

I N F L U E N Z A

CLINICAL NOTES on 50 CASES with PATHOLOGICAL &
BACTERIOLOGICAL OBSERVATIONS on 100 AUTOPSIES.

(Work done as PATHOLOGIST with charge of small MEDICAL
TENT No. 11 STATIONARY HOSPITAL, FRANCE, October-
November, 1918.)

A T H E S I S

for the DEGREE of M. D., EDINBURGH
UNIVERSITY

by

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March, 1919.



A. CLINICAL NOTES. (50 Cases)

I. SIMPLE UNCOMPLICATED INFLUENZA.

II. INFLUENZA + (i) Purulent Bronchitis.

(ii) Bronchiolitis and
Broncho-Pneumonia.

(Septicaemia)

B. PATHOLOGICAL NOTES. (100 autopsies)

C. BACTERIOLOGICAL NOTES.

A. CLINICAL BACTERIOLOGY.

B. POST MORTEM BACTERIOLOGY.

Notes on the Organisms isolated.

D. SUMMARY NOTES.

A. CLINICAL NOTES .

(50 CASES.)

These fifty cases were admitted as an overflow from the Medical Division of the Hospital to an emergency "Influenza" tent which was placed in my charge. One has thus been able to add a few clinical notes to the Pathological and Bacteriological findings to be described in the second section of this communication.

The majority of these fifty cases were "Local Sick" so that it has been possible to follow out the clinical picture from the first day of the disease. The diagnosis of "Influenza" - clinically or bacteriologically lies on very slender grounds, so that during the pandemic among the troops in France in October, and November 1918, - any man complaining of general malaise with headache - cough - sore throat - etc., and with fever, was immediately admitted to the "Influenza" wards. With many of these the fever was a matter of hours - the patient being quite well again with one or two days rest in bed/

bed. Such cases of mild febricular catarrh are not included in this analysis.

There were two main groups of Cases:-

I. SIMPLE UNCOMPLICATED INFLUENZA

37 Cases.

II. INFLUENZA + Purulent Bronchitis and
Bronchiolitis and Pneumonia

13 Cases.

I. SIMPLE UNCOMPLICATED INFLUENZA.

The ONSET was in 45 of the cases sudden and acute, 13 of the men describing a rapidly developing severe general prostration with marked weakness of the legs, so that they "fell down while at work" or "fainted" or "could not walk any further". Many cases had to be carried into Hospital on stretchers. One man who fell down by the roadside was able to recover sufficiently to struggle back to his billet.

Five cases, however, told of gradually increasing general weakness and "rotten" feelings - so that they were able to continue at work for one or two days before reporting sick or on "Medicine and Duty".

Once in bed the patients had no desire to move. On first lying down, although the beds were carefully/

carefully warmed, 12 men had marked shivering fits, in one or two cases amounting to definite RIGORS.

Sweating has usually been a marked symptom of the acute stage - and, in cases which have shown a scarlatiniform rash and sore throat, this moist, rather cold, clammy skin has helped to distinguish the condition from Scarlet Fever with its typically dry hot skin. In two cases there was definite hyperidrosis which continued into convalescence.

Vertigo, sudden severe giddiness was noted in 11 Cases.

Headache was a marked symptom in almost every case. Only six men had no head pains. The distribution of the pain was as follows:-

Frontal	32 Cases
Occipital	8 "
Temporal	3 "
Vertical	1 "

The severity of the headache usually subsided after the first 2 or 3 days - but in a few cases it gradually became worse; the pain shifting from the frontal region and becoming chiefly occipital or vertical and shooting down the back of the neck. To such a case the addition of nuchal stiffness and tenderness/

tenderness, with slight head retraction and a positive Kernig sign lead to the diagnosis of meningitis - but the cerebro-spinal fluid, obtained by lumbar puncture, though under slightly increased pressure yielded no organisms or abnormal cytology. Seven cases complained of severe pain at the back of the eyes with marked tenderness of the eyeballs. Though this symptom may sometimes have resulted from a supra-orbital neuralgia, the nerve in the supra-orbital notch being often very tender, the subsequent development of a purulent nasal discharge showed that the cause was sometimes to be found in an inflammatory process in the frontal-ethmoidal or maxillary sinuses.

A few cases complained of transient very severe pain along the first and second branches of the trigeminal nerve - associated with patches of hyperaesthesia in the sensory areas which they supply.

Backache was a prominent complaint in 29 cases - the pain being usually most severe over the Latisimus dorsi about the level of the highest points of the iliac crests. This pain was usually bilateral and associated with marked tenderness on pressure. This tenderness at the level of the space between/

between the 3rd and 4th lumbar vertebrae was sometimes found to persist when all other signs had cleared.

Pains in Legs and Arms:- 29 men suffered from severe pains in the legs - but only 5 complained of pains in the arms. These pains were rarely referred to joints or to the anterior muscles of the limbs; thus true shin pains, as occur in "Trench Fever", were never noted and, indeed, only a few patients complained of any pain below the knees. It seems probable that these pains are neuralgic in nature and associated with a tendency to neuritis affecting the branches of the lumbar segment. Occasionally one has been able to detect areas of anaesthesia and paraesthesia on the outer side of the thigh above the knee - also in the segmental sensory areas of the 2nd and 3rd lumbar vertebrae. That these pains are the result of a toxic neuritis would also account for the sudden loss of power in the legs which has been noted. In one or two cases similar neuralgic pains were described along the margins of the ribs - occurring without the development of any herpetic eruption and due, probably, to an intercostal neuritis.

RESPIRATORY SYMPTOMS.

Coryza, sneezing and lachrymation were marked/

marked symptoms in 30 cases, while all but a few cases complained of cough - so that a tracheitis and inflammation of the larger bronchi when they are slight must be regarded as an integral part of the disease and not a complication. The cough, in a majority of the cases, was of a hacking and persistent nature not unlike the inveterate barking of Pertussis - a whoop followed by a succession of exhausting, explosive paroxysmal coughs, in one or two cases, of a distinct brassy quality. This irritable cough sometimes persisted in convalescence, and it is possible that in these cases there was some point of irritation in the windpipe, though in one patient it was directly traceable to the trickling of pus from the accessory cavities of the nose into the naso-pharynx. When fits of coughing without sputum persist in convalescence and are associated with tachycardia, instead of the more common bradycardia, it is also possible that the source may be some toxic irritation of the pneumogastric nerve. This was observed in the convalescence of a transport driver, who, though feeling perfectly fit, was subject to fits of dry coughing with a variety of transient spasmodic asthma with rapid pulse: this latter the result of interference with the moderating cardio vascular fibres of the vagus.

In/

In 25 men this symptom was associated with another distinctive evidence of the Tracheitis - viz: soreness behind the sternum along the course of the trachea, usually described as a "pain" or "feeling of rawness" below the breast bone. The amount of Expectoration from the trachea was usually small, consisting at first of a scanty, sticky spit, dislodged with difficulty, but later, becoming more thin and containing air bubbles. The straining involved in coughing up the early glutinous sputum, was, in one case so severe as to lead to a rupture of the rectus muscle, on the right side, below the umbilicus, which was preceded by mechanical dyspnoea, stridor, and inspiratory retraction of the lower ribs.

The microscopical examination of the sputum of such uncomplicated cases, showed it to be derived chiefly from the back of the throat and trachea - (squamous and cylindric epithelium), also the incorporated air is in larger bubbles than are produced in the finer bronchi.

Laryngeal Symptoms were manifest in only 10 of the cases. In other Tents where American troops were admitted, complete aphonia or a very painful hoarseness was quite common. But in this series there was little to note beyond a husky voice. Some patients/

patients, though the voice was only slightly altered, complained of a raw burning pain at the back of the throat with difficulty in swallowing. A certain proportion of these were suffering from tonsillar inflammation, but in others, though the vocal cords were not involved, this burning pain was found to be due to swelling and congestion of other parts of the larynx (subglottic tissue - ventricular bands - arytenoid folds).

17 of the patients showed either marked redness and congestion of the tonsils or definite follicular tonsillitis.

Ten cases suffered from severe Epistaxis - sometimes of almost alarming degree. This always began after the patient had retired to bed and tended to recur for several days. It was necessary for three of the patients to have their anterior nares plugged. In two cases about 4 ounces of blood were lost daily for three days. This symptom always developed early in the fever, in one case at the onset, and was not necessarily followed by pulmonary complications.

GASTRO-INTESTINAL SYMPTOMS.

Seventeen men emphasised abdominal pain as
an/

an early symptom. This has usually been referred to the iliac and epigastric regions, and as occurring in spasms independently of the taking of food. Definite abdominal rigidity was sometimes observed. In one case (not in this series), the pain was sufficiently circumscribed and severe to lead to the diagnosis and radical treatment of appendicitis.

Vomiting occurred in ten cases, - usually forcible and the vomitus consisting of large quantities of bile stained fluid.

Constipation was much more common than diarrhoea, the latter occurring in only 8 cases. During the febrile period - anorexia was the rule, patients being nauseated with the sight of food.

SIGNS.

The flushed face with injected conjunctivae was a marked feature in the first two days of fever. The patients were usually drowsy and only too glad to lie still in bed. When roused the eyes were fully opened but there was often to be noted a definite loss of tone of the upper lids.

The skin was usually covered with a profuse clammy sweat, sometimes leading to widespread sweat vesicles/

vesicles (sudaminae and miliaria) . A diffuse erythematous rash, especially on face, trunk and upper limbs was occasionally observed. This was not followed by desquamation - but in the acute stage, owing to its association with a sudden onset, sore throat, headache and vomiting and possibly albuminuria, this rash led to doubt in the diagnosis of Influenza from Scarlet Fever. As a rule, however, this rash did not show the usual puncta of Scarlet Fever and also differed in that the neck and face as well as the trunk and limbs might be involved. A mild, transient, morbilliform rash was once noted.

