yet the almost universal death-rate is, in my opinion, far too high, and it seems to me that if we are to improve our treatment we must look at the question from a fresh standpoint, and ask ourselves why do so many persons die from an acute but short specific disease? When a patient dies it is a simple enough matter to find out sufficient reasons to account for his death, but it is much better to see the danger signals ahead and try to steer the patient clear of them.

You will not infrequently meet with men who tell you that they never or only very seldom have a death from pneumonia, and they will detail some line of treatment which has long since been discarded by men of experience. You can swallow as many of their statements as you like, but in my opinion the man who never sees a death from pneumonia never sees much, and his patients belong to that large class who get well in spite of treatment. Moreover, when dealing with the incidence of this disease, I pointed out the enormous disparity in the death-rate in different parts of the country, at different ages and between the sexes. The severity of the disease varies much and also the natural powers of recovery of the patients. I would like to see some of those gentlemen located for twelve months in Blackfriars, where the death-rate from this disease is nearly six times that of Kelvinside.

In Children.

We will now consider the classes of patients who die from pneumonia. I have referred to the very heavy mortality which occurs during the first five years of life, and more especially during the first two years. No doubt the vast majority of these cases included in the Registrar-General's returns are cases of bronchopneumonia or capillary bronchitis, but yet after the second year true croupous pneumonia is not at all uncommon. The case mortality is variously stated as from 30 to 50 per cent., and I have a shrewd opinion that the bronchitis kettle is to a considerable extent responsible for this excessive mortality. This is not only one of the most useless, but one of the most diabolical inventions ever foisted on the public; it may cause bronchitis and drown the patients, but it will not cure them. These little patients should be kept in a warm, dry atmosphere.

But independent of treatment, many of these little patients after a long struggle gradually succumb from failure of the right side of the heart. Why should this be? Their young hearts are healthy and particularly sensitive, so that they will not stop on a slight provocation. I have often demonstrated the effect of respiration in carrying on the circulation of the blood, and have shown what assistance can be afforded the right side of the heart by simply shutting the glottis and expanding the chest. Now if a young child suffering from laryngeal diphtheria is observed, it will be seen that the resilient chest walls cannot expand against the atmospheric pressure; the diaphragm is pulled down, but the lower part of the sternum and the costal cartilages are pushed in, so that the heart gets comparatively little assistance from the

respiratory pump. In capillary bronchitis and pneumonia where there is little variation in the dimensions of the lungs between expiration and inspiration, the same conditions apply, though to a less extent.

The situation of the heart, where the soft cartilages are easily pushed in by the atmospheric pressure, prevents the blood-vascular cavity from obtaining much relief. Moreover, the stomach and bowels are frequently so much distended with gas, owing to too much food of an improper quality, that the diaphragm has got very little play, and thus the respiratory pump is still further thrown out of gear. However, there is one point in favour of these young children, and even of those of less tender years, suffering from pneumonia; their inspirations may appear short, shallow, and catchy, but there is frequently a considerable pause between the end of inspiration and the commencement of expiration which enormously assists the pulmonic circulation.

In Adults.

In children after the age of 5 years with strong chest walls, and in young adults, the surplus vital capacity, even when a whole lung is involved, is usually sufficient to tide the heart over its difficulties until resolution takes place. In women—and especially in pregnant women—the vital capacity is less and the case mortality, *ceteris paribus*, is greater than in men. With advancing years and rigid chest walls there is a gradual failure in the respiratory pump, and a corresponding increase in the death-rate. However, there is a great difference in individuals, and some spare men keep a good pump even up to old age. In very old people, as was pointed out by Sir William Gull, pneumonia is frequently a mode of dying, and they die as comfortably from it as from any other disease. However, I am convinced that a good many terminal pneumonias might be obviated or cured by the timely use of a vaccine. Many patients cannot expand their chest owing to a pleuritic stitch, but if they partly empty it, by groaning or otherwise, they get the advantage of the respiratory pump during the succeeding inspiration. They should be induced to hold the chest expanded at the end of inspiration for a short period, and for this purpose it is advantageous to lay hold of a rail above the head with both hands. I know a big, heavy man who dislocated his humerus by this manoeuvre, but, notwithstanding the accident, he avers that he owes his life to this assistance to his respiration and to semi-starvation.

The big, plethoric, pot-bellied man often succumbs rapidly to an attack of pneumonia. How is this? Such men are not particularly prone to the disease; the pneumococcus has no special predilection for fat; the disease is not more intense than in lean persons, except that the non-conducting layer of fat is apt to maintain a higher internal temperature, and if the temperature be high, it is more difficult to reduce, but in these cases the temperature is usually not very high, because the primary failure is in the fatty infiltrated heart.

