eventually kill these cells, as has resulted in hundreds of cases, still some length of time must elapse before this happens, or, putting it in another way, the formaldehyde keeps on exerting its deleterious action for a long time.

From a consideration of all the facts we would advise that the following treatment be instituted as soon as possible.

1. Repeated gastric lavage during the first four or five days to remove the alcohol excreted by the gastric glands.

2. A large fluid intake to dilute the poisons circulating in the blood stream.

3. Pilocarpine sweats and hot packs daily to aid elimination through the skin.

4. And most important, the withdrawal of as large an amount of cerebrospinal fluid as possible daily, 4 to 5 days. The pressure should not be allowed to fall below 100 mm. water, to dilute and mitigate the attack of the poisons on the central nervous system especially the eye.

This treatment, of course, is to be used whether the eyesight is damaged or not.

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A CASE OF FRIEDLÄNDER'S PNEUMONIA*

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THE case of Friedländer's pneumonia which is here presented is considered to be of some general interest, not only because it is a typical example of a rather rare form of pneumonia but also on account of the fact that very favourable opportunities for bacteriological studies were presented. In this report the clinical and pathological findings are described, but chief consideration is given to the bacteriological aspects which are believed to be worthy of special attention.

The following are the details of the case:—

Mr. D. (Hosp. No. 6463/31), an adult, white, male, 42 years of age, was admitted to the service of Dr. C. A. Peters at the Montreal General Hospital on November 10th, 1931.

Complaints were cough with expectoration, pain over the right chest aggravated by deep breathing, chills, warm flushes and sweats, and generalized pains and stiffness. The illness was of three days' duration.

The *family history* was irrelevant.

Personal history.—He had had influenza in 1917. In 1928 he was admitted to hospital with an infected lacerated wound of the lower lip. During his stay in hospital he developed an attack of delirium tremens. In 1929 he was again admitted, suffering from lobar pneumonia involving the lower left lobe. Pneumococcus Type II was obtained from the sputum at that time. The temperature fell gradually by lysis and resolution of the consolidated area was slow, but resolution was apparently complete and there were no sequelæ. He had been subject to frequent "colds in head and chest."

Present illness.—The patient was well until three days before admission when, on rising in the morning, he "felt poorly", vomited, soon began to suffer from headache, and had chills, warm flushes and sweats, cough and expectoration. He attributed this to exposure to inclement weather two days previously. Since the onset of the illness he had remained in bed the greater part of the time. Expectoration had been profuse. There was generalized soreness and stiffness and a severe pain in the right chest which was aggravated by breathing. The exact time of onset of these latter symptoms could not be determined.

Physical examination.—The important findings on admission were as follows: The patient appeared extremely ill. There was frequent cough with expectoration. Cyanosis of the ears and lips was present. Temperature, 101.4°; pulse, 96 per minute; respirations, 32 to 44. Mild conjunctivitis was present. There was no herpes. The teeth were dirty, the tongue was dry and coated, and the pharynx reddened.

The chest was emphysematous. There were typical signs of consolidation over the upper part of the right chest down to the third interspace in front and the fifth rib behind. The right base presented only moist râles. A friction rub was present high up in the right axilla. The left lung was clear, except for occasional scattered moist râles.

The pulse was rapid, of fair volume; blood pressure, 108/64; possibly a slight displacement of the heart to the left. The abdomen presented moderate distention. There was slight tenderness and resistance to palpation in the right upper quadrant. The liver was thought to be slightly enlarged on palpation and percussion. The spleen seemed to be enlarged on percussion but could not be palpated.

Examination of the other systems revealed no abnormalities. The urine showed some albumin; the laboratory findings otherwise were negative.

Progress notes.—Cough and expectoration became more marked, the temperature ranged between 101.4° and 104.4° and, the day following admission, signs of consolidation appeared at the base of the left lung. The patient's condition became steadily worse and he died 38 hours after admission to the hospital, on the sixth day of the illness. Administration of Felton's concentrated antipneumococcus serum, Types I. and II., was commenced shortly after admission, and a total of 60,000 units of each type was given without appreciable effect on the course of the disease.

Post mortem.—(A-31-236.) Apart from the changes

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in the pleuræ, lungs and bronchi which are described in some detail, the abnormal findings were:—marked cyanosis of the face and finger-nail beds; bloody frothy material exuding from nostrils and mouth; a moderate degree of early atheroma of the aorta; a few small areas of sclerosis and lymphocytic infiltration in the left kidney and the usual changes seen in an acute toxæmia—cloudy swelling of the liver, kidneys and adrenals and large soft dark red congested spleen. There were no evidences of localized foci of acute infection in any part of the body except the respiratory tract.

