

and when the atelectatic condition happens to many lobules. The bronchial glands frequently participate in the inflammation, become hyperæmic, swollen, and filled with secretion, or the gland elements undergo hyperplasia and ultimately the cheesy transformation.

Symptoms.—There may be catarrh of the upper air-passages, and at the same time there is experienced a raw and sore sensation under the sternum, and a dry, harsh, and rather ringing cough, which awakens pain, and has often a suppressed character because of the pain. At first the cough is dry, corresponding to the dry stage of the mucous inflammation, and is most troublesome in the evening. There are also much muscular soreness and a sense of fatigue, but no other symptoms of illness. In other cases there may be some feverishness, headache, and anorexia. The cough, which was dry, now brings up some mucus, at first only after repeated coughing, but in a short time easily and abundantly, and the expectoration at last has an entirely purulent character, and comes up in globular masses. The fever now disappears, the pain and soreness cease, the cough is easy and less frequent, the appetite is restored, and the return to health is completed in a few days. Such is the course of a simple acute bronchitis (a cold on the chest), which terminates in recovery in about sixteen days. In such a case the changes in the mucous membrane, we may suppose, consist in hyperæmia and swelling, with increased secretion of the glands and more or less destruction of the epithelium. The more severe cases of bronchitis come on with muscular soreness, headache, chilliness, and fever. There is not a single violent chill marking the onset of the disease, but a succession of chills in which there is merely some chilliness felt several times during the course of the day, and having no influence on the fever, which has an exacerbation in the evening and a remission in the morning, or a complete intermission. Sometimes the febrile movement exists without there being any other symptoms for several days, but the more usual onset is the simultaneous appearance of chest symptoms. There is a sensation of heat and stuffing under the sternum; cough, which is accompanied by soreness within the chest, now comes on, and it is dry, harsh, ringing. The frequency and force of the coughing make the diaphragm and chest-muscles sore, and now and then the stomach is emptied in a violent paroxysm. In a few days—usually from three to five—the dryness of the mucous membrane ceases, and abundant secretion of mucus now takes place, and there is brought up frothy mucus, which day by day assumes more of a purulent character. The fever now declines somewhat, but frequently a gastro-intestinal catarrh is lighted up and diarrhœa supervenes. This is apt to be the case with children, in whom the nausea, vomiting, and diarrhœa assume an important position. The coincident development of bronchial and gastro-intestinal catarrh produces a complexus of symptoms to which the term *catarrhal fever* has been applied. In bronchitis the sonority of the chest is not altered from the normal.

During the dry stage the swelling of the mucous membrane narrows somewhat the lumen of the bronchial tubes, but there is no secretion to produce a new sound. The passage of air through narrowed tubes modifies the vibrations, and hence the terms sibilant and sonorous *râles*, audible at this stage, both with inspiration and expiration. When secretion of mucus, muco-pus, and pus succeeds to the dryness, the *râles* are said to be *moist*. Those are *sub-crepitant* which are produced in the smaller tubes, and *mucous* and *sub-mucous* formed in the larger tubes. The largest sounds, or *gurgling*, are produced only in cavities, or that which is equivalent, dilated bronchi. The sub-crepitant is more distinct in inspiration, but all of these *râles* are audible both in inspiration and expiration. Moist sounds are modified by coughing and expectoration—may, indeed, be caused to disappear by them.