Their vital capacity is poor and the respiratory pump is easily thrown out of gear. The best treatment for these individuals is prophylactic; you should start months or years before the attack to reduce their "corporations" and strengthen their fat, flabby right hearts. However, when you are dealing with the emergency the vascular tone must be maintained, and in most cases pituitary extract does much good; there must be no overloading of the vascular system; the lime salts must be given freely; the respiratory pump must be kept in action; the stomach and bowels must be kept unloaded and no distension permitted; the diet must be very simple and light, such as syrup of glucose or sugar of milk. There must be an abundant supply of cool, dry air, and there should be some counter-irritation with a mustard poultice or fly-blister; of course, a vaccine should be administered at the earliest moment.

There is many a spare individual with a fatty, degenerated right ventricle, but with a good respiratory pump, who goes about his ordinary business for years with an extremely irregular pulse, and a barely perceptible first sound over the right ventricle. Of course such patients are apt to succumb to any acute illness, but it is sometimes marvellous how their good respiration carries them safely through a mild attack of pneumonia. Early recognition and prompt treatment is required in such cases.

Patients suffering from emphysema are not good subjects for pneumonia, but the right side of the heart is usually hypertrophied, and does not stand in much need of respiratory assistance, so if there be no accompanying bronchitis it may suffice for a pneumonia of one lobe.

In diabetes there is frequently much emaciation of the muscles, a feeble respiratory pump and weak heart, conditions which favour a fatal termination.

In advanced kidney disease there is uraemic poisoning, a tendency to pulmonary oedema, indicative of right cardiac failure. Both acute and chronic alcoholism lead to cardiac asthenia, and the frequently associated abdominal distension interferes with the respiratory pump, so such cases are liable to rapidly succumb from cardiac failure, accompanied by a large *ante-mortem* clot in the right side of the heart. The case is quite different with the gouty individual; his heart is usually hypertrophied and healthy, and, if there be no kidney mischief, he stands an attack of pneumonia well.

CARDIAC FAILURE.

There are certain cases who have got no innate power of recovery, and who seem to fall victims to the intensity of the poison, but the vast majority of the deaths are due to cardiac failure arising from want of proper assistance owing to a defective respiratory pump. Mere carbonic acid poisoning is scarcely ever a cause. In bad cases of emphysema with bronchitis the patient is often more livid for weeks, but so long as the right heart does not fail there is no danger from the mere lividity.

It is true that in carbonic acid poisoning there is a general rise in arterial pressure and secondary overloading of the right side of the heart, but in pneumonia this sequence is prevented by the vasomotor paresis. The overloading of the right side which takes place is due to failure of the heart and of the respiratory pump. At the very commencement of an acute pneumonia, with a severe stabbing pain in the side, the patient's face is often extremely purple and congested; this is not due to any obstruction in the lungs, as is shown by the large, full, bounding, relatively high-tension pulse, but arises from the fact that the patient cannot use his respiratory pump owing to the sharp pleuritic pain. These are the cases where the removal of 10 to 20 oz. of blood from the arm affords immediate relief, but, *cui bono*? A good dose of opium or opium and antimony has a similar salutary effect by relieving the pleuritic pain, and enabling the patient to put his pump in action.

Cardiac failure is the proximate cause of all cases of somatic death; anyhow we would scarcely say the patient was dead until the heart ceased to beat.

What are the causes of cardiac failure in cases of pneumonia? A certain number of hearts have such degenerate coronary vessels and muscle walls that they fail under the slightest stress, or cease to beat under any marked inhibition. We are never likely to be able to prevent such deaths unless by prophylactic measures. The large majority of hearts, however, make a desperate struggle for continued existence. The failure takes place from:

- (a) Granular degeneration of the muscle fibre induced by continued high temperature and by toxæmia.
- (b) Low arterial pressure, which prevents proper nutrition of the heart, and this organ gets exhausted pumping blood into unfilled vessels.
- (c) Any interference with the proper action of the respiratory pump leads to overloading and ultimate failure of the right side of the heart.
- (d) The toxæmia leads to loss of muscular tone and dilatation of all the cavities of the heart.
- (e) Extensive lung consolidation.

Our indications for treatment, therefore, are (1) to lower the temperature and control the inflammatory process at the earliest possible period, before stagnation of the blood and hepatization have taken place, and thus preserve as far as possible the integrity of the respiratory apparatus; this also lessens the risk of involvement of the nutritive vessels of the lungs; (2) to maintain fair systemic blood pressure; (3) to keep the respiratory pump acting by lessening the frequency and increasing the depth of the respirations; (4) remedies to lessen the toxæmia and maintain the tone of the cardiac muscle; (5) methods to lessen the spread of the mischief.

