

Samuel West¹¹¹ states that broncho-pneumonia is associated with several varieties of pathogenic organisms, the streptococcus, the staphylococcus, the tubercle bacillus and others, but that chief among all is the pneumococcus, which is present either alone or in association with others in at least 50 per cent. of the cases. The bucco-pharyngeal origin of the pathogenic organisms was shown by Pasteur, Netter, Thost and Besser.¹¹² Darier¹¹³ states that the development of the disease is favored by diminution of the body's resistance to infection, and that all debilitating influences predispose to it. Tyson¹¹⁴ also holds that "all influences depressing to life, such as overwork, fatigue, the air of badly ventilated and crowded houses, insufficient food, and defects of hygiene" act as predisposing causes.

The debilitated condition of the organism at large being attended by a corresponding condition of the adrenal system, the pulmonary secretions are inadequately supplied with auto-antitoxin and phagocytes, and the bacteria inhaled are free to multiply.* The bronchial fluids soon become, therefore, laden with pathogenic bacteria and what toxins some of them may secrete. They excite, therefore, a primary bronchitis, a local inflammatory process, which extends from the bronchi to the bronchioles, causing bronchiolitis, the so-called "capillary bronchitis." The bronchioles become obstructed through the inflammatory thickening of their walls and by the inspissated mucus secreted, and the alveoli no longer receive air. Hence the cyanosis, which corresponds in intensity with the number of alveoli rendered useless by the morbid process.

Simultaneously another pathological condition is developed, *i. e.*, involvement of the parenchyma of the lung surrounding each inflamed bronchiole. As the corresponding alveolus becomes depleted of its air, it collapses (atelectasis) and is itself soon involved in the inflammatory process. As many inflamed bronchioles and alveoli are merged together by a similar process, an area of consolidation is finally formed. This does not mean, however, that the inflamed structures are destroyed, for after death they are usually found to have retained their anatomical conformation, and may be inflated by means of a tube inserted into a bronchus. But every evidence of a very acute inflammation is present, capable, if not arrested, of finally causing obliteration of such large areas of air-cells that life becomes impossible.

* Author's conclusion.

¹¹¹ Samuel West: Brit. Med. Jour., May 28, 1898.

¹¹² Pasteur, Netter, Thost and Besser: Cited by Darier: *Bebove and Achard's "Manuel de méd.,"* T. I, 1896.

¹¹³ Darier: *Ibid.*

¹¹⁴ Tyson: "Pract. of Medicine," third edition, p. 229, 1903.

Important in this connection is the fact that the pulmonary lesions are partly auto-protective, in the sense that the inflammatory process has for its purpose the destruction of the pathogenic organisms and their products, and the repair of destroyed tissues.* An intense hyperæmia is present, the blood-vessels being distended and tortuous, and the capillaries are so engorged that some are ruptured, allowing blood to ooze into the bronchi and stain the muco-purulent substances expectorated.

It is this intense hyperæmia that is relieved when the carbon dioxide accumulates to such a degree in the blood, that the little patient is brought to the verge of death.* If the consolidated areas are so numerous that the oxygenation becomes inadequate, dissolution follows, but if a sufficient proportion of the inflamed areas are still in a condition of atelectasis, the more or less rapid disgorgement of the capillaries of the bronchioles opens up a corresponding number of alveoli.* The additional supply of oxygen the body now receives serves to tide it over the dangerous period, until another auto-protective factor asserts itself and brings on recovery, *viz.*, the accumulation in the blood of toxic wastes.* Indeed, gradually as the intake of oxygen is being reduced, catabolism becomes steadily more imperfect until such time when the tissues, owing to their superior affinity for it, utilize all the gas available. Filled with toxic wastes, the blood violently stimulates the previously torpid test-organ, and a flood of auto-antitoxin and a host of phagocytes invade all the fluids of the body, including the blood of the diseased area, destroying the pathogenic germs and their toxins, and the patient suddenly, as we have seen, becomes convalescent.*

Treatment.—All the cardinal measures that have stood the test of time in the treatment of this disease have a common physiological action: that of stimulating the adrenal center.* *Calomel*, one of the most active agents of this kind* at our disposal, is regarded by many practitioners as the most efficient initial remedy when given early and in sufficiently large doses to produce catharsis after a few doses have been taken, *i. e.*, $\frac{1}{8}$ to $\frac{1}{6}$ grain (0.008 to 0.01 gm.) every two hours with sodium

* Author's conclusion.

bicarbonate, for a child under one year of age. It enhances not only the production of auto-antitoxin, but also the vulnerability of the bacteria to the phagocytes by increasing the production of thyroidase, *i.e.*, opsonin.*

Suggestive in this connection is the fact that diphtheria antitoxin has been used with success, from 1000 to 3000 units being injected. It should be renewed if necessary.