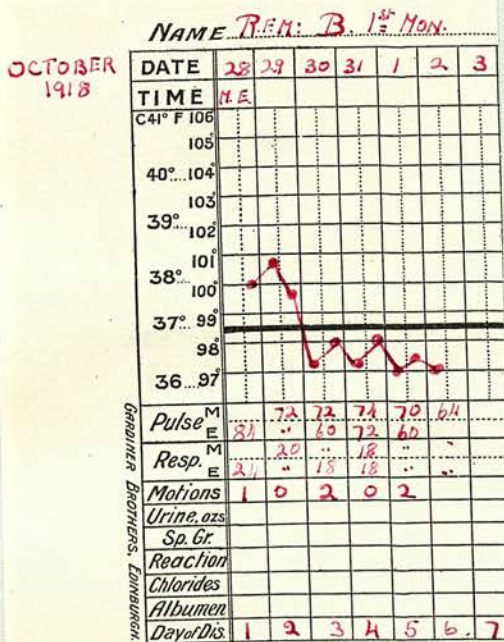
Salivation was in some cases difficult, but a majority showed the usual febrile mouth with excess of slimy and most foul mucus. This may have been a contributory cause of the curious fetor which was present in many, even mild cases, and which in severe cases with much sweating was almost overwhelming.

The tongue was unusually large and covered with a brownish or white fur, leaving a definite, clear marginal zone and red tip. After the first two or three days, the edges showed indentations. The yellow or brown fur, which was so common in Trench Fever, was present in about one half of the cases. In only two patients was the spleen definitely enlarged and palpable.

A few cases, especially those with an erythematous rash, showed an injection of the palate and anterior fauces with sometimes a definite follicular tonsillitis. Severe oedema of the uvula was observed in two cases. The vocal cords scarcely showed any change, beyond slight congestion and swelling - hoarseness being in this series an infrequent symptom. Marked congestion of the nares was usually found.

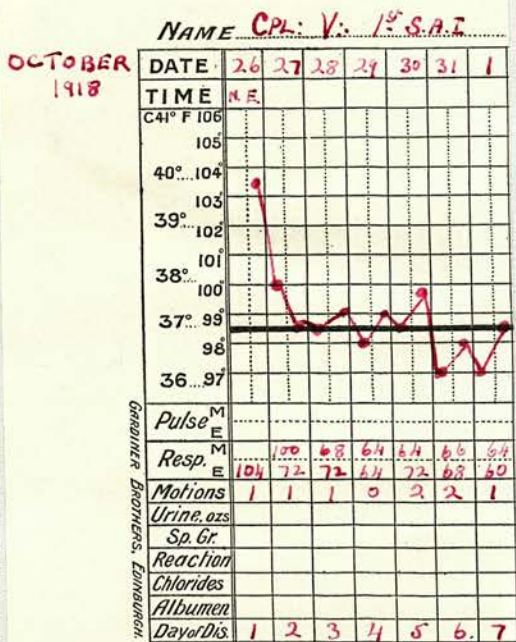
On examination of the chest a majority of the cases showed absolutely no physical signs. When the mucous membrane of the larger bronchi became swollen, and congested - the respiratory murmur became louder, with a harsher inspiratory sound. It is not easy, always to draw any clinical distinction between a moderately severe bronchitis and a bronchiolitis; but a few definitely simple cases undergoing a normal convalescence showed at their bases the characteristic sharp, high-pitched "sticky" râles of Goodhardt. Also in a few quite satisfactory cases, one was able to detect scattered patches of atelectasis, resulting from the obstruction of some of the smaller bronchi by plugs of mucus, or swelling of the mucous membrane. These small areas of collapse gave rise to slight comparative dulness with distant respiratory murmur.

The Temperature was usually moderately raised/



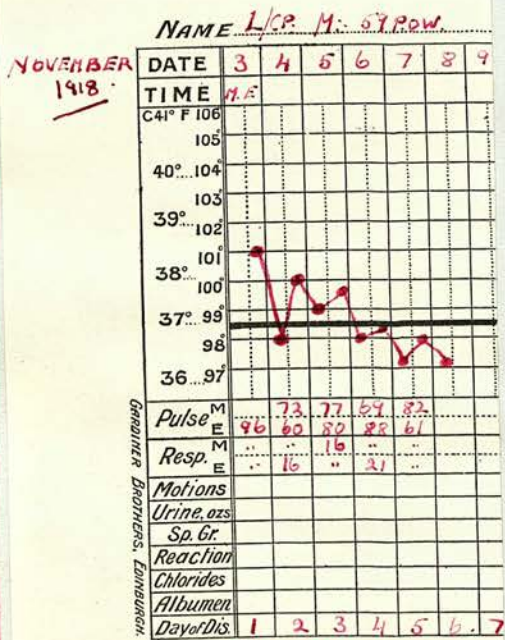
INFLUENZA:
MILD FEVER TYPE

CHART 1.



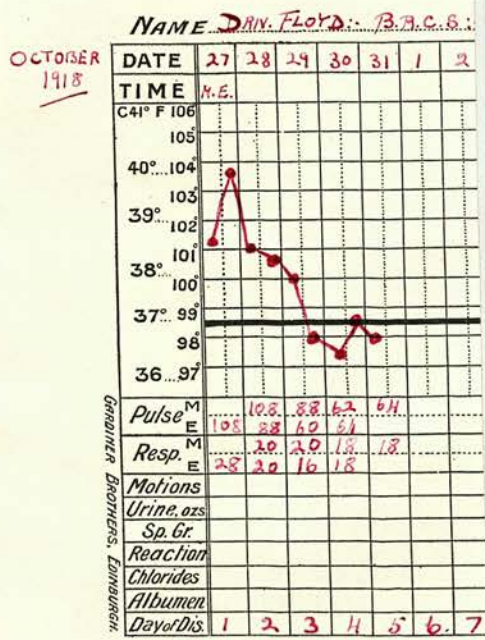
INFLUENZA:
MILD FEVER TYPE

CHART 2.



INFLUENZA:
MILD FEVER TYPE

CHART 3.



INFLUENZA:
MILD FEVER TYPE

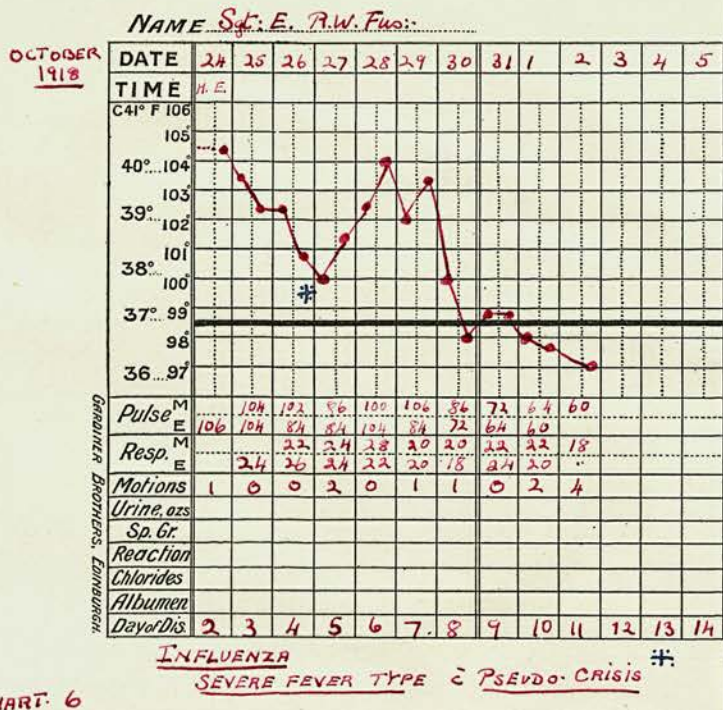
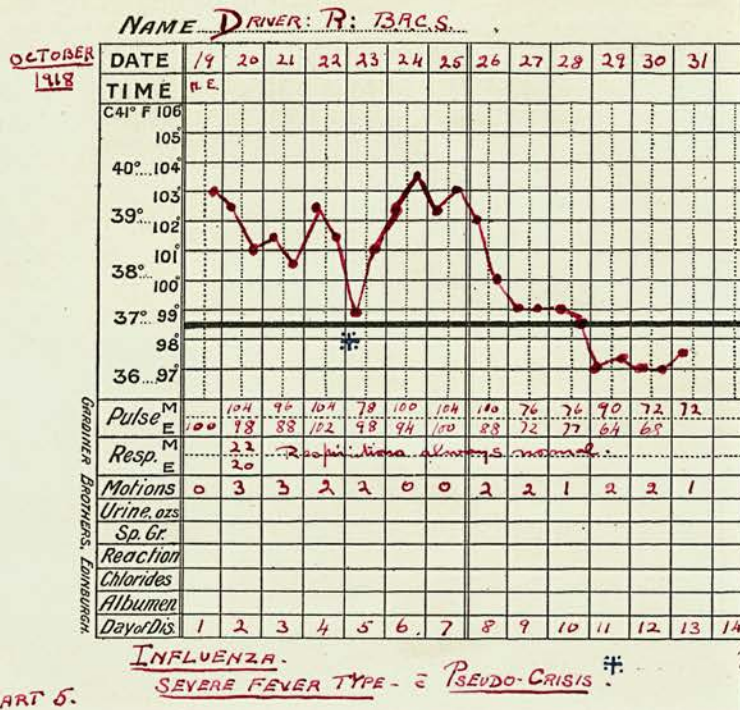
CHART 4.

raised at onset, reaching its acme on the first day, but occasionally on the 2nd day. There were no apyrexial cases. The fever lasted for a variable number of days, and on examining the charts one found two distinct types.

- i. Fever of short duration - where the whole pyrexial phase is completed within 48 to 72 hours. In a majority of these the temperature fell by lysis. (Charts 1-4.)
- ii. Fever of longer duration - usually of 7 to 8 days, also tending to fall by lysis, though, in some cases a distinct crisis was noted. (Charts 5-8). A feature which has been observed to occur very regularly in this type of the fever is a distinct drop in the temperature, a sort of pseudo-crisis, occurring usually about the fifth day of the illness. (Charts 5-8 and Chart 9).

