CHAPTER 20

RESPIRATORY DISEASES

RESPIRATORY diseases have not been of great importance in Australian forces actually in the field during the war. In camps and training areas respiratory epidemics have been important wasters of men, and have carried with them the usual complications, sinusitis and middle ear inflammations, and to a lesser extent pneumonia.

UPPER RESPIRATORY TRACT INFECTIONS

This comprehensive title familiarly abbreviated to "U.R.T.I.", avoids the aetiological problem which can be solved only by full expert investigations into the bacterial and viral agents responsible. During the first winter of the war widespread outbreaks of respiratory disease attacked the training camps. These were accentuated somewhat by the unsatisfactory conditions prevailing in some of these camps, where building and the hygienic accessories of plumbing and hot water had not yet caught up with military requirements. One of the medical anxieties of a war, particularly in its early stages, is to prevent the spread of communicable disease in surroundings that are often unsatisfactory from the standpoint of hygiene. The care of men slightly ill with such complaints is often a difficult matter, as each man acts as a nucleus of infection.

We are, at present, however, more concerned with the technical aspects of these infections, which not only affected men under training, but were epidemic in the civilian population too. Methods of prevention are closely concerned with the military aspects of quartering and facilities for isolation and treatment, and are dealt with in Volume II. It may be remarked here that no such measures can be complete or successful without taking into account modern work on dust and infection in hospitals. The oiling of floors and blankets, and the efficient sunning and airing of bedding, with the avoidance of undue agitation in closed spaces, should be considered in model routine orders for camps. There can be little question that early morning bedmaking activities can become what would be aptly described as a "cross-infection parade".

Apart from these important problems of prevention the most significant medical questions were the incidence of severe accompanying pulmonary disease, such as lobar or broncho-pneumonia, and the possibility of an epidemic of severe influenza. Fortunately during the epidemic of respiratory tract infections in 1940 pneumonia seldom occurred, though many men were quite ill with symptoms and signs of an intense tracheobronchitis.

In all training areas of Australia, particularly during the cold weather there were outbreaks of these respiratory diseases, often complicated by the co-existence of diseases like measles, also spread by droplet infection. All armed Services were affected. The Royal Australian Navy experienced not only a high incidence of common colds and similar epidemics in

training establishments but also in ships, where the closed nature of the community enhanced the risk of infection. H.M.A.S. *Cerberus,* chief shore training establishment, lost nearly 6,000 man-days in the war period 1939-1941. There is some interest in studying graphs of the rate of incidence of these respiratory infections; in some States sharp short rises with high peaks were seen, with a base of some three to four weeks. This was particularly noticeable in circumscribed areas such as Tasmania. Though there is a tendency to think that these epidemics are chiefly troublesome in the early days of the war, the lines of communication areas were plagued with them right through. In 1944, for instance, combined figures for "U.R.T.I." pneumonia and influenza showed a considerable incidence. The months of greatest illness were not the same in all areas: in N.S.W., for example, a maximum of 12 per 1,000 per week was reached in April and May, in Queensland, 11 per 1,000 in May, and in Western Australia 10 per 1,000 in May and June; in Northern Territory and South Australia the incidence was very low, not over 3 per 1,000. In New Guinea during this year the rate rose slightly in April and May but remained consistently low, not over 4 per 1,000. In general, respiratory disease was uncommon in the tropical areas.

A certain amount of mild respiratory disease, apart from pneumonia, occurred in the Middle East. Some of this appeared in the winter months: at other times it was noticed in Egypt after men had returned from leave in Palestine. Considerable numbers of such infections were common on sea transports from Australia, especially the large ships which were not adapted for large numbers of men travelling through the tropics. The significance of these outbreaks in relation to inflammatory affections of the sinuses and middle ear has been noted in Chapter 56. Occasional outbreaks of acute streptococcal infection occurred, for instance, in the winter of 1942 when one death occurred in a field ambulance in Syria, and other virulent attacks were seen, usually with considerable glandular swelling in the throat. Care was taken in New Guinea to maintain a certain barrier between white troops and natives to minimise the passage of infections. This was particularly so with respiratory disease, but the segregation of natives in compounds for the sake of malarial control, the care given by Angau medical services, and the good standard of native hospitals prevented any trouble of this kind.