Edelheit of Vienna¹¹⁵ used calomel with success in broncho-pneumonia, and held that its chief property was to promote metabolic processes. Marfan gives small doses every hour.

Antitoxin was first tried by Montgomery Paton, of Australia, who considered it as a specific. It was also used by Joseph O'Malley, of Philadelphia,¹¹⁶ who was also led to conclude that it is a most valuable agent, especially in secondary broncho-pneumonias, from 1000 to 3000 units being used in the cases reported. Uninterrupted convalescence followed.

Potassium or sodium iodide, which also stimulates the test-organ—and through it the adreno-thyroid center*—is also an efficient remedy. It may be given to children in 1- or 3-grain (0.065 or 0.2 gm.) doses every 3 hours, with a tablespoonful or more of water. Iodoform in 1/2-grain (0.03 gm.) doses, has also given excellent results. Its action is similar to that of the iodides.

Albert Abrams,¹¹⁷ as a result of observations in 61 cases, reached the conclusion that the most important features of the treatment of broncho-pneumonia were compressed air and potassium iodide. Iodoform, according to Gambardella,¹¹⁸ causes rapid dissipation of the pulmonary symptoms and fevers. Its unpleasant odor renders it obnoxious, however, and it offers no advantage over the iodides.

Another remedial measure which has been highly recommended is the *cold bath*. This agent, like other forms of cold, causes an accumulation of waste-products in the vessels of the skin, by lowering the catalytic activity of the cellular trypsin. It brings on, therefore, the critical period which ensues when the little patient approaches dissolution, which ends when the waste-products violently stimulate the test-organ.* It is especially indicated when the temperature is high, and contraindicated only in asthenic cases and when the cardiac action is defective. *Cold pack* to the chest is likewise beneficial and acts like the cold bath, but with less intensity.*

Le Gendre¹¹⁹ holds that the temperature of the first bath should be 82° F. (27.8° C.) and last from 5 to 10 minutes; and that the fol-

* Author's conclusion.

¹¹⁵ Edelheit: *Semaine médicale*, vol. xv, p. 472, 1895.

¹¹⁶ Joseph O'Malley: *American Medicine*, Jan. 17, 1903.

¹¹⁷ Albert Abrams: *Medical News*, Sept. 24, 1898.

¹¹⁸ Gambardella: *Semaine médicale*, vol. xviii, p. 55, 1898.

¹¹⁹ Le Gendre: *Ibid.*, vol. xvi, p. 89, 1896.

lowing baths may be from 75° to 65° F. (23.9° to 18.4° C.), but never lower. D'Espine and Picot contend that the first bath should be at 90° to 95° F. (32.2° to 35° C.), and subsequent ones 86° F. (30° C.). Hutinel states that the most striking effects of the cold baths are an increased excretion of urine, saliva and digestive fluids—precisely the results to be expected by an increase of metabolic activity such as that which follows stimulation of the adrenal center.

Zangger¹²⁰ reported 10 cases of broncho-pneumonia in children three months to eleven years of age, in which defervescence was realized in one to four days. The author ascribes this favorable result to his method of giving the little patients from one to seven "half baths" of four to seven minutes each, the water at a temperature of from 30° to 28° C. (86° to 82.4° F.), gradually reduced to 26° or 24° C. (78.8° or 75.2° F.). The room must be moderately warm, and the child be placed in a bath-tub with only enough water in it to cover the body, leaving the breast almost uncovered with water. The child is rubbed during the bath, and after two minutes cool water is added to bring the water down to the desired temperature. The little patient is then rubbed dry with warm towels and put back to bed. These half baths are given night and morning; a little milk is given to the child before and after the bath. The diet should be milk, diluted or not, and cold spring water should be sipped frequently. The author's experience has been that these baths twice a day raise the blood-pressure, strengthen the heart, promote expectoration and soothe the nervous irritability, etc., much better than any other measure.

The wet compress system of Prof. Lemoine, of Lille, is easily carried out, and insures almost uniform success.¹²¹ The child is stripped to the waist, and a piece of gauze (tarlatan) folded in six or eight doubles, and so cut that it reaches from the clavicles to the umbilicus in front and to the sacrum behind, and wide enough to overlap in front, is steeped in hot water, so as to remove as much of the starch as possible, and when properly wrung out it is plunged again into cold water (the temperature of the room). The gauze is then squeezed as much as possible, and applied around the thorax and the upper portion of the abdomen; a piece of oil-silk of the same size is placed over this so as to prevent evaporation. The child is then dressed and put to bed. At the end of half an hour the application is renewed, and so on as long as the symptoms (temperature over 100° F. [37.8° C.], with vesperal exacerbation, agitation, quick-breathing, etc.) require it. There exists no contraindication to these wet compresses.

Holt¹²² recommends the cold bath followed by friction for infants when the temperature reaches 105° F. (40.5° C.), and the cold pack for older children.

