THE PRESENT STATUS OF THE TREATMENT OF PNEUMONIA

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The past two decades have shown remarkable progress in our understanding and treatment of many of the common infectious diseases. While formerly, numerous cases of typhoid fever were seen, this disease has become almost a rarity owing to better sanitation and the use of vaccine. The incidence and mortality of diphtheria have been greatly reduced by the widespread prophylactic and therapeutic use of antitoxin. Scarlet fever appears to have assumed a less virulent form and its severity has been lessened by the recent development of a specific antitoxin.

Pneumonia, however, continues its deadly work in much the same fashion as it did fifty years ago. Musser and Louis in a paper twenty years ago remarked, "The historical consideration of the treatment of pneumonia offers a gloomy retrospect, the sombre hue of which is not much lightened by the contemplation of the present. Ever since the days of antiquity, pneumonia has been observed and studied while one method of treatment after another has been vaunted with enthusiasm, only to be abandoned in despair, the disease meanwhile pursuing the even tenor of its way with scant respect for the methods employed against it." Pneumonia is still responsible for approximately 10 per cent of the deaths in most communities, the most reliable statistics showing a mortality rate varying from 20 to 35 per cent. It spares neither age nor sex and is no respecter of persons. The lobular form especially claims as its victims many in the early years of life, and in the aged and those chronically ill from other diseases, it frequently writes the final chapter. Nor does it respect the individual in his prime. Frequently the surgeon's best efforts are nullified because of the onset of this disease and he is robbed of the fruits of his work. The economic loss in a year due to this one disease is inestimable, to say nothing of the suffering and sorrow caused by its ravages. It still justifies Osler's designation, "Captain of the Men of Death."

The question naturally arises — why has therapeutic progress failed to include this condition in its scope? Certainly it has not been from lack of interest on the part of the profession or from failure to appreciate its importance. The voluminous amount of literature on the subject which has appeared in the past few years bears

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testimony to the widespread investigations which have been carried on in all parts of the world. Investigators have attacked the problem from the serological, biochemical and purely chemical standpoint, and as a result of their efforts, many new lines of therapy have been developed. Some of these methods of treatment have been hailed with enthusiasm at first, only to be given up as clinical trial revealed their inefficacy. Others have shown us the way towards therapeutic knowledge which is of real and lasting value and these represent milestones which will eventually lead us to the desired end. The ultimate in progress of knowledge of any disease is the discovery of a specific. How far we are still from such a goal in our knowledge of pneumonia, we do not know, but we firmly believe that sound progress has been made.

Lack of knowledge of the causative factor has not been the difficulty as it has been established that pneumococcus is the etiological factor in lobar pneumonia. The bronchial or lobular types are caused by pulmonary infection with a variety of organisms — Diplococcus pneumoniae, Streptococcus, Staphylococcus, Micrococcus catarrhalis and Bacillus influenzae (Pfeiffer's bacillus). Because of this diversity of organisms, the chances for development of a specific are, of course, obviously poor but in most instances of the disease in which the etiological factor has been established, specific therapy has followed rapidly. That such has not been the case in lobar pneumonia is due to some extent to the character of the pneumococcus itself and also to the peculiar pathological conditions associated with the disease. The pneumococcus does produce a toxin which can be identified in culture and in blood, but the main factors in the disease are evidently due to mechanical interference with pulmonary function and the secondary results of this interference, rather than to toxic action. There is also a condition peculiar to pneumonia in which the purulent exudate is trapped in a sac, as it were, which obstructs the free passage of air to and from the alveolar lining, a movement absolutely essential to proper pulmonary function. This condition simulates an abscess in some other part of the body, which calls for drainage as a primary surgical procedure, but here our hands are tied. We have no adequate means of establishing such drainage.

Serum Therapy

The discovery by Cole[1] that all pneumococci are not of the same strain marked the beginning of a scientific effort to develop an adequate serological weapon. By agglutination reactions he classified pneumococci into three fixed groups and a fourth heterogeneous

group. This last group has been more recently subdivided by Park into a number of definite subgroups. So it has developed that even in lobar pneumonia we are dealing with a family of organisms rather than with an individual organism. It is now recognized that variations in the clinical picture depend upon the type of pneumococcus involved. Thus Type III generally produces a severe pneumonia with a mortality rate of up to 50 per cent. Cecil[2] even considers that the type of organism may have something to do with complications of the disease. He terms the pneumonia due to Type I as the pneumonia of empyema and that due to Type II as that of septicemia. In his series, pneumonia due to Type II has been slightly more commonly fatal than that due to Type III.