Occasional outbreaks occurred in advanced base areas, such as Moresby; tonsillitis appeared in Tarakan during the Borneo operations; in Bougainville in the Solomons this and other manifestations of upper tract infections were common in 1945. In Finschhafen in New Guinea too, coryzal illness appeared in the spring of 1944, with many cases of bronchitis. These infections were undoubtedly brought from the mainland, where there were always foci, regardless of season. On the Atherton Tableland, for example, respiratory disease was not uncommon, and even in tropical climates like Townsville occasional outbreaks occurred. It is interesting that during the Owen Stanley campaign in 1942, in spite of exposure to

rapid changes of climate and privations of comfort, sleep and food, the men did not suffer from respiratory disease.

The clinical and bacteriological findings varied from season to season and from place to place. Mixed bacterial infections were not uncommon, and at times these produced severe complications. An instance of this was seen at Bathurst camp in the winter of 1942. Respiratory tract infections such as the "common cold" were widespread at the time, and measles was also prevalent. A number of unusually severe broncho-pneumonias occurred, with several deaths. The sputum contained haemolytic and non-haemolytic streptococci, and *Staphylococcus aureus*. The most severe infections were found in men who, during the pre-eruptive stage of measles, had been exposed to other catarrhal cross-infections. Early isolation was not always easy in a large training area in which there was some shortage of medical officers, but when this was achieved the pneumonic complications ceased.

INFLUENZA

A question which caused considerable anxiety in medical circles in Australia during the early days of the war was whether there would be a visitation of pandemic influenza. Indeed throughout the war years this anxiety persisted, as there had not been a pandemic of influenza since 1918-1919. Such global outbreaks have occurred at intervals before, but one unusual feature of this 1918-1919 epidemic marked it on the calendar with special emphasis. This was the high mortality it caused in young adults. Indeed there was a certain assumption in the minds of many hygienists and epidemiologists that, since the world appeared to be due for another epidemic, one would appear of similar character to that which swept the world after the last war. Prophecies were not fulfilled, but nonetheless the research done during the war years on influenza was most valuable, and had an outbreak occurred at least the community would have been better prepared than previously. Knowledge of influenza has been gathered only of recent years, since virus research has become of sturdy growth, and it is very incomplete yet. The reasons for the appearance of epidemics due to different forms of virus are not clearly understood, nor why the epidemics die down or assume a sporadic character, when there is evidence that there are many people unprotected in the community.

Since 1935 much successful work in the isolation of the influenza virus had been carried out at the Walter and Eliza Hall Institute in Melbourne, and important advances were made in the technique of cultivating it in the chick embryo. By 1940 it was possible to harvest considerable quantities of cultivated virus from the allantoic fluid, by use of the Hirst agglutination method of titration. By these means not only could viruses be isolated, but they could be grown in bulk sufficient to produce vaccines for experimental purposes, and tests for immunity in the blood serum of human subjects could be readily carried out.

In the winter of 1939 Dr F. M. Burnet and his co-workers in Melbourne had duplicated the English experience in finding several types of

influenza virus during an apparently homogeneous epidemic. An outbreak in Europe was then expected to occur, and if immunisation was to be attempted it was obvious that recognition of the viral types was important. In Australia the use of an attenuated living virus was thought to be promising for immunisation, and during 1940-1941 volunteers in Victoria were treated with nasal spray of such a preparation. Antibody titration gave rather uneven results, but Burnet found that persons with very low antibody usually responded to a living virus vaccine with a mild general reaction and a definite rise in antibody. These persons were those who should be most susceptible to the disease.

In Puckapunyal camp in Victoria an epidemic of upper respiratory tract infections broke out in the early winter of 1940. By the beginning of July, 250 men were in hospital each day in the camp area. There were few serious complications, but intense pharyngitis and laryngitis were common. Few cases of pneumonia occurred. Two instances of dendritic ulcer of the cornea were noted, of herpetic origin, and associated with respiratory tract infection. Influenza virus was isolated during this outbreak, and proved by ferret inoculation. For the first time too, direct inoculation of nasal washings into the embryonic amniotic sac was successful. During 1940 there was little true influenza in Melbourne, but several strains of virus were isolated from various sources. The volunteers mentioned above, who were treated with nasal spray of attenuated virus, did not always resist a fully active strain, and it was evident that a less attenuated strain would have to be used to produce effective immunity. One interesting finding in this work was that the "new" influenza "*B*" virus recognised overseas had been causing attacks in Melbourne during the previous two years. As no cross immunity existed between types *A* and *B* both strains would need to be used for a vaccine.

