A Further Investigation into Influenzo-Pneumococcal and Influenzo-Streptococcal Septicæmia:

EPIDEMIC INFLUENZAL “PNEUMONIA” OF HIGHLY FATAL TYPE AND ITS RELATION TO “PURULENT BRONCHITIS.”

BY ADOLPHE ABRAHAMS, M.D. CANTAB., M.R.C.P. LOND.; MAJOR, R.A.M.C.; CONSULTING PHYSICIAN TO THE ALDERSHOT COMMAND; AND

NORMAN HALLOWS, M.D. OXON., D.P.H.; CAPTAIN, R.A.M.C.; PATHOLOGIST TO THE ALDERSHOT COMMAND; AND

HERBERT FRENCH, M.D. OXON., F.R.C.P. LOND., F.R.C.S. ENG., F.R.C.S. SCOT.; LIEUTENANT-COLONEL, R.A.M.C.; CONSULTING PHYSICIAN TO THE ALDERSHOT COMMAND; PHYSICIAN TO GUY’S HOSPITAL.

(With Coloured Plate.)

INTRODUCTION.

When we published a paper upon “Purulent Bronchitis, its Influenzal and Pneumococcal Bacteriology,” in conjunction with Dr. John Eyre, in The Lancet of Sept. 8th, 1917, we were particularly desirous of drawing attention to the anomalous character of many of the cases of “pneumonia” that we had encountered in the Aldershot Command during the years 1915, 1916, and 1917, and because we felt that “pneumonia,” in the sense of true croupous lobar pneumonia, was a misnomer in connexion with many of them. The “purulent bronchitis” type of certain of these anomalous cases that had up to that time been returned generally as “pneumonia” is now familiar to most Army physicians, but at the time of our own investigations, and those of Hammond, Rolland, and Shore,1 the bacteriological nature of this severe purulent bronchitis, with its remarkable heliotrope cyanosis, abundant sputum, and high mortality, was not, we think, recognised generally.

Though it was occurring in the form of multiple small epidemics in France and in England, there was then no generalised epidemic to lead to the suspicion that it had an influenza basis; and it was as the result of extended bacteriological research, intra vitam and post mortem, and not from the observation of clinical phenomena, that its causation was found to be primarily influenzal, with symbiotic or secondary invasion of the respiratory tract and circulating blood by either pneumococci or streptococci, the virulence of which, it seemed, had been so exalted by the coexistence of influenza bacilli that they caused death in a high percentage of cases by reason of a veritable pneumococcal or streptococcal septicæmia.

The condition, though labelled “purulent bronchitis” on account of the dominating characteristics—viz., the severity of the chest symptoms, and particularly the appearance and quantity of the sputum—seemed to us, even at that time, to be an influenzno-pneumococcal, or an “influenzno-streptococcal” septicæmia with a prominence of lung symptoms rather than a purely pulmonary disease. The question of the relationship of the streptococcal to the pneumococcal cases is elaborated later in this paper, but it may at once be stated that there is now much evidence in favour of the view that the streptococcal organisms described in certain epidemics may be really pneumococcal growing temporarily in streptococcal form.

Since 1916, when the “purulent bronchitis” cases were differentiated more or less clearly from amongst the big group of anomalous “pneumonia” cases, we have had ample opportunities, more especially during the recent epidemics, for broadening and extending our views. We believe now that the “purulent bronchitis” type is merely one of many; that “influenzno-pneumococcal septicæmia” is responsible for much, if not all, of the fatal “influenzal pneumonia” which is at the present moment (October, 1918) causing sickness and death, not only amongst troops in camps, but also, and to an almost greater extent, amongst the civil population, affecting Africa, America, and Asia as well as Europe, leading in many towns unfortified with acquaintance both to hospitals and the homes of the public.

By others to deal with the bacteriology, we would confine our remarks to the clinical, bacteriological, and post-mortem aspects of the disease as we have seen it amongst troops at Aldershot and elsewhere. But once again, and even at the risk of becoming monotonously insistant, we would emphasise the view that in these Influenzal-Pneumococcal “purulent bronchitis” that we and others described in 1916 and 1917 is fundamentally the same condition as the “influenzal pneumonia” of this present pandemic, and that it is only a matter of degree whether the “pneumonic” or “broncho-pneumonic” cases are to be regarded as merely a lesser degree of the same disease amongst the civil population, or as a type more or less characteristic of the lung lesions of the soldiers. In other words, the extent of pulmonary involvement is of comparatively little importance and bears no relation to the virulence of the essential septicæmic conditions.

CONCLUSIONS: Incidence.—Owing to the extreme pressure of work, the overstated scope of the medical staff, the variability of nomenclature in official returns, and other similar causes, it has been impossible to keep detailed records of all the cases encountered, either by us or others, in any country. We have seen several thousands, of which well over two thousand have been autopsied, and have examined over four hundred autopsies. So variable, however, is the severity of the influenza itself in different units or hospitals at the same time, and so greatly does the mortality of troops from different countries at different times vary, that we have give statistical details, beyond indicating that our experience is based on thousands of cases and not merely on hundreds.

Pneumonic incidence in the influenza cases.—Of the total number of cases seen in Aldershot Command during the last few weeks, the majority have been straightforward influenza. Roughly speaking, we may say that out of 1000 cases of “influenza” upwards of 800 have taken an ordinary simple uncomplicated course with fairly speedy recovery and without sequelæ. The remaining 200 have become or less pulmonary—of these perhaps 80 being of moderate severity, the remaining 120 have been desperately ill; and of this last-named category somewhere between 60 and 80 have died.

These figures do not hold good throughout, for the lung complications and mortality have struck us as being very much higher amongst soldiers who have recently joined up than among those of longer service. They have been in the theatre of operations for too long a time. In South Africa, it has been described as an “influenza pneumonia” that has prevailed in the unit for a week or two. It is when the epidemic is in its earlier days that it is apt to spread like wild-fire and cause the greatest damage and the highest death-rate; although, so far as a whole Command is concerned, the daily sick and the daily mortality may continue at a high level for a longer time than it does in a single unit owing to the fact that the epidemic, whilst subduling in one unit, tends to spread and break out in fresh units one after another.

THE SYMPTOMS.

(a) In the Straightforward Influenza Cases.

The symptoms in the straightforward influenza cases are similar to those of ordinary influenza as it occurs in other places and at other times.

The onset has generally been sudden and acute. There have, of course, been many quite mild cases, but again and again a perfectly healthy man may be taken ill in the street or on duty with a sense of general malaise; he feels chilly, suffers from ache in his back, limbs, and head, and rapidly develops such a sense of depression that wherever he is he has to lie down. He may rally sufficiently to be able to get himself back to his quarters with some difficulty, or he may be so far incapacitated that he has to be carried.

He gets to bed and is only too glad to stay there. He is nauseated at the sight of food and “feels rotten.” Though drooping, he cannot sleep. His temperature is raised, generally as high as 104° F. or more. The pulse is full and firm, its rate is as rule not raised proportionally to his temperature and to his respiratory rate, but it may be as high as 120. Many cases have red injected palate and anterior fauces and congestion in the submucous coats of the nose, but the bronchial nodes which, it seemed, had been so exalted by the coexistence of influenza bacilli that they caused death in a high percentage of cases by reason of a veritable pneumococcal or streptococcal septicæmia.

