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THE TREATMENT OF PNEUMONIA*

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Pneumonia is the most widespread and fatal of acute diseases in civilized lands, and its control is one of our most serious problems. While during the last fifty years there has been a striking reduction in the mortality from other infections, such as tuberculosis, typhoid fever, small-pox, and scarlet fever, that from pneumonia actually increased until the last few years. It is instructive to compare graphs of the deaths from pneumonia, pulmonary tuberculosis, and influenza during the last half-century. In 1884 the deaths from pneumonia were 1,000 per million living, but with the influenza epidemic of 1890–1 they rose to 1,400 and did not fall to 1,000 again for thirty years. Since 1920 they have been below 1,000, except in 1922 and 1929, years in which influenza was prevalent. It will also be seen that fifty years ago the mortality from pulmonary tuberculosis was 80 per cent. greater than from pneumonia, but since then there has been a steady fall, and from 1900 deaths from pneumonia have exceeded those from phthisis.

Frequency of Lobar Pneumonia

In most discussions on the treatment of pneumonia it seems to be assumed that we are mainly concerned with acute lobar pneumonia, but older physicians have frequently remarked that classical lobar pneumonia is now less frequently seen than formerly. The association of a rise in the mortality from pneumonia with that from influenza at once suggests that under the heading of pneumonia is included so-called influenzal bronchopneumonia. This is, of course, well recognized during epidemics, but I think it is not sufficiently appreciated that in ordinary years a large proportion of acute primary pneumonias are of influenzal origin. It is not always easy to determine the type by clinical methods, and even on post-mortem examination pathologists would not always agree as to the kind of pneumonia present in a given lung. My colleague Dr. Stuart MacDonald kindly examined for me the post-mortem records at my hospital during the ten years 1925–34. Excluding all cases of secondary bronchopneumonia there were 246 cases of pneumonia, and of these sixty-six were lobar pneumonias and 180 bronchopneumonias: 110 were in children under the age of 10, and all these were bronchopneumonias. There remained 136 cases over the age of 10, and of these sixty-six were lobar pneumonias and seventy bronchopneumonias. Of cases between the ages of 10 and 60 sixty-one were lobar pneumonias and fifty-five bronchopneumonias. It seems, therefore, fair to assume that only about half the cases of primary pneumonia in adults are true lobar pneumonia, although the proportion varies from year to year and doubtless from place to place. The point is of considerable importance in connexion with treatment, especially by specific methods, and also as regards prognosis. Bronchopneumonia has a far greater liability to produce permanent damage to the lungs, and is responsible for the great amount of pulmonary fibrosis which is seen to-day.

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Old and New Remedies

A century ago our predecessors fought pneumonia with the powerful weapons of bleeding, blistering, purging, and starvation. Patients might be bled twelve or fifteen times, twenty to thirty ounces of blood being taken at a time. Mercury was given in amounts to produce soreness of the gums and marked salivation in a few days, and tartar emetic was prescribed up to 30 grains a day. It is a great tribute to the stamina of our ancestors that so many survived this heroic treatment. It was not until the middle of the nineteenth century that a reaction set in under the influence of Skoda of Vienna, whose methods were introduced into this country by Dr. George Balfour and Dr. Hughes Bennett, and the era of expectant treatment began. Since then various drugs have had their periods of popularity—quinine, veratrum, creosote, musk, digitalis, alcohol—but the fact remains that there is no drug which has a specific action or materially influences the progress of the disease. Apart from specific antibacterial methods and improvements in nursing we cannot say that there has been any real advance since the first introduction of expectant treatment. Much of our treatment is traditional and has no rational foundation, and the mortality, though varying from year to year, remains about 20 per cent.

In the absence of a drug which has a selective action upon pneumococci when given in therapeutic doses various antiseptics have been injected intravenously, in spite of the manifest impossibility of obtaining a sufficient concentration of the drug to kill germs without at the same time injuring leucocytes and the reticulo-endothelial cells upon which protection really depends. Perchloride of mercury and mercurochrome have been recent favourites. The claims for the latter may be examined. It is advised that 10 c.cm. of a 0.5 or 1 per cent. solution be injected—that is, 0.05 to 0.1 gram. The volume of the blood is 5,000 c.cm., so that the concentration in the blood would be at the most 1 gram in 50,000 to 100,000 c.cm. But for external use the strength required to act as an antiseptic is from 5 to 25 per cent. Even the small doses injected intravenously have produced fatal nephritis and intestinal ulceration.