Cole developed an antipneumococcus serum which contains antibodies against Type I. In cases of this type it has proved valuable but the difficulties encountered in administering it have made the method impractical outside of large hospital clinics as it entailed the intravenous injection three times daily, at first, of 100 c.c. of serum. Because of its large protein content the use of this serum resulted in a considerable number of reactions.

Huntoon[3] endeavored to separate off the antibodies from their protein environment and thus secured what is known as the antibody solution. It is a protein-free, water-soluble extract of antipneumococcus serum containing antibodies against Types I, II and III. However, this solution is not in concentrated form, its potency varies considerably, and its administration frequently results in severe thermal reactions.

A further refinement of serum therapy has been accomplished by Felton,[4] who has produced a concentrated polyvalent serum by precipitating out the immune bodies from ordinary antipneumococcus serum by means of ammonium sulphate or distilled water and redissolving them to make a concentrated solution. In this serum, free protein is present in small amounts together with a high concentration of immune bodies against pneumococci of Types I and II, this concentration being usually five to ten times as high as in ordinary Type I antipneumococcus serum. Felton has standardized his serum in units. A single unit is defined as the amount of serum which will protect a mouse against a million lethal doses of virulent pneumococcus culture. He has shown that such a serum if administered to monkeys in which typical lobar pneumonia has been induced results in clinical improvement and rapid sterilization of the blood stream, especially if the organism be of Type I. If it be of Type II, the improvement will be less marked.

The efficacy of the methods described above must be proved by clinical observation. Preceding the administration of antipneumococcus serum it is necessary to be sure that the patient is not sensitive to horse serum. If there is a history of asthma or hay fever or if the patient has formerly had injections of serum, its administration is attended with a certain degree of danger of anaphylaxis and such individuals should not be given this type of treatment. If there is no such history, an intradermal or ophthalmic test is made to determine the sensitivity of the patient to the serum. The ophthalmic test is made by dropping one drop of a 1-10 solution of the serum into the conjunctival sac. If in fifteen minutes there is no lacrimation, edema, or conjunctival congestion, it may be safely concluded that no sensitivity exists. Five c.c. of the solution is then given intravenously, very slowly, and if no negative signs develop, three or four doses of 15-20 c.c. each are given in the first twenty-four hours and probably the same amount the following day, depending on the condition of the patient. If the ophthalmic test shows that the patient is sensitive to the serum, small diluted doses should be given subcutaneously, gradually increasing the dose in order to bring about desensitization. Adrenalin should be at hand for use in case of any anaphylactic reaction.

Serum therapy is designed to provide a temporary passive immunity in the patient. It is not antitoxic but rather provides the patient with a supply of antibodies — agglutinins, opsonins, precipitins, and substances which aid the process of phagocytosis. Such antibodies are found naturally in the blood of pneumonic patients particularly at the crisis when ordinarily the blood stream becomes sterile. The use of serum helps to bring about, apparently, the conditions obtaining at the crisis.

Cecil's series of cases at Bellevue and Harlem hospitals constitutes by far the largest clinical investigation of the value of serum therapy. Cecil regards it as of definite therapeutic value especially in cases of pneumonia due to Type I. Practically all the patients in this classification who were treated within the first two days recovered, the early use of the serum being a very definite factor in its efficacy. The results in cases due to Type II were less striking and in other groups of cases only such benefits as may come from the injection of some foreign protein, resulted. In cases due to Types III and IV little benefit was noted. The clinical improvement in all these cases was shown by a drop in temperature, reduced respiration and cardiac rates, and a general amelioration of symptoms. Apparently the onset of the crisis was hastened although

it is difficult to be sure of this since the crisis may occur at variable periods in the progress of the disease in different individuals.

The efficacy of serum is apparently not affected by the age of the patient, and Cecil[5] believes that even in the presence of such complicating factors as previous chronic ill health or chronic alcoholism, beneficial results are obtained. It is realized, of course, that further progress in the refinement of serum therapy must and will follow, but even at the present time experimental and clinical evidence combine to prove its efficacy and it is plain that investigation is along fertile lines. Further clinical trial and observation is necessary and this will be made possible by the fact that during this winter Felton's refined antipneumococcus serum will be available to the general practitioner, since it is being made in quantities by the Lederle company.