1 The Lancet, July 14th, 1917, p. 41.

No. 4975

THE LANCET, January 4, 1919.
beginning, more often after the patient has already gone to bed, and in quite a number of cases the hearing has become much impaired, a few cases even complete deafness. Night sweats and an extreme desire for a light supper may also be a factor. In this, but that there is middle-ear catarrh in at least some of these cases has been shown by subsequent ear discharge, and in one or two cases the bleeding of the ear.

Vomiting has not been unusual, but it has occurred often enough to attract attention, and is of considerable importance. A man in shock even in those cases on the first day or two has been rather less uncommon.

Abdominal pain has not been a pronounced feature although occasionally a man has complained acutely of pain to lead him to the diagnosis of appendicitis, and even to some solicitude as to differentiation from an acute abdomen, an urgent necessary operation.

In the earlier part of the recent epidemiic typhoid symptoms were not common to the same extent as in a curious outbreak of supposed typhoid fever in melancholy (not described, 1918), but latterly quite a number of the men have been husky-voiced or even unclippingly coughing. These cases have not necessarily passed on to the "pneumonic" type.

The temperature has remained raised a variable number of days. (See Charts.)

Frequently there is febrility as only as the second day, sometimes ending almost by crisis on the third, fourth, or fifth days, sometimes coming down more gradually to reach normal by lysis between the third and the fourth day of the attack. Speaking generally, the duration of the pyrexia has been far longer in the recent pandemic than in the cases of 1914, in June, and the subsequent prostration appears to be proportionately greater.

As long as the temperature has been up to anything like 101° the patient has continued to feel "rotten." With the fall of temperature rapid improvement sets in; the tongue cleans, the patient feels altogether better, and with the fall of temperature a feeling of uplifting, and a more optimistic note than usual.

More often the patient has been ill for a day or two with simple influenza, often apparently not at all severe and indistinguishable from the influenza of the same period as a long course of acute catarrhal pulmonary complications set in, and they may die so rapidly and without any sign of consolidation as if nearly a case of "influenza" but something more generalised, a veritable septicemia, which kills them.

In a third type of case the "influenza" has nearly run its course, and the temperature may have returned to normal or nearly so for a day or two, and then at last rises again with the onset of "pneumonic" complications.

All three types have been met with in abundance; the commonest is that in which the case has seemed to be one of simple "influenza" for one, two, or three days before it passes on to the serious phase of lung and general systemic complication.

There may or may not be a definite rigor; the temperature, already high, may or may not rise further. (See Charts.)

The patient complains in some way of his chest; he coughs with short dry hacking to begin with: the question of his sputum is commonest is that in which the case has seemed to be one of a suppurating broncho-pneumonia with hardly any sputum; others, again, with bronchitic signs, and yet an expectoration of 15 ounces or more; or in the middle lobe, for once they are found first in the upper lobes in front, there are occasional cases in which the dulness, bronchial breathing, and crepitant rhonchi develop in the right lobe, but not in the lower lobes at all.

(b) Symptoms in the "Pneumonic" Cases.

The "pneumonic" or "bronchitic" complications, so much dreaded just now, come on at no fixed or definite period of the influenza attack.

Frequently there is no distinct influenzal period at all, the case being then very similar to one of ordinary lobar pneumonia in the first day or two. Numbers of such cases have been diagnosed as true lobar pneumonia, with sudden high temperature, severe cough, and bronchial breathing, and it is remarkable how difficult it is to persuade those who have not seen such cases to believe that the true influenza may involve the lungs. More often the patient has been ill for a day or two with simple influenza, often apparently not at all severe and indistinguishable from the influenza of the same period as a long course of acute catarrhal pulmonary complications set in, and they may die so rapidly and without any sign of consolidation as if nearly a case of "influenza" but something more generalised, a veritable septicemia, which kills them.

The patient has continued to feel "rotten." With the fall of temperature rapid improvement sets in; the tongue cleans, the patient feels altogether better, and with the fall of temperature a feeling of uplifting, and a more optimistic note than usual.

The patient has continued to feel "rotten." With the fall of temperature rapid improvement sets in; the tongue cleans, the patient feels altogether better, and with the fall of temperature a feeling of uplifting, and a more optimistic note than usual.

The patient has continued to feel "rotten." With the fall of temperature rapid improvement sets in; the tongue cleans, the patient feels altogether better, and with the fall of temperature a feeling of uplifting, and a more optimistic note than usual.

The patient has continued to feel "rotten." With the fall of temperature rapid improvement sets in; the tongue cleans, the patient feels altogether better, and with the fall of temperature a feeling of uplifting, and a more optimistic note than usual.
The temperature charts in the cases of influenza and influenzal "pneumonia" have been so extremely variable in type that a hundred or more would have to be reproduced if every species were to be depicted. The above serve to represent certain of the commoner types, however. The five on the left-hand side are from cases that recovered; the five on the right-hand side from cases that died. The authors think that the charts and their variability speak for themselves, so they have not commented on them in detail.
of sputum. Probably this is not a universal rule, but it has been a striking phenomenon in the present epidemic in which we have seen large quantities of it in what has been called "pneumonia" cases. The sputum, when it is abundant, has generally consisted mainly of pus with or without blood; it is then not strikingly frothy. When it is essentially blood it is generally much more copious than in any form of orthopneea even in patients who are breathing very rapidly. In the "pneumonic" cases the breathing in the latter stages is the absence of orthopnea even in patients who are breathing very rapidly.

Other forms of haemorrhage have not attracted notice; we have seen a small number of cases the urine has been blood tinged or even red or blackish: but in all of these that we have seen the haematuria has been part of a process and encourages the suspicion that the pneumococci gain access with pneumococci, sometimes associated with Pfeiffer's bacillus. The virulent type. In quite a number of cases the epistaxis has been really hemorrhagic erosion type. Such hsematemesis is not confined to the fatal cases of orthopneea even in patients who are breathing very rapidly.

Hæmoptysis.—Apart from more or less altered blood in the sputum itself, actual hæmoptysis has been a very common phenomenon.

In the slighter cases with this condition the sputum pot exhibits frothy mucous, mixed with blood and splashes of bright red blood in varying quantity. This blood is spat up as a rule independently of the actual sputum, even if sputum be present. In severe cases, the sputum is very much blood, and the blood has attained a degree comparable to that of phthisis. The bed-clothes, wall, and floor have become blood-splattered during a coughing paroxysm, and as much as 10 ounces of bright red blood may be coughed up in a few minutes. The conclusion has sometimes arisen that an old phthisical cavity must have become lit into activity by the new acute pulmonary infection, but post-mortem examination in such cases has not confirmed this supposition, and there is little doubt that the hæmoptysis is due in many cases to the opening of small pulmonary arterioles by the acute infective process and be due to the infects in the lungs which are seen frequently at autopsy.

In cases of only slight hæmoptysis streaks and wisps of blood may be seen in the sputum, and the patient himself is unaware of any bleeding, yet the lower trachea and bronchi are often stained red, and a localized lung destruction, with the opening of arterioles before they have time to thrombose, and the prognosis is grave.