Value of Immunotherapy

It must be recognized that a patient only recovers from pneumonia, as from any bacterial infection, by the provision of sufficient antibodies, and it is in some form of immunotherapy that our hopes must be placed. With

immunotherapy we have the choice of vaccines and serums. Both have their appropriate places in treatment. Theoretical objections are often made against the use of vaccines in acute infections, the most important being the fear of producing a reaction, a phase of lowered immunity in a patient who is seriously ill. This is due to a misunderstanding of the principles involved. Reactions occur in subjects who are sensitized, whose cells are allergic. This state of sensitization depends upon the presence of specific antibodies, and if these antibodies are absent there is no sensitization, and no reaction will occur with any reasonable amount of vaccine. This is clearly seen in the case of tuberculosis: 1 c.cm. of tuberculin can safely be injected into a non-tuberculous and therefore unsensitized infant, whereas 0.000001 c.cm. may produce a reaction in an infected and therefore sensitized person.

It was unfortunate from the point of view of the treatment of acute infections that the first experiences with vaccines were with patients suffering from chronic infections, who were therefore sensitized and easily reacted. It was assumed that the variations in the opsonic index found after injection of a vaccine in chronic cases were similarly obtained in cases of acute infection, and so there was a natural hesitation to use vaccines in such instances. Specific antibodies are present in all cases of chronic infection ; therefore reactions are easily produced, and the initial dose of vaccine must be small in such conditions as chronic bronchitis, asthma, chronic arthritis, pyelitis, the later stages of septicaemia, and unresolved pneumonia. In acute infections specific antibodies are only present after a certain interval has elapsed, as the process of formation is comparatively slow. Until these antibodies are present the patient is unsensitized. It is this interval before sensitization has occurred that gives the opportunity of intervening safely with an adequate dose of vaccine. This is a general principle, which applies equally to other acute infections, such as cerebro-spinal fever, erysipelas, simple influenza, and acute septic infections.

In pneumonia the curve of intoxication rises rapidly and then remains at a high level. Specific antibodies are at first absent, but begin to appear about the fourth or fifth day ; the curve rises slowly at first, then rapidly, reaches the curve of toxaemia about the seventh day, and in a favourable case a crisis will occur. The problem is to hasten the production of antibodies so that the rise takes place earlier at a time when the curve of toxaemia is still rising. These antibodies, however, are strictly specific, and injection of a vaccine a few hours after the onset of pneumonia will still only produce a rise of specific antibodies some days later. If, then, we had to rely upon specific antibodies it would be impossible to obtain a rapid effect in controlling the disease. Fortunately a vaccine also has an immediate effect in stimulating the production of mobilization of non-specific antibodies. Here there is no question of a slow formation, but a rapid and immediate outpouring of bactericidal substances. It is this form of immunity that is exploited in the early treatment of acute infections. Non-specific antibodies are the first line of defence ; they are the general practitioners of immunity, ready to deal with any emergency. Only later, when these fail, are the specialists, the specific antibodies, evoked.

The aim of vaccine treatment in pneumonia is therefore to produce an early non-specific immunity while the curve of toxaemia is still rising, while the leucocytes are vigorous and capable of response, and before toxins are fixed in dangerous amount in nerve and heart cells. It must also be remembered that in the early stage the circulation through the lung is unimpeded, and that organisms are accessible to antibodies in the blood. A few days later the vaccine will also produce a specific effect and reinforce the immune bodies which may be naturally produced. It is therefore desirable that the vaccine should contain organisms corresponding to those causing the infection.