Measures which induce congestion of the skin and thereby deplete somewhat the pulmonary congestion are preferred by some clinicians. The *mustard-paste* poultice is probably the most efficient of these external applications. They tend also to enhance the antitoxic activity of the blood by increasing its temperature, and therefore the activity of its auto-antitoxin.* The *mustard-linseed poultice* is also regarded as efficacious.

* Author's conclusion.

¹²⁰ Zangger: *Correspondenzblatt f. schweizer Aerzte*, Bd. xxxv, S. 7, 1905.

¹²¹ Lemoine: Cited by Albert: *Thèse de Paris*, 1896.

¹²² Holt: *Medical News*, Dec. 1, 1900.

Winters¹²³ states that when there is filling up of the bronchial tubes and numerous moist râles, there is nothing more valuable than the mustard paste composed of 1 part of mustard to 4 of flour applied over the chest several times a day. Sheffield¹²⁴ recommends the following poultice: "5 parts each of flaxseed-meal and camphorated oil; 1 to 2 parts of mustard and a sufficient quantity of boiling water to make a thick paste by thorough stirring. This mass is spread on thin gauze or paper (two layers) and applied snugly to the chest and back. The child is then wrapped in an oiled-silk jacket, lined with absorbent cotton, and in a blanket, which, with the hyperpyrexia of the body, maintains the heat of the poultices; so that it requires renewal but three or four times in twenty-four hours."

The obstruction of the bronchioles (which admit the air into the alveoli) being due to intense congestion of their walls, a remedy capable of reducing the quantity of blood supplied to them, by causing constriction of the local arterioles, is indicated.* *Belladonna* is especially active in this particular, and is very beneficial when given in sufficiently large doses. *Opium*, given in the form of Dover's powder, acts much in the same way,* is especially effective when the cough is severe, but it tends to cause constipation, and should be avoided if possible.

Coutts¹²⁵ in a series of 60 cases only lost 2 by giving $\frac{1}{4}$ -grain (0.016 gm.) doses of the extract of belladonna (B. P.) every three or four hours. Flushing and a definite scarlet rash may appear, but after a few doses the dyspnea ceased and the temperature fell to normal. D. A. Hodghead, of San Francisco,¹²⁶ also obtained excellent results in 25 cases. He first gives calomel, $\frac{1}{10}$ grain (0.0065 gm.) every hour, until a free movement is obtained, and between these doses, also every hour, 2 drops of the tincture of belladonna. As improvement begins the belladonna is reduced to 1-drop doses hourly. The mortality was 5 per cent. He states that like results were obtained in three London hospitals, whereas by the older methods the mortality was 60 to 80 per cent.

The congestion of the bronchioles may also be reduced by agents which depress the functional activity of the vasomotor center, the general relaxation causing the blood to recede from the pulmonary and other capillaries.* The most active agent of this kind is *nitroglycerin*, of which $\frac{1}{500}$ grain (0.00013 gm.) may be given every hour to a child one year old; and it is especially valuable when the heart is oppressed and failing. *Sweet spirit of niter* is a milder agent of this kind. *Alcohol* produces the same result, but in another way, viz., by becoming

* Author's conclusion.

¹²³ Winters: Medical Record, June 26, 1897.

¹²⁴ Sheffield: Graetzer and Sheffield's "Pract. Ped." p. 259, 1905.

¹²⁵ Coutts: Brit. Med. Jour., Jan. 28, 1899.

¹²⁶ D. A. Hodghead: Pacific Med. Jour., June, 1899.

itself oxidized, thus depriving the blood of some of its oxygen and reducing it in proportion to its efficiency as an antitoxic agent.*

When any of these remedies are used, *oxygen* inhalations should be administered simultaneously, to enrich, as much as possible, the air inhaled while the bronchioles are patent.

In asthenic cases, *strychnine*, $\frac{1}{300}$ grain (0.0002 gm.), or *caffeine*, $\frac{1}{20}$ grain (0.003 gm.) is sometimes useful, but as they both stimulate the vasomotor center* they should be avoided in sthenic cases, i.e., those in which the temperature remains high.

Some authors speak well of digitalin, strophanthus and other cardiac stimulants, but their use is indicated only in asthenic cases. The heart fails in sthenic cases because the resistance of the blood-column is too great for it, and in the rest because its walls are not receiving enough blood, owing to excessive vasomotor constriction of its coronaries. Cardiac stimulants whip up the organ to drive it more rapidly to its doom. In weaklings, however, these agents are valuable.