We have seen a hemorrhagic erosion type of haemoptysis occurring immediately before death that the hæmoptysis itself could be regarded as actually having an influence on the fatal result. In such cases there has been considerable hæmoptysis recovered, so that though a very grave sign it is not a hopeless one; when the hæmoptysis has been only in small quantity, we have commonly thought the outlook worse than it is in the cases generally.

As a rule, reference to hæmoptysis must be made to a few cases in which, after recovery has occurred and the patient has been apyretic for several days, he has begun to expectorate quantities of comparative, large amounts of fresh blood; in all these cases—we have perhaps eight in all—nothing untoward has subsequently developed.

Hæmorrhages.—Hæmoptysis has been common, as just described, but epistaxis has been far more common.

This symptom is not confined to the "pneumonia" cases, but has been met with in a high percentage of the uncomplicated cases. We do not regard it as indicating any increased liability of the influenza to develop into the dreaded "pneumonic" or virulent type. In quite a number of cases the epistaxis has been really severe and difficult to control more often, however, it has been merely a temporary nuisance liable to recur several times but invariably coming to an end. The blood from the nose has generally been bright red, such as would come from arteries or cutaneous vessels, and the patient himself has during the process and encourages the suspicion that the pneumococci gain access to the bronchial tree, by blood in these cases, nor is there any defect in the oxygen-carrying capacity of the blood (see below); the condition is one apparently of great mortality. In one of these cases an angina was the cause of death. On the other hand, we have seen cases with acute rapidly developing in the circumstances.

The breathing.—One of the most striking features about the breathing in the "pneumonic" cases is the absence of orthopneea even in patients who are breathing very rapidly.

Amongst female cases the desire to be propped up by pillows is not so universal. In fact, we have seen upwards of 500 cases in all stages of the disease, and it will be exceptional to find even one who is destitute of being so supported. The great majority lie at full length, and although it is probably good to
The patients breathe with greater rapidity than normally, silently as a rule, except in the terminal phase, and such respiration is short and shallow. The pulse may be 120 or more for 20 or 30 times a minute, but the slightest exertion, such as that entailing coughing or movement of the arms or legs, will reduce the rate to 80 or 90 per minute. Earlier, the pulse-rate is generally not faster than corresponds to the degree of pyrexia; and often it is less rapid than the ordinary true pulse-rate of the patient. It is noteworthy that in no single case did we meet with pericarditis causing an accelerated pulse-rate. It is remarkable how often, when the general appearance of a patient shows he has only minutes to live, the pulse may still be quite regular, although the heart and lungs are most affected, and the heart may be of good volume, and not much faster, perhaps, than 120 per minute.

The eyes and eyelids.—Quite early in the disease the upper eyelid tends to droop, as though the patient were half asleep. This is illustrated typically in Plate I. Even when no quinine, aspirin, or salicylate has been administered. It is noteworthy that in no single case did we meet with pericarditis causing an accelerated pulse-rate. It is remarkable how often, when the general appearance of a patient shows he has only minutes to live, the pulse may still be quite regular, although the heart and lungs are most affected, and the heart may be of good volume, and not much faster, perhaps, than 120 per minute.

Jaundice.—Jaundice has been quite uncommon in the cases in the Aldershot Command. It is remarkable how often, when the general appearance of a patient shows he has only minutes to live, the pulse may still be quite regular, although the heart and lungs are most affected, and the heart may be of good volume, and not much faster, perhaps, than 120 per minute.
the patient has had a small dose of paraldehyde or any such drug some time previously; but the smell seems to have no relation to any drug administered.

In several cases there has been quite a different smell—a real stench, not a mere smell of the feet, but of the general tissues; and this may be one of the more serious complications of the living body. It has no particular application to those who have died of the disease, for in no case at autopsy has the body produced any unusual odour, nor do the tissues decay until the smell becomes evanescent with any undue rapidity, at any rate at the temperature of the month of October.

Nephritis.—A high percentage of the "pneumonia" cases suffering from this complication would have been missed if reliance were placed upon clinical evidence alone.

There is no oedema of the legs, back, or eyelids. The amount of urine passed daily is not lessened beyond what one would expect from the particular state of affairs. The total number of cases, however, varied between 45 and 70 ounces, with an average of 54 ounces. It is very exceptional to find enough haematuria for it to be recognised as nephritis, where the course of routine urinal examination has been followed. However, albuminuria is found in some degree in nearly all the severer cases. The amount of albumin present varies from 1 to 5 parts per 1000. In association with renal epithelial cells, and fragmentary tube casts, generally epithelial and often ill-formed owing to the acidity of the condition. Red blood corpuscles are seldom seen and we would urge that the routine examination of urines should be carried out with even greater zeal than usual during an epidemic of this sort lest lost patients should be discharged as cured when really they are still nephritic. It is from cases such as these that "Rose Bradford kidneys" arise later on—the small, white, granular kidney of unknown origin. Large, red, blood-oozing kidneys of the type seen in acute scarlatinal septicaemia occur very frequently. The mechanism of the whole and the occurrence of this acute nephritis is further evidence of the interrelation of the two systems. The most rapid resolution of the oedema, the "pneumonic" part of the disease being but a portion of the whole.

Localised abscesses.—The commonest form of localized abscess in these cases is empyema.

Acute pleurisy is the rule rather than the exception. The pleural rash is in many cases the only sign that precedes the occurrence of a small amount of fluid, thin but turbid, often blood-stained, not actual pus, though it contains numbers of polymorphonuclear leucocytes, dysprasia, and a few fine blood-corpuscles. In fact, the pleura is generally found to be the site of innumerable minute abscesses, one is thought not to be the presence of micro-organisms and pus cells in it. Here and there, however, we have found cases in which the fluid has gone on accumulating, and far from this proving a bad omen, the majority of such cases have ultimately done well.

Ruptured rectus abdominis muscles.—In upwards of 20 cases we have seen spontaneous rupture of one or both rectus abdominis muscles, generally in that portion of the muscle which lies below the level of the umbilicus.

The effort of coughing is apparently the immediate cause of this rupture, but the muscle has become diseased before it breaks. Sometimes one finds the rectus extensively affected post mortem without actual rupture having occurred. In most instances, even when there has been no rupture, the affected portion of the muscle presents the same sort of appearance as does the breast of a pheasant when one skins the bird after it has been badly shot at close quarters; the muscle is dark crimson, of bruised appearance, full of diffusely extravasated dark red blood, readily palpable through the skin, fingers, and it may be squeezed into a pulp mass without much force.

Why this muscle in particular should be affected in this way we do not know, unless it is due to the peculiar position of the lung in relation to the diaphragm, which, in the process of violent coughing efforts, doubtless is a factor in the degeneration of muscular fibres. One of the most familiar maladies, for example: But in ordinary Zender's degeneration the muscle is pallid and not hemmoragie, whereas in the present cases there has gone on to a local haemorrhage pulpy state even if the muscle has not been actually ruptured during life. Both rectus muscles are not always affected at the same time. In cases in which either is affected at all, that is to say, bilateral rupture has been as common as unilateral.

Subcutaneous emphysema of the chest wall.—In about 15 cases altogether palpation has elicited the striking phenomenon of widespread subcutaneous crickling of the deep tissues of the chest and neck and back, the result of subcutaneous emphysema.