During 1941 no epidemic of virus influenza was recognised, though a respiratory epidemic clinically of influenzal nature occurred during the early summer. Further experiments were carried out on volunteers, all available *A* and *B* types of virus being used. The strains attenuated by 40 to 100 passages in chick embryos were used for immunisation of these volunteers, with the cooperation of Colonel Gordon Shaw, D.D.M.S., Victorian lines of communication area. It was recognised that evaluation of the results would be difficult, owing to the patchy nature of influenza except in widespread epidemics, and the probable lack of adequate controls. There seemed to be reason to hope that immunisation by this method would be at least as effective as the subcutaneous method then being used in America, for which 50 per cent success was claimed.

During 1942 one hundred and twenty volunteers from the army were inoculated with a mixed virus vaccine. An atomiser of the de Vilbiss pattern was used, vaporising 0.2 c.cm. of allantoic fluid. Symptoms were trivial, not more than a mild coryza, and rises of antibody were demonstrated, particularly where its previous level was low. The potential importance of this work was enhanced by the possibility of a pandemic at this time, when the movements of armies and refugee populations ap-

peared to favour its appearance. In the late autumn of 1942 a typical outbreak of influenza occurred in camps in Victoria. Characteristically, cases were recognised in camps separated widely, sometimes by hundreds of miles, within a week of the first demonstrated infection of true influenza. The peak occurred within two or three weeks, the rate per 1,000 men rising from 10 to 100. The clinical characters resembled strongly those of the epidemic in Britain in 1937, and influenza virus *A* was isolated in May and September 1942.

Titrating experiments showed that the initial antibody level was lower in patients than in others who remained well, but a sharp rise was observed during convalescence. Though the incidence of influenzal disease had been lower at this time than at any period since the outbreak of the war, 1,731 cases occurred during the last week in May when this outbreak was at its peak. It was possible to investigate thoroughly only a small group of thirty men, as the resources of the Walter and Eliza Hall Institute were at the time largely occupied by the production of attenuated virus for inoculation. This work, however, led to interesting observations on contrasting features of this influenza virus and of stock strains when inoculated into the amniotic sac of the chick embryo. The strains were found to possess certain "unadapted" characteristics, and thus the O type (original or unadapted) and D type (derivative) were distinguished.

By the time a large-scale immunisation plan could be put into effect this epidemic was well under way, but in one unit of 7,000 to 8,000 men some observations were possible on the results of the experiment. The total figures for respiratory disease for the epidemic period were 6.6 per cent among the unimmunised and 4.4 per cent among the immunised. No difference was apparent among the numbers of men sent to hospital for clinical influenza. Thus no striking results were obtained in this partial experiment. Mawson and Swan in similar work in South Australia found that nasal inoculation did not produce more antibody than subcutaneous injection, but they thought that the acquisition of local resistance would be valuable. Numbers of other technical observations were made in the course of this work which are too detailed for consideration here, as we are concerned rather with the broad picture of the possibilities of influenza among masses of recruits in training camps, and among the civil community.

One local epidemic of a severe and sometimes fatal respiratory epidemic of influenzal character was reported from Niue, in the Tonga Group, in the later part of 1943, but this did not spread further in the Pacific.

During 1944 no epidemic influenza occurred in Australia, and neither *A* nor *B* type of virus was isolated from patients with respiratory disease. Records of soldiers immunised against influenza showed no difference in the incidence of respiratory infections. Some useful research work was carried out at the Walter and Eliza Hall Institute on matters relating to immunity and to the susceptibility of influenza virus to iodine vapour. The latter appeared to have some possibilities in air sterilisation under conditions of crowding with concentration of infective particles.

From the service point of view not much was achieved in the prevention of influenza, because no large scale epidemic occurred. Burnet has pointed out that even in severe epidemics the morbidity rate does not reach 50 per cent, and that this can only be due to differences in the immunological reactions. Attempts to increase resistance are certainly crude, and can be made either by injection of killed virus or introduction into the superficial or deep parts of the respiratory tract of living attenuated virus. Up to the end of the war it had been shown that both methods could cause rise in antibody titre in the serum. Intranasal inoculation has been proved practical: whether it would be effective in a serious pandemic was not answered by the work done up to the end of 1945.