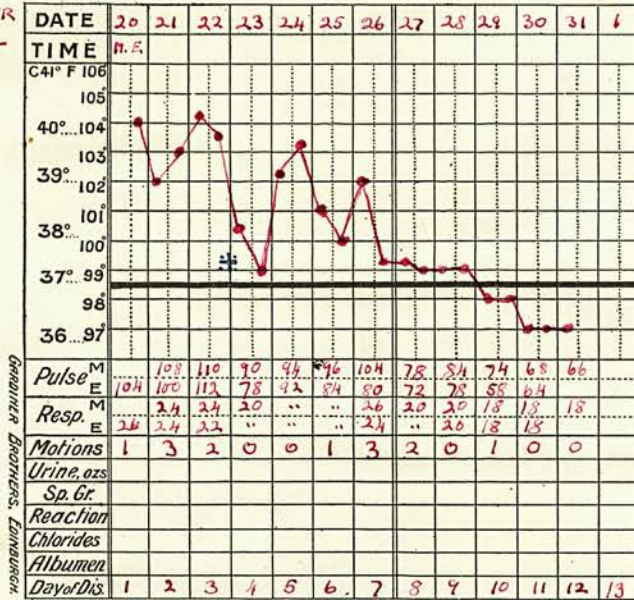
All patients were treated alike, mild purges and diaphoretics being the only drugs employed, so that these various forms of temperatures are probably not artifacts. As a rule, the severity of the intoxication was greater in the second and more prolonged type of fever and it was in these cases that post influenzal prostration and depression were most marked.

In/



OCTOBER 1918

NAME DRIVER, A. BACS.

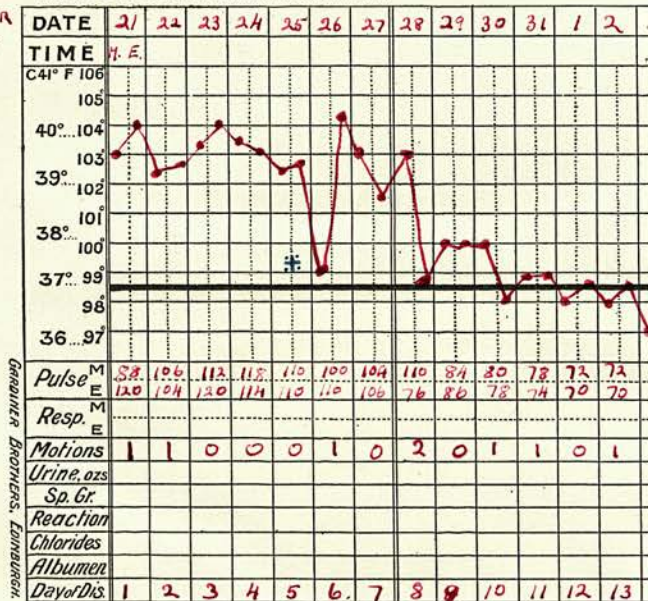


INFLUENZA - SEVERE FEVER TYPE = PSEUDO-CRISIS. #

CHART 7.

OCTOBER 1918.

NAME PIE, W. CANAD. BR.



INFLUENZA SEVERE FEVER TYPE = PSEUDO-CRISIS. #

CHART 8

In a few of the cases with short sharp fever, however, the general poisoning has been just as severe.

Short relapses of pyrexia and symptoms, without other complications, were occasionally observed about the end of the first week. But as a rule with the first fall of the temperature the patient began to feel better and entered an uninterrupted though slow convalescence.

The Pulse was accelerated - though often not in proportion to the rise of temperature. Even in uncomplicated cases there was a low arterial pressure. After the fall of the temperature the pulse often remained slow (60-65) for several days. This bradycardia was in some cases associated with a fall in the blood pressure, but though the pulse tension became low, it was never (in uncomplicated cases) definitely dicrotic.

Marri's Atropin Test was performed in seven selected cases of severe uncomplicated Influenza. The pulse was counted until it was found to be steady: 1/33d gr. atropine sulphate was then injected hypodermically over the triceps region. Twenty-five minutes later the pulse was again counted minute by minute till it was found to be steady. The difference between the average pulse rate before the/

the injection and the maximum half an hour after gave the "escape" or acceleration of the pulse rate. If the escape is 14 or less the test is said to be positive to the enteric group of infections. In these seven influenza cases one obtained "escapes" varying from 0 to 30.

A further evidence of cardiac fatigue was sometimes noted in a soft, short, first sound at the apex and soft second at the base.

Among the uncomplicated cases there was no instance of Influenzal cardiac syncope, though Pre-cordial pain was occasionally complained of. This pain was neuralgic and not attended with any obvious cardiac symptoms: it was limited to the precordium and its immediate neighbourhood and never radiated in any direction.

Tenderness of the eyeballs was very marked in five cases: this sign was associated with suffusion of the conjunctivae and photophobia and in one man with marked blepharitis.

The Pupils were often noted to be slightly dilated and to react sluggishly to light.

All patients were tested for lateral nystagmus, which was so common in Trench Fever, and it was found that three showed definite bilateral nystagmus/

nystagmus and three right lateral nystagmus. These cases had no defective vision and it is probable that the sign was an indication of weakness of the internal and external recti, resulting from slight toxic neuritis of the oculomotor and abducens respectively. None of these men were coal miners.

Seventeen Patients had very marked tenderness on pressure over the supraorbital nerve, in some the pain so induced being obviously intense.

In 3 cases the knee jerks were definitely sluggish and difficult to elicit. Plantar, Gordon, and Oppenheim reflexes were always normal.

The areas of paraesthesia in the sensory segmental areas of the 2nd, 3rd, and 4th lumbar roots have already been noted.

A few men complained of a definite loss of the sense of taste - persisting after the nose and tongue had cleaned: this was limited to the interior half of the tongue. When the sense of smell was abnormal, it was associated with fetid purulent nasal discharge.

Deafness was occasionally complained of, and examination revealed no evidence of otitis media or haemorrhage into the tympanic membrane.

Quininism could also be excluded. There were/

were 3 Cases of such deafness without evidence of ear disease.

The Urine in uncomplicated Influenza was found usually of high specific gravity, due to an excess of urea; so that the addition of nitric acid gave a deposit of scaly nitrate crystals.

Specimens were systematically examined for albumin and casts:-

3 Cases: had albumin in considerable quantity, but without casts. This albuminuria persisted for several days, but cleared up with convalescence.

1 Case: albuminuria which persisted till patient was discharged to England.

1 Case: Albumin and granular casts with trace of albumin persisting in convalescence.

2 Cases: had abundant albumin with blood and epithelial casts. These cases were also transferred to England.

In none of these patients was there any evidence of renal oedema.

The Blood was examined in 18 Severe but uncomplicated cases.

The white cell count varied between 2,000 and 15,800, but 10 of the readings were below 6,000. These observations were made at the height of the fever/

fever, so that there seemed to be a distinct tendency to a low white count which in a few cases amounted to a definite leucopaenia.

In one case the leucocytes were counted daily from the first day of the disease, the fever here being of short duration (4 day) type.

ON ADMISSION:-

1st day of illness	7,200	Temp.	101°
2nd	"	3,000	(height of fever)
3rd	"	6,200	(sudden fall to 99°)
4th	"	7,200	(Temp. 99°)
5th	"	9,200	(Temp. nl.)

This shows the rapid recovery of normal white count with fall of fever.

Differential counts in cases with a leucopenia, showed that the polymorphs were chiefly affected, accompanied by an increase in the lymphocytes and large mononuclears. Twice a 2% basophil count was found.

No definite changes were found in the red cell count in the uncomplicated cases. The blood itself as a rule, clotted readily.

Convalescence/

Convalescence began with the fall of the fever. In many cases it was a protracted business and especially in those who deferred taking to bed at the beginning. In the prolonged fever type, patients may have been allowed up or moved (as from C.C.S. to Base) at the time of the pseudo-crisis on the 4th or 5th day, and in these cases also convalescence was more tardy. Marked weakness and general prostration was common, patients complaining of want of appetite and being "nothing like myself". Persistent frontal headache was a marked feature in one case, associated with an absence of the sense of well being. Patients were easily fatigued and exhausted. Post febrile depression was remarkably constant in severer cases, the mental state of the convalescent being often intensely subjective or self conscious. Among the personnel of the Hospital one was able to follow this feature of convalescence. It sometimes lasted for as long as three weeks, and was accompanied by a subnormal temperature with low bodily powers and general resistance. Although this condition was most marked after severe attacks, it was in a few instances notable after quite a mild fever. It often left the patient suddenly in the course of a day.

Breathlessness/

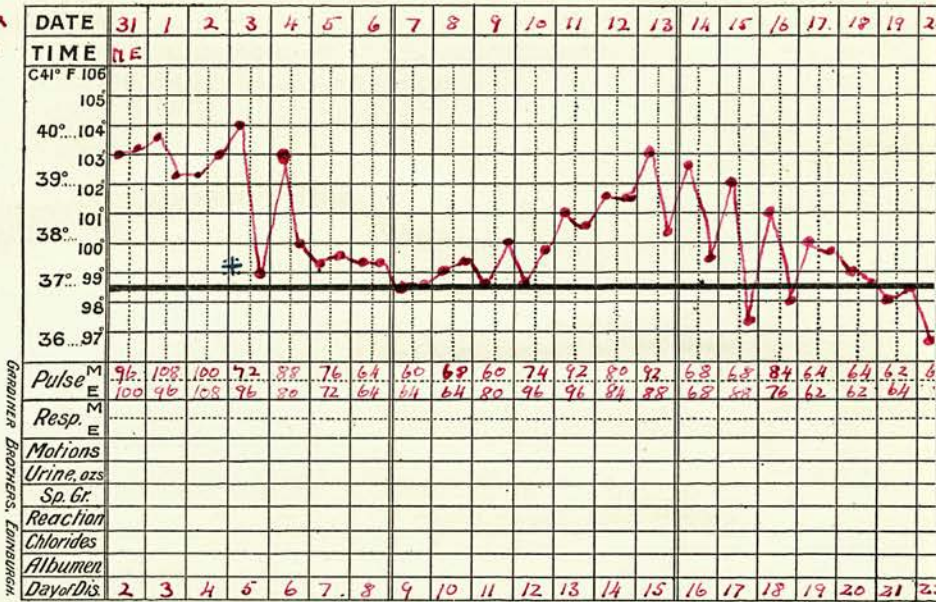
Breathlessness on moderate exertion was frequent. Although the pulse rate was often low there was usually a marked tendency to tachycardia on slight exertion. Systolic murmurs noted in convalescence and sometimes associated with neuralgic precordial pains were always transitory - the result of cardiac dilatation and of no special significance. In no case was there any evidence of valvular disease attributable to the Influenza. Among category motor drivers of the B.R.C.S. were several cases of chronic valvular disease, but in none of these was the condition aggravated by the Influenza poison.

Persistent cold hands and feet, hot flushes, fainting in billets etc. were indications of vasomotor disturbances and susceptibility of the peripheral circulation.