This has always started on one or other side of the thorax itself, generally in front or towards the axilla rather than behind, spreading to a variable extent over the whole chest wall. It may extend to the neck, where it may form a complete collar of cracking swelling. It is not of very grave import, though one case at least after recovery developed subcutaneous emphysema of the chest wall, and no instance of widespread subcutaneous crickling of the deep tissues of the chest and neck and back, the result of subcutaneous emphysema.

Skin rash.—We have referred above to one case of purpura of the legs associated with hemorrhagic bullae between knees and ankles, and to a number of cases exhibiting curious painful purple spots over the dorsum of the foot accompanied by general oedema of one or both feet. We have also referred to the absence of any generalised purpura in our series of cases, though so many of them were so extremely toxic or septic, and we have described herpes of the lips and ears.

Other skin eruptions were infrequent.

In a small number there has been acute inflammatory reddening of the skin around the nose and nostrils, spreading for a variable distance on the cheeks, and producing a very severe malodour. In no instances were any similar eruptions of the mouth or of the sputum, nor the result of incontinence, but only of the nose and the mouth. The nose was always clear and contained no excess of albumin, very few cells, and was always sterile.

Ruptured rectus abdominis muscles.—In upwards of 20 cases we have seen spontaneous rupture of one or both rectus abdominis muscles, generally in that portion of the muscle which lies below the level of the umbilicus.

The effort of coughing is apparently the immediate cause of this rupture, but the muscle has become diseased before it breaks. Sometimes one finds the rectus extensively affected post mortem without actual rupture having occurred. In most instances, even when there has been no rupture, the affected portion of the muscle presents the same sort of appearance as does the breast of a pheasant when one skins the bird after it has been badly shot at close quarters; the muscle is dark crimson, of bruised appearance, full of diffusely extravasated dark red blood, readily palpable through the skin, fingers, and it may be squeezed into a pulp mass without much force.

Why this muscle in particular should be affected in this way we do not know, unless it is due to the peculiar position of the lung in relation to the diaphragm, which, in the process of violent coughing efforts, doubtless is a factor in the degeneration of muscular fibres. One of the most familiar maladies, for example: But in ordinary Zender's degeneration the muscle is pallid and not hemmoragie, whereas in the present cases there has gone on to a local haemorrhage pulpy state even if the muscle has not been actually ruptured during life. Both rectus muscles are not always affected at the same time. In cases in which either is affected at all, that is to say, bilateral rupture has been as common as unilateral.

Subcutaneous emphysema of the chest wall.—In about 15 cases altogether palpation has elicited the striking phenomenon of widespread subcutaneous crickling of the deep tissues of the chest and neck and back, the result of subcutaneous emphysema.

This has always started on one or other side of the thorax itself, generally in front or towards the axilla rather than behind, spreading to a variable extent over the whole chest wall. It may extend to the neck, where it may form a complete collar of cracking swelling. It is not of very grave import, though one case at least after recovery developed subcutaneous emphysema of the chest wall, and no instance of widespread subcutaneous crickling of the deep tissues of the chest and neck and back, the result of subcutaneous emphysema.

Skin rash.—We have referred above to one case of purpura of the legs associated with hemorrhagic bullae between knees and ankles, and to a number of cases exhibiting curious painful purple spots over the dorsum of the foot accompanied by general oedema of one or both feet. We have also referred to the absence of any generalised purpura in our series of cases, though so many of them were so extremely toxic or septic, and we have described herpes of the lips and ears.

Other skin eruptions were infrequent.

In a small number there has been acute inflammatory reddening of the skin around the nose and nostrils, spreading for a variable distance on the cheeks, and producing a very severe malodour. In no instances were any similar eruptions of the mouth or of the sputum, nor the result of incontinence, but only of the nose and the mouth. The nose was always clear and contained no excess of albumin, very few cells, and was always sterile.

Ruptured rectus abdominis muscles.—In upwards of 20 cases we have seen spontaneous rupture of one or both rectus abdominis muscles, generally in that portion of the muscle which lies below the level of the umbilicus.

The effort of coughing is apparently the immediate cause of this rupture, but the muscle has become diseased before it breaks. Sometimes one finds the rectus extensively affected post mortem without actual rupture having occurred. In most instances, even when there has been no rupture, the affected portion of the muscle presents the same sort of appearance as does the breast of a pheasant when one skins the bird after it has been badly shot at close quarters; the muscle is dark crimson, of bruised appearance, full of diffusely extravasated dark red blood, readily palpable through the skin, fingers, and it may be squeezed into a pulp mass without much force.

Why this muscle in particular should be affected in this way we do not know, unless it is due to the peculiar position of the lung in relation to the diaphragm, which, in the process of violent coughing efforts, doubtless is a factor in the degeneration of muscular fibres. One of the most familiar maladies, for example: But in ordinary Zender's degeneration the muscle is pallid and not hemmoragie, whereas in the present cases there has gone on to a local haemorrhage pulpy state even if the muscle has not been actually ruptured during life. Both rectus muscles are not always affected at the same time. In cases in which either is affected at all, that is to say, bilateral rupture has been as common as unilateral.

Subcutaneous emphysema of the chest wall.—In about 15 cases altogether palpation has elicited the striking phenomenon of widespread subcutaneous crickling of the deep tissues of the chest and neck and back, the result of subcutaneous emphysema.

This has always started on one or other side of the thorax itself, generally in front or towards the axilla rather than behind, spreading to a variable extent over the whole chest wall. It may extend to the neck, where it may form a complete collar of cracking swelling. It is not of very grave import, though one case at least after recovery developed subcutaneous emphysema of the chest wall, and no instance of widespread subcutaneous crickling of the deep tissues of the chest and neck and back, the result of subcutaneous emphysema.

Skin rash.—We have referred above to one case of purpura of the legs associated with hemorrhagic bullae between knees and ankles, and to a number of cases exhibiting curious painful purple spots over the dorsum of the foot accompanied by general oedema of one or both feet. We have also referred to the absence of any generalised purpura in our series of cases, though so many of them were so extremely toxic or septic, and we have described herpes of the lips and ears.

Other skin eruptions were infrequent.

In a small number there has been acute inflammatory reddening of the skin around the nose and nostrils, spreading for a variable distance on the cheeks, and producing a very severe malodour. In no instances were any similar eruptions of the mouth or of the sputum, nor the result of incontinence, but only of the nose and the mouth. The nose was always clear and contained no excess of albumin, very few cells, and was always sterile.
Morbid Anatomy.

The lungs. Although we believe that the infection is widespread and not confined to the lungs, the patients exhibit a preponderance of chest phenomena, so that naturally the lungs attract first attention at autopsy. We would emphasise, however, that the bacteriological findings in the heart blood and sputum for the presence of pneumococci, as indication that the lung lesions are very far from being the whole basis of the so-called "pneumonic" cases. We think that the fatal disease is an influenza-pneumococcal or influenza-streptococcal septicemia with more or less marked localised lesions, though it is true that in the main the lung disease may be very much more easily felt than seen, of deep crimson consolidation due to various conditions may be mingled together, namely: -

The lobes of the other pale and over-distended, and the remaining lower lobe so variable in the degrees and extent to which the following widespread through all the lobes of both lungs, with or without acute congestion, as a rule. And yet in pre-clinical cases there has been perfect absence of the term "pneumonic" of every form of lung consolidation that happens to have a lobar distribution.

