side air. The cabinet is designed for the application of differential atmospheric pressures, the differentiation being between the cutaneous and pulmonary circulations. Coincidently it may be advantageously employed in the administration of the various inhalations. It has no relation to, and is in no way comparable with altitude, but is properly classed with apparatus for the use of compressed and rarefied air. It differs, however, from all other apparatus of this class in that the differential pressure is applied to the systemic as well as the pulmonary circulation. As this differentiation is always negative, the effects upon vascular tension and blood flow are directly the opposite of those from compressed and rarefied air.

Physics.—The available variations of atmospheric pressure to which the patient may be subjected and under which respiration may take place are:

1. Diminished pressure on both cutaneous and pulmonary surfaces, the patient being in and breathing the rarefied air of the cabinet, called negative pressure.

2. Increased pressure on both surfaces, called positive pressure (rarely if ever used).

3. Barometric pressure on the pulmonary, with diminished pressure on the cutaneous surface, the patient being in rarefied air while breathing from without, called negative differentiation.

4. Barometric pressure on the pulmonary, with increased pressure on the cutaneous surface, called positive differentiation.

Respiration may be continuous under either of the above conditions or the differentiation may be shifted between inspiration and expiration, giving the following combinations:

COMBINATIONS.

Inspiration.	Combined with expiration.	Called.
Under No. 3.....	Under No. 1.....	Forced inspiration.
Under No. 3.....	Under No. 4.....	Forced respiration.
Under No. 2.....	Under No. 4.....	Forced expiration.
Under No. 4.....	Under No. 3.....	Obstructed respiration.

Clinical experience has shown that negative differentiation, and its combination with negative pressure in the form of forced inspiration, are the most effective and, essentially, the only desirable methods of application. The physical demonstration is, therefore, limited to these two motions.

Negative Differentiation.—In this motion respiration is carried on under a constant differential pressure, that upon the pulmonary circulation being barometric, and that upon the cutaneous and abdominal circulations being less by the amount of rarefaction in the cabinet. The mechanical effects are identical with those from compressed air aside from the circulation; but as they can be obtained in larger degree by forced inspiration with an increased instead of retarded circulation, this motion is never employed for the purpose of expanding and clearing the lung. Because the respiratory effort is shifted from inspiration to expiration, respiration under these conditions has been thought to be of benefit as a form of pulmonary gymnastics, and in developing the expiratory muscles. But the results are of little clinical value as it is the voluntary muscles which are increased, not the normal expiratory forces of pulmonary and thoracic elasticity.

The value of this form of pneumatic differentiation depends solely upon its action on the circulation. Respiration under negative differentiation results in:

1. Reduction of vascular tension in both the systemic and the pulmonary circulations.

2. Depletion of the pulmonary vessels with venous hyperæmia of the systemic circulation.

3. Slowing of the entire circulation, both systemic and pulmonary.

4. Mild anæmia of the cerebro-spinal vessels.

The manner in which these conditions are developed is obvious. While the barometric pressure of the respired air offers no increased resistance to the pulmonary circulation, and hence no impediment to right heart action, the lower pressure on the cutaneous surface becomes essentially a suction force influencing all the systemic circulation, save that of the brain and cord, which are protected by their bony envelope. As the result all the systemic vessels, and particularly the capillaries, are dilated, vascular tension is lowered, and for a moment the circulation is hastened as the blood is drawn from the lung. But with the continuance of the differentiation the contracting arteries gradually force a relative excess of blood into the veins, from whence it passes more slowly to the pulmonic vessels which are under the higher barometric pressure. The coincident slowing of circulation and pulmonary anæmia are such that a strong man can hardly breathe five minutes under a negative differentiation of one inch of mercury without marked dyspnœa. Clinically, therefore, this motion must be alternated with negative pressure, which increases the pulmonary circulation.

The pathic conditions to which negative differentiation is applicable are: (*a*) pulmonary hemorrhage. There is no measure at our command which so quickly arrests bronchial hemorrhages. It is an almost universal impression that pneumatic differentiation of necessity causes abnormal expansion of the lung, and is therefore dangerous in all cases of hemorrhage, or where there is softening of pulmonary tissue. Such is not the case, and negative differentiation may be applied with even less than normal expansion of the chest. It is, therefore, of value (*b*) in all forms of acute inflammatory hyperæmia of the lung or pleura. It affords immediate relief in (*c*) pulmonary congestion from any form of cardiac disease, except mitral obstruction, and is the proper motion with which to begin the treatment of any organic cardiac or arterial disease, with the above exception. In all of the above conditions after the acute processes have been relieved, negative differentiation should be supplemented or replaced by forced inspiration.