Cases did not remain long enough under observation to note any thinning of the hair - defluvium capillorum. But in the series of autopsies there was one case from the medical division, in which almost all the hair of the body came out in the course of the few days before death!

OCTOBER 1918

NAME PIE: B: D.L.I.



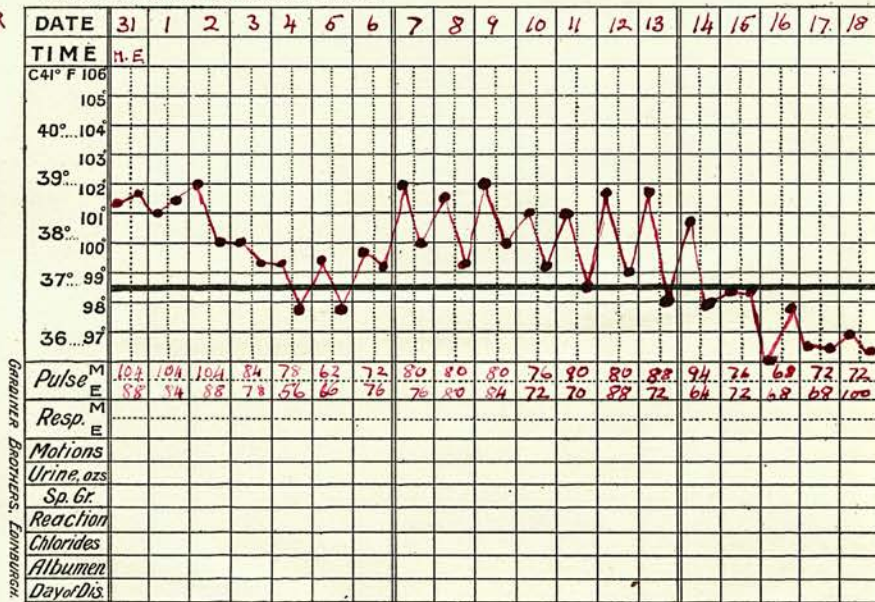
GENERALER BROCHITIS, EMPHYSEM.

Showing: BEUDO-CRISIS ON 5th DAY - AND INVERTED REMITTENT FEVER DURING BRONCHO-PNEUMONIC PHASE.

CHART-9.

OCTOBER 1918

NAME PIE: A: D.L.I.



GENERALER BROCHITIS, EMPHYSEM.

Showing - INFLUENZA + PURULENT BRONCHITIS - RECOVERY - INVERTED REMITTENT FEVER.

CHART-10

II. INFLUENZA + PURULENT BRONCHITIS

OR

BRONCHO-PNEUMONIA.

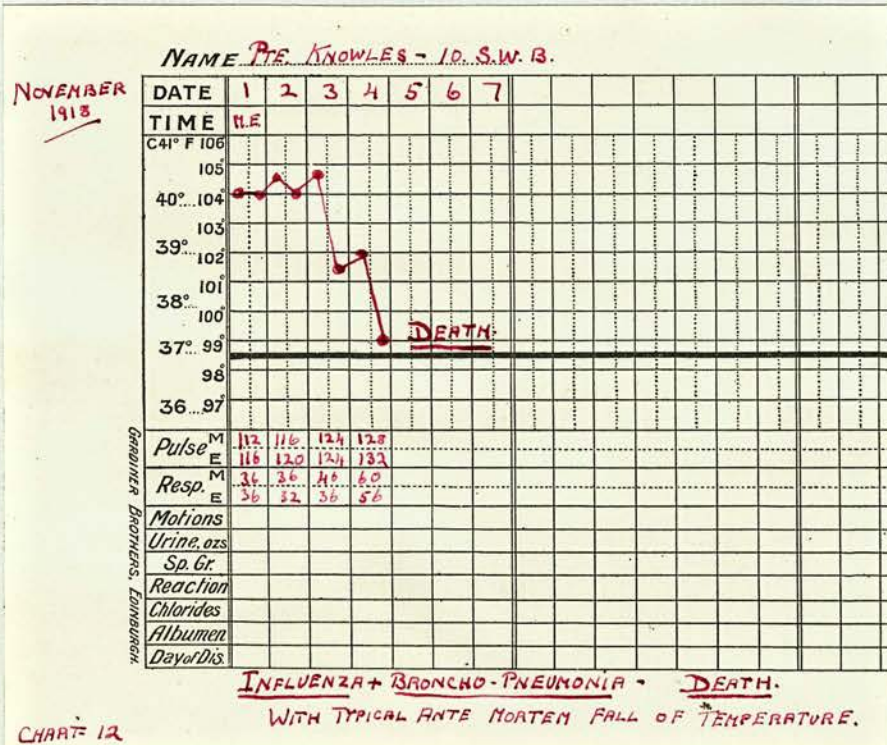
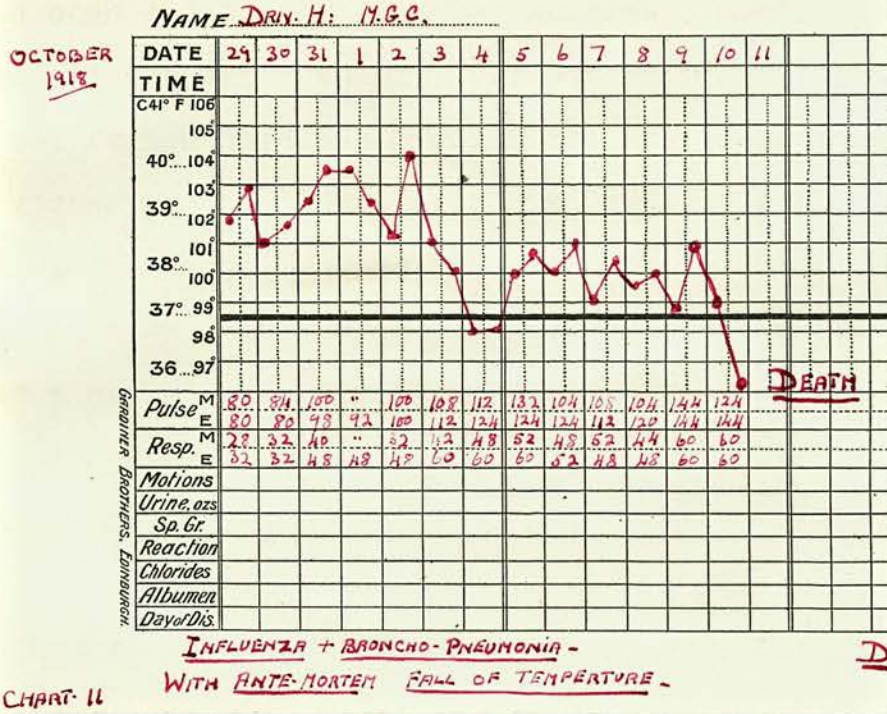
("INFLUENZAL" SEPTICAEMIA)

Serious pulmonary complication with severe toxæmia or septicaemia occurred in 13 of this series of fifty cases: of these, eight died.

There were no cases of rapidly developing bronchiolitis and pneumonia with lung oedema which cause death in two or three days. In all of them there was a distinct "Influenzal" period, the "bronchitic" or "pneumonic" complications coming on from 4 to 10 days after the onset of fever; so that in some cases the temperature had reached the normal before the pneumonia and general systemic complication supervened. (Charts 9 & 10.)

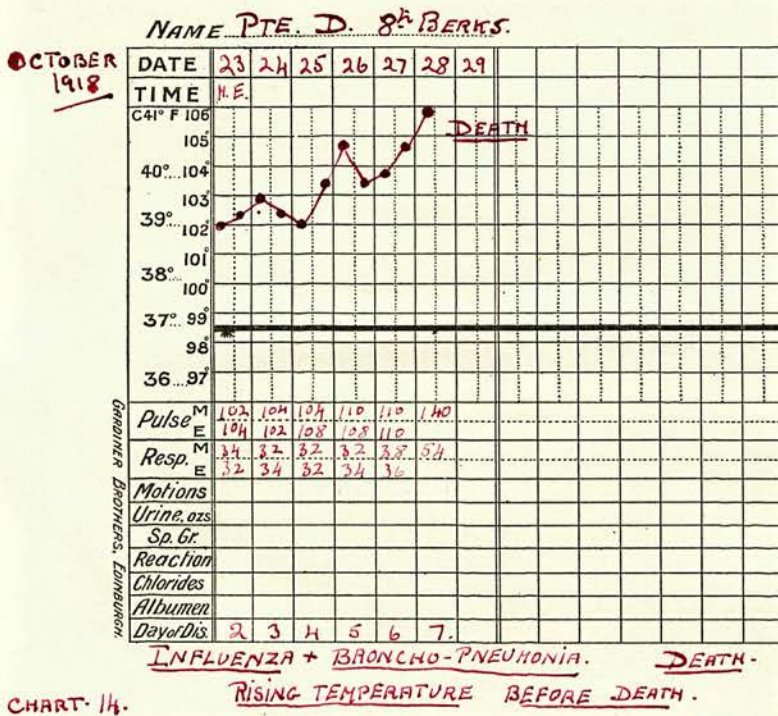
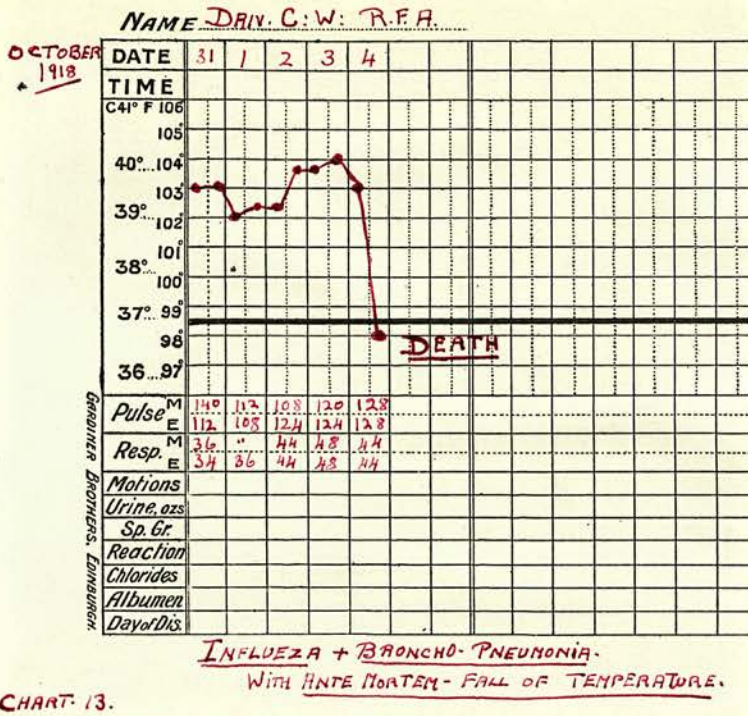
SECONDARY RIGORS were noted in one or two cases but were not necessarily associated with a further rise of temperature. When a purulent expectoration was established there was invariably a swinging type of pyrexia with a range of several degrees. In three cases of recovery, the falling fever was of an inverted remittent type (Charts 9

&/



& 10), but a falling temperature did not necessarily offer a good prognosis. One case reached its worst phase after the temperature had been normal for several days (apyretic). Also there was frequently an acute ante-mortem fall of the fever occurring 12-24 hours before death. This crisis was not accompanied by any lowering of the pulse or respiration rate (Charts 11-13). In no case of recovery was the fall of temperature by crisis. On the other hand a progressive broncho-pneumonia was sometimes associated with a rising fever chart, the maximum temperature being reached just before death. (Chart 14.)