The pertinent question arises as to the necessity of typing the sputum before the serum is administered. By the older method a delay of twenty-four hours was necessitated for the incubation period of the sputum, or of washings of a nasopharyngeal swab within the peritoneal cavity of a mouse. Typing was then done by the agglutination reaction between known types of sera and the peritoneal washings. The time loss has been much reduced by the newer method which was developed by Sabin[6] at Harlem Hospital. He does a perineal puncture with a glass pipette three hours after inoculation. Typing of sputum, however, still presents technical difficulties in practice. Cecil believes that the use of Felton's concentrated serum is justified in the treatment of adults up to the age of forty without waiting for recognition of the type of organism. He bases this opinion upon his statistics showing that in two-thirds of cases of infection in patients below forty years of age the disease is of Type I or Type II, whereas in individuals in later life the disease is more commonly of Type III or Type IV. He therefore advises the prompt use of serum in the former class of patients and delay for typing in the latter class. Such use of serum must of course be carried out with the necessary precautions with regard to anaphylaxis.

Vaccine Therapy

The question of the efficacy of vaccine therapy recurs frequently. Theoretically it is a little difficult to understand in what way the injections of dead organisms into the blood stream can influence the defensive mechanism of the body when we know that at least 60 per cent of patients suffering from pneumonia have a bacteremia. However, reliable clinicians, among them Alexander Lambert of

New York,[7] believe that the administration of vaccine reduces markedly the severity of the disease and lessens the mortality. He uses a mixed stock vaccine and gives 1-2 c.c. intramuscularly, every six hours as long as the temperature is above 99 degrees F., and when the temperature falls to 99 degrees or below he gives one to two doses every twelve hours, then one to two doses every twenty-four hours. Wynne[8] believes that when vaccine is used promptly and decisively the disease in many cases can be aborted, and the mortality can be reduced. If it is used within the first twenty-four hours of the course of the disease he believes the results are brilliant. Some writers suggest that vaccine be given in every incipient case of pneumonia in the hope of aborting the attack or lessening its severity. All are agreed that its value is enhanced by early use. There is a good deal of divergence of opinion on the subject, Lord[9] stating that "there is very little theoretical justification for the belief and no evidence, direct or indirect, that dead, living or autolyzed pneumococci used as a vaccine can be of any service whatsoever in the treatment of pneumonia."

At the present time the prevailing opinion would seem to sanction the early use of a polyvalent vaccine.

An interesting offshoot of vaccine therapy is the development of so-called Immunogen by Parke, Davis & Company. Immunogen consists of antigenic agents of the same general order as vaccine and is made by washing the bacterial bodies in saline. It contains no bacterial bodies but only the material washed from fresh cultures.

Quinine

Although optochin has been used extensively, especially in Germany in dosage of 0.3 gms. five times daily, its use is attended by a certain degree of danger of optic neuritis, and more recently according to the Cohn-Bronner method, quinine has been administered in solution consisting of quinine muriate 2 gms., urethane 1 gm., in 20 c.c. of distilled water. Five c.c. of this solution containing half a gram of quinine muriate are injected intramuscularly into the thigh as soon as possible after the initial chill. This dose is repeated in twenty-four hours unless the fever has subsided and a third dose is administered after seventy-two hours if necessary. This method is given a considerable degree of support, and beneficial results are reported.

Potassium Permanganate

In recent years the use of potassium permanganate in solution has come into vogue in some centres. The solution used is made of

two grains of potassium permanganate in 750 c.c. of water. From four to six ounces of such a solution is given per rectum, one-half hour after a cleansing enema has been given, and the dose is repeated every two to six hours. The solution must be freshly prepared every 12 hours and given slowly and carefully. Certain observers — Oerting[10] in this country and Knott[11] in England — report striking results from this method in lessened cough and cyanosis, reduction of restlessness and promotion of sleep. The mechanism of the effects of this method seems somewhat obscure. It is not known whether the benefit received is due to the oxidizing effect of the drug or to some specific effect of the manganese.

