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A COURSE OF LECTURES ON CLINICAL MEDICINE.

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LECTURE VII.

Fatal case of acute Bronchitis, preceded by pulmonary or chronic catarrh: History of the case, and post-mortem appearances.—Distinction between pulmonary catarrh and bronchitis.—Catarrhal affections of the pulmonary mucous membrane; their frequent tendency to recur.—Pathological state of the mucous membrane in acute catarrh.—Catarrhal irritation always extends from above downwards, from the larynx to the bronchi, never reversely from the bronchi upwards.—Microscopic characters of catarrhal secretion.—Pathological characters of acute bronchitis; stethoscopic signs; secretion.—Plastic exudation in the severest forms of bronchitis.—Heart-disease, and pulmonary catarrhal affections, tend mutually to aggravate each other.

Gentlemen,—At our last meeting I had occasion to explain to you the pathological conditions of broncho-pneumonia; and at that time I made allusion to another case in the same ward, of a patient suffering from symptoms of acute bronchitis, but which had supervened upon a chronic affection of the mucous membrane of the air-passages, and from which he had suffered for some time, amounting probably in its earlier stage to little more than pulmonary or chronic catarrh, a complaint but too often neglected, from its being usually at first unaccompanied by any great disturbance of the general health, but which is constantly prone to pass into very serious and fatal lesions of the pulmonary tissues.

A. B.—, aged 40, a German watchmaker, was admitted on January 6th. He was suffering from urgent and suffocative cough; distressing dyspnoea; face livid from venous turgescence; profuse sputa; has suffered from cough and dyspnoea during the last two months; the cough has occurred in paroxysms; the countenance is very anxious; features turgid; lips livid; eyes protruding and glazed; intellect torpid; there is also general anasarctous swelling of the surface of the body, trunk as well as extremities. The chest appeared well proportioned, was resonant throughout, but more so than natural in the mammary and lateral regions of both sides; the respiratory murmur was not audible; cooing and wheezing sounds present in every region, but more particularly

in the interscapular space; mucous rhonchi of large bubbles also in each region; the heart's sounds were rhythmical, but somewhat sharper than usual. The bowels had been relieved; tongue moist; pulse 108, small and compressible; sputa very profuse, frothy, and stained with blood; urine very high-coloured, and loaded with urates.

These symptoms were palpably indicative of an inflammatory condition of the whole extent of the bronchial mucous membrane, and from the existence of cough and dyspnoea for two months preceding, it was considered as an attack of acute bronchitis, supervening on pulmonary catarrh. The nature of this complication will be presently explained. It was obvious that the treatment must be conducted on the principle of relieving the congestion of the bronchial mucous membrane, and by medicinal agency preventing the further throwing off the products of inflammatory action. To this end he was cupped between the shoulders to eight ounces, a mode of relief to the congestion of the pulmonary organs, in general very efficient, and in most cases of this kind preferable to general blood-letting from the arm. A blister was applied to the anterior part of the chest, and he was ordered Hydrarg. Chloridi cum Opio, utr., gr. j., sextis horis, and the Mistura Salina Ammoniata, quartis horis. This latter medicine was prescribed with the view of obviating any tendency to prostration and collapse, as well as at this stage to promote secretion from the bronchial passages, with free expectoration, which object is well obtained by saline draughts with ammonia in excess.

On the 7th, the day following, the report states that he was relieved much by the cupping, and for an hour or two breathed freely and comfortably, the lividity of the countenance subsiding, and the expression being less anxious. He, nevertheless, passed a very restless night, with much wandering and moaning; and on the examination at the daily visit, cooing and sibilant sounds were heard everywhere, with much expiratory wheezing, and mucous rhonchi of both large and small bubbles. The sputa were very plentiful, frothy, fluid, and sanguinolent; urine loaded with urates; the pulse was very small, soft, and compressible, 90. Later in the afternoon the lividity and congestion of the countenance again returned; the respirations 48, hurried, gasping, and laborious. A remarkable amount of venous congestion of the vessels of the scalp appeared, which was followed by a state of coma, and he died at 4 a.m.