Forced Inspiration.—The effects of this motion are of two distinct forms, mechanical and circulatory. The pulmonary expansion, the opening and clearing of collapsed and plugged alveoli, and the stretching of pulmonary and pleuritic fibroses attained by means of the pneumatic cabinet do not differ in themselves from the corresponding effects of compressed air. The clinical results, however, are very greatly superior by reason of the coincident effect of the cabinet upon the attendant pathic processes through its control of the circulation. In this motion, during inspiration, which takes place under negative differentiation, the action upon the circulation is the same as with negative differentiation alone. It is greater in degree since a higher differentiation can be employed when the patient is to expire into rarefied air. With the decrease in cutaneous pressure the vessels are dilated and the blood is drawn from the lungs through the heart and arteries into the veins with a quickened flow and lowered tension. Before this action reaches the point of slowed circulation inspiration is ended and the differentiation instantly changed to negative pressure, under which, although the absolute pressure on the cutaneous and pulmonary circulations is the same, there is, nevertheless, a relative negative differentiation in favor of the pulmonary vessels due to their weaker anatomical protection and support. A pulmonary suction is thus developed which draws the blood from the hyperæmic veins into the depleted pulmonary vessels, again with quickened flow and under lowered tension. Thus during each respiratory cycle a double negative differentiation is developed alternately in favor of the systemic and the pulmonary circulations.

Continuance of this process results in increase of both circulations with all which that implies of increased absorption and improved nutrition, and this, too, under decreased vascular strain.

It is this power of the cabinet to hasten circulation and diminish arterial strain which distinguishes it from all

other forms of apparatus for the use of pneumatic differentiation, and which renders it the most potential measure for the relief of very varied conditions. All the mechanical effects of compressed air may be attained by forced inspiration, with the addition of improved tissue nutrition. This motion is valuable in all forms of inflammatory pulmonary disease after the acute stage. All pulmonary and pleuritic fibroses are loosened and absorbed much more quickly than by any other means. The effect of forced inspiration upon all forms of organic heart disease, with the exception noted under negative differentiation, is more immediate, satisfactory, and prolonged than that from any other method of treatment. Cardiac angina and dyspnœa are speedily relieved, often within a few minutes, and in young subjects this relief often becomes permanent after a few treatments. Cases of aortic regurgitation give especially brilliant results.

In all conditions producing high arterial tension also, this measure affords very marked relief, the extent and duration of which depend, of course, upon the nature and continuance of the primary cause. The treatment does not cure Bright's disease, but it does relieve and delay the secondary arterial and tissue changes.

Charles E. Quimby.

PNEUMOGASTRIC NERVE, RESPIRATORY FUNCTION OF. See *Respiration.*

PNEUMONIA, BRONCHIAL.—(Synonyms: Bronchopneumonia, catarrhal pneumonia, lobular pneumonia, capillary bronchitis, etc.) The name bronchopneumonia is growing in favor, especially in this country, and is preferable. The condition is marked by the presence of bronchitis with areas of pneumonia. The latter are as a rule peribronchial, being confined to the immediate vicinity of the small bronchi, the bronchioles and their atria, the cells adjacent to which are filled with exudate.

Etiology.—The disease is most common in the extremes of life, that is, in the aged and in children under five years old. Of the cases occurring in children, about one-third are primary, the others being secondary most often to the diseases of childhood. Of these, measles is most frequently complicated by bronchopneumonia, and after this come pertussis, diphtheria, scarlet fever, influenza, and chickenpox. It will be noticed that these are diseases in which bronchitis is regularly present, or in which the upper air passages are involved in the morbid process. In older children and adults the disease may occur as a complication of any long-continued, severe illness, especially in those cases in which the mucous membrane of the mouth and pharynx becomes foul and the laryngeal reflexes are less effective than normally.

The predisposing causes in primary cases are old age or infancy, bad hygienic surroundings, the impure air of overcrowded, poorly ventilated rooms, bad feeding, and institutional life. We must also include among the predisposing causes the frequent presence of the diplococcus pneumoniæ and other pathogenic micro-organisms in the healthy air passages.

The exciting causes are sometimes difficult to discover. Exposure to cold and wet is one cause, and this accounts for the greater frequency of the disease in the cold months. The predisposing causes of secondary bronchopneumonia are the same as those of the primary form of the disease, plus dorsal decubitus and the weakened condition due to the original disease. The exciting causes are again hard to determine. Exposure is one, but there is a something in addition which favors the growth and multiplication of the micro-organisms usually present, even in health. In cases of deglutition-pneumonia the exciting cause is manifest.

The development of bronchopneumonia in old people is favored by the diminished powers of resistance and the less perfect expectoration.

Bacteriology.—In studying the flora of bronchopneumonia we have again to distinguish between primary and secondary cases. The micro-organisms most commonly found are the diplococcus pneumoniæ, streptococcus, staphylococcus aureus and albus, Friedländer's bacillus, and Loeffler's bacillus.

In nearly all of the primary cases the diplococcus pneumoniæ is present, and in about half of these it exists alone. When not alone, it is most often associated with the streptococcus and much less frequently with the staphylococcus and the other organisms just mentioned. Infrequently the streptococcus is found alone.

In secondary cases it is the rule to find a mixed infection. The diplococcus pneumoniæ appears in about seventy-five per cent. of the cases, but seems less potent in giving character to the disease than the streptococcus. The diplococcus pneumoniæ, the streptococcus, the staphylococcus, and Friedländer's bacillus may each be present alone, unassociated with other bacteria, but in the case of Friedländer's bacillus, at least, this happens only rarely. Although, generally speaking, the streptococcus plays the most important part in bronchopneumonia complicating measles, it is precisely in this form that the diplococcus pneumoniæ is more often found in pure culture than in other secondary cases.