With pneumonia, then, there is a margin of time during which the patient is unsensitized and in which prompt measures to produce immunity may control or even abort the disease. This issue is then to a large extent in our hands. I would therefore urge the extreme importance of early treatment. Pneumonia should be regarded as an acute medical emergency in the same sense as a surgeon speaks of an acute abdominal emergency. Prompt action requires prompt diagnosis, but unfortunately the public has not yet been trained to regard a pain in the chest as seriously as a pain in the right side of the abdomen, and the doctor is not called in as early as in cases of threatened appendicitis. Even when called in early there is often a delay in making a diagnosis. I am not infrequently told " This man has been ill for three days with a high temperature and a pain in the side, but it was only to-day that I found signs of pneumonia," as though previously he had been suffering from some other disease. It is unfortunate that pneumonia should be regarded as synonymous with consolidation of the lung instead of as a general disease in which consolidation is a comparatively late manifestation. To wait for consolidation before making a diagnosis of pneumonia is like waiting for abscess formation before diagnosing appendicitis. The object of immunotherapy is to control the infection before it is out of hand and to prevent the development of symptoms which later we may be powerless to control. It is not used to treat toxic symptoms but to prevent them. It is probable that the fate of the patient is mainly decided during the first forty-eight hours.

Treatment with Vaccine

The vaccine I use is a plain, straightforward emulsion of germs sterilized by heat and as far as possible made from young primary cultures. The vaccine must be active and of known antigenic power. I place great stress upon the activity of the vaccine. It is now known that when organisms are subcultured colonies separate out into smooth and rough varieties. The smooth contain organisms that are virulent, pathogenic, and have antigenic power, the rough have lost their pathogenicity and antigenic power. The more an organism is subcultured the more of the rough colonies appear ; and, finally, cultures may be entirely inert. This is one of the causes of the variation in activity of vaccines and of the failure to get good results. The vaccine contains equal numbers of pneumococci, streptococci, and *B. influenzae*. If we were only concerned with lobar pneumonia the vaccine need only contain pneumococci, but as it is not always possible to determine at an early stage whether a patient has loba pneumonia or bronchopneumonia it is best to use a mixed vaccine for all. As an immediate non-specific effect is aimed at it is not absolutely essential that the vaccine should contain all types of pneumococci, although this is desirable for the sake of the after-specific effect. But active antigenic power should not be sacrificed to typing. For an adult a suitable dose is 200 millions of each of the three organisms—that is, 600 millions in all. Children require proportionately smaller doses, but even at a year old 20 millions of each organism can be given. If the temperature does not fall after the first injection it can be repeated every twenty-four hours until three doses have been administered.

When such doses are given on the first day of the illness the temperature frequently falls to normal during the next twenty-four hours, with a corresponding fall in the pulse and respiration rates and improvement in the general condition. With each day's delay such rapid

defervescence is less easily obtained, but even when the temperature does not appreciably fall an improvement in the patient's condition may be noted. When cases are not seen until the fourth day or later the lung will be consolidated, signs of nervous exhaustion and circulatory failure may be present, and the favourable opportunity for intervention will have passed.

The following case illustrates the typical result of early vaccine treatment. A medical man aged 53 was seen one evening about twelve hours after the initial rigor. His temperature was then 105° F., pulse 136, respirations 36. There was pain in the right side of the chest, with grunting respirations. There were diminished resonance over the right lower lobe and fine crepitations. Vaccine was injected and the temperature was normal when the patient was seen next morning. The right lower lobe was then consolidated, and he presented the striking picture of a patient with a portion of his lung solid, but free from distress and with normal pulse and respirations.

This phenomenon of early consolidation with an absence of symptoms is a characteristic result of vaccine treatment. Vaccines appear to hasten the evolution of the lung phenomena. In a consecutive series of one hundred cases of lobar pneumonia forty-nine were injected during the first three days, with one death; but of fifty-one treated for the first time on the fourth or later days twelve died. The only patient who died among those treated early was an asthmatic woman of 29, pregnant at term. The first injection was followed by an improvement, but labour set in and she died on the seventh day, of circulatory failure.