The Reduction of High Temperature.

Whatever means be adopted for dealing with the temperature of the patient it should be kept within moderate bounds, as high temperature leads to granular degeneration of the heart muscle, sleeplessness, delirium, and nervous exhaustion. It is often sufficient to keep the patient very lightly clothed—a single sheet over the body with a blanket over the lower extremities—and thus allow free evaporation of the sweat, which carries off a large amount of latent heat. All eiderdowns, cotton-wool, waterproof, and every impervious covering should be avoided; cold or tepid sponging is very comforting to the patient. I am a firm believer in the danger of continued high temperature, and I have used many methods to control it, such as cold sponging, the application of ice to the affected side, ice-cradling, the abstraction of heat by radiation with black semicircular ice tins over the patient, by evaporation with large moist, cool poultices and compresses, and by convection with currents of warm dry air.

The Abdominal Ice-bag.

In the beginning of 1900 I introduced the abdominal ice-bag in the treatment of this disease, and I have continued its use ever since in all cases of high temperature with the best results. The abdomen affords a large cooling surface, and it occurred to me that one or more ice-bags sufficient to cover the whole abdomen would lower the temperature, and, from the action of the cold on the splanchnic area, would raise the general arterial pressure, would lessen the distension of the abdomen, and finally increase the depth and lessen the frequency of the respirations. This was no simple theoretical speculation, because I had long previously used this method for reducing the temperature in typhoid fever, and I had observed the above effects times without number. Moreover, the abdomen is not very sensitive to cold, except the groins, which can be easily protected by a little cotton-wool, and so this method of treatment is not particularly uncomfortable to the patient.

I had thought this plan well out and was quite ready to give effect to it, when, on January 3rd, 1900, my house-physician, Dr. Alderson, telephoned to me that he had admitted two severe cases of pneumonia, both of whom were so violently delirious that they could not be restrained in bed. The results in these two cases were remarkably successful and were a happy inauguration of this line of treatment.

Maintenance of the Systolic Blood Pressure and Ventilation.

It is most important to maintain the tone and tension of the vascular system, otherwise the nutrition of the heart fails, its cavities dilate; the large vessels hold an inordinate amount of blood and the heart gets exhausted in its attempt to carry on the circulation. The lime salts are the best agents in maintaining cardiac and vascular tone; digitalis has not much effect when the temperature is high, and strychnine has no marked effect on the blood pressure and is apt to exhaust the nervous system, so should be reserved for a late stage of the illness. Adrenalin, pituitary extract, and strophanthin are often very serviceable.

You should avoid everything which would depress the nervous and vascular systems, such as a dull, dismal, badly-ventilated bedroom, a moist, overheated atmosphere, and alcohol. The room should be the best in the house, and if possible should contain at least 1,000 cubic feet for each occupant, and the whole air of the room should be changed three times every hour. There is no difficulty whatever in freely ventilating a room. Feverish patients do not catch cold, so that bugbear may be set on one side. Night and day a stream of pure air should be admitted without creating draughts. I usually throw a window widely open. The play of fresh air about the patient stimulates respiration and exhilarates the patient. Dr. W. P. Northrup, of New York, has treated patients with pneumonia on the open roof of the hospital for six hours a day "in all weather, when harsh high winds, rain, and snow did not prevent." This may do for New York, but I am certain it would not suit Glasgow or Liverpool. A cold, foggy, moist atmosphere would materially lessen the patient's chances of recovery. The atmosphere of the

room should be maintained about 60° to 65° F., by a large fire. The ordinary atmosphere at this temperature is not saturated with moisture, and is therefore capable of holding the patient's exhalations, and there is not much danger of him drowning in his own excretions. I have never found the atmosphere in this climate so dry as to require any additional moisture.

As long as a strong light or radiant heat from the fire is not playing on the patient's face, the more bright and cheerful the room the better. I do not believe in converting the bedroom into a dark chamber, which makes it difficult for the patient to distinguish day from night, and is apt to give him the impression that he is cast into outer darkness. If the patient has a comfortable night he will not require much sleep during the day.