Holt reports six tuberculous cases which were studied by Wollstein, and in all of which the diplococcus pneumoniæ was also found; indeed, this organism gave the character to the disease in these cases, as clinically they were indistinguishable from those of an ordinary bronchopneumonia, the post-mortem examination alone revealing their tuberculous nature.

Bronchopneumonia has in rare instances been found to be due to forms of streptothrix, and French investigators have reported the finding of the colon bacillus.

In deglutition-pneumonia the streptococcus and staphylococcus are most commonly found, and then, as a rule, in virulent form.

Pathological Anatomy.—In about eighty per cent. of the cases coming to autopsy, lesions have been found in both lungs. These lesions consist essentially of those of bronchitis and of pneumonia.

When the chest is opened the pleural cavities are seen usually to contain little or no excess of fluid. The parietal and pulmonary pleural surfaces may be normal or the seat of a fibrinous pleurisy. The lesions of the latter consist of patches of fibrin which vary considerably both in extent and in character. At times they are almost invisible lustreless spots, and then again they may be quite large and thick (as much as half a centimetre thick) and more or less discolored. Such patches correspond closely to areas of superficial pulmonary consolidation.

The lungs do not collapse as completely as they normally should, though crepitation is found quite generally when the lungs are handled in the search for nodules of consolidation. The latter are most often found in the lower lobes posteriorly. There may be found collapsed areas, bluish or bluish-brown in color, set in a lighter background. These are areas of simple atelectasis, and will yield to gentle inflation through a tube inserted in a bronchus. The bronchial nodes are invariably congested and enlarged. The heart—the right side more commonly—may be dilated.

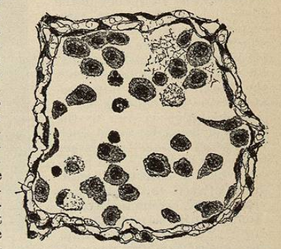


Fig. 3826.—Bronchopneumonia. Exudate in an air cell, consisting of exfoliated epithelium, a few pus cells, and a little fibrin. (From Delafield and Prudden.)

On section, the pneumonic areas stand out a little, are of a dark mahogany color, or more or less marbled with gray, smooth or finely granular, and moderately wet; only a small amount of dark blood escapes from the

vessels. Such areas vary greatly in size, and may be close together or widely separated. Near the centre of each a bronchus is seen, white or gray, because of the exudate which it contains. The unconsolidated lung tissue may

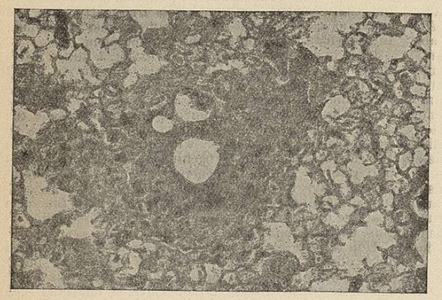


FIG. 3827.—Bronchopneumonia in a Child, Showing Single Lobular Pneumonic Area, with Bronchus in its Centre. The thickened wall of the latter merges into the surrounding zone of pneumonia. Near the corners the accompanying emphysema is shown. (From Delafield and Prudden.)

be normal, but more often it is congested and œdematous, particularly behind. An emphysema, usually vesicular, is often present, being most pronounced anteriorly. Upon section of the areas of atelectasis, dark fluid blood escapes; the cut surface is seen to be smooth, with occasional lobules projecting above it. Creamy pus can be pressed from the smallest bronchi: portions carefully removed are found to contain no air and they sink in water.

With the aid of the microscope we see that the exudate within the bronchi of the consolidated areas is composed of leucocytes, mucus, desquamated epithelium in various stages of disintegration, a few red blood cells, and the micro-organisms responsible for the condition. The walls of the bronchioles and bronchi are swollen and infiltrated with new small round cells with more or less indistinct contours and having large nuclei. (See Plate XLIX.)

Northrup mentions a mechanical dilatation of the smaller bronchi. These dilatations, which are for the most part fusiform in shape, are found with especial frequency in the lower lobes. They are associated, according to this authority, with three conditions: (1) Weakened bronchial walls; (2) abundant secretion within the bronchi; and (3) impermeable tissue surrounding them. The dilatation is due to the secretion being forced by each inspiratory impulse from larger to smaller bronchi. The process, which is observed in children between three and five years of age, occurs more often after the fifth day of the disease. The dilatations disappear entirely on the recovery of the patient.

As the walls of the bronchioles are swollen and infiltrated with new cells, so also are those of the atria and of the air sacs, including the partitions between the air cells. The capillaries are engorged with blood and small hemorrhages may be noted here and there. The air cells, air sacs, and atria are filled with leucocytes, swollen desquamated epithelium, occasionally a few red blood cells, and sometimes also a little fibrin.