The usual termination of these cases of bronchitis is in resolution. The fever ceases, the tongue cleans, the appetite improves, the cough subsides, the expectoration is copious, easy, and purulent, but the amount declines rapidly. Certain types of subjects manifest a great susceptibility to attacks of bronchial catarrh, and the effects do not cease. This is the case in the dyscrasias, and when the catarrh is due to cardiac disease there can only be a temporary subsidence in the severity of the symptoms. In those debilitated by constitutional causes, or in subjects of the strumous type, the acute attack passes into the *chronic* form. Acute bronchitis, by an extension of the inflammation to the finest tubes, becomes *capillary bronchitis*. This is often the case in whooping-cough, and in the eruptive fevers—notably in measles. In those debilitated by previous illness, in the old, and in infants, capillary bronchitis is a most serious malady. A sudden increase in the temperature and a marked difficulty of breathing announce the onset of this disease when it arises as just indicated. So difficult is the breathing that the patient calls into use the auxiliary muscles of respiration; unable to lie down, he sits, inclined forward, the arms resting on some support, struggling to get breath, and the respirations, shallow and incomplete, reaching in an adult to forty, in infants to eighty per minute. The difficulty of breathing is incessant; although, now and then dislodging some mucus by coughing or vomiting, there is a temporary alleviation of the distress. At first the respirations, although hurried and oppressed, are normal; but, when the air can not enter, the lungs are not expanded, and the diaphragm is not depressed, the inferior part of the chest and the epigastrium are drawn in with each inspiration instead of being elevated, while the upper portion of the chest remains immovable. At first the face is red, the eye bright, and the skin hot with the unwonted effort, but as the air fails to reach the lungs the blood is not oxygenated, the face becomes pale, the veins enlarged, and the countenance has an increasing duskiness from the accumulation of carbonic acid in the blood. The restlessness and anxiety yield to an increasing stupor, and the approaching cardiac

failure is announced by rapidity and feebleness of the pulse. When no efforts succeed in removing the obstruction to the entrance of air, death takes place in four or five days, but the duration is longer if by vomiting or other means the access of air is secured, even for a brief period, to the alveoli of the lungs. When a favorable termination is about to take place, the dyspnoea becomes less urgent, the pulse improves in volume and lessens in rate, the fever diminishes, the expectoration is less viscid and comes up more abundantly, and ten or twelve days from the onset convalescence is fairly inaugurated. More or less simple bronchitis may persist for weeks longer. The physical signs are similar to those of bronchitis, except the differences due to the volume of the tubes attacked. Besides the coarser sounds of bronchitis, the dominating *râle* is the sub-crepitant, audible all over the chest. As in capillary bronchitis collapse of lobules takes place, the physical signs of atelectasis are superadded. These have already been sufficiently discussed.

Course, Duration, and Termination.—Simple bronchitis usually terminates in resolution in about ten to fifteen days. In children the course may be more protracted, and the symptoms more severe, if complicated by gastro-intestinal troubles. The termination may be in the chronic form of the disease. There may be an extension of the morbid action from the larger to the finest bronchial tubes. Capillary bronchitis pursues a more rapid course, and may terminate in four or five days, but it usually continues up to the ninth, even twelfth day. The mortality from capillary bronchitis is large, because of the occurrence of atelectasis and broncho-pneumonia or catarrhal pneumonia.

Diagnosis.—Acute bronchitis is to be differentiated from catarrhal pneumonia and croupous pneumonia. Bronchitis pursues a much milder course, is of shorter duration, and is greatly less dangerous to life. While the moist sounds are the same in the two diseases, the sub-crepitant *râle* preponderates in catarrhal pneumonia, and in the latter the vesicular murmur is replaced by blowing or bronchial breathing and bronchial voice. Bronchitis commences by chilliness persisting for several days—pneumonia by a distinct and severe rigor; in bronchitis there is fever of moderate height—in pneumonia, the range of temperature is very high; in bronchitis, the fever declines gradually—in pneumonia, there is a sudden defervescence; in bronchitis, the sputa consist of muco-pus and pus—in pneumonia, of a peculiar viscid material stained with blood; in bronchitis, there are moist sounds, with sub-crepitant *râle*—in pneumonia, there is crepitant *râle*; in bronchitis, there are no sounds indicating pulmonary lesions—in pneumonia, there are bronchial breathing, bronchial voice, etc. Bronchitis of the larger is to be distinguished from bronchitis of the smaller tubes, by the dyspnoea, by the fineness of the sounds, and the greater danger to life. The onset of catarrhal pneumonia from bronchitis is announced by

the increased difficulty of breathing, the rise of temperature, and the diminishing sonority of the chest over the affected parts, with the auscultatory phenomena of consolidation.