Though most of the work was done in Victoria and references to epidemics were made with regard to that area, these outbreaks were also seen in other States. The lay public and the servicemen spoke of "Puckapunyal", "Ingleburn" or "Woodside" throat and similar names, as though these camps were responsible for a unique type of disease, but the general pattern was similar in all areas. As pointed out earlier, there were individual differences in different places, both in clinical characters and bacteriology. For instance, Rudd isolated a virus closely related to the "Melbourne" type at Puckapunyal, and Jessica Mawson as well as finding *A* type virus in South Australia, noted the prevalence of *Haemophilus influenzae,* whereas Barbara Cook *et alii* did not isolate a virus but found *H. influenzae* in 90 per cent of cases, and also in a significant number of apparently normal recruits.

PNEUMONIA

Pneumonia was not a disease of greater importance in the Services than in similar age groups in civil life. In the Middle East the disease was usually mild. In Palestine, for example, total dosage with sulphapyridine seldom exceeded 20 to 25 grammes, and in Syria during the cold winter following the campaign an increased number of cases was seen, but of mild type. It was noted then that a large proportion of these were of the benign focal type. Where streptococcal infections were common, as in the instance previously noted, a greater proportion of empyema was found. Both broncho-pneumonia and lobar pneumonia were seen in the training camps in Australia, especially during the winter months, but the graphs showed curious "spikes" of short duration, illustrating the epidemic tendency of pneumonia.

Coccal types of pneumonia need not be further discussed here. The drugs used chiefly were sulphapyridine in the earlier years, and sulphamerazine later. The latter was by arrangement made in Australia, being chosen partly because of its rapid absorption and relatively slow rate of excretion, and partly because of a hope that it might be effective in malaria. When penicillin was first available supplies were limited and it was only used for special conditions due to organisms sensitive to penicillin or resistant to other drugs. Later it was used with greater freedom, and observations were made on its dosage and action in pneumonia. The

rapidity with which the radiographic signs cleared was especially noted in the Heidelberg Military Hospital in 1944. Concentrated penicillin was then found to give good results in pneumococcal pneumonia, and injections every eight hours for one day and every twelve hours for three days gave excellent results. The dosage used was one hundred thousand Oxford units dissolved in one millilitre; while this method used more than the customary amount of penicillin it had the advantage of disturbing the patients very little.

PRIMARY "ATYPICAL" PNEUMONIA

The so-called "atypical" pneumonia which has attracted so much notice during the war was frequently encountered among the Australian forces. Probably it occurred much more often than was known, as only X-ray examination will reveal the lesions with certainty, and this was often not practicable. The clinical features need not be recounted here, but the features observed tallied well with other observations. The rather gradual onset, the constant feature of a cough at first dry, and later productive, and the usual accompaniments of a respiratory and mildly toxic disease were "atypical" in the sense that they were not characteristic of any special infection. On the Australian mainland and in all fronts occasional cases were seen, even in the tropics. From the Middle East, from the northern coast of New Guinea, and Bougainville, from Northern Queensland, both on the tableland and coast areas, cases of this disease were reported. Frequently the illness presented itself as a pyrexia of undetermined origin, but the suggestive though usually scanty fine accompaniments to breath sounds or the surprisingly extensive X-ray signs with their diffuse hazy shadows usually told the story. Pleural involvement was rare. Drugs such as penicillin and sulphonamides had no specific effect. Where tests for cold agglutinins could be carried out, an increased titre of agglutination of human red cells was found in a small proportion. In view of difficulties of diagnosis, uncontrolled figures are probably not trustworthy, but the following represent a period when "atypical" pneumonia was being looked for by physicians:

	Rates per 1,000 per year	
	1943	1944
"Colds" and Coryza . .	20.81	12.95
Sinusitis	0.89	3.78
Pneumonia (unspecified) .	3.3	2.6
Atypical pneumonia . .	0.03	0.12

The lack of correspondence between mild epidemic respiratory infections and pneumonia of various types will be noted.

In Changi gaol, Singapore Island, respiratory disease was common owing to the crowded conditions and low resistance. In one month fifty cases of mild pneumonia were seen, but the exact nature of these is not known.