In deglutition- or aspiration-bronchopneumonia the process is more intense, the infiltration with leucocytes often resulting in suppuration and gangrene.

In the areas of atelectasis the bronchi are seen to be filled with pus and swollen and detached epithelia, and the walls of the bronchioles are infiltrated; the air cells and sacs are partially collapsed, the diminished lumen being filled with swollen and proliferating epithelia and pus cells. The blood-vessels are tortuous and gorged with blood. Here and there are hepatized lobules. In some cases the emphysema is very marked (see Fig. 3828).

The bronchial lymph nodes may or may not show a cellular infiltration. They are always congested.

SYMPTOMS.—The symptoms may be most obscure, even misleading, making it almost impossible, for a period of several days, to reach a correct diagnosis.

Prodromal Symptoms.—In primary cases, as in acute bronchitis, the early signs are a general malaise with more or less anorexia, slight elevation of temperature, acceleration of pulse and respiration, and cough, dry or with mucous expectoration in patients old enough to perform that important act. The invasion may resemble that of lobar pneumonia, being marked by a chill or convulsion and by rapid rise of temperature to 103° or 104° F. or over; or the invasion may present no characteristic features, the symptoms resembling those of typhoid fever or meningitis. In the cerebral cases there may be repeated convulsions, apathy, photophobia, retraction of the head with rigidity of the neck, and an absence of physical signs of consolidation.

In *secondary* cases, the prodromal symptoms and the invasion are masked by the symptoms of the primary disease. The invasion is gradual, seldom marked by a chill or convulsion, the child becomes restless, the temperature rises, and the pulse-respiration ratio diminishes. If there was a cough before, it becomes worse, or one develops if there was none previously. If there is any expectoration it is muco-purulent in character. An early symptom may be the cough,—painful, frequent, and hacking,—and it often continues after resolution has taken place.

The temperature varies according to the extent of the

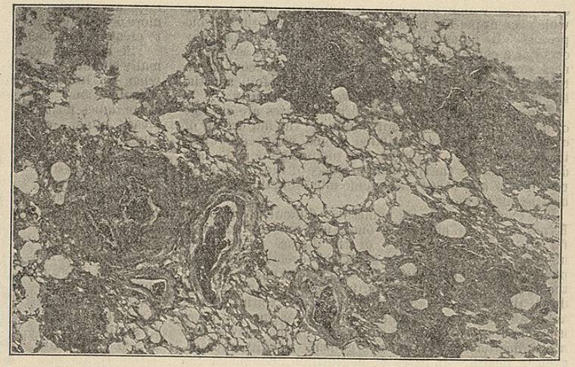
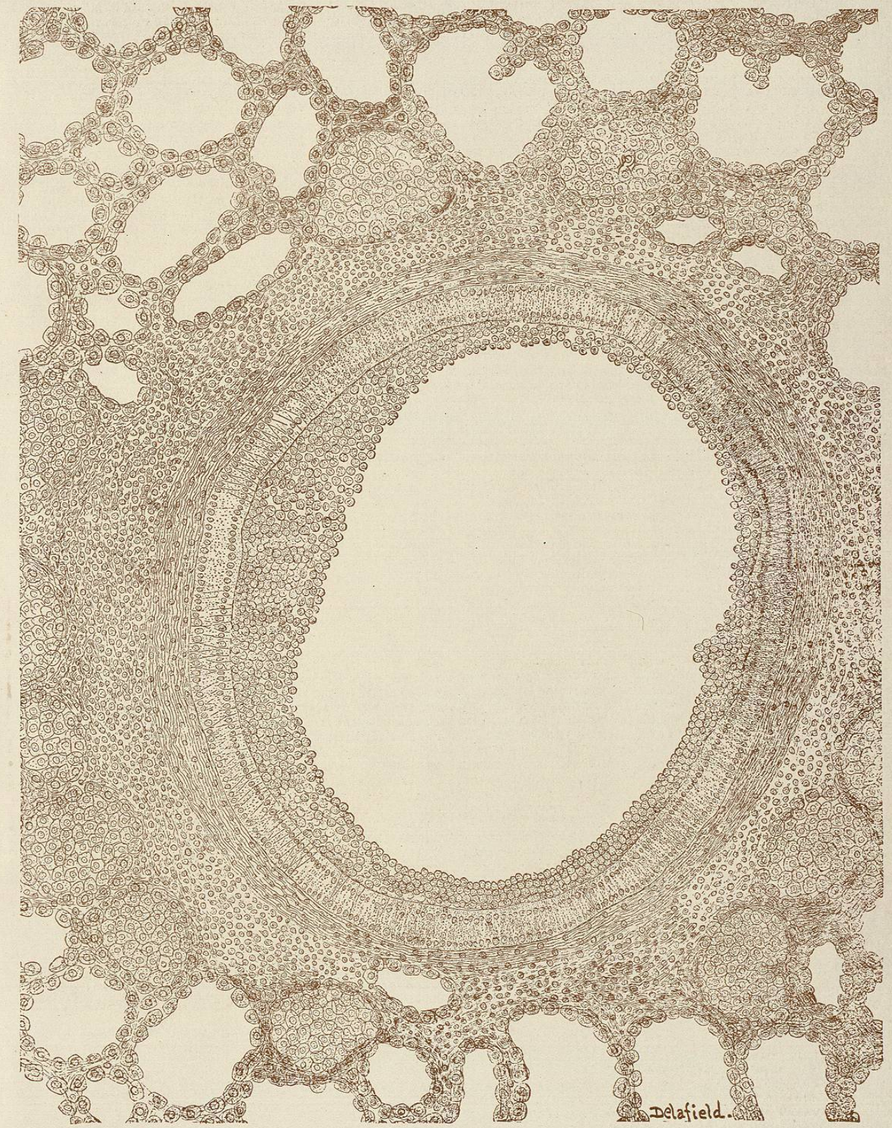