No one can survive long without oxygen, but there is more in the air than the blood can take up; in fact, the atmosphere only loses 4 of its 20 per cent. in the process of respiration. Of what necessity or value, then, are the cylinders of oxygen largely used in this disease? Of what value are 20 to 60 cubic feet of oxygen compared with 72,000 cubic feet of fresh air with which each patient should be supplied every twenty-four hours? The public craze for oxygen has not yet died out, and medical men are often too apt to pander to the popular demands. Many men readily acknowledge that they have never seen any life saved thereby, but the public want oxygen, and oxygen they get, on the supposition that it cannot do any harm; just in the same way many prescribe a teaspoonful of brandy every four hours because they say it can do no harm and may please the patient's friends. Our prescriptions should not be placebos, but we should diligently inquire respecting all our remedies, Will they do any good? Let us see on what scientific basis, if any, this expensive luxury of oxygen rests, and more especially so as it can be had in as pure a state in the atmosphere for nothing. The nurses, perhaps the patient, and the patient's relatives will tell you that the free supply of pure oxygen affords great relief and makes the patient breathe more easily. This may seem to some an unanswerable reason; but it is not merely the patient's comfort, it is his recovery we are after.

I have again and again pointed out the great value of the respiratory pump in carrying on the circulation, and if the patient's breathing becomes easy and shallow, the pump is thrown out of action. You want to make the patient breathe as deeply as possible, and this is encouraged by a stream of air playing on the patient's face. I have often used for this purpose a foot-bellows, and an electric fan is very serviceable. Every one knows how rushing through the air in an open motor car makes you breathe. Carbonic acid is the natural stimulus for the respiratory centre, and in cases of pneumonia the stimulus should be in constant action, but when you freely supply oxygen to the air cells the red corpuscles do not necessarily take up more oxygen, but the carbonic acid tension in the blood falls, the respiratory centre does not receive its necessary stimulus, and the heart is handicapped; thus the comfort of the patient is at the expense of his vitality.

Dr. Yandell Henderson has shown how hyperpnœa may so reduce the carbonic acid in the blood—a state which is called acapnia—as to induce fatal apnoea. Fortunately it is not very easy to produce this condition in pneumonia, but it is just as well to keep the patient breathing as long and as deeply as possible, as he can die "from want of breath" just as readily as from "failure of the heart's action."

I suppose you are all familiar, and if not you should be, with the excellent work of Dr. Ernest Thomson of Glasgow on the "True position of oxygen as a restorative in carbonic acid poisoning." This investigation on the subject of choke-damp asphyxia was undertaken at the instigation of the Council of the Mining Institute of Scotland, and was published in the *Glasgow Medical Journal* for 1893 and 1894. He conclusively showed that in these cases of asphyxia pure oxygen had no advantage over atmospheric air. Also, "an animal may be placed in a chamber the general cavity of which contains about 50 per cent. of carbonic acid, and retained there for a long time without supervention of muscular collapse, provided a gentle stream of a respirable gas—air or oxygen indifferently—be allowed to play upon the nostrils and agitate the surrounding atmosphere."

GENERAL PRINCIPLES OF TREATMENT.

Successful treatment largely depends on early recognition of the disease, and in this respect the general practitioner has many advantages over the consultant, while in hospital cases the fate of the patient is often sealed before he arrives. If the patient can be properly treated and nursed at home keep him there, but if not send him to a hospital at the earliest possible moment; you have no moral right to bundle him off at a later stage, when the mere movement may turn the scale against him.

We shall suppose that we are dealing with a case from the commencement. When you meet with a case of high fever of sudden onset without any definite localizing symptoms, do not imagine that you have got a legitimate point of attack and begin to knock down the temperature with such drugs as phenacetin, or antipyrin, or by saturating the patient with sodium salicylate. You may in this way, for the time being, lower the temperature and make the patient quiet, but you thus mask the symptoms, put yourself in a fool's paradise, prevent the early recognition of the disease, and in no way modify its course, but perhaps do irreparable mischief to the patient. You must not keep hovering between conflicting opinions as to whether the patient has got pneumonia or typhoid fever, influenza, or some other disease, waiting to see what will turn up. You must be prepared to treat the individual rather than the disease. You must find out the condition of every organ of his body, and if you do this the nature of the affection will not long escape your detection. Pneumonia is a disease which varies very much in intensity, and its prominent symptoms are more or less pronounced according as the individual is robust and plethoric, or weak and debilitated. A typical case with a flushed face, rapid breathing, high temperature, and a stabbing pain in the side is early recognized, but the majority of cases are not typical in their onset. In the young and aged errors most frequently occur, but with careful examination every case should be diagnosed within the first twelve or twenty-four hours. The febrile process and quickened respirations should arrest your attention. Very careful physical examination should detect a very moderate degree of lung engorgement and thus enable you to localize the mischief. If there be a rigor the patient should be warmly clothed and have a hot drink. In the very early stage I am in favour of a warm bath with plenty of soap, but if this be impracticable, either from the condition of the patient or the environment, he should be well washed and the action of the skin encouraged. If the temperature rapidly reach a high level, such as 104° F., the sooner a large ice-bag is applied to the abdomen the better. I am much in favour of reflex stimulation, I therefore order a large mustard poultice to the affected side. The nerve supply to the lungs is derived from the first six dorsal segments; if, therefore, you apply a mustard poultice to the cutaneous nerves of the upper part of the thorax on the affected side as low down as about the level of the ninth dorsal spine, you produce a reflex action in the nerves supplying the lung, and thus increase vasomotor tone. To be of any value this must be done at an early stage; there is no use stimulating the lung when the lung is solid and the mischief done. At a later stage, however, good is often done if applied to other portions of the same lung or the opposite lung, by lessening the collateral oedema which not infrequently occurs. It is this collateral oedema or spreading area, and not the solid portion of the lung, which gives rise to the expectoration. A few leeches applied to a painful spot on the side acts in a similar way: there is a depletion of the vessels in the vasomotor tract supplied by that segment of the spinal cord. If there be a defective leucocytosis I apply a large fly-blisters at any stage of the illness.