Nucleinic Acid

Another interesting therapeutic venture has been the use of nucleinic acid in five per cent solution, the object being to stimulate leucocytosis. It is a well-known fact that a low leucocyte count ordinarily suggests a bad prognosis. It is affirmed that there is a reactionary increase in the leucocytes of the peripheral blood following the subcutaneous injection of two c.c. of the nucleinic acid solution supplemented by the use of sodium bicarbonate and glucose by mouth, but so far no very convincing evidence has been advanced to prove that the clinical course of the disease has been affected.

Thus the problem of the treatment of pneumonia is being attacked from many different angles often with such conflict of opinion that the busy practitioner, concerned wholly with the care of individual patients, is inclined to turn his back on all these methods, so far as specific therapy is concerned, and to use such symptomatic treatment as he feels is indicated and trust to nature to carry on the fight successfully.

It is true that we are dealing with what is usually a self-limited condition. At the end of a few days the body develops a high degree of specific immunity, the infection is overcome and recovery occurs. Since we have no absolute specific as yet, it becomes doubly urgent that nature be given all possible symptomatic assistance.

Oxygen Therapy

The most important symptomatic therapy in any type of pneumonia is the use of oxygen. Anoxemia would seem to be a greater factor than toxemia in the cause of the disease. Normal arterial blood has an oxygen saturation of 95 per cent, venous blood has an oxygen saturation of 70 per cent. Cyanosis becomes apparent at 85 per cent saturation, is marked at 80 per cent, and at 70 per

cent saturation tissue damage occurs if the situation is not quickly relieved. By arterial puncture it has been demonstrated that some degree of arterial unsaturation exists frequently in pneumonia. Clinically this condition is evidenced by headache, nausea, depression, delirium, increased and irregular respiration and pulse, weakened cardiac action and cyanosis.

The effective administration of oxygen apparently began in 1917 when the Haldane apparatus was used in the acute pulmonary edema of gas poisoning. The oldest method and the one most often used at the present time although useless, unfortunately, is the administration of oxygen through a funnel held in front of the patient's nostrils. The nasal catheter has also been widely used. A rebreathing apparatus was another forward step in oxygen therapy, soda lime being used for the absorption of carbon dioxide. Since 1921, oxygen chambers have been used and recently this idea has been carried forward in the development of the practical oxygen tent or head tent. The Mayo Clinic, the Presbyterian Hospital of New York, and other hospitals have special oxygen rooms which are air-tight, even the doors being hermetically sealed.

Ordinarily, inspired air contains about 21 per cent of oxygen. By the above methods, the oxygen content of inspired air can be increased up to 100 per cent. It is probable that oxygen, in order to be of therapeutic value, should be administered at a certain optimum concentration and within a certain maximal and minimal range. If the oxygen content is above 70 per cent there seems to be distinct danger since animals if placed in such an atmosphere develop an acute serous pneumonia. Atmospheres having an oxygen content of 60 per cent appear quite safe and an oxygen content of over 30 per cent is necessary for any therapeutic effect. The majority of patients with an oxygen deficiency in the blood are best treated with an atmosphere of 40 per cent oxygen content.

The maximum concentration of oxygen obtainable by the funnel method as judged by samples taken from the nasopharyngeal air has been found to be about 24 per cent. Therefore the method, as well as being wasteful, is useless in relieving arterial anoxemia. The nasal catheter, when carefully employed, using two liters of oxygen per minute, gives a nasopharyngeal oxygen concentration of 30-33 per cent. This method involves the use of a good deal of oxygen and is most practicable when used with high pressure tanks. The clinical results are variable. In mild cases and occasionally in the more severe cases, a measurable increase in the arterial oxygen saturation may occur, but in no case does the rise reach normal levels. In patients who are seriously ill, it has sometimes been

noted that a severe anoxemia was made worse by the nasal administration of oxygen, and was later relieved by the administration of an atmosphere having an oxygen content of 40-60 per cent in an oxygen tent or rebreathing apparatus. It would seem therefore that the intranasal method is limited in its effects to mild and moderate cases of anoxemia and that in the more severe cases it is necessary to have recourse to those methods by which it is possible to obtain a much higher percentage of oxygen in the atmosphere.