In turn, when, through some variety or degree of consolidation has been the rule throughout the serious cases in the present epidemic, we would lay much stress upon the fact that here and there an autopsy reveals practically no lung consolidation at all.

The lobes may be black-red, almost black-red, heavy, edematous, congested, the upper lobes pale and distended; but no part of any lobe actually sinks in water, or, at any rate, only tiny portions, carefully examined, were seen to be without any air whatever. These cases without consolidation have run almost identically the same clinical course as those with consolidation. It is one of the striking features of the disease that the extent of the lung consolidation is no measure whatever of the severity of the infection.

This is precisely what struck us when we wrote in 1917 about "purulent bronchitis." Fatal cases of the latter exhibited varying degrees of broncho-pneumonia associated with bronchitis. Brionchitis has been an "inconstancy of broncho-pneumonia" at all. And we believe that "purulent bronchitis" then described was only one type of a condition which has recently shown itself to be remarkably protean.

The next point to emphasise is the absence of thick abundant bronchiolar pus in our own cases at the present time.

In the "purulent bronchitis" cases one of the most marked phenomena post mortem was the way in which thick yellow pus welled up in smaller or larger spots and dots from all the bronchii when the lung was cut. The yellow pus has been almost uniformly absent about the majority of the recent Aldershot influenza cases, only small quantities of clear pus being expressible from the tubes, as a rule. And yet in pre-clinical cases "purulent pneumatic" cases seen in another command during the same epidemic the amount of pus expressed from the bronchioles was similar in amount to that of the "purulent bronchitis" cases. There is nothing constant about the lung lesions, and what may be true of a group of cases in one place may not hold good for another.

We will now try to indicate the kind of lesions met with, as a rule. It is not easy to depict these because they are so variable in the degrees and extent to which the following various conditions may be mingled together, namely:

Broncho-pneumonia. Oedema of small air passages.
Congestion. Diffuse hemorrhage, yellow, of the lung. Solitus hemorrhage, of the lung. Infarcts.

Bronchopneumonia. -


Difficult to demonstrate macroscopically, but shown to be extensive microscopically. One may exhibit extensive congestion and oedema, with disseminated non-confluent broncho-pneumonia, subpleural hemorrhages, and angry-looking purulent pleuritic lymph.

The lung may exhibit extensive congestion and oedema, with disseminated non-confluent broncho-pneumonia, subpleural hemorrhages, and angry-looking purulent pleuritic lymph.

The lung may exhibit extensive congestion and oedema, with disseminated non-confluent broncho-pneumonia, subpleural hemorrhages, and angry-looking purulent pleuritic lymph.

The lung may exhibit extensive congestion and oedema, with disseminated non-confluent broncho-pneumonia, subpleural hemorrhages, and angry-looking purulent pleuritic lymph.

The lung may exhibit extensive congestion and oedema, with disseminated non-confluent broncho-pneumonia, subpleural hemorrhages, and angry-looking purulent pleuritic lymph.
This albuminous exudate throws much light on the nature of the dreaded cyanosis. If the oxygen in the alveoli has to traverse this albuminous layer in addition to the alveolar wall, as has been suggested, it is no wonder that there is a reduction of the alveolar air and a consequent cyanotic change. It is evident why there is such marked anoxæmia.

Other Post-mortem Findings.

The larynx, trachea, and bronchi.—Starting at a variable distance down the trachea, often near the top of it and sometimes in the larynx itself, there is reddening and congestion of the mucosa, the depth of crimson increasing down the trachea, bronchi, and lungs, until in the main bronchi the dark-red colour is extreme.

That there is tracheitis and bronchitis in addition to whatever changes there may be in the lungs suggests strongly that, even if a single process is at the bottom of this, we should look for an inflammation of the respiratory tissues by extension from above downwards is pretty certain. The fact is, that deep crimson congestion there is often a granular appearance of the surface of the mucosa of the lower part of the trachea and of the main bronchi, suggestive of a small amount of exude upon the surface. This may even reach the stage of giving the appearance of a very fixed milky film over a crimson base, but we have not seen the definite membraneous exude described by others.

When viewed in an oblique light the inflamed mucosa often exhibits multiple minute depressions, very shallow but well defined. These took like extremely small surfcice ulcers not penetrating the whole thickness of the epithelial covering, but they may, on the other hand, be merely normal unevennesses exaggerated by the congested swollen state. As yet we have not settled this point histologically.

The bronchial glands.—The lymphatic glands below the bifurcation of the trachea have been found enlarged and congested in practically every case and as a rule they have been not merely large but very large.

In one case only had actual suppurition occurred in a big gland below the right bronchus; in this instance it contained fully 2 drachms of pus. It had not burst to produce mediastinal suppuration, though it seemed clear that this must have been the result if the purulent exudate had not yielded to a day or two of drainage.

The glanuliferous glands, not confined to those about the main bronchi; the glands in the root of each lung, in the superior and posterior mediastinal region, and over the diaphragm, as well as over the cardia cartilage also are often enlarged and deeply crimson from inflammatory congestion. We have not noticed similar involvement of glands elsewhere—for example, in the abdomen.

The thyroid gland.—Considerable enlargement of the thyroid gland has been the rule.

In one or two cases the swelling has not been less than that seen in a very marked case of subacute thyroiditis. This enlargement would, however, be in the same proportion as the lateral lobes. Presumably this enlargement of the thyroid gland has been the result of an inflammatory congestion; in this respect its enlargement in some other forms of toxic trouble; at any rate, it has been quite pronounced and almost constant in our cases.

The heart.—The most remarkable feature about the heart is the general absence of dilatation.

In quite a large proportion of cases there has been no trace of dilatation though some dilatation of the auricles has often occurred. In the right side, but this has seldom been extreme, perhaps enough to cause the apex of the heart to be formed about equally by right and left auricles, but the heart has not appeared to be much dilated. In a few cases ant the apex has been formed entirely by the left ventricle. This absence of dilatation is, perhaps, the most striking feature of these cases, as is the relative constancy of the size of the subepicardial pachykele, such as are generally met with in toxic conditions.

The spleen.—In many cases no enlargement of the spleen has been evident; in many others it has been slightly enlarged—half as big again as normal, or, exceptionally, twice its normal size. It has never been pronouncedly big—never big enough, for example, to have been palpable below the rib margin.

In most cases the spleenic substance has looked normal. In a few there has been a definite flattening, but there was no albuminous exudate over the surface, and its colour, due apparently to quite small infarcts. In two cases there have been apparent signs of destruction of the red cells and of the histio- cytes and there was an albuminous exudate over the surface. In one or two cases there have been multiple ill-defined small areas of blackening of the rest just beneath the capsule, not firm like infarcts, not palpable at all, and yet on close inspection seeming to be very slightly swollen ab ov the general contour of the organ. None of these have awakened any suspicion of an abscess being present, as there have been granular epidermal deposits of recent fibrin on their surface, so that they would appear to be the earliest infarction in the spleen with focal acute capillaries over them.

The liver.—The liver has been in nearly all cases of a paler brownish-red colour than normal and moderately increased in bulk, but not obviously so in size. The changes are those common to any acute febrile illness of short duration. There has been no undue congestion, still less any nutmeg change.

The stomach, intestines, and vermiform appendix.—The alimentary canal has not exhibited any particular change.