Blood-letting has not been in vogue for many years, but I have no doubt in some few plethoric cases it does good. If it be deemed advisable in any particular case, the sooner it is performed the better. It should never be adopted after the first forty-eight hours, and never at any time if the pulse be small, feeble, and compressible. Pneumonia in the female is often relieved by a commencing menstruation, and an epistaxis is occasionally beneficial. If at the beginning of the disease there be a full bounding pulse and laboured respiration in a plethoric individual you may abstract 10 or 12 oz. from the arm. Venesection should not be performed

in the very young, the old, or debilitated, though I once took over a pint from a lady aged 89 who was in the status epilepticus from a cortical haemorrhage. She lived till she was 95. After bleeding, the patient should abstain from fluids for some hours. The cases, however, in which venesection is beneficial are few and far between.

The expectoration should be examined and a suitable vaccine administered at the earliest possible moment. I have seen excellent results from the pneumococcus vaccine prepared by Sir Almroth Wright.

Sleep.

It is important that the patient should have a fair amount of sleep from the onset; the exhaustion of the nervous system from want of sleep lessens the patient's chance of recovery. There is no objection to opium in the early stage, and two or three 10-grain doses of Dover's powder during the night often answer admirably. In alcoholic subjects a combination of opium and antimony answers well. When the lung is engorged and the right side of the heart handicapped you should avoid all preparations of opium, as they blunt the respiratory centre, or only use morphine in combination with hyoscyne and atropine, or strychnine. If sleep has been obtained in the early stages it is not difficult to induce it in the later. A quiet restful sleep tends to lower the temperature, and on the other hand, a high temperature is very inimical to sleep. The low muttering delirium which frequently accompanies the disease is usually controlled by free ventilation and the reduction of the patient's temperature, which is best effected by large ice-bags to the abdomen. The body should be lightly clothed, but the lower extremities kept warm. Pneumonia complicated with delirium tremens is a very fatal malady. It is often difficult to draw a distinction between the delirium of pneumonia and alcoholic delirium complicating pneumonia. The latter generally starts in the later stages of the illness, or as a rule not earlier than the third day, the delirium is active, often violent, delusions of sight and hearing, great tremor, irritability of the nervous system, and the knee-jerks are usually absent.

In such cases it is essential to keep the nervous system quiet and obtain sleep, but this is often a most difficult problem to solve, especially when the delirium tremens arises late in the pneumonia attack. There must be no mechanical restraint, nor any struggling with the patient, as thus fatal syncope is readily induced. I have often seen these patients become quiet when they were allowed to stand or walk about in a well-ventilated room. Under these circumstances the fall in the blood pressure and the lessened blood supply to the brain has a calming effect. When the patient has been induced to go back to bed, if it be in the early stage of the disease, and the pulse full and bounding, or small and firm, he should have repeated doses of antimony and opium. If it be in a later stage, with the pulse small, short, and feeble, and with the lungs engorged and skin very moist, a hypodermic injection of hyoscyne, morphine, and atropine answers better. A few whiffs of chloroform or the A.C.E. mixture often gives the sedative an opportunity of acting. To these patients I frequently allow two pints of beer or stout in the twenty-four hours as a sedative. It is not wise to entirely cut off alcohol from a patient bordering on delirium tremens. Under no other circumstances do I prescribe alcohol in pneumonia. Alcohol does not increase the power of the cardiac muscle, but merely lessens the peripheral resistance by producing vasomotor paresis, an effect which cannot often be required, as the systemic blood pressure is usually too low without any assistance from alcohol. It also increases the diastolic tension within the ventricles and leads to cardiac dilatation. Alcohol dries the tongue, increases the delirium, and makes the sleep more perturbed. The good effects of abstinence are well seen in those cases who have been overdosed, when you abruptly cut off all alcohol; the delirium, restlessness, and parched mouth are replaced by quiet sleep and moist tongue. During convalescence the patient may, if thought necessary, revert to his accustomed use of alcohol, but in great moderation.