The rebreathing appliance in its various forms appears to be an effective method of administering oxygen, it being possible in most cases to provide a 40 per cent oxygen concentration without disturbing the patient. It is probably the most economical and the least wasteful method. It has the disadvantage of the necessity for wearing some form of mask and a few patients are sure to find this uncomfortable. This difficulty is overcome in the oxygen chamber, the oxygen tent, and the head tent in which precise oxygen percentages can be supplied and maintained.

The oxygen tent as described by Barach[12] consists of an inverted V-shaped simple pitched-roof tent suspended above the bed and closed by a horizontal sheet fitting underneath the mattress. A relatively air-tight compartment is thus made, the material used being a rubberized fabric specially constructed of three-ply layers of cotton cemented by rubber tissue. The tent is provided with windows and flaps through which access may be had to the patient. Ventilation is accomplished by an external closed circuit which provides an oxygen-rich atmosphere free from carbon dioxide, heat and excess moisture. Adequate air motion within the tent is assured by a small fan. Roth[13] describes a head tent which fits about the shoulders only and is similar in principle to the bed tent.

Clinically, the patient appears to be more comfortable soon after his entrance to the tent, the cyanosis diminishes or disappears in truly remarkable fashion, restlessness decreases and there is usually considerable relief of dyspnea. In many cases there is a drop in the pulse rate or in the respiratory rate or in both. Slowing of the pulse is the result most usually noted and is most striking in the more severe anoxemic cases. Promotion of sleep and decreased tendency toward delirium are other results noted in the use of efficient oxygen therapy. In general it is felt that the value of oxygen therapy is supportive rather than curative. In cases of severe dyspnea accompanied by cyanosis, oxygen treatment has appeared to prolong life until such a time as the immunity mechanism was able to accomplish recovery. Subjectively, the results have been good, most patients experiencing a great relief of symptoms and an

increased sense of well being. Such an apparatus as the portable oxygen tent should be part of the equipment of any hospital.

DIATHERMY

The principle of diathermy which was applied some years ago in the treatment of pneumonia is the application of the bipolar high frequency current of D'Arsonval which produces a central heat between electrodes. It can be given wherever alternating current is available and any one of several types of portable apparatus supplied with a milliamperemeter and capable of delivering 7000 milliamperes of current may be used. Usually about three treatments of 20-30 minutes each are given in twenty-four hours, although in severe cases the treatment may be repeated every four hours. As resolution advances, the treatment may be cut down rapidly both in amount and frequency.

It has not been proved that the duration of the disease is affected by the use of diathermy although it would appear that the period of resolution is definitely shortened. Symptomatically the results have been good. In most cases increased respiratory excursions and some decrease in cyanosis are noted, and there is usually an increase in ease and quantity of expectoration. Generally there is some decrease in both systolic and diastolic blood pressures.

These results of the use of diathermy must be due to the simple presence of increased intrapulmonary heat, with its stimulating effect upon the body's natural defenses against the organism. It is conceivable that the heat causes an analgesia of sensory nerve terminals, thus accounting for the cessation of the respiratory grunt. There is probably some improvement also in the pulmonary circulation around the area of consolidation, but the consolidation itself is little affected. Furthermore since the body's defense is in part undoubtedly due to the bactericidal effect of phagocytic enzymes, a process in itself stimulated by the febrile temperature developed in the disease, the improvement is further promoted by the artificial high temperature produced within the lung by the use of diathermy.

Diathermy is not a specific cure for pneumonia. In many cases it seems to have no beneficial effect. It has proved of value as a helpful adjunct to treatment and as such it should be regarded. Innumerable methods have been developed from time to time in an attempt to reduce the mortality of this disease and if diathermy offers another means of attack, as seems to be likely according to statistics, it should be used. No untoward effects have been noted

from its use and no other part of the treatment need be neglected or curtailed because of the use of it.

General Treatment

The methods discussed above are unfortunately mostly hospital procedures. Let us discuss briefly the important general points in the treatment of the individual patient who is cared for in the home.

He should be put to bed in a sunny, airy room. In the lobar type of pneumonia, the patients stand cold air well; in the lobular type they usually require heated air, but each type of patient should be in a well ventilated room preferably with air in motion. The covering should not be burdensome. The initial chill in a case of pneumonia has so impressed the laity that many patients are found to be almost smothered with clothing. The diet should be light but nourishing, milk frequently forming the staple part of it. More important is the ingestion daily of about 3,000 c.c. of fluid. The increased temperature with resultant perspiration, and increased respirations cause a rapid loss of water and dehydration in itself is a cause of much discomfort. A pitcher of water should always be convenient to the bedside. Initial purgation is usually advised followed thereafter by the use of enemata if necessary.