The high fever which attends practically all cases, causes the alkaline salts of the blood to be utilized with unusual rapidity, especially sodium chloride, which is constantly being voided with the excretions and secretions, the urine, the sweat, saliva, and tears.* The blood loses its bactericidal and antitoxin activity gradually as its alkalinity is being reduced, and acidosis is becoming more manifest. Osmosis, which should be normal to insure the freedom of all secretory functions—particularly in pulmonary disorders, of the glandular elements of the bronchi—becomes markedly impaired, and the time finally comes when practically all the fluids of the body can no longer fulfill their functions.*

The aim should be, therefore, to keep the organism supplied with alkaline salts. In children old enough to expectorate, and adults, the first evidence that these salts are beginning to fail is the viscosity of the sputa, soon followed by great difficulty in "raising" them, and a marked increase of cough. *Ammonium chloride* or *carbonate*, by increasing the alkalinity of the blood, corrects these morbid phenomena. Large doses are not necessary and tend to disturb the stomach: $\frac{1}{4}$ grain (0.016 gm.) in a child under 1 year of age; $\frac{1}{2}$ grain (0.03 gm.)

* Author's conclusion.

for one from 2 to 3 years old, and from 1 to 3 grains (0.065 to 0.2 gm.) for older subjects, every two hours, suffice. It should always be given with as much water as the patient will take. *Liquor ammonii acetatis* is another valuable agent, given in doses varying from 5 to 30 drops—also in considerable water—according to age.

The onset of collapse is not only advanced, but may be actually caused by the absence of sodium chloride in, or lowered alkalinity of, the blood, or both of these conditions. *Hypodermoclysis* promptly restores the patient—even when he is approaching the moribund state, in some cases. In the infant, 4 to 6 ounces (120 to 180 gms.) of normal saline solution may be injected slowly under the scapula, and renewed if necessary. Hypodermic injections of *aromatic spirits of ammonia*, 2 drachms (8 gms.), being injected into the arm, repeated as needed, have also been found useful.

Still better than all these measures is to avoid the need of them by using alkaline beverages from the start, thus keeping the blood supplied with its normal salts.* The measures indicated on page 1367 may be utilized, reducing quantities according to age. *Saline enemata*, *i.e.*, rectal injections of warm saline solution, are, also of very great value, especially in young children.

I cannot sufficiently emphasize the importance of not waiting until the disease is far advanced, to resort to the use of alkaline beverages. Their use should begin when the patient is first seen. Quite as important is to supply the patient with fresh air, *i.e.*, air not partially deprived of any of its oxygen, and with all the water he wants to drink.

The use of normal saline solution in this disease has been found very advantageous by J. Madison Taylor¹²⁷ when used as ordinary beverage. Lemaire¹²⁸ used hypodermoclysis in 11 cases of infantile bronchopneumonia, 6 ounces (180 gm.) being injected under the skin of the abdomen or thigh in children 3 years old and over. Under that age the injections were 2 ounces (60 gm.) three times a day. All the cases recovered. Injections of the aromatic spirits of ammonia were found very effective, though somewhat painful, by H. Morell.¹²⁹ He states that the action of the remedy is noticed almost immediately, the face losing its livid color and becoming flushed.

* Author's conclusion.

¹²⁷ J. Madison Taylor: *Medical Record*, Jan. 13, 1906.

¹²⁸ Lemaire: *Loc. cit.*

¹²⁹ H. Morell: *N. Y. Med. Jour.*, Sept. 7, 1895.

CHAPTER XXIX.

THE INTERNAL SECRETIONS IN THEIR RELATIONS TO PATHOGENESIS AND THERAPEUTICS (*Continued*).

THE ADRENAL SYSTEM IN THE CATARRHAL AND NERVOUS DISORDERS OF THE RESPIRATORY TRACT.

The four diseases studied in the present chapter are intended to exemplify the manner in which the adrenal system reacts when exogenous or endogenous irritants assail the mucosa of the respiratory tract. Under Acute Bronchitis I submit the manner in which the tracheo-bronchial mucous membrane becomes the seat of an acute inflammatory process through the operation of a factor whose pathogenic influence has been abundantly confirmed but not explained. Bronchial asthma illustrates a complication which endows the disease with its autonomy as a morbid process, namely, hypersensitiveness of the vagal center in the pituitary body—and the manner in which stricto-dilation (the mode of action of all motor-nerves) provokes muscular contraction—the minute bronchial muscles, in this instance. A kindred disorder, hay-fever, serves to indicate how the same process operates in the nasal mucosa, where the stricto-dilators regulate the flow of blood into sinuses, which thus become engorged with blood, causing the copious secretion, marked obstruction, etc., observed in this disease. This process prevails as well in acute coryza and in other disorders of the upper respiratory tract, which cannot be treated in full in this volume. The fourth disease analyzed, pertussis, exemplifies the manner in which cough is elicited by irritation:—a reflex excitation of the vagal center (or trigeminal center, if the nasal field is involved), the violence of which is such in this disease as practically to exhaust the lungs of air, thus necessitating sudden and violent inspiration, the characteristic “whoop.”