Treatment.—The simplest means suffice for an uncomplicated case of acute bronchial catarrh. The combination of tartar emetic (gr. $\frac{1}{16}$) and morphine (gr. $\frac{1}{2}$) in some sirup of lactucarium, or in water, a mustard-plaster to the chest, and confinement to bed, will afford satisfactory relief. In children, sirup of ipecac, sirup of tolu, and paregoric usually suffice. If there is much fever, and the pulse active, tincture of aconite-root (gt. j) should be added to the ipecac and paregoric. When the acute symptoms have subsided, the stimulant expectorants should be used—acetum scillæ, sirup of senega, and sirup of tolu, for example. When the bronchitis is severe, there is high fever, and the inflammation seems disposed to invade the finer tubes, and especially if the finer tubes are invaded, tartar emetic in sufficient quantity to produce a little nausea, morphine in very small doses, and the tincture of aconite, are highly serviceable. The more the finer tubes are invaded, the greater the need of ammonia, carbonate or chloride, and the iodide. Should there be much obstruction, emetics of subsulphate of mercury or of apomorphine must be employed to tide over the emergency, and then the iodide and carbonate of ammonia, in small doses, should be given frequently. Should the temperature rise high and continue so, antipyretics, as cold baths and quinine, more especially the latter, must be administered. A temperature requiring antipyretics may be attained when a simple bronchitis becomes a capillary bronchitis or broncho-pneumonia. A persistently high temperature greatly increases the danger of cardiac failure. If there be indications of such failure, ammonia carbonate and alcoholic stimulants must be freely but judiciously administered. The diminution in the supply of oxygen and the accumulation of carbonic acid are important sources of danger in capillary bronchitis. The timely use of emetics, by giving at least temporary admission of air, will postpone the period of stupor from carbonic-acid narcosis. When bronchitis in children assumes the aspect of catarrhal fever, the remedies employed must be different in character. Nauseants, emetics, and irritants must be discontinued if they have been used. Paregoric, with some carbonate of ammonia, in sirup of tolu, is a good prescription in these cases. In all cases of the different forms of acute catarrh of the bronchial tubes, alimentation is important, but especially so in those cases accompanied by gastro-intestinal disorder.

CHRONIC BRONCHITIS—CHRONIC BRONCHIAL CATARRH.

Definition.—By this term is meant an inflammation beginning in the mucous membrane of the bronchial tubes, chronic in type, and in-

volving not only the mucous membrane, but the substance of the tubes and the peribronchial connective tissue.

Causes.—Chronic bronchitis but rarely succeeds to a pronounced acute attack. Usually the early symptoms escape recognition, or the chronic form is a resultant of not one but numerous acute attacks. This malady is always associated with obstructive lesions of the heart or lungs. It accompanies or is a local development of the dyscrasiae, as rickets, scrofula, Bright's disease, and of the infectious diseases. The tendency to it may be inherited, or rather a type of mucous membrane disposed to such changes may be transmitted.

Pathological Anatomy.—The mucous membrane is brownish in color, or has a steel-gray color. In other examples, owing to the development of vascular loops, it has a bright-red color. The follicles of the mucous membrane are swollen and enlarged by hypertrophic thickening of the connective tissue, and by accumulation of their contents. The connective tissue, especially of the posterior part of the tubes, and the peribronchial connective tissue, become greatly thickened; the cartilages are invaded and much weakened. Under the strain of coughing, especially if there be at the same time firm pleuritic adhesions, the bronchi yield and dilate. The dilatations are cylindrical, fusiform, and sacculated. In cylindrical dilatations the tube or tubes are uniformly enlarged throughout; in the fusiform variety the enlargement has a spindle-shape, and in the sacculated there is a lateral protrusion forming a sac or a cavity. To these might also be added the moniliform, in which there is an enlargement of one part, then the tube is normal, then again an enlargement, so that the normal portions by comparison with the dilated seem to be contracted.

The secretions in chronic bronchitis differ greatly from the normal. Fragments of the detached epithelium, mucus, and pus-corpuscles, are the morphotic elements, the purulent being very largely in excess. Usually the secretion is very abundant, greenish-yellow in color, and sometimes fetid. When the secretion consists of young cells and mucus corpuscles and granules, it is called *mucous catarrh*; when the cellular elements are not present, and the secretion is viscid, colorless, without odor, and resembling white of egg, it is called *pituitous catarrh* or *bronchorrhœa*; if the secretion is scanty, tough, rather glistening, semi-transparent, and occurs in defined, globular masses, it is entitled *dry catarrh*. Whenever the secretion is retained and undergoes decomposition, as is apt to be the case when the tubes are dilated, especially in the saccular form, it is known as *fetid bronchitis*, the fetor being chiefly due to the fat acids.