There are few diseases in which nursing care is of greater importance. Mental or physical rest is often accomplished by the ministrations of a conscientious nurse and may be sufficient to tip the balance in a favorable direction.

The relief of pain and the procuring of rest are two of the most important principles in the treatment. For the relief of pleuritic pain, which is usually a prominent feature early in the disease, the application of mustard paste, which should be renewed every four hours, is very useful. Care must be taken to prevent blistering and this may be done by removing the plaster when a good skin reaction has occurred, and by careful oiling. In many cases, strapping the chest gives relief from this distressing symptom. For severe pleuritic pain and also to control the nonproductive painful cough which is associated with pleurisy, it will frequently be necessary to use morphine. Fortunately this can be done with impunity early in the disease when the consequent depression of the respiratory center is not such a disadvantage as it is in the later stages of the disease when the center is likely to be greatly depressed. Fortunately the pleurisy will have abated or disappeared when this condition obtains. Atropine may be used in conjunction with morphine to overcome the depression of the respiratory center. However, there are

few greater aids to bodily resistance to disease and to the keeping up of the morale of the patient than sleep, and there is no question that the judicious use of morphine for this purpose early in the course of the disease has saved many lives.

The conservation of an efficient circulation is a very important principle, for in spite of the negative pathological findings, most clinicians are agreed that in cases in which the disease has proved fatal, the issue has been decided very often by the failure of the cardio-vascular apparatus either from right-sided cardiac failure or from failure of the blood pressure regulating mechanism or from failure of both. For this reason it becomes of the utmost importance that an efficient circulation be promoted by every possible means. The factors which throw an additional strain upon the heart are (1) impairment of circulation in the pneumonic lung, (2) toxemia, and (3) anoxemia.

Careful watch should be kept for signs of right-sided cardiac failure. These signs are increasing cyanosis, weakening of the second pneumonic sound, venous stasis in the neck, edema of the bases, a fall in tension of the pulse rate and a fall in blood pressure. Digitalis should be used early in the disease in order that digitalization may occur early. This is preferable to giving large doses of digitalis later on in order to meet a cardiac emergency when the toxic action of the drug adds itself to the bacterial toxemia. Massive dosage may be employed such as suggested by Eggleston — 0.15 c.c. of tincture to pound of body weight in 24-36 hours. In cases in which cardiac disability is known to exist massive dosage may be used with profit from the beginning. Where cardiac failure is severe, digitalin in grs. 1-50 doses may be used hypodermically or intramuscularly. Strophanthin grs. 1-250 may be used intravenously. Where digitalis by mouth causes nausea it may be given hypodermically.

Recent opinion has questioned the value of digitalis. Cecil reports a ten per cent greater mortality in a series of cases treated with digitalis over those in which the patients received no digitalis.

Falling blood pressure is always an ominous sign and calls for energetic stimulation of the cardio-vascular system. Numerous drugs have been recommended for this purpose. The usual ones recommended are strychnine, camphor and caffeine in appropriate dosage. The first two are of very doubtful value. Adrenalin chloride may be of decided value in an emergency. One of the best drugs is pituitrin, particularly in cases where the hypotension is due to a dilated periphery. The use of alcohol as a stimulant in cases of pneumonia is probably decreasing. In certain cases of elderly and

debilitated patients, however, and particularly patients who are accustomed to its use, it is useful and necessary. Certainly we should not institute an era of temperance in a patient when he is suffering from pneumonia.

Venesection may be very useful early in the disease in the case of the plethoric, obese individual with full bounding pulse, and later on in the disease, right-sided cardiac dilatation may be greatly decreased by the prompt and rapid removal of a quantity of blood. Fifteen to twenty ounces should be drawn rapidly. The vein should be incised and allowed to bleed freely or a large needle should be used.

Delirium is a symptom which may add greatly to the nursing care. Constant watching is of course necessary as these patients may harm themselves. A mild delirium just preceding the crisis is very common but occasionally a noisy delirium is seen early in the disease. A low muttering delirium is often seen before dissolution and evidences a very severe toxemia.