FIG. 3828.—Bronchopneumonia in an Adult, Showing Several Areas of Consolidation, with the Central Bronchus Filled with Exudate. Marked emphysema may also be seen in parts of the section. (From Delafield and Prudden.)



ACUTE BRONCHO-PNEUMONIA

(COPIED, BY PERMISSION, FROM DELAFIELD'S STUDIES IN PATHOLOGICAL ANATOMY.)

lesions, the virulence of the infection, and the general condition of the patient; apparently also it is influenced by the variety of micro-organism present. It may rise slowly or very suddenly, as a rule to 103° or 104° F., and it averages moderately high, with sharp elevations, most often in the afternoon, but at times in the early morning. The variations in the temperature curve gradually become less and less; in favorable cases the general trend is downward, restoration to the normal being by lysis. In unfavorable cases the trend of the curve is constantly upward, the temperature sometimes going as high as 107° F. The temperature may be of a high, continued type, this usually portending a fatal issue. On the other hand, in greatly debilitated subjects the temperature may rise little if at all above 100° F. The usual termination of such cases also is death.

Pain is not a constant symptom, and as a rule it occasions little trouble.

Cyanosis is quite common, but there is little or no dyspnœa. When it is caused by atelectasis the temperature remains unaffected or falls a little. The skin is often cold and clammy. These symptoms disappear upon the removal of the cause of the atelectasis, and the patient is then about as well as before the attack. If the cyanosis persists for more than a day or two, however, the result is a fatal one.

In well-marked cases, the respiratory rhythm is changed. Instead of the inspiratory murmur being nearly continuous with the expiratory, the pause which in health was after expiration and before inspiration, is now transferred and is after inspiration and before expiration. The child quickly draws its breath, holds it, then with an explosive grunting sound expires and without pause inspires. The expiration is prolonged and loud. There may be Cheyne-Stokes respiration.

Gastro-enteric symptoms, such as loose green stools without vomiting, are frequent in infancy. The urine may become scanty, high colored, and with a trace of albumin, but casts are rare.

In cases ending in recovery amelioration of all symptoms may occur at any time from the fourth day to the third or fourth week. In mild cases it is looked for from the fourth to the eighth day.

Resolution takes from seven to fourteen days in favorable cases. Relapses are common.

Physical Signs.—It may be that for days no signs at all can be discovered within the chest, and it frequently happens that no signs of consolidation are found at any time during the course of the disease. In primary cases the first signs are due to congestion and bronchitis; they are either localized in one or more areas, or are generally distributed. The results of percussion may be negative, or there may be slight dulness. On auscultation we detect feeble breathing, which later has a higher pitch over the affected areas, and is associated with fine sibilant and coarse sonorous râles of the same or of wider distribution. These râles may disappear when the patient coughs. A little later, very fine moist râles are heard, as a rule, only over one or more areas, usually in the lower lobes behind. The vocal fremitus is unaltered. In such cases the pneumonic areas are deeply seated, small, and scattered.

The signs of consolidation, when present, vary according to the degree of consolidation, the area involved, and its proximity to the chest wall. In well-marked cases percussion reveals the existence of dulness in varying degree, associated at times with a sense of resistance. The vocal fremitus is increased only over areas of fairly complete consolidation. Auscultation reveals the presence of the râles above mentioned, only they are more marked and apparently closer to the examining ear; the breathing is bronchovesicular or diminished; the voice sounds approach the bronchial in character. In the cases in which there is a considerable area of complete consolidation, the signs more nearly approach those of lobar pneumonia, a disease which occurs in young children more often than was formerly believed. The dulness and vocal fremitus, however, are less than one would expect to find with voice and breathing of such a bronchial character. The signs of bronchitis are rarely general, and are most numerous in and near the edges of the consolidated areas. Friction sounds are infrequently present, usually only in cases of complete consolidation extending to the pleura.

It may be necessary to make the patient cough in order to develop the sounds of bronchitis, or crying may bring out, in an area of diminished voice and breathing, a marked bronchial quality. In extreme cases the breathing becomes shallow and very rapid, 80 or more to the minute, with retraction of the xiphoid and ribs and playing of the alæ nasi. The right ventricle of the heart may be found increased in size.