Symptoms.—If there be no complications, chronic bronchitis is not attended by fever. When it occurs with disease of the heart, Bright's disease, or other dyscrasiae, the clinical features are those of the original malady, bronchitis being one only of the morbid complexus. As a

substantive affection succeeding to acute attacks, it is slow of development. There are observed, for some years, autumnal and winter seizures of bronchitis, which cease with the warmer and more stable weather of the summer. It may be a number of years before the bronchitis becomes constant, which indicates the existence of permanent changes in the tubes. In the so-called *dry catarrh* there is but little expectoration, and that is brought up with difficulty, and after repeated and most distressing paroxysms of coughing. Next to coughing the most important symptom is dyspnoea, due to the viscidness of the exudation, to the swelling of the mucous membrane, and the implication of the finer tubes. The difficulty of breathing is not considerable when at rest, but exertion at once develops it, and it is accompanied by more or less wheezing. Owing to the impaired elasticity of the lung and the dilatation of the tubes, the upper part of the thorax is kept in the position of maximum inspiration, and the expiration is prolonged and difficult. The result is, that the supply of oxygen is insufficient for the depuration of the blood, and cyanosis appears, the face becomes congested, the lips and mucous membrane bluish, and the superficial veins enlarged. The pulmonary circulation is hindered by reason of these conditions, venous stasis ensues, and œdema slowly develops about the ankles. The habitual difficulty of breathing is now and then varied by attacks which have an asthmatic character, excited by the inhalation of dust, remaining in a crowded apartment, taking cold, and especially by an attack of acute bronchitis with profuse secretion (humid asthma). These seizures are not very protracted, and terminate after some hours by an abundant discharge of mucus. The cases of chronic bronchitis characterized by profuse expectoration differ from the preceding type in several respects—in a more abundant expectoration, in a less troublesome cough, and in less habitual difficulty of breathing. In these cases of so-called *humid bronchitis* there are occasional paroxysms of dyspnoea, due to extension of the morbid process to the smaller tubes, causing difficulty of breathing by swelling of the mucous membrane, by accumulation of secretion, etc. With or without such paroxysms, the chief troubles arise from the cough, which is most annoying at night or in the early morning, and an abundant expectoration. The sputa consist of muco-pus, or of a semi-transparent, albuminous, viscid fluid (bronchorrhœa), or of a greenish-yellow pus, and the variations represent differences in the local changes already designated. Percussion reveals no change in the normal sonority of the lungs in uncomplicated cases. If emphysema, or broncho-pneumonia, or fibroid phthisis have occurred, there will be changes in sonority, but these diseases are not in question. In dry bronchitis, on auscultation sibilant and sonorous *râles* of every variety will be heard; in humid bronchitis, mucous and sub-mucous, and sub-crepitant *râles* will be abundant according to the amount of secretion

present in the tubes. The vesicular murmur may be entirely displaced by the loud *râles*, especially the more nearly the lesions approach to the acini. Dilatation of the tubes impresses some special characters on the rational and physical signs. The expectoration is very abundant and often has a butyric and fetid odor, and is sometimes, as in the morning, expectorated in a great mass, due to the emptying of a sacculated dilatation of a bronchus. This expectoration, when collected, differs from that of phthisis in being homogeneous and of a greenish-yellow color. Hæmorrhage from a dilated bronchus is a very misleading symptom; it may occur gradually and continue for some time, there being considerable loss in the aggregate. The blood coming from a dilatation is fluid, dark, and does not clot, and it may be mixed with the contents of the sac. The physical signs of dilated bronchi are practically the same as those of a cavity formed in other ways, but the distinction may be made by the history of the case and by the situation of the dilatation.

Course, Duration, and Termination.—Chronic bronchitis pursues an essentially chronic course, but it is diversified by variations in the intensity of the symptoms, by remissions and intermissions. These intermissions are only possible in the early period; after a time the symptoms persist. Chronic bronchitis may continue during a lifetime, and death be caused by some other disease. Recovery may ensue in the milder cases, and is more likely to occur in young than in old subjects. Severe cases of bronchitis lead to the production of other maladies. The long-existing purulent exudation in the tubes, interstitial pneumonia having been produced by the extension of the peribronchial connective-tissue inflammation, excites tubercular deposition. Fibroid phthisis is usually, probably always, produced in this way, chronic bronchitis initiating the series of morbid changes. Emphysema is a result of dry catarrh, for in this case the chronic inflammation is seated in the finer bronchi, the secretion is highly viscid, the membrane much swollen—conditions most favorable to collapse of lobules and emphysema. Hypertrophy and dilatation of the right cavity, venous stasis, and general œdema are also results of chronic bronchitis, and in this way a considerable proportion terminate. The disturbed circulation in the lungs and the venous stasis cause congestion of the liver and of the kidneys, and death may be due to the maladies thus created.