Each pleural cavity contained about 300 c.c. of dark hæmorrhagic fluid. There were no adhesions on the left side. On the right side recent adhesions were present at the apex and anteriorly. The pleural surface of the upper lobe of the right lung presented a shaggy appearance. Elsewhere over the right lung and over the left lung the pleura appeared normal in the gross.

The right lung weighed 1,250 grm. The upper lobe was greyish-red in colour, uniformly firm and solid in consistency and non-crepitant. The cut surface exuded a large amount of mucinous greyish purulent material. The slimy slippery feel of this cut surface was a prominent feature. The middle and lower lobes showed congestive changes, more marked in the lower lobe, without evidence of true consolidation.

The left lung weighed 800 grm. Both lobes showed large patchy greyish areas of consolidation, with the intervening areas of lung congested but still only subcrepitant. These areas of consolidation presented the same characteristics as the diffusely consolidated upper lobe of the right lung. On both sides the bronchial passages showed acute inflammation of the lining membranes with bloody purulent material in the lumina.

Microscopic examination of sections taken from various portions of both lungs presented the following features. In all sections there was evidence of some degree of acute fibrino-purulent exudation over the pleura, most marked over the upper lobe of the right lung. Sections from consolidated areas showed marked vascular congestion and a very cellular exudate completely filling the lumina of the alveoli. This exudate consisted of approximately equal numbers of polymorphonuclear leucocytes and large mononuclear cells and varying amounts of fibrin and extravasated red blood cells. The proportion of fibrin and red blood cells in the exudate varied considerably in different alveoli. In some these elements were scarce, while in others they formed a very conspicuous portion of the alveolar contents. Sections from congested areas presented a picture differing from that in the consolidated areas, chiefly in the predominance of a coagulated serous material over cells and fibrin in the alveolar exudate. Anthracotic pigment was everywhere abundant.

Bacteriological studies.—The Friedländer's bacillus was obtained from three sources in this case—the sputum (ante mortem), the ante-mortem blood culture and the post-mortem blood culture.

The sputum, which was brought up by the patient in large amounts, consisted of dark red blood-stained fluid of watery consistency in which were suspended large masses of stringy mucoid yellowish material streaked with red blood. Direct smears of sputum, which had been washed in normal saline several times to remove adherent saliva, showed considerable amounts of stringy mucus, "pus cells" and large numbers of the organism which is to be described presently and was identified as the Friedländer's bacillus. Very few other organisms were to be seen in these direct smears and when washed sputum was plated upon solid media almost pure cultures of the Friedländer's bacillus were obtained. A white mouse, inoculated intraperitoneally with washed sputum, was very toxic 28 hours after inoculation and when killed at that time pure cultures of Friedländer's bacillus were obtained from the heart's blood and the peritoneal exudate.

Blood culture, taken 10 hours before death, yielded a pure culture of the Friedländer's bacillus. Since the organism grew only on the broths and not in the blood plates no estimation of the number of organisms per cubic centimetre of blood could be made.

Blood culture taken from the heart 10 hours *post mortem* also yielded a pure culture of the Friedländer's bacillus. The blood plates showed growth in this culture and it was estimated that there were from 30 to 40 colonies in plates containing about 0.25 c.c. of blood.

The organisms obtained from these three sources were identical and there was no evidence that they did not represent one and the same species of organism. The organism presented a bacillary form with considerable variation in length. Some forms were quite long, so as to leave no doubt that the organism was a bacillus, while others were coccoid in form. They invariably showed a Gram-negative staining reaction. No motility could be demonstrated. Capsular development was very marked, especially in the sputum of the patient, and in the heart's blood and peritoneal exudate of inoculated mice. There was a tendency for the capsules to become less marked in subcultures on artificial media. The capsule could be seen clearly in smears stained by Gram's method in which it formed a very thick, clear, faintly pink stained envelope with a sharp border (Fig. 1). Frequently two or three bacilli were enclosed in a common capsule. In smears stained by Muir's method the bacilli were red and the capsule blue.

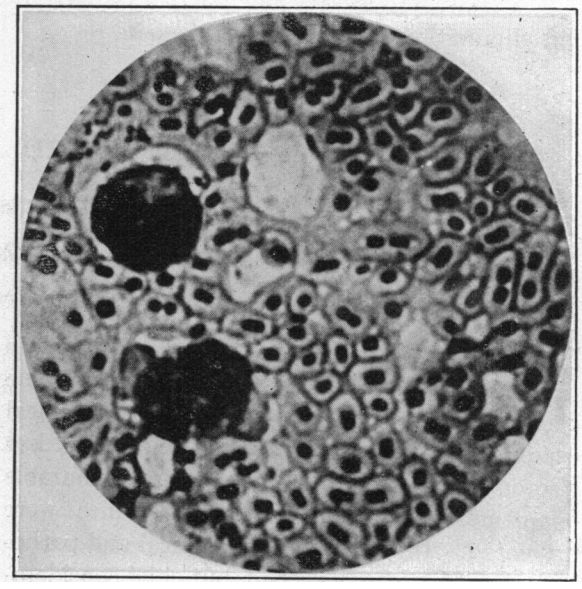

FIG. 1.—Photomicrograph of smear from peritoneal exudate of mouse which had been inoculated intraperitoneally with patient's sputum (x 2000 approx.) Note capsules.