Respiratory failure is often cited as the immediate cause of death and there seems good reason to believe that the delicate mechanism of the respiratory center becomes so loaded with toxemia that it fails. It is therefore advisable to use some respiratory stimulant but when we cast about for one we find that our armamentarium is pathetically small and of doubtful value. The use of caffeine and strychnine as respiratory stimulant is based upon the scantiest of evidence and clinically it is practically valueless. (Recently experimental evidence has been obtained which shows the cyanides to be of some value.) The most powerful respiratory stimulant is carbon dioxide, and of course, nature has made use of this as the factor in increasing normally the depth of the respiration. Up to the present, this method has not received the consideration as a therapeutic measure which its functional influence would indicate. Experiments by Meakins and Henderson[14] would indicate that carbon dioxide has the desired effect in cases of pneumonia. In extreme cases, it has not proved effective probably because the respiratory center has become exhausted and cannot respond to stimulation. Combined with oxygen, carbon dioxide in a concentration of five to seven per cent seem to have helped greatly but the clinical evidence which has so far been obtained is insufficient to prove this.

Prophylaxis

The problem of prophylaxis requires mention. Researches by workers in the Rockefeller Institute have shown that virulent strains of the pneumococcus frequently can be recovered from the

mouth and throat of convalescent patients and from persons in attendance upon them, whereas they can be recovered only rarely from non-contacts. The possibility of spread of the disease should therefore be kept in mind and a careful prophylaxis instituted. Sputum should be collected in paper cups and burned. After the illness, the patient's room should be thoroughly disinfected by the use of a formaldehyde vapour.

The common cold ought to be regarded as a potential source of pneumonia and should be treated accordingly. There is no question that if the person with an acute cold would remain in bed for a few days, the number of cases of pneumonia would be considerably reduced. Similar treatment applied to early cases in which the disease can be only suspected would also be extremely useful in reducing the mortality.

Vaccines offer a definite hope of reducing the incidence of the disease. Cecil has shown that a high degree of immunity can be produced by the subcutaneous injection of an ordinary saline suspension of Types I, II, and III. In military practice, it was amply demonstrated that the incidence of pneumonia among soldiers living under crowded conditions was greatly reduced by this method and certainly such prophylactic treatment might well be used in the case of industrial workers who are exposed to wet and cold. Similar work by Lister[15] among the native workers in the diamond mines of South Africa, where epidemics were formerly common, has greatly reduced the incidence of pneumonia and statistics show a reduction in the death rate from 5 per 1000 in 1916 to 1.68 per 1000 in 1924. It is probable that vaccine therapy might be of distinct value to the individual who has had repeated attacks of pneumonia and lives in fear of another. Cecil recently expressed the belief that repeated attacks of pneumonia in the same individual are due to different types of the organism and that the specific type immunity may last for life.

The prevention of postoperative pneumonia has been greatly assisted by the work of Henderson[16] and his co-workers in pointing out the value of inhalations of carbon dioxide. It has, of course, been well proved that carbon dioxide increases the depth of respiration. Henderson[17] believes that an atelectasis occurs as a result of the inhibitions of the normal mechanism to keeping open the air passages, namely, the cough reflex, ciliary action within the bronchi, and the peristaltic contraction of the bronchial musculature. With added secretion, occlusion occurs, an absorption of air takes place and a suitable nidus is formed for the development of pneumonia. The inhalation of a five to seven per cent concentration of carbon

dioxide after the anesthetic has been administered keeps open the air passages and lessens the danger of massive collapse of the lungs. Such inhalations, by increasing the depth of the respirations, free the patient from the anesthetic more readily. This procedure has been definitely shown to be of value clinically.

The above findings show the extent of our knowledge of the treatment of pneumonia. Although this knowledge is incomplete and unsatisfactory in many respects yet there is evidence that in the not far distant future much more will be known of the cause and treatment of this disease. Meanwhile the fight must be carried on with such weapons as are available.

Summary

1. Pneumonia is a disease for which no specific therapy has been found. It is self limited, consequently the nursing and symptomatic treatment are of great importance.

2. Treatment with drugs is largely designed to relieve discomfort and to lend support rather than to cure the disease.

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