When resolution begins the signs of consolidation, which were the last to come, are the first to go. They may disappear very rapidly or they may persist for days or weeks. The signs of bronchitis subside less rapidly, often being found as late as from two to four weeks after resolution has begun. The blood count, as a rule, reveals a decided leucocytosis; in influenza pneumonia, however, it is only in exceptional cases high.

Complications.—We rarely find any pleurisy, except when there is marked pulmonary consolidation that reaches to the pleura. The simple fibrinous pleurisy is the most common.

The possibility of empyema must always be borne in mind. Abscess of the lung complicating bronchopneumonia is found in about seven per cent. of the cases that come to autopsy; these abscesses are usually minute and multiple, and not clinically discoverable. Gangrene is less frequent. Tuberculosis may complicate any bronchopneumonia, and in fatal cases cannot be diagnosed before death.

As in lobar pneumonia, so in bronchopneumonia, a purulent meningitis may occur, and may mask the symptoms of the primary disease.

Pericarditis is found at times, almost always in cases in which there is marked consolidation in the left lung. The rarity of endocarditis makes it hardly worth mentioning.

It is common to find functional derangement of the gastro-intestinal tract, as shown by vomiting and diarrhœa, which are serious, not in themselves, but in that they reduce the patient's chances of recovery in the other fight.

Nephritis is not a common complication, and when it does occur it is usually of an acute exudative type and does not much affect the course of the original disease.

Diagnosis.—The diagnosis of primary bronchopneumonia from lobar pneumonia is at times very difficult. It must be made on the age, history, and mode of invasion, on the character of the temperature, on the sputum (when there is any), and on the physical signs; the latter alone furnish positive evidence.

The diagnosis from pleurisy with effusion or from empyema must be settled by an exploratory puncture, several dry taps with a large-calibre needle being necessary to establish the absence of fluid.

As an aid to diagnosis in uncertain cases, in children two years of age or under, Northrup gives the three following points:

1. The pulse-respiration ratio tends to depart from the normal, which is as four is to one, and approximates or exceeds three to one. For instance, instead of being 80 to 20, it approximates the ratio of 120 to 40.

2. Fever; persistent elevated temperature, whether remittent, intermittent, or uniform.

3. Râles; subcrepitant and crepitant over a circumscribed area or areas, and especially if these râles are found on one side only.

Malaria is excluded by the absence of malarial organisms, by normal spleen, and by no history of exposure in malarious regions; the presence of leucocytosis also argues against malaria.

Treatment.—No treatment directly influences the pneumonic process. Much, however, can be done to prevent the development of the disease and to help

the patient pass safely through it, when once it is established.

I would outline the treatment under the following heads: (1) Prophylaxis. (2) General management of the disease. (3) Diet and feeding. (4) Special treatment: (*a*) by drugs; (*b*) by serum therapy. (5) Symptomatic treatment: (*a*) to relieve pain; (*b*) to lower the temperature and moderate the nervous symptoms; (*c*) to stimulate the heart, in order to prevent cardiac failure or to overcome it if present; (*d*) to stimulate respiration.

Prophylactic treatment is very important. Care must be taken to see that children are sufficiently clothed yet not overclothed; that they are much out of doors, and that while indoors they are in well-ventilated rooms, with a temperature not over 68° or 70° F. during the day and a few degrees lower at night. Children ill with any diseases, particularly those that are most likely to be complicated by bronchopneumonia, should be turned often in bed, now on one side, then on the other, now on the back and then on the abdomen. Bronchitis in an infant should be most carefully treated, as such cases, especially if neglected, are very prone to develop bronchopneumonia. In all cases the mouth should be carefully washed at least once daily, preferably with some alkaline antiseptic solution; and antiseptic nasal sprays are advisable as preventive measures.

General Treatment.—Infants are better for being much held in the nurse's arms; older patients are to be put to bed at once and the bowels moved by calomel, in doses of one-tenth of a grain every half-hour or every hour for ten doses, or until the desired effect is obtained. The sick-room should be large, light, and well-aired; there should be a steady renewal of the supply of fresh air, and—if it is deemed advisable—additional moisture should be imparted to it. A change of rooms several times in the twenty-four hours is the best arrangement, provided all of the windows of the one which the patient leaves be opened wide so that it may be in the best condition upon his return. An open fireplace is an excellent ventilator. When the patient's temperature is high the temperature of the room may be at from 65° to 68° F.; when the patient's temperature is normal, the room temperature should be 70° F. The chest had better be protected by an oiled-silk jacket throughout the attack, and the skin of the chest may advantageously be kept red by some light application of mustard. Thick hot poultices should not be used.

It is well to establish a more or less strict isolation, and to disinfect the patient's rooms and their contents before they are used by another person. Especially should this be done in secondary cases.

Great care should be exercised in the management of the diet, as the turning of the tide one way or the other often depends upon it. Plenty of cool water, not iced, should be at hand, and the patient should be encouraged to drink it.