The change in the Facies was a most marked feature, and was sometimes evident before there were any definite physical signs in the chest. The red flush of the simple case gradually changed to a curious bluish-purple which was usually first evident on the lobes of the ears, the lips and the tongue. Two fatal cases, just before death, showed a large dry, bluish-black indented tongue. This cyanosis resembled the acutely "gassed" cases, and only two men who presented this feature, even in a mild degree, recovered. This cyanosis was not necessarily associated with any serious respiratory or cardiac embarrassment the pulse, though raised in proportion to the fever, being/



being full and steady and there being no actual dyspnoea. One case which towards its close became very delirious, showed marked tache cérébrale.

LABIAL HERPES, with haemorrhage into the vesicles was observed in one case. No case presented any purpuric eruption, nor was jaundice ever noted. The eyes were "heavy" with dull conjunctivae and altogether these patients had the appearance of being profoundly poisoned.

DELIRIUM at night was remarkably constant, sometimes of a slightly violent nature, such patients always wanting to get out of bed, but perhaps more commonly of the low muttering type with subsultus tendinum, floccitatio and carphologia.

With the onset of pulmonary complication the patient usually began to complain more of his chest, the cough was more troublesome and sometimes caused pain on one or other or both sides. Breathing became more rapid but was not as a rule associated with dyspnoea. Even markedly cyanotic patients lay flat on their backs: orthopnoea was noted in only one man who was a chronic bronchitic with emphysema.

THE SPUTUM was never very abundant in any type of case. With the establishment of a purulent bronchitis, the sputum consisted of a tenacious creamy/

creamy pus, not particularly offensive and which stained linen a yellow colour. This lemon coloured spit was found to be most common in streptococcal infections. On one case with very difficult expectoration, small nummular lumps of fibrino-purulent were brought up. Occasionally the sputum was definitely "rusty", and sometimes also it showed streaks of bright red blood, but there were no cases of marked haemoptysis.

From an Examination of the Chest it was almost impossible to draw any clinical distinction between severe bronchitis and broncho-pneumonia. The autopsies revealed that these conditions usually co-existed, so that it was only a matter of degree whether there was "purulent bronchitis", "bronchiolitis" or "broncho-pneumonia". Often, in the early stages, with rapid respiration and evidence of severe poisoning, there might be an entire absence of signs suggesting any extensive involvement of lung tissue, so that neither from a diagnostic nor prognostic point of view, was much gained by physical examination of the chest.

In the milder cases the breath sounds were usually harsh, accompanied by rhonchi and medium pitched crepitations. These explosive inspiratory crepitations were always first looked for at the bases/

bases, but they soon tended to wander from one part of the lung to another. They have not often attended with any definite degree of dulness on percussion, though sometimes, especially along the lung borders indefinitely defined patches of dulness with distant bronchial breathing could be made out. The tendency of the pneumonic process to spread, was very marked, so that it might be invading a new part of the lung, while resolving in another. In one case, the left base gave all the signs of a typical lobar pneumonia - dulness - tubular breathing - pectoriloquy etc. - but the post-mortem revealed a confluent broncho-pneumonia with oedema and areas of collapse and haemorrhage. The insidious onset and atypical course of these pulmonary complications were most remarkable.

Of the five cases of recovery after broncho-pneumonia, one developed a right sided empyema. This was indicated by a definite dulness with faint, distant, breath sounds, and a rise in the leucocyte count from 7,000 to 22,400. Localised pleuritic friction was noted in several cases and was usually accompanied by pain in the side.

The PULSE RATE was always raised, but was often less rapid than the ordinary temperature pulse ratio. In cases going badly the pulse, at first full, became small and thready, while the heart sounds became/

became soft and muffled. In one case of recovery a blowing systolic murmur developed at the apex and gradually disappeared in convalescence. When death occurred, it seemed to be more due to an intense intoxication than to actual lung or heart disease.

BLOOD CHANGES in PNEUMONIC CASES.

An anaemia of secondary type was found in all serious cases and especially in those where haemolytic streptococci were isolated from the sputum. In films, the red cells were pale and there were usually a few poikilocytes: platelets seemed diminished in number. Coagulation time was not tested.

In uncomplicated cases the leucopenia persisted until the temperature became normal, but with the occurrence of secondary infection, whether streptococcal or pneumococcal, a definite leucocytosis usually developed, and its absence in such a complicated case was of bad omen. Thus:-

- i. In two cases of broncho-pneumonia with recovery, the white count rose from 7,000 and 9,800 to 22,400 and 28,200 respectively.
- ii. Five cases of broncho-pneumonia terminating fatally, gave white counts varying between 7,400 and 2,000; in 1 case the count which at first/

first rose to 17200 fell to 4,800 before death.

In a case showing marked lividity of the face, it was interesting to note that the leucocyte counts when the blood was taken first from the lobe of the ear and secondly from vein at the elbow, were practically the same. Were the cyanosis due to venous engorgement resulting from failure of the right heart, one might have expected a higher white count in the blood taken from the lobe of the ear, owing to the purely mechanical effect of slowing of the blood stream which leaves the cells, especially the leucocytes, in the capillaries.

With a leucocytosis it was always the polymorphs which were increased. Myelocytes were occasionally seen. The glycogenic reaction was tested in a few cases and was always present: it was specially marked in cases showing a low count.

The CONVALESCENCE of cases which had developed broncho-pneumonia was always protracted and very tedious. Cough and sputum were very persistent and associated usually with an abundance of scattered crepitations. It was evident that the Influenzal Broncho-Pneumonia was slow and difficult of resolution. One was not able to follow out such prolonged cases as they were evacuated to England as soon as they were/

were fit to travel, but it seems likely that a certain degree of interstitial pneumonia must be a fairly common sequel.

OTHER COMPLICATIONS.

There were no cases of Haematemesis - bloody diarrhoea or melaema. One case showed marked abdominal distension before death.

OTITIS MEDIA developed for the first time in two cases. None of the men had any haemorrhage from the ears. There were no cases of Arthritis. One man developed a suppurative left sided parotitis.

Paralysis of limbs did not occur, but occasional terminal loss of control of the organic reflexes was observed. No case developed true meningitis; meningism with cervical rigidity was once noted.

B./

B. PATHOLOGICAL NOTES.

(On 100 consecutive personally conducted
Autopsies).

This series of 100 Post-Mortem Examinations represents the total deaths from Influenza and Broncho-pneumonia in the Hospital for six weeks in October and November 1918.

The age incidence of the 100 deaths was as follows:-

19-25 = 40%)) 58% below 30 years.
26-30 = 18%)	
31-35 = 22%)) 42% above 30 years.
36-40 = 11%)	
40-50 = 9%	

There was a big percentage of older men at the base, and the majority of the local sick were admitted to this hospital. These figures thus show a larger proportion of deaths among men under 30, which might be explained by a survival immunity in the older generation.

RESPIRATORY/

RESPIRATORY SYSTEM.

The BRONCHIAL LYMPHATIC GLANDS at the bifurcation of the trachea and at the roots of the lungs were almost invariably slightly swollen and injected. In 11% of the cases, they were very much enlarged and congested and in 25% small punctate areas of haemorrhage were noted. In one case the glands at the roots of both lungs had undergone acute suppurative changes and contained liquid pus. Two glands contained large calcareous deposits about the size of a hazel nut.

THE LARYNX was not examined in every case. No very marked changes were ever noted. Once or twice the vocal cords were found red and swollen with similar congestion of epiglottis and arytenoid folds.

The mucous membrane of the TRACHEA was usually diffusely reddened and coated with a thick viscid mucus which, on being removed left a granular surface.

The LARGER BRONCHI were in all cases acutely inflamed, the capillaries and venules in the bronchial wall being distended with blood. Stained films from the congested surface showed partially destroyed/

destroyed ciliated epithelium and an abundance of leucocytes. The nature of the secretion in the larger bronchi varied, however, from case to case; in 54% it was of a brownish red, chocolate-coloured, frothy nature, while in 33% the lumina of the bronchi exuded on section yellow pus.

The majority of these 33 cases of purulent bronchitis were associated with broncho-pneumonia changes in the lungs, but seven of the specimens showed no evidence of pulmonary consolidation.

THE PLEURAE:

Subpleural petechiae were frequently noted on the lung surface, especially over the base, and also occasionally under the parietal pleura.

A general congestion of the visceral pleura with a mild degree of fibrinous or sero-fibrinous pleurisy, was almost constantly present.

Very marked secondary fibrinous pleurisy occurred in the following proportions:-

Right & Left Sides	3%)	} =	17%
Right side only	11%)		
Left side only	3%)		

In these cases the lungs were covered with large/

large flakes of fibrinous exudation, patchy or diffuse, and of variable thickness. Microscopically they consisted of a fibrin network entangling large numbers of leucocytes and organisms.

Notable serous effusions were observed in the following cases:-

Right and Left	1% (2 pints on either side))
Right side only	9% (5 ounces to 30 ounces)) 11%
Left side only	1% (8 ounces))

In a majority of these the fluid has been sterile and the cytology chiefly lymphocytic with a varying admixture of polymorph cells. It was usually of an orange yellow colour, but in a few cases was markedly haemorrhagic.