Diagnosis.—The same considerations govern the diagnosis of chronic as of acute bronchitis. The disease with which chronic bronchitis is most apt to be confounded is phthisis. The difficulty of separating chronic bronchitis with sacciform dilatation from phthisis with cavities is very great. The differentiation must rest on the history of the cases, the evidence of pulmonary lesions outside of the cavity, to be discovered in phthisis and not in bronchitis, and

in examination of the sputa, those of phthisis containing elastic fibrous tissue, etc.

Treatment.—The indications of treatment vary somewhat with the form. In dry bronchitis, full doses of iodide of potassium, or preferably iodide of ammonium (ten to twenty grains), every three hours when the difficulty of breathing is great, are very effective. For the interval between the asthmatic paroxysms, the best results are obtained by a combination of iodide of ammonia and arsenic, with a balsamic expectorant, as eucalyptol, turpentine, copaiba, cubeb, etc. The persistent use of these remedies will often accomplish important results, and will in all cases afford relief, if not cure. When there is profuse expectoration, quinine with atropine, and codeine, to quiet cough, and the balsams, are the most efficient remedies. If the expectoration is fetid, the free internal use of quinine, eucalyptol, and turpentine, is to be commended, and inhalations of the vapor of turpentine and of iodine, or atomization of benzoate of sodium, carbolic or salicylic acid, or thymol, may be practiced. Of these remedies applied by atomization, carbolic acid is most efficient. In all cases of chronic bronchitis with considerable expectoration, much good results from the persistent use of the now well-known phosphate of iron, quinine, and strychnine. The lactophosphate of lime is also highly useful, probably because of the waste of this important material under these circumstances of profuse suppuration. Arsenic is highly useful when the secretion is not abundant, as in dry bronchitis. It may be combined with the iodides, or with the sirup of the lactophosphate of lime. The hypophosphites, as well as the compound phosphates, are useful when there is waste by suppuration. Alcohol has the power to diminish suppuration and to arrest fermentative processes, and is therefore useful in chronic bronchitis. Whisky is the best alcoholic in such cases. It may be taken with cod-liver oil, the two forming a nutrient of much value—a teaspoonful of cod-liver oil and a tablespoonful of whisky after meals. A generous supply of nutritious aliment is, of course, highly necessary.

As taking cold is the principal cause of attacks of catarrh (employing that term to indicate the nature of the influences causing catarrh), it is highly important to avoid this accident by suitable clothing, by good air, and by favorable hygienic surroundings. If a cold should occur, the patient ought to receive at once an efficient dose of quinine and morphine (gr. xv—gr. ss.). As a humid, variable climate, characterized by cold winds and extremes of temperature, is very unfavorable, a change to a mild, equable, and dry climate should be advised.

PSEUDO-MEMBRANOUS OR CROUPOUS BRONCHITIS.

Definition.—*Croupous bronchitis* is an inflammation of the bronchial mucous membrane, characterized by the exudation of a false

membrane. It corresponds to croupous enteritis and to laryngeal croup. It may be acute or chronic.

Causes.—The ordinary causes of bronchitis excite this form apparently, but nothing is known of the conditions which give this direction to the products of inflammation. The cases occur usually in youthful subjects, from six to forty* years of age, and in those who have been subject to attacks of bronchial catarrh. A depressed state of the body, and possibly an inherited tendency, are also causes. According to Riegel, pulmonary hæmorrhage sometimes precedes, according to Street succeeds to attacks of croupous bronchitis.