Influenzal bronchopneumonia reacts to a vaccine in much the same way. In a series of 107 cases during the 1918–19 epidemic seventy-three were injected during the first three days and three patients died. Of thirty-four injected on the fourth and fifth days seven died. Of the twenty-eight injected on the first day 71.4 per cent. had a normal temperature within twenty-four hours after the injection, and 85.7 per cent. within forty-eight hours. Only one patient out of fifty-one injected on the first or second day died. She was admitted with mania. Crisis occurred thirty-six hours after the first injection and the temperature remained normal, but she died a week later from pulmonary embolism. The majority of the patients were soldiers. All cases were of a severe type, often with extreme cyanosis.

In a series of 113 hospital patients during the years 1928–30, including the epidemic of 1929, fifty-eight were injected during the first three days and five died; fifty-five were injected on the fourth or later days and nine died. These included all types of pneumonia and a more than usual number of bad subjects. The only patient who died of those injected during the first day was a man of 56 who had been extremely alcoholic for years. The following table gives the results of the combined three series.

Day of First Injection	Cases	Recovered	Died	Per cent.
1	49	47	2	5
2	61	59	2	
3	70	65	5	
4	48	37	11	20
5	34	28	6	
6	21	18	3	
7	10	9	1	
8	9	8	1	
9 etc.	18	12	6	
	320	283	37	11.5

The table shows that of 180 patents treated during the first three days the mortality was only 5 per cent., but was 20 per cent. in the 140 treated later than the third day. In any series of cases, especially those admitted to hospital, there will be a number of bad subjects—alcoholics, patients with cardiac and renal disease—and it is doubtful if the mortality of pneumonia can be reduced much below 5 per cent.

Young children appear to respond particularly well to vaccine treatment, and old age does not contraindicate it, several of the successful results being in patients over 80. A good evidence of the efficacy of vaccine treatment is given by patients who have had more than one attack cut short by prompt injection. One patient has recently been successfully treated for his fourth attack.

Serum Treatment

I now turn to serum treatment. The discovery of serological types of pneumococci made it clear why early attempts to produce an effective serum failed, and also showed that the problem was complicated by the fact that each type required its own specific serum. The pneumococcus produces a specific soluble antigen which accumulates in the blood in large quantities, and the object of serum treatment is to raise the concentration of the antibody to an adequate level. For this end the antigen already present must be neutralized. It is therefore necessary to inject early and in large amounts. The serum is not antitoxic but bacteriotropic, and aids phagocytosis. Cole and his fellow workers at the Rockefeller Institute succeeded in obtaining an effective serum against Type I pneumococcus, but were only slightly successful with Type II, and not at all with Type III. Their serum required to be injected in large amounts, such as 100 c.cm., intravenously every eight hours until the temperature fell. The large amount of foreign protein caused in many cases severe rigors and serum sickness. The necessity also of typing the pneumococcus and the consequent delay interfered with its popularity, and now this unconcentrated serum is used only to a slight extent. Cole's early results showed in a series of 195 cases a reduction from the usual mortality of 25 per cent. to 9.2 per cent.

Attempts were then made to concentrate the serum. Huntoon introduced his antibody solution, which apparently gave good results, but caused alarming thermal reactions. Finally, the introduction of Felton's concentrated serum revived interest in the method. This serum contains antibody to Type I and to a less extent to Type II pneumococcus. It is now available from English sources. The successful results have been obtained almost entirely with Type I infection, as with the original serum. Its early use has a similar action to that of a vaccine in controlling the infection.

The following table gives the results of serum treatment in some series of cases.

Mortality of Type I Lobar Pneumonia Treated with Felton's Serum Compared with the Mortality of Simultaneous Controls Without Serum

	With Serum			Without Serum		
	Cases	Deaths		Cases	Deaths	
		No.	Per cent.		No.	Per cent.
Cecil and Plummer ...	239	48	20.1	234	73	31.2
Park, Bullowa, and Rosenbluth	58	13	22.0	54	19	35.0
Finland	80	17	21.3	70	22	31.4
Cases of less than three days' duration:						
Cecil and Plummer ...	103	12	11.7	97	26	26.8
Park, Bullowa, and Rosenbluth	29	6	21.0	28	10	36.0
Finland	42	4	9.5	16	6	37.5
Type II lobar pneumonia:						
Cecil and Plummer ...	252	102	40.5	253	116	45.8
Early cases	21	3	14.3			