We have had no case of pneumatic or staphylococcal peritonitis. The mesentery and intestines have been literally empty, for the patients have been too ill to take food. There has been no special tendency to over-distension of either the stomach or the bowels with gas, and the cause of any local and slight distension is often due to changes of the wall. We mention this because there has been a tendency elsewhere, for certain of these influence-pneumonia cases to develop acute appendicitis.

The kidneys.—These, in the fatal cases, have presented uniformly, the same, or approximately the same, appearances. There have been slight changes only. In a few cases there has been something like finely granular albuminous exudate over the surface of the glomeruli, with renal surface not strikingly abnormal, but on cutting one can see the dark-red colour of the blood oozing from the glomeruli. In other cases there has been no more than a pale creamy albuminous exudate over these, and in one instance the glomeruli have been distinctly congested and dark in colour. This has been bilateral, and there has been no haematuria. In one case the whole kidney has been redder than the others, probably due to the great density of the albuminous material over the surface of the glomeruli. In general the kidneys have been well-nourished, the capsule has been formed entirely by the left ventricle. This nature seems the more likely.

There have been brownish-red granules on the outer surface of the kidney, and there is a considerable increase in red blood on section; in many others it has been slightly yellow. There has been much perivascular congestion; in a fair number of others there has been some dilatation of the vessels, and we have seen the acute infarcts in the kidney have been multiple small areas of increased firmness and of darkened red colour. In some cases the kidneys have been rather softer than normal, and in two cases there have been multiple small areas of increased firmness and darkened red colour, but the difference was not pronounced enough to be of much importance.

In one only was there no naked-eye evidence of disease of one or other, or both, particularly of the splenic gland which lends itself most easily to examination. This is the case in the splenic gland, bright-yellow bright in the splenic gland cells; in several of these pus had occurred out on the heald used for opening the dome. There there is a yellow yellow pus, and in others, especially in the submucous and the thickened mucosa of the lining membrane and adjacent parts. Doubtless this is a sequel in the serous membranes, as the patients complain, when they are not too ill to complain at all.

We did not examine the frontal sinuses or the middle ear as a routine. We are much impressed, however, by the frequency with which the splenic air sinuses are infected or full of pus, and we must add in passing that we think this serves to emphasise the importance of the uppermost air passages, especially the naso- WF, in connexion with the disease. It is very unlikely that the splenic air sinuses become infected secondarily to the others. In some cases the total length of illness had been so short that, for so much prurulent fluid to have been present in the splenic air cells, infection in that region must have been present from the start. When the frequency and severity of epistaxis is remembered, as well as the tendency to utility media already commented on, the importance of the naso-onyx as a likely site from which the whole trouble starts can hardly be exaggerated. The practical issue of this surmise should be insistence on the simple antiseptic toilet of the nose and throat—by nasal douche and gargle—as a routine. We are much impressed, however, by the frequency with which the cases in the sphenoidal which lends itself most easily to examination. In one case only had actual suppuration occurred in a big gland; the others had been entirely free from symptom, though it seemed clear that this must have been the result if the pus had not burst to produce mediastinal suppuration. In two cases there have been multiple small areas of increased firmness and darkened red colour.

In some cases the kidneys have been rather softer than normal, and in two cases there have been multiple small areas of increased firmness and darkened red colour, but the difference was not pronounced enough to be of much importance.

In one only was there no naked-eye evidence of disease of one or other, or both, particularly of the splenic gland which lends itself most easily to examination. This is the case in the splenic gland, bright-yellow bright in the splenic gland cells; in several of these pus had occurred out on the heald used for opening the dome. There there is a yellow yellow pus, and in others, especially in the submucous and the thickened mucosa of the lining membrane and adjacent parts. Doubtless this is a sequel in the serous membranes, as the patients complain, when they are not too ill to complain at all.

In one only was there no naked-eye evidence of disease of one or other, or both, particularly of the splenic gland which lends itself most easily to examination. This is the case in the splenic gland, bright-yellow bright in the splenic gland cells; in several of these pus had occurred out on the heald used for opening the dome. There there is a yellow yellow pus, and in others, especially in the submucous and the thickened mucosa of the lining membrane and adjacent parts. Doubtless this is a sequel in the serous membranes, as the patients complain, when they are not too ill to complain at all.

In one only was there no naked-eye evidence of disease of one or other, or both, particularly of the splenic gland which lends itself most easily to examination. This is the case in the splenic gland, bright-yellow bright in the splenic gland cells; in several of these pus had occurred out on the heald used for opening the dome. There there is a yellow yellow pus, and in others, especially in the submucous and the thickened mucosa of the lining membrane and adjacent parts. Doubtless this is a sequel in the serous membranes, as the patients complain, when they are not too ill to complain at all.

We did not examine the frontal sinuses or the middle ear as a routine. We are much impressed, however, by the frequency with which the splenic air sinuses are infected or full of pus, and we must add in passing that we think this serves to emphasise the importance of the uppermost air passages, especially the naso- WF, in connexion with the disease. It is very unlikely that the splenic air sinuses become infected secondarily to the others. In some cases the total length of illness had been so short that, for so much prurulent fluid to have been present in the splenic air cells, infection in that region must have been present from the start. When the frequency and severity of epistaxis is remembered, as well as the tendency to utility media already commented on, the importance of the naso-onyx as a likely site from which the whole trouble starts can hardly be exaggerated. The practical issue of this surmise should be insistence on the simple antiseptic toilet of the nose and throat—by nasal douche and gargle—as a routine. We are much impressed, however, by the frequency with which the cases in the sphenoidal which lends itself most easily to examination. In one case only had actual suppuration occurred in a big gland; the others had been entirely free from symptom, though it seemed clear that this must have been the result if the pus had not burst to produce mediastinal suppuration. In two cases there have been multiple small areas of increased firmness and darkened red colour.
Fig. 1.—This illustrates an early case in which the facial colour is frankly red, and the patient might not appear ill were it not for the drooping of the upper eye-lids, giving a half-closed appearance to the eyes.

Fig. 2.—This illustrates a pronounced degree of the "heliotrope cyanosis." The patient is not in physical distress, but the prognosis is almost hopeless.

Fig. 3.—This illustrates another type of the cyanosis, in which the colour of the lips and ears arrests attention in contrast to the relative pallor of the face. The patient may yet live for twelve hours or more.

THE "HELIOTROPE CYANOSIS" OF INFLUENZO-PNEUMONIC SEPTICÆMIA.
As a routine procedure every case was given calomel gr. iv. and mag. sulph. 5 i. on the following morning. As 'specific' remedies we employed ol. cinnamon, aspirin, quinine, and so on. saline. Our ultimate conclusion has been that although drugs at this stage are of value as symptomatic remedies no value attaches to their application either in cutting short the duration of a mild attack or in preventing its development into the more serious type.

We will now add a warning that the attempt to belittle the condition and allow the patient to return to his occupation while he is still short of breath is both short-sighted and economizing. In very many cases—we are speaking of the present epidemic, as distinguished from the cases in June, of the present epidemic, as distinguished from the cases in June, the employment of oxygen in the routine fashion is produced by this drug, we can at least publish the experience of seeing eight cases in men who had for a month previously to their admission to hospital with influenza been taking 10 grains of quinine regularly every day for malaria.