Morbid Anatomy.—There are two forms of the croupous process in the bronchial tubes—the *diffused* and the *circumscribed*: the former are so designated because the exudation extends from the trachea through all the divisions of the bronchi; the latter, because confined to certain tubes. The mucous membrane has been found both intensely injected and pale; the epithelium intact, or entirely removed over the whole extent of the surface covered by the exudation. Sometimes ciliated and cylindrical epithelium has been found embraced in the casts; in other cases none has been found. These contradictory observations are due to the fact that the examinations were made at different stages of the disease. Indeed, displacement of the epithelium is not a necessary part of the process of membrane formation. It is most probable that an albuminous solution is poured out, and white corpuscles migrate, the whole consolidating. It may happen that some epithelial cells are embraced, but this is not necessary. The tubular casts form an outline of the tubes in which they were produced. They may be rolled up into a ball, or expelled in fragments, or as a whole. The author has had a case in which a complete cast of one bronchus and all of its subdivisions was expelled entire. The casts differ much in thickness and length. Those coming from the upper tubes are shorter and straighter, and terminate in fine prolongations; those from the lower tubes are longer, and gradually divide into smaller casts. They are not solid usually, at least the larger casts are not, and contain in their interior mucus and air. They have a lamellated structure, and the lamellæ have a concentric arrangement (Riegel)†. The casts are elastic and compact, and bear a good deal of strain. They are whitish or yellowish-white in color, and consist of a “hyaline basement substance,” ‡ sometimes fibrillated, as was the case in the author's observation.

Symptoms.—There are two forms—as regards the clinical features—the acute and chronic. The acute attacks begin as an ordinary acute

* Dr. Street's case—a man aged thirty-nine, “American Journal of Medical Sciences,” January, 1880, p. 149.

† Ziemssen's “Cyclopædia,” vol. iv.

‡ “Report of Cases of Fibrinous Bronchitis,” by Dr. Glasgow.

bronchitis, with chilliness, fever, general *malaise*, a troublesome cough, soreness of the chest, and oppression. These symptoms continue for several days, when more formidable troubles are manifested by an increasing dyspnoea, “livid, swollen countenance,”* high fever, rapid pulse, a dry, harsh, and resonant cough, anxiety, and sometimes hæmoptysis. There may be no preliminary symptoms of acute bronchitis merely, but the disease set in at once by severe difficulty of breathing, preceded by a rigor, and accompanied by high fever. At first the expectoration is that of bronchitis, but in a few days the characteristic casts are brought up with a good deal of coughing and straining. There may be then immediate relief afforded, the dyspnoea subsiding and the cough becoming much less severe. In the course of a few hours, or a day or two, there may be a recurrence of the severe dyspnoea and the straining cough, and more casts will then be discharged. More or less hæmorrhage may occur, or masses of bloody mucus may be expectorated. In the chronic form of croupous bronchitis, there is usually a history of chronic bronchial catarrh, or of some form of pulmonary disease. During the course of such disease, acute bronchial symptoms come on, fever, dyspnoea, and a most severe straining cough, cyanosis, anxiety, etc., during which casts of the tubes are expectorated. Then the symptoms subside, and afterward only those symptoms pertaining to the chronic malady are experienced, until there occurs a return of the paroxysms. In some cases, during a long time—a year—there may be discharged every few days casts; in other cases the attacks may occur two or three times a year.† When the attacks happen at longer intervals, the symptoms are apparently more acute and severe.

Course, Duration, and Termination.—The acute cases run their course in a few days. The fatal cases may terminate within the first week, as early as the fourth day, and none continue longer than two weeks. About one half of the cases terminate fatally. In the fatal cases the casts either remain *in situ* or are in part discharged, or are reproduced. The cyanosis rapidly deepens, carbonic-acid poisoning supervenes, the dyspnoea augments, and the patient dies asphyxiated. The chronic form pursues a different course. The attacks recur from time to time, during the prolonged existence of a chronic bronchitis, and a fatal result is reached in an acute attack with symptoms of asphyxia, or by the changes belonging to the associated malady. Other cases are connected with phthisis, emphysema, etc., and pursue a similar course, death occurring usually in an acute suffocative attack.

Diagnosis.—Until the characteristic casts have been discharged, it will be impossible to distinguish these attacks from those of capillary bronchitis. As there are no symptoms of laryngeal stenosis, bronchial will be readily separated from laryngeal croup. A careful considera-

* “Transactions of the Pathological Society,” vol. xi, p. 23.

† *Ibid.*, p. 24.