Sero-purulent and frankly purulent effusions were found in only 4% of the cases.

Right side	1% (20 ounces)
Right & Left	1% (5 ounces in either sac)
Left side	2% (10 ounces & 30 ounces).

In one of these four cases the pulmonary tissue showed extensive involvement, but the other 3 were primary empyaemata unoperated. Such cases of primary/

primary empyaema, when recognised and operated, usually recovered, for with the localising of the infection, the amount of general poisoning was less.

Old chronic fibrous pleural adhesions were found in 26% of the cases:-

Right side only	10%)	} = 26%
Right & Left sides	11%)	
Left side only	5%)	

These were most frequently limited to the apex and upper lobes, but sometimes involved the greater part of the pleural sac.

A large right-sided Pneumothorax was found in one case, and its origin was traced to the bursting of a small sub-pleural abscess. This case also showed large emphysematous bullae at the anterior margins and it is possible that the bursting of one of these may have contributed to the pneumothorax.

Marked oedema of the visceral pleura was once found on the right side.

Altogether pathological changes in the pleurae have been much more frequently found on the right side than the left.

THE LUNGS.

The Lungs were usually the seat of the most marked pathological change observed at autopsy. The variety of lesions and their combinations were so many that practically no two cases were exactly alike. The following is an attempt at a classification of the various morbid changes found:-

A. Broncho-Pneumonia	77%
B. Lobar Pneumonia	12%
C. Purulent Bronchitis (with oedema & collapse but no consolidation)	7%
D. Primary Empyema (described above)	3%
E. Diffuse Purulent Infiltration of right & left lower lobes with incipient <u>gangrene</u>	1%

A. BRONCHO-PNEUMONIA was by far the most common lesion found, and the following table shows approximately the distribution:-

Diffuse in all lobes	58%
R. & L. upper lobe	1%
R. & L. lower lobe	11%
R. lung only (lower lobes)	3%
Left lung only (lower lobes)	4%

Thus the lower lobes were affected much more frequently than the upper.

There were numerous areas of
brick/

brick-red and grey lobular consolidation scattered throughout the lungs and separated by small areas of air containing lung tissue often showing compensatory emphysema. When set closely together, and especially when occurring in one lobe only, such areas by their fusion gave the appearance of a lobar consolidation, a pseudo-lobar lobular pneumonia. But on section there was usually a mottled marbled appearance, the result of different lobules of consolidation being at various stages of the inflammatory process. The cut surface was usually granular. Occasionally the broncho-pneumonia was of distinct peri-bronchial type with a central bronchiole exuding yellow pus.

In a few cases these patches of greyish-yellow consolidation were extremely small - the size of a pea and even less. They were found scattered throughout the lungs in distinct peri-bronchial arrangement. Such forms were, at first taken to be miliary tubercles, but microscopically the chief thing to be noted was a deposit of fibrin in the peri-bronchial alveoli.

An attempt was made at sub-dividing these 77 Cases of broncho-pneumonia according as the consolidation was pinkish-red and rather ill-defined, or more advanced and of greyish colour and more definitely/



SECTIONS OF LOBULAR CONSOLIDATION-
SHOWING CELLULAR NATURE OF INFILTRATION



definitely circumscribed. There were no cases showing only the earlier pinkish patches as by the time death occurred a certain number of these had passed on to the grey stage.

A large proportion of these cases of broncho-pneumonia were associated with diffuse areas of haemorrhage into the lung substance: this was usually accompanied by much oedema so that on section much dark frothy, blood-stained serous fluid poured from the cut surface.

Microscopic examination of the broncho-pneumonic patches showed the consolidation to be due chiefly to a cellular inflammation, the bronchioles and alveolar cells being tightly packed with leucocytes and desquamated epithelium, and in the haemorrhagic cases with an abundance of red cells. The air vesicles immediately surrounding the bronchioles were sometimes found to contain a varying amount of rather dense fibrinous material.

(Photographs 1 & 2.)

These 77 Cases of typical lobular pneumonia might, roughly, be classified as follows:-

	(Red & Grey lobules (c Haemorrhage & oedema	29%
Broncho-Pneumonia 77%	(Red & Grey lobules c Haem. (but no marked oedema	11%
	(Alternating red & grey (areas	20%
	(Greyish areas only	17%

Various/

Various other pathological conditions were found associated with these Broncho-Pneumonic cases:- Thus

DEFINITE INFARCTS were found in 7% of the cases. These were firm, well defined dark-red wedge-shaped areas, usually situated in the lower lobes and near the lung surface.

PULMONARY ABSCESS was found in 11% of the autopsies:-

Right Lung	3%
Right & Left Lung	4%
Left Lung	4%

A few of these were the result of suppurative changes supervening in haemorrhagic infarcts. They were always associated with marked oedema, congestion and haemorrhage in the surrounding tissues. In one case the rupture of such a sub-pleural abscess had produced an extensive right-sided pyo-pneumothorax.

"Acute Congestion" occurs in the notes of 48% of the Cases and refers to portions of lung tissue which were dark red, oedematous and semi-solid and lying between patches of definite pinkish or grey patches of lobular consolidation.

Multiple small areas of collapse were almost always found appearing as small slate coloured irregular/

irregular patches, depressed below the general surface of the lung. Six per cent of the cases showed massive collapse of the greater part of one lobe, the collapsed tissue being of a dark brown colour, sinking in water and on section showing the compressed air spaces with obliterated cavities.

COMPENSATORY EMPHYSEMA was usually a very marked feature in these broncho-pneumonic cases and often seemed to develop out of all proportion to the amount of consolidation. Fairly large areas of pale compensatory emphysema in the lung substance intervening between patches of consolidation, were noted in 28% of the cases. But more commonly (40%) this change was limited to the anterior precordial margins, basal margins and apices, where pale thin walled bullous projections were found. In 12% of these cases rupture of such an emphysematous bulla had led to marked interstitial emphysema of the anterior mediastinum. This condition was usually found spreading to the root of the lung and cellular tissue of the posterior mediastinum and in 2 cases there was marked subcutaneous emphysema of neck and thorax.

B. LOBAR CONSOLIDATION was found in 12% of the autopsies:- of these a certain number may have been cases of simple primary pneumonia, unassociated with Influenza. The hepatisation was of the red type in 5% and of the grey in 7% of the cases. The upper lobes were more frequently affected than the lower, the side distribution being as follows:-

Right side	6%
Right & Left side	4%
Left side	2%

These, I think, were cases of real Lobar Pneumonia and not confluent broncho-pneumonia giving rise to anatomical lobar consolidation. Sections showed the air cells to be filled with fibrin, (in the grey forms showing retraction) red cells and leucocytes. These cases of Lobar Pneumonia were usually associated with a varying amount of acute congestion in the other parts of the lungs.

C. PURULENT BRONCHITIS alone was present in 7% of the cases. The lung tissue itself might show oedema and areas of collapse with compensatory emphysema, but there was no actual consolidation. Two cases showed also a definite bronchiectasis.

The/

The medical officers in charge of these cases remarked that both physical signs and the severity of infection had led them to expect extensive consolidation of pulmonary tissue. ~~in these cases.~~

D. PRIMARY EMPYEMA.

There were 3 Cases - all unoperated - with marked compression of the lung in all cases.

E. INCIPIENT GANGRENE was observed in only one case where suppurative changes had supervened on a confluent broncho-pneumonia affecting the lower lobes of both lungs.

Old healed Tubercle was found in 10% of the 100 Autopsies; 7% at R. apex and 3% at the left apex. A gumma was found in one case at the right apex.

The Heart almost always showed pathological changes of one type or other.

Patches of fibrous thickening of the epi-cardium - "milk spots" or "soldiers spots" were noted in 20% of the cases. They were chiefly found on the anterior surface of the left ventricle and most commonly towards the apex. In one case associated with a small red kidney, there was a large oedematous/

oedematous milk spot over the anterior surface of the left ventricle. In one or two cases these fibroses were almost of the consistence of cartilage.

Definite, though slight, increase of Pericardial fluid was found in 19% of the autopsies. The fluid in these cases was mostly of clear serous type, perhaps containing a few flakes of fibrin but showing no abnormal cytology and giving negative cultures. Marked fibrinous, non-infective, recent Pericarditis was observed in 4 cases. In these both epicardium and parietal pericardium were coated with large shaggy masses of fibrin - giving the typical "dog's tongue" or "battered bread" appearance. In one of these cases there was an associated acute nephritis. There was one case of purulent pericarditis - the sac containing about 2 ounces of fibrino-purulent material, giving in pure culture micrococcus pyogenes aureus.

There was only one case of simple cardiac adiposity or infiltration, but 71% of the cases showed definite degenerative changes in the myocardium. In these the heart muscle, especially of the left ventricle, was pale and cloudy and sometimes of a mottled appearance. These changes were often most notable in the papillary muscles and under the endocardium, though a marked "thrush breast" appearance was/

was never seen. Some of these hearts were most extraordinarily soft, flabby and friable, and when laid on the post-mortem table simply flattened out losing all tone and contour. Three cases showed sub-endocardial haemorrhages, most marked on the inter-ventricular septum and on the papillary muscles. Four cases showed advanced chronic myocarditis, the muscle of the left ventricle containing towards the apex, small irregular pale areas of fibrous tissue: the papillary muscles in these hearts, were hard and white and almost cartilaginous and there was associated marked chronic fibrous thickening of the endocardium. In one case a syphilitic gumma was found in the wall of the left ventricle. One autopsy showed a very small wrinkled, dark brown heart - a small Brown Atrophy. Definite Hypertrophy of the left ventricle was noted in 12% of the cases. In a majority of these there was some associated condition to account for the myocardial change. e.g. chronic renal disease, valvular disease etc. In all cases the condition of the right heart was noted as carefully as possible; in only 23% was definite dilatation present. In these the right auricle and ventricle were distended with large tough yellow aſonal or "chicken fat" thrombi often extending for some considerable way into the pulmonary artery and covered/

covered with dark, friable post-mortem clot.