Finally, we would add a warning that the attempt to belittle the condition and allow the patient to return to his occupation while he is still short of breath is both short-sighted and economizing. In very many cases—we are speaking of the present epidemic, as distinguished from the cases in June, the employment of oxygen in the routine fashion is produced by this drug, we can at least publish the experience of seeing eight cases in men who had for a month previously to their admission to hospital with influenza been taking 10 grains of quinine regularly every day for malaria.

We finally would add a warning that the attempt to belittle the condition and allow the patient to return to his occupation while he is still short of breath is both short-sighted and economizing. In very many cases—we are speaking of the present epidemic, as distinguished from the cases in June, the employment of oxygen in the routine fashion is produced by this drug, we can at least publish the experience of seeing eight cases in men who had for a month previously to their admission to hospital with influenza been taking 10 grains of quinine regularly every day for malaria.

We finally would add a warning that the attempt to belittle the condition and allow the patient to return to his occupation while he is still short of breath is both short-sighted and economizing. In very many cases—we are speaking of the present epidemic, as distinguished from the cases in June, the employment of oxygen in the routine fashion is produced by this drug, we can at least publish the experience of seeing eight cases in men who had for a month previously to their admission to hospital with influenza been taking 10 grains of quinine regularly every day for malaria.
prevented from developing into the virulent type would be a useless method of estimating the value of the treatment, since the large majority of results which, spontaneously recover would have to be credited to the particular treatment under consideration. It cannot be argued that any time was lost once the suspicion arose that a desperate case was to be anticipated, and since it is obviously impossible to quote actual statistics under this head, we can only express a conviction that such an observation extended nothing to prevent the development of the serious case from one apparently trivial, and nothing can claim to avert the course of its virulence once it has developed.

**PROGNOSIS.**

This leads us to say a few words on the question of prognosis. The great majority of cases of influenza, of course, recover. What particular percentage comes to this category it is not possible, since of the 3800 or so cases admitted to the Connaught Hospital during the recent epidemic afford no indication as to the total number of cases in the Command, and the difficulty of obtaining figures sufficiently reliable to be of value has been inimperable. The comparatively mild cases are treated in large numbers at their own units, only those who are clearly from the outset of comparative severity or those in whom pyrexia has persisted for 48 hours are sent into hospital. We would once again indulge in the consolatory reflection that we are considering the past and must be attached to the deprivation of early hospital treatment in all cases; neglect of any case is of course to be condemned, but again we would add that the virulent case appears to be something sui generis.

As regards the prognosis of the admittedly serious case, we must confess to having found difficulties in the establishment of criteria, even after an experience of many hundred cases. Early in the epidemic we were persuaded that the cyanosed cases invariably succumbed. Later we were fortunately able to note that such severe cases as those where death occurred, recovered; and yet the latter have been quite indistinguishable from the majority of the cyanosed cases who died. No criteria as to temperature, pulse-rate, or respiration-rate, and not even of general condition, can be absolutely determined. It is true that a rapid fall in temperature without any amelioration of symptoms was in a "blue" case almost always a precursor of death within 24 hours, and that the case with blue colour, when accompanied by a cold, clammy skin, might be considered to be beyond hope of recovery. And yet cases whom earlier in the epidemic we considered to be beyond redemption certainly recovered, encouraging the determination not to abandon hope entirely until the patient was unmistakably moribund.

An even more painful indication of one's prognostic dexterity, however, was the admission of cases who, not only at their admission but even for several days of treatment in hospital appeared to run a comparatively trivial course and to give rise to no legitimate anxiety, suddenly took a turn for the worse, rapidly developed cyanosis, and died within a few hours of being only trivially ill.

**PROPHYLAXIS.**

A few final words may be added on the question of prophylaxis. We cannot refer to the greater question of dealing with the prevention of the epidemic or of "limiting its spread once it has appeared, for these are matters for the consideration of sanitary officers, both relating to troops and the general public. The precautions taken in the hospital itself were the ordinary routine procedure adopted for all in attendance upon the patients and for those patients who had exhibited the disease to a comparatively mild degree. The solutions utilised were either pot. per-manganate 1:4000 or tinct. iodine 1 drachm to the pint. In addition all medical officers, nurses, and orderlies were instructed to use a gauze mask around the nose and mouth whenever they were in attendance upon patients.

It may be added that not a single case developed in five special wards of the hospital devoted to tuberculous and neurasthenic cases, although these patients were from forces of circumstances being visited by medical officers who were in attendance elsewhere upon influenza patients, and that in the large venereal division of the hospital only two or three sporadic cases appeared — these had apparently entered the hospital with the disease — who were immediately segregated, and no instance of infection of other patients occurred. In the Detention Barracks at Aldershot, in which every patient occupying a separate cell in which he takes his meals, only coming into contact with his fellow inmates when he parades in the open air, not a single case developed. Incidentally, to complete the story, it must be added that the medical officer who visits these barracks daily is attached to the Connaught Hospital, and in addition to other duties has been in charge of influenza patients.

**PATHOLOGY.**

This investigation was carried out with a view to establishing, if possible, the identity of the causal organism or organisms and their distribution in the body in cases of influenza. Furthermore, the work appeared profitable if it were only to establish or disprove the connexion between the present epidemic and what had previously been described under the term "purulent bronchitis."

The most striking feature of the results obtained is the frequency with which streptococci were isolated, while the *Bacillus influenzae* could not be demonstrated with equal certainty. These streptococci fell into two groups: (1) a long-chained streptococcus; (2) a small short-chained streptococcus exhibiting a preponderance of diplococcal forces. This latter organism appeared to have some claim to individuality and will be referred to as a "diplostreptococcus."

Before describing the organisms in detail the pathological and bacteriological findings will be considered.

**Throat cultures.** — The material was taken from the nasopharynx with a West swab and inoculated on to blood-agar.

**Blood cultures.** — Blood cultures were made in glucose broth in 10 cases shortly before death, but although several dilutions were tried only 1 case gave a positive result; the organism in this instance was the *Streptococcus longus*. Where the results were in any way significant, a small number of sputa examined.

**Urine.** — Examinations gave the following results:—

<table>
<thead>
<tr>
<th>Case</th>
<th>Albumin %</th>
<th>Protein</th>
<th>Culture</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Severe</td>
<td>0.02</td>
<td>Gr. and c. casts.</td>
<td>No growth.</td>
</tr>
<tr>
<td>2. Moderate</td>
<td>0.01</td>
<td>No c.</td>
<td>No growth.</td>
</tr>
<tr>
<td>3. Severe</td>
<td>0.04</td>
<td>Transitional epithelial cells.</td>
<td>No growth.</td>
</tr>
<tr>
<td>4. Urine analysis</td>
<td>0.06</td>
<td>Cellular casts and leucocytes.</td>
<td>No growth.</td>
</tr>
<tr>
<td>5. Bronchitis</td>
<td>0.08</td>
<td>Transitional epithelial cells.</td>
<td>No growth.</td>
</tr>
</tbody>
</table>

It is remarkable that although in some cases casts were abundant, red blood-cells were not identified in the urinary deposit. Examination of the kidneys from these cases furnished no evidence of old-standing renal disease.