Special Treatment.—Drugs can often be given to advantage by inhalation. The child should be placed under a tent and some kind of a vaporizer employed. A variety of drugs may be added to the water or it may be used by itself. The addition of creosote gives particularly good results. Turpentine, compound tincture of benzoin, and terebene may also do good service when exhibited in this way. The inhalations should be given for from eight to fifteen minutes at a time, every two to six hours. The cough is often greatly relieved by such inhalations. The administration of drugs which, it is believed, can make the blood a less favorable medium for bacterial life, is not to be considered in the case of infants and young children.

For accomplishing this purpose we must look to the better preparation and use of serum therapy, which is now only in its incipiency.

Symptomatic Treatment.—Pain severe enough to demand the administration of some form of opium is unusual. When such a condition does exist, small doses of Dover's powder are quite efficient. Ordinary temperatures, say those under 104° F. rectal, do not in themselves call for special treatment. However, it may be advisable to apply cold, when this degree of temperature is reached, in order to control the nervous symptoms, such as sleeplessness, restlessness, or delirium. In some cases Holt gives for this purpose one grain of phenacetin every two hours to an infant of six months.

The cold is best applied by cool or tepid sponging, or by packs. The spongings are to be frequently repeated until the symptoms for which they are given are controlled. Both cardiac and respiratory stimulants may be needed. Of the first class we will mention alcohol in the form of brandy or whiskey, strychnine, nitroglycerin, and caffeine. None of these is to be administered as a routine treatment. As a matter of fact, however, very many, indeed nearly all, patients with secondary bronchopneumonia need cardiac stimulation, the chief indication for such being a weak, rapid, irregular pulse. The physician should determine how much alcohol it is desirable to give in the twenty-four hours and have it administered in small divided doses, well diluted with at least from six to eight times its bulk of water. A child one year old may need only half an ounce of brandy during the day, or he may need as much as two ounces. The dose, whatever it is, should be reduced as soon as possible, and the alcohol should not be continued for too long a time. Nitroglycerin may be used to help the heart over a particularly hard strain. To a child of the age mentioned above, gr. $\frac{1}{100}$–$\frac{1}{100}$ can be given every hour for several doses, say five or six. Strychnine is not to be given so frequently as alcohol or nitroglycerin. To a child of the age mentioned gr. $\frac{1}{100}$ to gr. $\frac{1}{100}$ of strychnine may be given every three or four hours. It is often best to use two of these drugs, giving them alternately. The effect of caffeine is less certain and the drug is not so much used as the others for its effects upon the heart; as a respiratory stimulant it is better.

The seat of the disease being in the lungs, it is very natural that respiratory stimulants should be called for. Strychnine helps here just as it does in cases of cardiac failure, and in addition to it we can use atropine, caffeine, and oxygen, all of which may be necessary in cases of respiratory failure. We should not wait until the patient is *in extremis* before giving oxygen; when administered it should be considerably diluted with air.

After an attack of bronchopneumonia general tonics are indicated, and it is especially advisable for the patient to have a change of air, preferably to a warm, dry climate, where he should remain for several weeks.

Prognosis.—This must always be guarded, for bronchopneumonia is a dangerous disease. The mortality of all cases, considered together, is between sixty and seventy per cent.

The mortality of primary cases varies greatly, viz., from ten to fifty per cent., depending upon the previous condition of the patient, upon the virulence of the infection, and upon whether the child is an inmate of an institution or not. In private practice the maximum mortality is about thirty per cent.

In secondary institutional cases the mortality of infants under one year of age is appalling. In certain diseases it reaches and stays at one hundred per cent. for months at a time.

The prognosis depends upon the child's age, surroundings, and previous condition, and upon the nature of the infection. Rachitic children developing bronchopneumonia are almost sure to succumb. Bronchopneumonia is most fatal when associated with pertussis, next with measles, and then with diphtheria. This order, however, is a matter about which statistics differ.

Holt says the shortest cases are the most fatal; that the only termination under ninety-six hours is a fatal one, and he says further that, in cases of over two weeks' duration, the prognosis grows worse with each day of continued temperature.

Patients having a low temperature, little or not at all above 100° F., are usually in a condition of low vitality, and consequently about seventy-five per cent. of them die. The mortality of cases in which the temperature

reaches 106° F. or over is about eighty-five per cent. The most favorable prognosis is in cases with a fairly even temperature curve, one that does not run to either extreme, and does not vary much one way or the other from 103° or 104° F., during the period of activity of the infection.

A steeple chart with great rises and correspondingly great drops of temperature, simulating a pus temperature, usually indicates a mixed or a streptococcus infection, and the prognosis is worse than in the cases with a more even curve.

A convulsion or two at the onset of bronchopneumonia does not affect the prognosis unfavorably, but when convulsions come later in the course of the disease they do affect it, and that decidedly for the worse.

Bronchopneumonia may terminate in resolution, suppuration, gangrene, chronic bronchopneumonia, or death.

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PNEUMONIA, CHRONIC.

—(Synonyms: Interstitial Cirrhosis of the Lungs, Chronic Interstitial Pneumonia, Pulmonary Fibrosis, Fibroid Phthisis.)