But if the mortality from pneumonia is to be lowered by any form of immunotherapy it must be such that it can readily be used on a large scale by general practitioners, and at present there are many obstacles in the way of the popular use of serum. Serum is expensive, and if it is to be used economically the type of infection must be determined. This is not easily obtained for patients treated in their own homes, even if sputum is available, which is not always the case. There may therefore be considerable delay, and the longer the delay the larger the dose of serum required. It must be injected intravenously, and repeated injections into a vein require considerable dexterity, especially in children. If expense is ignored, typing can be abandoned and a polyvalent serum used for all, which means that a large proportion would not obtain any advantage from the serum. There is no doubt of its great value when given early in Type I infections, but Type I infections form only about one-third of all lobar pneumonias, and we have seen that lobar pneumonias are only about one-half of all the cases of primary pneumonia in adults.

At present it may be wise to restrict the use of serum in general practice to cases which from the outset appear to be of more than usual severity. To such cases 20,000 units (about 12 c.cm.) of a polyvalent serum should be administered as soon as possible. If sputum is obtainable this should be sent for typing. If this shows the infection to be due to Type III or Group IV pneumococcus, serum should be abandoned, but if Type I or II is found 20,000 units of the corresponding Type I or II serum should be injected every six hours until the temperature falls. Usually a maximum of 120,000 or 150,000 units is not exceeded. Unpleasant symptoms such as rigors, anaphylactic shock, and respiratory distress may occur, but should not prevent administration, as they are usually relieved by an injection of adrenaline. It is inadvisable to inject serum into allergic subjects such as asthmatics or into elderly arteriosclerotics.

On the whole, therefore, vaccines have the great advantage over serum of simplicity of administration. The vaccine can be carried in the bag ready for use when a case is first diagnosed, its injection requires no skill, and it does not produce unpleasant symptoms, such as the thermal reactions and rigors often seen with serum. Vaccines will do all that is claimed for serum, and an immediate injection of a vaccine may prevent the need of considering the use of serum.

Symptomatic Treatment

I now pass to other points of treatment. There is general agreement upon the elements of nursing—the importance of absolute rest, a well-ventilated room, avoidance of overclothing, abundance of fluids, the use of glucose, and so on—but even to-day the practitioner may have to overcome the opposition of well-meaning but old-fashioned relatives and even of nurses who have not been properly trained in the nursing of pneumonia patients.

In the early stage relief of pain is the chief consideration, and linseed or kaolin poultices are generally employed. They should be used for pain only and not for the pneumonia, and should be applied in such a way as not to add to the respiratory burden. They often fail to provide much relief, and with severe pain the most certain relief is obtained, when a pneumothorax apparatus is available, by the injection of 300 or 400 c.cm. of oxygen between the layers of the pleura. The effect is immediate: the distressed patient is relieved, and will generally drop off to sleep. The patient not only has pain, but mental anxiety and restlessness. He worries about his work and his family, and cannot sleep. Here an opiate is of priceless value in calming the mind, relieving anxiety, and subduing the racking, ineffective cough: 10 grains of Dover's powder in a saline draught may suffice, but 1/4 grain of morphine sulphate is more certain. This can generally be repeated in lobar pneumonia for three or four nights. Contraindications to its use are much bronchial secretion (as in many cases of influenzal bronchopneumonia), cyanosis, and a tendency to meteorism. When there is sleeplessness without pain 30 grains of potassium bromide, with 15 grains of chloral, are safer and more effective than the barbiturates. When morphine fails to bring sleep or allay excitement paraldehyde may succeed in doses of 2 drachms or more by mouth, or 3 to 4 drachms per rectum.

It is surprising that expectorants are so often prescribed in lobar pneumonia, in which the exudate is purely alveolar and there is no indication for increasing the bronchial secretion. In influenzal bronchopneumonia, when sputum is abundant and the bronchial tubes tend to get blocked, ammonium carbonate, in doses of 5 grains four-hourly, increasing if necessary to 10 grains every hour for a few doses, may be helpful. As it is a nauseating drug it is best given in half a teacupful of milk.