**Leucocytes counts.** — The following are the total leucocytes per c.mm. and the differential counts (P., polymorphonuclears; L., lymphocytes; L.M., large monocytes; E., eosinophiles):

<table>
<thead>
<tr>
<th>Case</th>
<th>Total P.</th>
<th>L.</th>
<th>L.M.</th>
<th>E.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Severe</td>
<td>6500</td>
<td>54%</td>
<td>39%</td>
<td>6%</td>
</tr>
<tr>
<td>2. Moderate</td>
<td>5900</td>
<td>68%</td>
<td>28%</td>
<td>3%</td>
</tr>
<tr>
<td>3. Urine analysis</td>
<td>4360</td>
<td>59%</td>
<td>30%</td>
<td>3%</td>
</tr>
<tr>
<td>4. Bronchitis</td>
<td>6500</td>
<td>61%</td>
<td>32%</td>
<td>3%</td>
</tr>
</tbody>
</table>

In the last case bronchitis with purulent expectoration was present, which may account for the higher polymorphonuclear count in the other cases.

**Cerebro-spinal fluid.** — In two severe cases the fluid was clear, pressure normal; albumin (1) 0.006 per cent., (2) 0.009 per cent.; cells normal; organisms negative; culture, no growth. In the absence of signs of meningitis or meningism this examination was not pursued to any
length, and the above results are typical of the total number investigated.

**Oxygen capacity of blood.**—This was in control case and four severe cases as follows (oxygen per 100 c.c. of blood):

<table>
<thead>
<tr>
<th>Material</th>
<th>Number of cases</th>
<th>Pneumocoecus</th>
<th>Diplostreptococcus</th>
<th>Strept. longus</th>
<th>B. influenzae</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart blood...</td>
<td>26</td>
<td>2</td>
<td>9</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Spleen...</td>
<td>26</td>
<td>23</td>
<td>9</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Lungs</td>
<td>12</td>
<td>6</td>
<td>4</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Sphenoidal sinus</td>
<td>20</td>
<td>12</td>
<td>6</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Rhinoidal sinus</td>
<td>5</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>2</td>
</tr>
</tbody>
</table>

**Description of the Organisms Isolated.**

The characteristics of the organisms isolated are given below.

The long-chained streptococci grew well on all ordinary media, and on agar formed discrete pinpoint colonies. On blood agar hemolysis occurred. No diastase was formed in milk during 3 days' incubation, but acid was produced in lactose and glucose media.

The "diplostreptococcus" also grew well on all ordinary media. On agar the colonies were larger than those of the long-chained streptococcus and showed flattening of the surface and a spreading margin, which was raised. Frosting of the colonies was seen in some cases. Hemolysis occurs to a slight extent.

Ancillary action of the Staphylococcus pyogenes aureus was very marked, especially when increased size of the diplostreptococcus was noted. A turbidity was usually formed in broth during the first 24 hours of incubation. In 24 hours' pure culture on agar many diplococcal forms appear, together with short chains of coccoid individuals. After repeated subculture the streptococcal forms predominate. The formation of chains does not appear to occur more readily in broth or other fluid media than on agar.

The organism has been found in pleural exudates during life and showed diplococcal and streptococcal forms, while pure cultures obtained from autopsies again gave the same organism.

The action on carbohydrate media has been uniform: acid is produced in glucose and a dense clot is formed in milk; there is no action on lactose, mannite, saccharose, or inulin, nor has gas been formed in any of the media used. The organism is bile soluble. Agglutination reactions with antipneumococcus sera Types I, II, and III, were negative.

Four cultures from heart blood and two from the lung were inoculated subcutaneously on guinea pigs, in one of them the animal died on the 3rd day and a local suppurative lesion produced. In one case following subcutaneous saline injection abscess formation occurred, and it is interesting to record that the organism is lated were the "diplostreptococcus" and the Staphylococcus pyogenes aureus.

The "diplostreptococcus" appears to resemble the Streptococcus brevis, although the latter is not usually regarded as pathogenic to man. Perhaps it would be best to use the name Streptococcus brevis generally; the "diplostreptococcus" could then be regarded as a species if its consistency of action and conformity of type could be established. In some respects the diplostreptococcus resembles the Streptococcus viridus, but the characteristic greenish hue of the colonies was not observed.

Gruber and Schäfer, and also Bernhardt and Meyer, have recently described a diplostreptococcus which occurred in the internal organs of cases examined post mortem. They regard this organism of depligate importance in the causation of acute pulmonary conditions and fatal complications of influenza.

**Histology.**

The histological findings in the lungs, kidneys, and liver are now briefly described.

**The lungs.**—In the majority of cases congestion and edema were the most marked changes recognised in the post-mortem region, while a definite broncho-pneumonia was of less frequent occurrence. In the former type of lung the alveoli contained a scanty fibrinous exudate with erythrocytes and polymorphonuclear leucocytes. The bronchial epithelium was thickened and proliferating, and leucocytic infiltration of the peribronchial tissue was present. Dilatation and engorgement of the peribronchial blood vessels was a marked feature, the appearance corresponding with those seen as an early stage of broncho-pneumonia. The lungs examined from cases at a later stage showed a confluent broncho-pneumonia. The alveoli were completely filled with serofibrinous material, in which numerous polymorphonuclear leucocytes and degranulated eosinophile leucocytes were present. The alveolar walls, the interalveolar septa, and the peripheral portions of the alveoli, contained numerous leucocytes and epithelial cells formed in a serofibrinous matrix. In the more congested areas in many places the alveolar walls had given way and the exudate had become confluent.

**Summary.**

1. The recent pandemic of influenza has included a large number of cases of pneumonia or toxemia with a high degree of mortality.

2. These severe cases appear definitely related to the cases of "purulent bronchitis" which have been described as occurring in various parts of the country and in France. The essential feature is an infection by the Bacillus influenzae with a secondary infection by some other organism. The existence of copious purulent expectoration is an outcome which may or may not be present and which has been singularly absent in the recent pandemic.

3. The secondary organism in question is the pneumococcus, Streptococcus pneumoniae longus, or the "diplostreptococcus," the virulence of which appears to be exalted by the initial menillae infection.

4. The characteristic features of the septicaemic type of case are variable lung symptoms, ranging from slight bronchitis to lobar pneumonia, very characteristic hemoptysis, lividity, dyspnea, or rather polyplegia, and very rarely orthopnea. These, with other so-called complications of influenza, such as pleurisy, nephritis, and others of lesser import, are evidence of the septicaemia or toxemia referred to.

5. The relative frequency of the septicaemic type of case cannot be estimated with any degree of accuracy. The bacteriological findings in post-mortem material. The pathological, has been performed. We are also greatly indebted to Colonel Robertson, C.A.M.C., O/C. Bramshott Pathological, Institute, and to the greater part of the investigation, clinical and pathological, has been performed. We are also greatly indebted to Colonel Robertson, C.A.M.C., O/C. Bramshott Institute, and to the greater part of the investigation, clinical and pathological, has been performed. We are also greatly indebted to Colonel Robertson, C.A.M.C., O/C. Bramshott Military Hospital; Lieutenant-Colonel Cole, C.A.M.C., O/C. Medical Division, Bramshott Hospital; Lieutenant-Colonel Tidbury, O/C. Woking Military Hospital; and C.A.C.M., O/C. Means, of the United States Medical Service, all of whom have generously placed at our disposal the patients under their command and care.

To the medical officers attached to the hospitals where investigations have been performed we offer a general expression of gratitude for their invaluable cooperation.