At body temperature the organisms grew luxuriantly under aërobic conditions on the simpler laboratory media such as plain meat extract broth and plain agar, as well as on media enriched by the addition of blood. On solid media, plain agar, blood agar and potato, the colonies presented a colourless translucent glistening appearance and a mucoid viscid consistency, with a tendency for fusion of colonies to occur, producing an irregular confluent growth. On litmus milk very slight acidity with no coagulation was produced. There was no indol formation from Dunham's peptone solution. The fermentation reactions on sugar media were: dextrose—acid, no gas; saccharose—acid, no gas; lactose—no fermentation; maltose—slight acid, no gas; mannite—acid, no gas.

The bacterial suspension, obtained by washing out the peritoneal cavity of a mouse which had been inoculated with the sputum, was tested with Types I., II. and III. antipneumococcus sera. No precipitation or agglutination occurred. Intraperitoneal injection into a white mouse of 1 c.c. of a suspension of the pure culture of the organism of approximately the same turbidity as a 48-hour broth culture produced death of the mouse 8 hours after inoculation. The organism was present in pure culture in the peritoneal exudate and heart's blood of the mouse.

DISCUSSION

It is now generally accepted that the Friedländer's bacillus may either be the primary cause of a pneumonia or occur as a secondary invader in pneumonia due primarily to some other organism. In the case reported, no other possible causative organism was found in association with the Friedländer's bacillus, which was apparently the primary and sole etiological organism. On the basis of cases reported before 1915 Sisson and Thompson[1] stated that the Friedländer's bacillus appears to play a part in the causation of from 5 to 10 per cent of all pneumonias, including both those cases in which it is the primary etiological agent and those in which it is a secondary invader. In a recent paper Fremmel, Henrichsen and Sweary[2] gave this incidence as 1 to 8 per cent. In a series of 2,000 cases of lobar pneumonia reported by Cecil, Baldwin and Larsen[3] there were 9 cases (0.4 per cent) in which the Friedländer's bacillus alone was the cause and another 9 cases (0.45 per cent) in which it occurred in association with the pneumococcus—a total of less than 1 per cent. Clinically, the most striking features of Friedländer's pneumonia are the rapidity of its course and the almost invariably fatal termination. As a rule death occurs from two to five days after the onset of the illness. However, cases of pulmonary infection by the Friedländer's bacillus running a chronic course resembling pulmonary tuberculosis have been described and, as opposed to the usual high mortality, Zander[4] reported an epidemic of the disease in which the mortality was only 35 per cent.

On post-mortem examination, Friedländer's pneumonia may show either a "lobar" or "lobular" type of involvement of the lung. As a rule the initial process is lobular with a later confluence of the lobular areas producing a more or less diffuse involvement. In the case reported here, signs of consolidation were already present over the upper right lobe on admission and at post-mortem examination this lobe showed a diffuse "lobar" type of involvement. Signs of consolidation in the left chest did not appear until the day after admission and on this side, where the consolidation was therefore more recent, a patchy type of involvement was found at autopsy. It seems probable that the sequence of events in the right upper lobe was an initial patchy type of involvement with later confluence of the consolidated areas producing the diffuse "lobar" type of involvement. A striking pathological feature of the lung is the mucinous character of the exudate. This gives to the cut surface a moist sticky slimy feel. This cut surface yields a clear or bloody mucus on scraping. The more important microscopic features, which have been emphasized in numerous reports in the literature, are the presence within the alveoli of considerable numbers of large mononuclear cells as well as polymorphonuclear leucocytes and the scarcity of red cells and fibrin as compared with cases of pneumococcal pneumonia. In our case mononuclears were present in considerable numbers, although they did not constitute a very striking feature, and red cells and fibrin were quite abundant.

The bacillus of Friedländer, or the *B. mucosus capsulatus*, the etiological agent in Friedländer's pneumonia, is a member of the colon-typhoid group of bacteria and shares with the other members of this group the following characteristics—a bacillary form, a Gram-negative staining reaction, facultative aërobic qualities, and inability to form spores. The name "bacillus of Friedländer" refers to the fact that the organism was first described by Friedländer in 1882. This investigator, confused by the superficial resemblance between pneumococci and this bacillus, and in fact describing it as a micrococcus, believed it to be the common incitant of lobar pneumonia. It was not until several years later that the pneumococcus group and the bacillus of Friedländer were clearly differentiated, and it was recognized that the latter causes pneumonia only very rarely. The name *B. mucosus capsulatus* draws attention to the two most prominent and distinctive features of the organism, namely, the marked degree of capsular development and its power of producing large amounts of mucoid material in its growth both on artificial media and in the human body.