Circulatory Failure

Much is written about the treatment of heart failure in pneumonia. With early specific treatment and control of the infection circulatory symptoms should not be prominent. There is still a lingering idea that heart failure in pneumonia is due to strain upon the right side of the heart, but right-sided congestive failure is not commonly seen, and post-mortem examinations and experiments on animals fail to show any conspicuous action of pneumonia upon the heart itself. It is said that failure may be due to rapid action of the heart from the action of toxins upon the medullary centre, but rapid action is not in itself a cause of heart failure, and indeed is a necessary part of the adaptation to the disease. The basal metabolism rises 7 per cent. for each degree of fever, so that in pneumonia metabolism may be raised 50 per cent., and this demands an increased circulatory rate. The wise way to reduce the rate of the heart is by controlling the fever, and if it were possible to slow the heart by any direct action, who can say that we should not be doing harm by interfering with a natural adaptation? The evidence now shows that circulatory failure in pneumonia is mainly peripheral and due to toxic action upon the capillaries. Peripheral failure is recognized by a falling blood pressure, cyanosis, and a slow return of blood when it is pressed out of the skin by the finger. Cyanosis is not a prominent symptom in lobar pneumonia, as the circulation through the consolidated lung is interrupted, no unaerated blood is reaching the circulation, and usually enough healthy lung remains to prevent serious anoxaemia until circulatory failure occurs. But in bronchopneumonia the condition is not the same, as blood passes through areas where it is imperfectly aerated, cyanosis may occur early, and anoxaemia be a factor in producing circulatory failure. The cyanosis is accentuated by the peripheral stasis, and so extreme degrees may be seen.

At the first indication of cyanosis oxygen should be administered. When an oxygen tent is available this should be used, but in most cases it will be administered through a nasal catheter. The cylinder should have a calibrated reducing valve, and two litres a minute be passed. When oxygen is required it should be given continuously day and night, and not for so many minutes in each hour or when the nurse thinks fit. One still sees it administered by the futile method of waving a funnel over the patient's face. I am reminded of the remark of a distinguished physiologist that it is as useless to expect to increase the pressure of oxygen in the alveolar air by administering it through a funnel as to expect to alter

the salinity of the ocean by emptying the bladder into it.

With circulatory failure the drug *par excellence* is adrenaline. It augments the heart's contraction, constricts blood vessels, and raises blood pressure: 5 to 10 minims can be injected every four hours, increasing, if necessary, to two-hourly. Pituitrin has no action upon the heart, but stimulates contraction of the smaller arterioles and capillaries. It can be used to augment the action of adrenaline—1 c.cm. every twelve hours, or not more often than every six hours. With both these drugs the point may have been reached when toxic action upon the capillaries has advanced so far as to make them incapable of response. They should be employed at the first sign of failure, and it must be recognized that with grave toxaemia we may be wholly powerless to combat circulatory failure.

Digitalis and Alcohol

The use of digitalis in pneumonia has been the subject of much controversy. It was for long out of fashion, and its revival is due to the advocacy in America of its early use in full doses with the idea that if the heart was digitalized early its failure might be prevented. This was due to a misconception of the nature of circulatory failure. Digitalis has been used to slow the heart, and also with the vague idea that it is a cardiac tonic and therefore must be of value in heart failure. But there is abundant clinical evidence that digitalis does not slow the heart in pneumonia. Its reputation depends almost entirely upon its power of depressing the function of the conducting tissues, a very desirable property in auricular fibrillation but surely not desirable in pneumonia, where we should aim at preserving the normal functions of the heart. Doubt has recently been expressed in America upon the value of digitalization in pneumonia, and Niles and Wyckoff made a controlled study. Digitalis was given to alternate cases over a period of two years. The control and treated cases were observed in exactly the same way. Electrocardiograms were taken every day during the febrile period. Of 404 patients who did not receive digitalis 136 died, a mortality of 33.7 per cent. Of 338 who were given digitalis 140 died, a mortality of 41.4 per cent., showing a difference of 7.7 per cent. In other words, for every 100 patients in the control group who died there were 122 deaths in the digitalis-treated group. A surprising result was that in twenty-three cases with auricular fibrillation or flutter the mortality was again higher in those receiving digitalis.