Chronic pneumonia is not an independent morbid entity, but occurs as a sequel of one or more previous or coexisting pathological conditions of the lungs or pleura. It is a chronic productive inflammation which may occur wherever connective tissue is found. It is encountered in two chief forms, circumscribed and diffuse. The circumscribed form is associated with tuberculosis, gummata, tumors, infarctions, hemorrhages, abscesses, and every morbid growth, and really is the attempt of the part to wall off the pathological condition.

The diffuse variety is secondary to incompletely resolved lobar pneumonia or to acute or subacute bronchopneumonia and chronic bronchitis, spreading mostly from the bronchial walls. It may also be a result of pleurisy, and is then called by Charcot pleurogenous.

Interstitial pneumonia may invade the lung in great bands, which develop in the normal septa. A potent cause of interstitial pneumonia is the inhalation, for a considerable length of time, of dust, as necessitated by certain occupations; for example, coal-mining, stone-cutting, and some kinds of work in iron. Zenker calls this form pneumonokoniosis.

In general arteriosclerosis inflammation of the connective tissue of the arterial walls extends to that of the lung itself and results in a diffuse interstitial pneumonia.

Chronic pneumonia is, as a rule, unilateral, but in pneumonokoniosis it is always bilateral. The circumscribed variety is, as a matter of course, distributed according to the distribution of the lesions with which it is associated. When these lesions are close to the pleura this membrane becomes involved, its two layers being thickened and adherent. The zones of new connective tissue about the original lesion contain blood-vessels at first, but later these become more or less obliterated, although there is not the same tendency to death of tissue as is found in tuberculous lesions. About these zones there is usually present a certain amount of emphysema.

In well-marked cases of the diffuse variety more or less of the pleura is adherent and greatly thickened, and the affected lung is smaller than normal and cannot be separated from the chest wall without tearing. The lung feels firm and leathery. The heart may be drawn to the affected side, and its right half may be hypertrophied.

On section the pleura is seen to be tough, fibrous, and of a grayish color. There is often a creaking sound as the lung is cut. The cut surface is firm, shiny, and of a dull red or bluish color or marbled. Much pigment is often present throughout the lung tissue and in the bronchial nodes. The walls of the small bronchi are increased in thickness and in many places dilated. Some of the dilatations are large and often contain varying amounts of pus. The microscope shows the new tissue to be connective tissue of the small-celled variety; most of the cells are round, but some are fusiform. There are at first blood-vessels in this new tissue, but they tend to disappear later; there is, however, as before mentioned, but little tendency to tissue necrosis. The walls of the atria, air sacs, and air cells are infiltrated with the new connective-tissue cells, and the air cells may contain organized exudate.

In the unilateral cases the unaffected lung is enlarged because of the compensatory emphysema present.

Symptoms.—In looking for the symptoms of chronic pneumonia we first get a history of one or more of the diseases which it follows, especially chronic bronchitis or protracted bronchopneumonia. In the early stages the patient may feel fairly well, complaining only of cough with sero- or muco-purulent expectoration. The cough is worse in the morning, and is paroxysmal when there is an accumulation of secretion in the lower lobes. As the process advances there is dyspnœa on exertion. Lying on the unaffected side may cause dyspnœa, as it restricts the action of the functioning lung; consequently patients with unilateral chronic pneumonia lie on the affected side. With the onset of ulceration a new order of symptoms is noted, all of them being worse during the winter season. The sputum changes its character and becomes a thin muco-purulent fluid, of a gray or black color and is often fetid. On standing it separates into layers; the lowest contains solid particles and is yellowish in color; the next above is a greenish fluid; and the top layer is thin and frothy and contains mucus and fat. Cavities are formed, allowing of accumulations of pus, and these in some instances are emptied by change of position. Fever, of a hectic type, and night sweats may be looked for early, and small, frequent hæmoptyses are common occurrences. With the conditions present giving such symptoms, it is no wonder that the patient's general condition becomes rapidly worse. The whole aspect of the case is that of chronic pulmonary tuberculosis, excepting that no tubercle bacilli can be found.

There is no elevation of temperature except during exacerbations of the bronchitis and after ulceration has begun, as noted above. Pain is by no means a constant symptom. It is present only when the pleura is involved, and then the diminution of respiratory movement on that side usually keeps it from being very severe.

For months we may be able to discover only the physical signs of previous or coexisting disease. Gradually there develop signs due to diminution of aërating surface, thickening of pleura, contraction of the new tissue giving lessened or absent respiratory movement, deformity of the chest, spinal curvature, and displacement of the heart. The cardiac pulsations are sometimes abnormally visible. The dilatations of the bronchi, with or without contained fluid, also give rise to special symptoms. In unilateral cases the unaffected side is increased in size, has increased respiratory movements, and shows the signs of compensatory emphysema.

Treatment.—In the management of these cases prophylaxis is of the utmost importance. All patients with persistent bronchitis, or with protracted or unresolved pneumonias, and those who have had several attacks of bronchopneumonia, should receive the very best tonic treatment with respiratory exercises; and above all, they should find the climate in which they do best and should, if possible, live there. When the trouble is due to the occupation, this must be abandoned. No treatment directly affects chronic pneumonia when once it is estab-