It is now recognized that organisms presenting the same characteristics as those of the Friedländer's bacillus isolated from the rare cases of Friedländer's pneumonia may be found in various situations in the human body. Such organisms may occur as apparently harmless saphrophytes or in association with a number of widely different disease processes. Thus these organisms have been found occasionally in the nose, throat and alimentary tract of apparently healthy individuals. They are frequently to be found in association with inflammation of the nasal sinuses, bronchitis and otitis media, apparently

as an etiological agent. They have been discovered in serous cavities, giving rise to pleurisy, pericarditis and peritonitis, as the case may be, and cases of septicæmia due to the Friedländer's bacillus have been reported. Claims have been made that this organism plays a part in the causation of rhinoscleroma and ozæna.

The diversity of the clinical pictures of the diseases in association with which this organism may occur is a striking feature. It may be associated with a condition such as an acute Friedländer's pneumonia of the type reported, in which the disease runs a rapid course with an early fatal termination. In contrast with this, it may be found in association with as chronic a condition as ozæna. It must be borne in mind, however, that an etiological relationship has not been definitely established between the Friedländer's bacillus and these more chronic conditions.

It is now appreciated that for the terms "Friedländer's bacillus" and "*B. mucosus capsulatus*", one might substitute the terms "the Friedländer group" and "the mucoid encapsulated group" of organisms and that there are a number of members of this group. However, differentiation of the members of this group one from another and even the group itself from other colon-typhoid organisms by agglutination tests, fermentation of sugars and other special methods has not been successful. Differentiation of the Friedländer group from other members of the colon-typhoid group still must be based upon the characteristics of marked mucus production and the high degree of capsular development presented by the Friedländer group. The differentiation of the various strains or species within the Friedländer group cannot be made as yet. The organism isolated in the case presented in this report was identified as a member of the Friedländer group, or mucoid encapsulated group, on this basis.

SUMMARY

A case of Friedländer's pneumonia is reported. The clinical, bacteriological and post-mortem findings are described and discussed. Special consideration is given to the bacteriological aspects of the case. The Friedländer's bacillus was isolated from the patient's sputum in almost pure culture and from the ante-mortem and post-mortem blood cultures in pure culture.

The author wishes to express his obligation to Dr. L. J. Rhea for his supervision of the work on which this paper is based, and to Dr. C. A. Peters for permission to make use of the clinical records in this case.

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THE EFFECT OF SMOKING ON BLOOD SUGAR.—Drs. E. and S. Thyselius-Lundberg, in a study of the effect of tobacco smoking on the blood sugar, have provided information of practical clinical importance on the action of nicotine in man. They observed the effects on healthy persons and diabetics produced by smoking two to four cigarettes; both smokers and non-smokers were tested. In all cases smoking caused a well-marked increase of the blood sugar, which, rising quickly immediately the smoking commenced, regained normal level after about half an hour. In most cases the blood sugar rose about 15 per cent above its initial value, but in one case there was a constant rise of 50 per cent. No change occurred with nicotine-free cigarettes. The reaction of diabetics to nicotine was greater than that of normal individuals, therefore they should smoke in moderation. These experiments also show that smoking may be a source of serious error in blood sugar estimations. Another point of interest is that here is a method for measuring the physiological action produced by moderate smoking in habitual smokers. The authors believe that the effect observed is caused by the stimulation of the suprarenals by nicotine, with the subsequent liberation of adrenaline.—*Brit. M. J.*, 1932, **1**: 392.

IMMEDIATE CÆCOSTOMY AND CONSTANT LAVAGE IN MERCURIC CHLORIDE POISONING.—In an analysis of 163 cases of mercury poisoning at the Mount Sinai Hospital of Cleveland, S. S. Berger, H. S. Applebaum and A. M. Young noted a number in which the patients survived the usual gastric and renal damage but succumbed to a gangrenous colitis. This lesion was apparently successfully prevented in three cases by constant colonic lavage following cæcostomy done within a few hours after the ingestion of the poison. The authors believe that immediate cæcostomy and constant colonic lavage is the most effective measure for the prevention and treatment of the gangrenous colitis. By immediate cæcostomy is meant its performance as soon as the patient is admitted, provided he is not in extreme shock. The diagnosis of mercury poisoning is first established by the detection of mercury in the gastric lavage by the electrolytic method of Booth and Schreiber, which can be done in a few minutes.—*J. Am. M. Ass.*, 1932, **98**: 700.