Alcohol has probably for long been the most used of all drugs in pneumonia. While it still has its supporters, opposition appears to be growing. In the early stages it may by its sedative action allay anxiety and promote sleep, but morphine will do this more effectively. The argument that it is a source of energy has not much weight when so easily assimilable a food as glucose is available. But the chief discussion is concerning its use in circulatory failure. Its reputation as a cardiac stimulant probably arose from its familiar use as a remedy for fainting. The girl who fainted in church was carried out into the porch and given brandy by the churchwardens. The effect on the circulation is then due to reflex action from its irritant effect upon the upper part of the alimentary canal. But this action is fleeting, and it does not follow that the same effect will be produced in gradual circulatory failure in acute fevers. When prescribed in pneumonia in the usual way of so many ounces of brandy every four hours or so it is its action after absorption which must be considered. Experiments on animals and man show that it has no direct action on the heart, but it causes some redistribution of blood. There is dilatation of peripheral blood vessels, flushing of the skin, and therefore a smaller supply for the internal organs. Alcohol is therefore likely to accentuate the peripheral circulatory failure. There is no doubt that much of the delirium and excitement attributed to pneumonia was actually produced by the alcohol given for treatment, and in my early days as a physician it was not uncommon to see alcohol urged for the treatment of active delirium which was entirely the result of the alcohol the patient had already received. With the smaller doses now used severe delirium is less often met with.

Strychnine was frequently prescribed in the past, but it is rather out of favour at present. It also has no direct action upon the heart, but is a central vasomotor and respiratory stimulant. It fails to act in toxic depression of the centre or in cases of peripheral paralysis of the vessels. Many other drugs have been advocated for their action upon the circulation, but mostly with the idea that the heart was primarily at fault. They may have some value in certain cases, but I have not found one which is of real value in saving life in serious circulatory failure.

It would seem that critical examination is depriving us of several time-honoured remedies, but we have the consolation that if our faith in certain remedies has proved false yet our means of preventing serious symptoms are steadily improving, and we are in sight of a truly rational treatment of a disease which takes a heavy toll at all ages, of the strong as well as of the weak.

SOME NOTES ON THE DIAGNOSIS OF BONE TUMOURS*

BY

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In the small space of time at my disposal it is impossible to deal with the radiographic aspect of all the different types of tumours of bones and to discuss the various classifications. These can be found fully described in numerous books, monographs, and magazines—their symptoms, signs, *x*-ray features, sites of predilection, prognosis, etc.

It is my intention to discuss and to illustrate certain pitfalls, and, above all, to emphasize the need for care in arriving at the diagnosis, especially as to the type of tumour, at as early a stage as possible, because the early differentiation is of great importance from the aspect of correct treatment. Mistakes may arise in several ways —from want of care in inspecting the skiagrams, from not making use of available clinical history and pathological findings, as well as from want of knowledge and experience. It is to be remembered that the *x*-ray findings are only one of the means of arriving at a diagnosis, though probably the most important means at present available. Signs and symptoms do not concern us at present, but I should like to mention the great importance of a careful radiographic examination of the chest before any mutilating operation is decided upon.

We are all *au fait* with the typical radiographic pictures of the main types of bone tumours—of osteoma, enchondroma, the variations in cartilaginous and bone development allied to the tumours (such as Ollier's disease, hereditary deforming chondrodysplasia), bone cyst and fibrocystic variations, of osteogenic sarcoma, Ewing's tumour, haemangioma, giant-celled tumour, etc. ; but all too frequently do we hear of errors in diagnosis in the case of bone tumours, sometimes, I regret to say, from want of care in examining the skiagrams and want of appreciation of the importance of slight or fine changes.

* Read in opening a discussion in the Section of Radiology at the Annual Meeting of the British Medical Association, Melbourne, 1935.