Drugs.

If the illness begins with nausea or vomiting, it is well to wash out the stomach with a few tumblerfuls of hot

water to which an equal number of teaspoonfuls of mustard have been added. The bowels should be cleared with a large dose of calomel. In sthenic cases—but such cases are the exception rather than the rule—antimony is useful. If there be much restlessness or delirium, antimony and opium is a good combination. All the coal-tar products are injurious; the same may be said for sodium salicylate, as it is a decalcifying agent. In no case should an acid mixture be given at the commencement. I have long since discarded quinine as an antipyretic agent in this disease.

For limiting the spread of the disease the lime salts are the best remedy. In the acute stages of pneumonia the more scanty and more sticky the expectoration, the more viscous the blood, the more lime salts and leucocytes it contains, the more favourable the prognosis; on the other hand, the more fluid and haemorrhagic the expectoration, the more liquid the blood, the less the lime salts and leucocytes, the worse the prognosis. The expectoration comes from the spreading area, and not from the consolidated lung, hence I prefer the lime salts to increase the coagulability of the secretion and limit the spread of the mischief. Acting on these views, I have long ceased to prescribe ammonium carbonate and other expectorants during the acute stage of the disease. Those cases of creeping and influenzal pneumonia where there is no proper consolidation are very fatal. Cardiac thrombosis is more frequently a sequel than a cause of cardiac failure; occurs chiefly in the right auricle and ventricle; is due to cardiac weakness, blood stagnation, leucocytic destruction, and fibrin ferment, rather than to any excess of lime salts. Thrombosis in the heart is usually a terminal phenomenon, the *ante-mortem* clots rarely preceding death by more than twenty-four hours; this occurrence is best prevented by maintaining the tone and contractile power of the cardiac muscles. A hypertonic serum consisting of calcium chloride, normal saline, and syrup of glucose would lessen blood destruction, and hence the tendency to clot formation. I have seen clots in the heart dissipated and the patients cured by the administration of equal parts of liquor ammoniac fort. and spiritus chloroformi, 5 to 10 minims every half-hour.

The necessity for calcium salts in the maintenance of cardiac contraction and muscular tone is, perhaps, fairly well known, but the knowledge is too often neglected in the treatment of this disease. In all febrile conditions the blood rapidly parts with its calcium, and unfortunately it is often most difficult to get the intestinal tract to take up a sufficient supply. You must not rest satisfied with the mere administration of lime salts by the mouth; you must satisfy yourself as to whether a sufficient amount is being absorbed. A direct examination of the blood by Blair Bell's method will solve this problem; but this is troublesome, and more especially so as it should be repeated many times during the illness. I find the urine a very good indicator and very easily examined. It has long been known that the chlorides are deficient in pneumonia, but in my observations they are not nearly so scanty as the lime salts. If you find the lime salts deficient and albumin present in the urine, you may safely conclude that both the free and fixed calcium salts in the blood are deficient, and the sooner they are replenished the better. You should prescribe the soluble salts of calcium—such as the glycerophosphate, the lactate, and the chloride. The carbonate is not very soluble, but it is often useful as an antacid for the intestinal tract, especially when combined with the bicarbonate and chloride of sodium. I have had good results from calcium iodide with tincture of iodine in cases of pneumonia complicating bronchitic asthma.

Somewhat similar views to my own have been expressed by Dr. Auld, who also is a Glasgow graduate. He says "that pneumonic consolidation is Nature's method of localizing the morbid process, and curing the disease. . . . Moreover, in cases of pneumococcus infection showing little or no tendency to pulmonary hepatization—when the pneumococci run riot in the organism, so to speak—the result is always grave, and indeed generally fatal." Dr. Auld informs me that "the results of his experiments on animals correspond to those observed on man. It was only in those cases where a culture of moderate virulence was employed that hepatization of lung was obtained in animals; a very virulent culture failed to give hepatization,

thus showing that when the organism of pneumonia freely enters the circulating blood it prevents the pulmonary coagulation, whereas when it is capable of being localized coagulation follows. These injections were also made into the pleural cavities with the same results. The time element was also considered, as when the animal was killed after a moderately virulent culture hepatization was observed to have begun, but after a very virulent culture this feature was absent, being replaced by a sanguineous serum."