Acute ENDOCARDITIS was conspicuous by its absence: recent valvular vegetations were never found. Slight chronic fibrous thickening of the aortic and mitral cusps were, however, quite frequently noted:-

Aortic Cusps	27%
Mitral Cusps	23%

These are not, of course, instances of chronic valvular disease, but merely a slight, though definite fibrous thickening of the cusps unattended by any evidence of incompetency or stenosis of the valves involved. Old chronic fibrous vegetations resulting in varying degrees of incompetency and stenosis were, however, noted in one or two cases. Thus 5% showed definite chronic fibrous vegetations on the Aortic cusps associated with considerable thickening of the valve segments. In one of these a very marked stenosis of the aortic orifice was produced. These vegetations occurred as the usual hard, irregular, nodular elevations along the margins of contact and the corpora Arantii. In 17 cases chronic fibrous plaques were found on the anterior mitral cusp. These were sub-endocardial fibrous patches and were usually associated with thickening of the chordae tendineae/

tendineae and similar fibrous changes in the papillary muscles, the latter very marked in 4 cases. Actual fibrous vegetations on the mitral cusps interfering with the valve functions were found in 3 cases.

Slight nodular atheroma of the first part of the aorta was very frequently observed (43%) . This refers to small irregular yellowish patches or nodules, fibrous thickenings of the intima, very commonly found round the orifices of the coronary arteries, and in one or two cases leading to quite considerable obstruction to these vessels. There were three cases of severe nodular atheroma of the aorta, where the patches were large and confluent and had undergone calcareous changes, without, however, any breach of the endothelial continuity.

GENITO URINARY SYSTEM.

ACUTE GLOMERULAR NEPHRITIS was found in 11% of the cases. These were large, red kidneys with capsules stripping easily, leaving a dark purple surface with marked injection of the stellate veins. On section there was marked swelling of the cortex - superficial and interpyramidal - which was of a mottled dark red colour, and by examination with a lens/

lens one could easily see the swollen, red glomeruli.

Large pale kidneys - Subacute glomerular nephritis - were found in 5%. The capsules stripped easily, leaving a pale, pinkish surface. On section superficial and deep cortex was found to be very much enlarged and of a pale, brownish-yellow, mottled colour - dotted here and there with little red points corresponding to distended vessels. Pyaemic abscesses scattered throughout the kidney substance, were found at one autopsy.

TOXIC NEPHRITIS was thus found in 17% of the cases. In all of those the urine from the bladder showed abundant epithelial-granular and hyaline casts; but red blood corpuscles were found in only a few of the specimens examined.

It was remarkable that none of these cases showed any evidence of renal oedema.

Less serious toxic effects were produced upon the kidneys in many other cases. Thus cloudy swelling was noted in 20% and early fatty degeneration in 25% of the autopsies. These changes were most marked in the cortex.

VENOUS CONGESTION was noted in 11 cases, the pyramids being clearly mapped out by the engorged, dark purple, straight vessels and the cortex showing alternating pale lines, with the red interlobular/

lobular vessels and on its surface, under the capsules, the engorged stellate veins.

Evidences of antecedent kidney disease were present in five of the bodies examined. Thus:-

Small, red, granular, contracted kidneys were found in two cases, small white, granular, contracted kidney in one case and there was one example of advanced double cystic disease, and one showing a syphilitic gumma in the renal cortex.

One case had a marked floating, but healthy right kidney.

The SUPRARENAL GLANDS were not always examined, but in one or two cases minute petechial haemorrhages into the cortical substance were noted.

There were two examples of undescended left Testicle with marked atrophy.

Venous engorgement of the LIVER was noted in 14% of the cases, and fatty degenerative changes in 17%, but no organ gave the definite "nutmeg appearance". Cloudy swelling of the liver was marked in 15% of the Cases.

Small islands of focal necrosis on the anterior surface of the liver, were noted in seven specimens: microscopically these areas showed necrotic liver cells.

Pyæmic abscesses were found in one liver.

Of/

Of chronic antecedent conditions, two specimens showed marked fibrous perihepatitis with slight multi-lobular cirrhosis, and in one case multiple gummata with early intercellular cirrhotic changes were found.

Two of the bodies were markedly jaundiced and in these the internal organs, especially the kidneys, were also bile-stained. There were, however, no signs of biliary obstruction.

General congestion of the mucous membrane of the small bowel, was observed in two cases, but no ulceration or other gross lesion of the gastrointestinal tract was noted. "Agonal" intussusceptions were occasionally seen in the lower portion of the ileum.

Slight, but definite, enlargement of the SPLEEN was a feature in 23% of the cases, many of these showing marked hypertrophy of the lymph follicles. In 8 cases the organ was large, haemorrhagic and diffluent, its pulp being of a dark, brownish, red colour. Actual suppuration was never, however, noted, and there were no cases of infarct. Although slight enlargement of the spleen was thus occasionally met with, there were no instances of marked enlargement of the organ.

Persistent THYMUS was seen in one case and congestion/

congestion with slight enlargement of the THYROID Gland was frequently noted. One case showed a parotid abscess on the right side. This did not interfere with the movement of the jaws and the mouth of the duct showed little change.

The BRAIN was examined only in instances where inflammatory changes within the cranium were suspected. Actual infection with micro-organisms was never demonstrated, but in 3 cases, there was definite increase of the cerebro-spinal fluid with some congestion and oedema of the pia-arachnoid. The cortical grey matter in one specimen showed considerable congestion.

Pale whitish areas of coagulative necrosis ZENKER'S DEGENERATION - were repeatedly noted in the rectus abdominis. These greyish patches occurred most frequently above the umbilicus, below the insertion of the muscle to the xiphisternum.

One case showed a complete rupture of the right rectus within its sheath and below the umbilicus. There was much haemorrhage into the muscle tissue itself which looked as though it had been cleanly cut with a knife.

C. BACTERIOLOGICAL NOTES.

The Bacteriology was studied -

- A. During life in the clinical cases described in the first section where the main sources of investigation were the sputum and the blood.
- B. After death, in the 100 autopsies, from the bronchi - the lungs - the heart blood - the spleen - exudates etc.

The following is a summary of the results obtained.

A. CLINICAL BACTERIOLOGY.

1. Blood cultures were made in 22 cases of complicated and uncomplicated Influenza. Nineteen of these after repeated subculture were negative and the remaining three gave pure cultures of the pneumococcus. The positive cultures were all obtained in cases complicated with broncho-pneumonia. The method employed was to take 10.c.cm. of blood from the patient's vein and incubate for 24 hours at 37° in 50 c.cm. of citrated broth. Subcultures were then made every 12 hours on human blood-agar plates.

The/

The Sputum was examined in 27 cases. Mucopurulent specimens were selected and washed in sterile normal saline and as far as possible smears and cultures were made from the interior of the nummula. Human blood agar plates were employed in all cases. The following organisms were isolated:-

Pneumococcus:-	81.5%	(5 times in pure culture)
M. Catarrhalis:-	70.4%	(2 times in pure culture)
B. Influenzae:-	40.8%	(once in pure culture)
Large gram + Bacilli:-	18.5%	(none in pure culture)
Streptococci:-	11.1%	(none in pure culture)
Staphylococci:-	3.7%	(none in pure culture)
Large gram + Diplococci	3.7%	(none in pure culture)

Faeces were examined several times for B. Influenza but always with negative results.

In the case of Empyema which recovered after rib resection, the pus from the pleural sac gave a mixed growth of Pneumococcus and Streptococcus.

Pus from a Parotid abscess and from an Otitis Media yielded in both cases a pure culture of micrococcus pyogenes aureus.

B: POST MORTEM BACTERIOLOGY.

Muco-pus (brownish-red and yellow) from the mucosa of the larger Bronchi was examined in 61 cases. Smears were made and stained by Gram's method and by dilute Ziehl-Fuchsin. For plate cultures the Media employed were Human blood agar, blood-smear agar, and rabbit's blood agar.

The following organisms were isolated.

Pneumococcus:-	83.6%	(4 times in pure culture)
Streptococcus:-	59%	(none in pure culture)
M. Catarrhalis:-	44.3%	(once in pure culture)
B. Influenzae:-	40.9%	(2 times in pure culture)
Staphylococci:-	13.1%	(none in pure culture)
Large Gram + Bacilli	9.8%	(none in pure culture)

Three examinations were made of Laryngeal

Mucus:-

B. Influenzae:-	3 times	(once in pure culture)
M. Catarrhalis:-	2 times	(none in pure culture)
Pneumococcus:-	once	(not in pure culture)

CONSOLIDATED LUNG TISSUE was similarly examined in 53 cases.

Pneumococcus	64.1%	(9 times in pure culture)
Streptococcus	33.9%	(once in pure culture)
M. Catarrhalis	30.3%	(2 times in pure culture)
Staphylococcus	15.1%	(3 times in pure culture)
B. Influenzae	13.2%	(once in pure culture)
Large Gram + Bacilli	3.8%	(none in pure culture)

PUS FROM LUNG ABSCESS 9 examinations:

Streptococci	5 cases	(none in pure culture)
Staphylococci	5 cases	(twice in pure culture)
Pneumococci	4 cases	(none in pure culture)
M. Catarrhalis	2 cases	(once in pure culture)
B. Influenzae	2 cases	(once in pure culture)

INJECTED/

INFECTED PLEURAL EXUDATES. 7 EXAMINATIONS.

Pneumococcus	4 times	(twice in pure culture)
Streptococcus	2 "	(none " " "
Staphylococci	2 "	(once in pure culture)
Large gram + bacilli	once	(not in pure culture)

HEART BLOOD was cultured on 17 occasions, and in all of these, the examination was made within half an hour after death. The method employed was the same as that for blood-cultures during life.

Six specimens gave no growth, but eleven were positive as follows:-

Streptococcus (pure culture)	5 times
Pneumococcus (" "	4 "
Staphylococcus aureus	once
Pneumococcus + M.Catarrhalis	once

SPLEEN PULP: 19 examinations. Direct smears and cultures on human and rabbit blood agar. Of these:-

3 gave a pure culture of pneumococcus and
1 " a pure growth of M.Catarrhalis

While the remaining 15 were negative.

Cerebro/

CEREBRO-SPINAL FLUID:- Seven specimens were cultured, but all with negative results.

INFECTED PERICARDIAL EFFUSIONS:- There were two cases yielding Staphylococci and Streptococci

NOTES on the ORGANISMS ISOLATED.

THE PNEUMOCOCCUS was the organism most frequently isolated - in the blood, in the sputum, and in the post-mortem specimens. Mice were not available for inoculation experiments, and one relied on microscopical and cultural characteristics. It is possible that in some cases what was taken to be a pneumococcus may really have been a diplo-streptococcus.