The appearance of this disease in tropical zones was as a rule due to its being carried there from centres of infection known to exist, in the present instance, in Australia or U.S.A. In December 1943 when American troops were present in Australia in large numbers, one unusually severe outbreak occurred in one area near Sydney.[1]

Toxicity varied in this outbreak from slight to extreme. Cyanosis, dyspnoea and other severe symptoms appeared in some patients, one of whom died. Extensive pulmonary lesions were demonstrated radiographically. No predominant organism could be demonstrated in the sputum or in the lungs after death. The infectious nature of the disease was evidenced in this outbreak by the spread of infection to men occupying adjacent tents, and to the contacts such as a nurse attending one of the patients. Cases were observed both before and after the arrival of these troops in Australia. The severe nature of the illness caused some concern lest there be some further local spread to Australian forces, but none occurred. One curious and perhaps coincidental feature was observed, the similarity to the fatal pneumonic infections seen in 1918. In this respect it is notable too that the same age group was affected. Reverting to Australian cases, no definite signs were seen suggestive of encephalitis, which has occurred in some outbreaks, except perhaps a well-marked lethargy of mind seen in some patients. It is, however, perhaps worth recalling that numbers of cases of acute infective polyneuritis occurred here and there during the war, and that some of these had a mild febrile beginning. Such syndromes have been described, for example, by MacDonald Holmes. It is possible that nervous lesions like these, and like serous or lymphocytic meningitis may be associated with atypical pneumonia, for the focal signs of the latter would not always attract special attention.

Australian physicians and pathologists were particularly interested too in the possibility of the occurrence of Q fever and psittacosis in the troops, since these are both familiar in Australia. So far as is known no Q fever was encountered, though the extremely contagious nature of the rickettsia (*R. burneti*) under certain experimental conditions is known. Psittacosis virus was thought of and looked for in a limited number of patients with an apparently non-coccal lung infection, but no evidence of the human form of this ornithosis was found. In both diseases, except in laboratory infections, association with animals or the vectors concerned is necessary; perhaps the conditions were not favourable. It seems curious that Australian medical officers had no opportunity to add to observations made in Queensland on Q fever, though the New Zealand forces in Italy had considerable experience of it.

Australian experience with primary atypical pneumonia coincides with that gained before and during the war elsewhere. Though it is difficult to establish the diagnosis except in well-equipped units, there seems reason to believe that this is a disease entity, though this is an assumption only

[1] Access was given to patients and records by courtesy of the Commanding Officer and the Senior Physician of 118th General Hospital, U.S.A., then at Herne Bay, Sydney.

in the absence of accurate aetiological information. Whether pneumonia described as the "benign focal" type is the same in nature is hard to say, except that a rapid resolution is usually seen with sulphonamides and penicillin in mild coccal pneumonia, but not in the "atypical" variety.

Occasional instances of pneumonic consolidation were also seen associated with eosinophilia. The cause was obscure. They were distinct from the so-called "tropical" forms of eosinophilia, and were not due to a pulmonary stage of infestation by hookworm and similar parasites. They were similar to the condition described by Loeffler. The question of allergy was of course raised, but was not further elucidated.

ASTHMA

Asthma in the forces was not a frequent cause of invalidity. The overall incidence never rose to 2 per 1,000 per year. In 1943 and 1944 when the figures for Australia were 1.74 and 1.86 per 1,000 they were only 1.3 and 0.8 for New Guinea. The increased incidence in certain areas is, however, of some interest. In the Northern Territory there seemed some reason for believing that pollens or other aerial allergens were responsible for many cases in susceptible men. Men who had previous attacks of asthma but who had been for some time quite free of symptoms broke down here and in several other areas, such as Bougainville. Some men after treatment were sufficiently relieved to return to their units, but others were unfit for further forward service.

In Malaya and Thailand asthma was a relatively common complaint. Many men had been returned from Malaya to Australia before the outbreak of the Japanese war. Harvey reported that asthma was common in the 2/10th Australian General Hospital; patients with acute bronchitis often had asthmatic symptoms as well. It is of passing interest that a man who died of what was thought to be septic broncho-pneumonia in Malaya, was found *post mortem* to have melioidosis. Many others suffered from asthma afterwards. Some, but not all of these, had a previous allergic history. At Nakom Paton for instance, respiratory infections were uncommon, but numbers of patients sought relief from asthma for which ephedrine could not be used, on account of its scarcity and its being needed for spinal anaesthesia. Usually bouts lasted four to five days and then disappeared. A botanist grew a stramonium-like plant from which extemporised cigarettes were made with great relief to the patients. In Changi gaol also from 1944 onwards there were a few cases of asthma, and here too relief was gained by smoking stramonium grown in the gardens.

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