When the blood pressure is very low and the heart dilated I have had good effects from the intravenous injections of small doses of adrenalin, but these have to be very frequently repeated, and I now prefer a hypodermic injection of 1 c.cm. of pituitary extract every eight hours. This also lessens the abdominal distension. In these cases it is also well to make use of the cardiac reflex of that versatile genius, Albert Abrams; the nurse should be taught to frequently apply mediate percussion over the seventh cervical and first dorsal vertebrae, and she should also use friction with her hand over the heart. Strychnine, caffeine, and digitalis are often useful; when the pulse is extremely frequent an intravenous injection of $\frac{1}{15}$ to $\frac{1}{10}$ grain of strophanthin will be found serviceable. When the febrile process is over it is well then to use some medicine to lessen the viscosity of the blood and liquefy the effusion in the alveoli, such as ammonia, sodium citrate, ammonium citrate, citric acid, lemon squash, etc.

If the lung pass into the stage of grey hepatization with purulent infiltration, or there be an abscess or gangrene of the lung, you should freely administer terebene or some of the turpentine series. In these cases the infection is usually very mixed, and the inflammatory mischief has been so intense as to involve the nutritive vessels of the lungs as well as the finer branches of the pulmonary artery supplying the affected area. I have seen good effects from tincture of iodine and calcium iodide in these cases. An autogenous vaccine may also help resolution. During convalescence some tonic is required and a liberal diet.

The teeth, tongue, mouth, and even the nose, should be kept clean with some antiseptic during the illness. The importance of keeping the mouth clean as a preventive measure is well exemplified in the so-called ether pneumonias, which are due to the aspiration into the trachea and bronchi of foul secretions from the mouth. Before the administration of an anaesthetic the mouth should be well cleansed with some strong antiseptic. Pure brandy or whisky answers very well, but this mouth-wash should not be swallowed. An excellent mouth-wash can be made with formalin, glycerine of carbolic acid, and eau de Cologne.

Diet.

One of the greatest difficulties in private practice is to control the diet; the public have been educated in the belief that great quantities of nourishment and stimulants are necessary, and too frequently the regulation of the diet is left to the nurses and relatives, consequently you frequently find the abdomen enormously distended with flatus which prevents the free play of the diaphragm. The medical attendant should not move along the lines of least resistance, but carefully consider every point in the interests of his patient. There is usually a paretic condition of the intestinal tract, and any food decomposition is apt to give rise to acute dilatation of the stomach and bowels; when this occurs pituitary extract is the remedy *par excellence*. There is scarcely any anabolic change going on during the febrile stage, so there is no use in troubling the patient with large quantities of nitrogenous food, which are not required and are only apt to form poisonous ptomaines. It is a great mistake to worry the patient with much food during the first three or four days of illness, and it should be very gradually increased as the patient seems capable of digesting it. It is not what you put in the patient's stomach, but what he assimilates, that proves of any value. A good combination consists of an infusion of half a pound of raisins in a quart of hot water with three or four ounces of syrup of glucose, two drachms of sodium chloride, and half a drachm of the glycerophosphate or lactate of calcium. The patient can drink this *ad libitum*.

Milk is an excellent item in the diet, but it is not always easily digested, and consequently it should be well diluted; it should be boiled to get rid of the *Bacillus coli* and other organisms. The following will serve an adult in the acute stage for twenty-four hours: About 2 pints of milk, 2 or 3 pints of barley water, whey, or plain water, 6 or 8 oz. of syrup of glucose, 4 or 5 drachms of table salt, and 1 drachm of the glycerophosphate of calcium.

If the syrup of glucose be too sweet or mawkish, a quarter of a pound of sugar of milk can be used. Later on the patient can have peptonized bread and milk or some infants' food, broths, raw eggs, jellies, cocoa or coffee, and a few biscuits. He can have cold water, when he likes; you can wait on the desire of the patient for solid food. Be always careful that the bowels are not loaded or distended.

In conclusion, I wish strongly to impress on you that pneumonia should always be looked upon as a serious disease; remember that no matter how mild the case may at first appear, you cannot always forecast how it may develop, and every medical man, in dealing with this affection, should feel the responsibility of a human life in his hands. It has been said that young men kill their patients and old men allow them to die. I wish you to take a different course and direct them into a harbour of safety. Early recognition and prompt treatment will save many a valuable life.

INVESTIGATIONS ON SYPHILIS AS AFFECTING THE HEALTH OF THE COMMUNITY.

A SUMMARY OF THE COLLECTIVE EXAMINATION OF OVER 3,000
CASES BY CLINICAL AND SEROLOGICAL METHODS.