STREPTOCOCCI were recovered much more abundantly from post-mortem specimens, than from sputum during life.

Thus:-

Sputum	11.1%	Streptococci
Bronchial Mucus (post-mortem)	59%	Streptococci

There were two distinct types - a long chained and a short chained - which occurred with about equal/

equal frequency. The short chains showed a marked tendency to a diplococcal formation; their colonies were larger and showed a definite tendency to fuse together, forming a slimy, greenish film (on blood-agar). Their haemolytic powers were much less marked than the long-chained variety. The colonies of the longer streptococcus were smaller and more discrete and on blood-agar plates almost always showed marked haemolytic powers. The two types quite frequently occurred together. In one case a powerfully haemolytic strain in the consolidated lung was associated with the short-chained variety in the heart blood. In the few cases where a haemolytic strain was recovered from, a patient's sputum blood counts did not show any very marked anaemia, nor were haemorrhages a special feature of these cases. All the streptococci which were isolated from the heart blood were of the short chain type.

"MICROCOCCUS CATARRHALIS" after pneumococci and streptococci, was next in order of frequency. This was a moderately large gram negative diplococcus, in smears quite frequently seen within leucocytes. It formed spreading, greyish, white colonies and did not liquefy gelatine. No fermentation was produced with Lactose, Glucose, Mannite or Cane-Sugar. Dulcitate was unobtainable at the time.

"BACILLUS INFLUENZAE". The identity of this/

this organism has not been easy to establish. Every effort was made to find it as often as possible. Failure to isolate this organism may have been due to faulty technique and unsuitable media etc. When it was found it was recognised as a small gram negative bacillus, which was non-motile and did not form spores. It was easily stained with weak carbol-fuchsin sometimes taking on the dye more deeply at its rounded ends. In the unstained condition under a cover-slip, the bacillus was very difficult to see. In stained smears the organism was quite frequently found in clumps and often in epithelial and pus cells. In sub-cultures the organisms were usually larger and sometimes showed a tendency to pleomorphism. Microscopically they were indistinguishable from B. Pertussis, Koch-Week's bacillus or the trachoma bacillus of Müller.

It was sometimes possible to grow the organism on ordinary agar, when this was inoculated with sputum, but human blood-agar, or better still rabbit's blood-agar, gave more abundant cultures. The organism would not sub-culture on human blood agar as a rule, but sub-cultures were comparatively easily obtained on rabbit's blood-agar. Pure cultures were not easy to grow, and the ancillary action of other organisms, especially/

especially staphylococci, greatly increased the number of colonies of the Influenza bacillus obtained. The small transparent dew-drop colonies were noted.

No Serological tests or inoculation experiments were made.

As regards the type of clinical case from which the bacillus was isolated it occurred with more frequency in the pneumonic cases, but it was also recovered from the sputa of a certain number of quite mild infections.

LARGE GRAM + NON-MOTILE and NON-SPORING BACILLI were occasionally found - also large gram + cocci - frequently in tetrad arrangement, but sometimes also in long chains. Both of these organisms were found to be haemolytic. They were never found in pure culture, but always in symbiosis with pneumococci - streptococci - B. Influenzae, etc.

D./

D. SUMMARY NOTES.

1. In simple uncomplicated Influenza there would seem to be two types of cases. One with a fever of short duration (2 to 3 days) and one with a temperature curve, lasting usually 8 or 9 days. In this latter variety there is very commonly a fairly abrupt fall of the temperature to normal on the 4th or 5th day, rising again rapidly after 12-15 hours. This "pseudo-crisis" is of importance in that patients feeling much better, and finding that their temperatures are normal, may rise from bed or even go out, and run other unnecessary risks when their fever is really only at half way. Thus, cases were frequently received from the C.C.S. with notes that "after 5 days of fever - temperature now normal - evacuated to base". Such men were admitted to the base with high temperatures, and being much exposed en route, were more liable than others to develop broncho-pneumonic complications.

2. In uncomplicated cases the degree of general intoxication in the fevers of short duration is not usually so severe as in those with more prolonged pyrexia. But occasionally the short pyrexia is very high and sharp and is associated with just as much general disturbance and post-febrile weakness as the 8 day fever cases.

3. Apart from the difference in the length of the fever in these two types of cases - the signs and symptoms are alike. The onset is usually sudden, with frontal headache - pains in the small of the back and leg pains. Arm pains are rare. Vomiting and diarrhoea have been noted; constipation is very common. Slight cough with pain below the sternum is common to both types - and epistaxis has been just as frequent in the fevers of short, as in those of long duration. The face is usually flushed with injection of the conjunctivae at onset, but actual skin rashes have been rare. The tongue is typically large and indented, with a white or brownish fur along the middle, leaving red edges and tip.
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The spleen is rarely enlarged. Lateral nystagmus is occasionally noted.

4. No uniform results are obtainable with Marris's Atropine Test.
5. The leucocytes fall on the second day of fever and a low count persists until the temperature returns to normal. This fall chiefly involves the polymorphs, so that the leucopenia is associated with a relative increase in the lymphocytes and large hyaline cells. A rapid rise in the white count usually accompanies any serious pulmonary complication. Its non-occurrence in such cases or fall after a preliminary rise, is of very grave prognostic significance.
6. Pulmonary complications are invariably present in fatal cases. There is cough with abundant expectoration and rapid breathing - but actual dyspnoea is rare and orthopnoea has never been observed, (except in one case, where there were an associated chronic bronchitis and emphysema.) Chest signs, however, often/

8. The myocardium is usually very pale. Dilation of the right heart does occur, but is much less frequent than the lividity of fatal cases would lead one to expect. Acute endocarditis has never been seen in this series.
9. Parenchymatous Nephritis is a complication of about 1/5th of the cases, while in many others the kidneys show degenerative changes, resulting from the severe toxæmia. There was never any evidence of renal oedema.
10. In the 100 autopsies one has been impressed by the large percentage of cases showing pathological conditions the result of antecedent disease, or premature senile change occurring with prolonged strain and exposure.
- Thus:--

Calcareous Bronchial glands	2%
Marked old fibrous pleural adhesions sometimes involving the whole pleural sac	26%
Healed Tubercle (chiefly apical)	10%
Syphilitic gummata in lung, liver, heart and kidneys	1%

Milk/

Milk spots and general fibrosis of epicardium	20%
Mild patchy aortitis (chronic)	43%
Severe atheroma of aorta	3%
Slight thickening of aortic cusps	27%
Slight thickening of mitral cusps	23%
Fibrous vegetations on aortic cusps	5%
Fibrous plaques on anterior mitral cusps	17%
Fibrous vegetations on mitral cusps	3%
Endocardial and Papillary Fibrosis (Chronic Interstitial Myocarditis)	4%
Small Brown Cardiac atrophy	1%
Small white granular contracted kidney	1%
Small red granular contracted kidney	2%
Cystic Disease of kidneys	1%
Floating right kidney	1%
Fibrous perihepatitis	2%
Persistent Thymus	1%
Atrophy of Testicles	2%

Many of the patients admitted to hospital were "Local Sick". These were, usually B. & C. Category men, which may account for the fairly large proportion of cases showing evidence of chronic lung/

lung, pleural and heart disease. Many of the conditions enumerated above were not recognisable clinically and were probably of little significance. But such morbid changes as extensive pleural adhesions, epicardial and myocardial fibroses, chronic valvular disease and chronic renal disease, must have exerted some influence in determining the fatal issue. Several cases of chronic valvular disease which were admitted to Hospital with severe Influenza, recovered without any evidence of further injury to the heart.

11. Both clinically, in the sputum and in the circulating blood, and post-mortem in the bronchi - lung tissue - heart blood and spleen - the organisms most frequently isolated have been the pneumococcus, the streptococcus and the micrococcus catarrhalis. In all cases, every effort was made to isolate the bacillus of Pfeiffer, but the organism succeeded in evading capture in fully $\frac{3}{4}$ of the examinations, and it was never found in the circulating blood or heart blood after death. This may have been the result of a faulty method of inquiry - incorrect technique - unsuitable/

unsuitable media etc. But similarly disappointing results have been noted in other laboratories. Some observers, on the other hand, have succeeded in isolating the B. Influenza in a much higher percentage of cases.

It is possible that there may be several epidemic clinical diseases resembling Influenza, but due to different micro-organisms. On the other hand, the uniformity in the clinical picture, the universal pandemic nature of the disease, and its extreme infectiousness, would lead one to look for some specific virus as the causal factor. And with the abundance of conflicting evidence at present in hand, one is lead to a purely hypothetical Conclusion.

INFLUENZA is a definite specific disease due to some virus as yet undiscovered. The virus may be some extremely thin and ultra-microscopic organism which is capable of passing through the finest filters. This factor attacks primarily the respiratory tract, but also exerts some powerful influence on the whole system, giving rise to very definite general symptoms and to a marked lowering of/
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lowering of the resistance to certain known secondary organisms of which the Pneumococcus, Streptococcus, M. Catarrhalis and B. Influenza are the chief. Thus Pfeiffer's bacillus plays no more important role than the ubiquitous pneumococci and streptococci and as a complicating, secondary organism is indeed much less virulent.

Agglutinins and other antibodies to B. Influenza have been demonstrated by some observers to be present in the blood of patients suffering from the disease. But this, of course, is not evidence of that organism being the primary aetiological factor.

The majority of cases of Influenza recover and therefore, the virus in itself is not particularly fatal. But when it has very much embarrassed the general defences of the body, these secondary organisms, which may have existed in the upper respiratory passages, and which before the advent of the specific virus, were afraid to assert themselves, now enter into an allied symbiotic combination and make an advance on the respiratory tract and circulating blood. The pneumococci and streptococci with Pfeiffer's bacillus thus exist as harmless saprophytes, until suddenly their virulence is raised/

raised as a result of the entry into the body of the specific virus. It is probable that in the different geographical areas there is a variation in the actual germs affecting this ancillary symbiosis, which would account for the great variety of results obtained by different observers.

VACCINES, consisting of a suitable admixture of the secondarily infecting organisms, may conceivably increase the resistance of the body to these germs and so be of benefit in limiting the disease to simple uncomplicated Influenza. It is, also possible, that the undiscovered virus may actually be present in the various vaccines used.

Henry Cram.
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