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ANY attempt to estimate the actual prevalence of a disease such as syphilis in the community is a task attended with great difficulty. In the first place, the recognition of the disease when in an active state depends on the presence of signs which may be fugitive or atypical in character. Secondly, when the evidence of disease which has ceased to be active is being sought for one has to rely, perhaps wholly, on the history, which may be fallacious, through intent or through ignorance. With regard to the signs of active disease, it must be borne in mind that practically no infective condition invariably presents characteristic clinical appearances. The reason for this is obvious when one remembers that the manifestations of disease in any particular case depend on the virulence of the infective agent, the amount of virus gaining access to the tissues, and the particular degree of resistance of the infected subject. Hence it happens that even such comparatively well-defined infections as diphtheria and typhoid fever escape detection in at least as many instances as are recognized. It is more or less true, of course, that these cases in which symptoms are so transient and mild as to escape detection are in slight need of treatment; but a second consideration, beyond that of the infected individual, is the question of the welfare of those who come into association with him. The great tendency of modern medicine is towards prevention, and in the case of infectious diseases prevention must largely take the form of measures to diminish the infectivity of those affected. The essential precursor of such measures, however, is the accurate and comprehensive recognition of the disease. Now, when conditions with such comparatively characteristic symptomatology as diphtheria and typhoid fever are readily missed, how much more frequently must syphilis escape detection, for here we are dealing with a disease whose manifestations are of the most multifarious description.

A further consideration of the highest importance is that the subjects of syphilitic infection, unless treated by the most energetic methods at our disposal, pass almost invariably through the carrier stage. The part played by

carriers in disseminating other infectious diseases has been amply proved; but the number of individuals who after apparently complete recovery from typhoid fever or diphtheria continue to harbour virulent organisms for long periods is relatively small in proportion to the sum total of those attacked by these diseases. In syphilis, on the other hand, it is well known that while, even without treatment, apparently complete restoration to health may follow the primary and secondary stages, the presence of the active virus is shown by the fact that the latent syphilitic is capable of infecting others, and the same holds good when the latent state is induced by mercurial treatment. In the course of time infectivity diminishes, and it is commonly accepted that the subject of acquired syphilis when persistently treated with mercury ceases to be a source of danger after about two years. But the loss of infectivity may not occur for many years. Thus I have observed the case of a man who was treated with mercury for about six months after the appearance of the primary sore; during the subsequent twenty-five years he has remained apparently perfectly healthy, but he infected his wife, whom he married thirteen years after contracting the disease. The latent syphilitic in the early stage, although apparently healthy, is a source of great danger to others, and it must be clearly borne in mind that cases in this category are, in the absence of a history, practically unrecognizable by clinical methods.

Apart from the difficulties attached to the correct diagnosis of the nature of existing lesions and to the recognition of infections in the latent stage, there is a further complication introduced by the fact that the characteristic primary and secondary stages may be missed or suppressed altogether, so that the affected individual is actually not aware of his state. This seems to be specially true in the case of women, particularly when syphilitic infection is associated with pregnancy; but a similar absence of early phenomena is met with in men also, and I have seen a case of tabes with rapidly progressing optic atrophy occur in a highly intelligent and well-informed man who had never, to his knowledge, presented any of the early signs of syphilis, although he volunteered the history of exposure to possible infection.

To arrive, therefore, at accurate conclusions regarding the prevalence of a disease with such varied features as syphilis, it is necessary to seek corroborative evidence from all possible sources. In the course of the past three years extensive clinical and serological observations on the part played by syphilis in the production of disease have been carried out in connexion with the Pathological Department of Glasgow University and Western Infirmary, where various workers have taken up special branches of investigation and have examined over 3,000 cases. At the present time, when interest is being aroused regarding the importance of venereal diseases as affecting the health of the community, a useful object may be served by giving a brief summary of the principal results obtained, with a view to emphasizing their significance for the general health, and in order to point out very briefly their bearing on future measures which may aim at the amelioration of existing conditions.

METHODS OF INVESTIGATION.

The information yielded by an investigation with the object here described obviously depends for its accuracy and completeness on the correlation of different methods of observation. This was clearly recognized, and it was apparent that, to obtain the most fruitful results, the clinical and the laboratory aspects of the conditions studied should either be examined by the same observers, or else by several workers, each of whom was conversant with all the problems concerned in the cases. The complete investigation aimed at was to obtain in every instance:

(a) The clinical examination of the patient; (b) the examination of the members of the patient's family; (c) the history of the health of the patient and his family; (d) the result of the Wassermann test with the blood of the patient and of the members of his family.

It is obvious that the carrying out of such a scheme in all its details is extremely tedious and frequently impossible. Dr. H. F. Watson has, however, investigated a large series of cases as far as possible on these lines, and has thereby done much to verify the specificity of the