Sectio cadaveris twenty-four hours after death. The body was œdematous over the entire surface; plentiful serous exudation from every tissue as the knife passed through the abdominal and thoracic parietes; a moderate amount of clear serum was present in the cavity of the abdomen. The lungs did not collapse on raising the sternum, but were attached by firm bands of tissue to the pleura costalis; no trace of recent plastic exudation could be detected; the lungs on their anterior surface, and particularly about the middle lobe, presented many emphysematous patches, one or two of the size of a filbert; the margins of the inferior lobes were also covered with emphysematous vesication; the posterior and inferior portions of the lungs were dense, with cadaveric infiltration, a plentiful sanguinolent serum (frothy,) exuding freely on a section being made. The mucous membrane of the bronchial tubes was turgid and swollen, of an intense dark, madder-red colour, and from them into the lesser series the colour passed into a purplish violet, and presented the appearance as of intense venous hyperæmia; the larger tubes were smeared over with a glutinous, tenacious, and very adhesive secretion, and many of the smaller tubes seemed quite blocked up with this gelatinous mucus. It was of a faint fawn-colour, and at no point could any appearance of yellow muco-purulent secretion be detected. Under the microscope this exudation had a fibrinous appearance, and exhibited many granular cells; none could be found that presented any of the characters of pus-globules. The heart was much enlarged, but uniformly so; no valvular thickening nor opacity; the walls were relatively thin in respect to the increased capacity of the auricles and ventricles; it weighed twenty ounces. The liver was not unhealthy in appearance, presented indications of a large amount of portal congestion, and weighed forty-eight ounces; the kidneys were free from any morbid appearance, the right weighed six ounces, and the left five and a half. The brain was not examined.

This case explains to us many of the pathological conditions of pulmonary catarrh, bronchitis, and emphysema. Pulmonary catarrh is one of the most frequent and commonest precursors of the severer and more fatal forms of bronchitis. Pathologically it can be said to differ from bronchitis only in the amount and intensity of the preceding hyperæmia; the usual products of inflammatory action, pus, and plastic exudations, being the result of the more intense morbid action; while in the milder affection, epithelial cells, granular corpuscles, and fluid mucus, are generated and expectorated to a greater or less extent. To the latter the term catarrh, or pulmonary catarrh, is usually applied; while, to express the former, we employ the word bronchitis. I propose to examine the pathological conditions of these affections somewhat minutely, as the case before us presents me with a favourable opportunity practically to illustrate these morbid conditions.

Catarrhal affections of the mucous membrane of the trachea and larger bronchial tubes may be reckoned among the most frequent derangements of the system, and except in rare cases, are from the first treated as

trivial, and receive no very great attention on the part of the patient; nevertheless, a condition apparently so trifling, and accompanied by no great amount of physical disturbance, may, by its tendency to recur again and again, under favourable circumstances, and often does, lead to serious mischief, and ultimately even to fatal consequences. According to the best authorities, in the earliest stage of acute catarrhal affection, distinct portions of the bronchial mucous membrane exhibit patches of a fine rose-red injection, which are not circumscribed by a definite boundary, but gradually become diffused, and insensibly lost in the surrounding pale tissue. This increase of colour arises from the injection of the capillaries of the spot, and expresses the condition of true, though limited, capillary hyperæmia. If the catarrhal irritation increases, the patches extend and coalesce, and the colour of the affected part becomes darker; and when the irritation has reached its maximum of intensity, the membrane assumes a bright vermilion-red hue. At this period there is a deficiency in the natural secretion of the membrane, and when the affection is seated high up in the wind-pipe, or extends no farther than the larynx, it is at this stage that hoarseness exists. It may be observed here that catarrhal irritation invariably proceeds from above downwards; and that, supposing the trachea to be the seat of the original catarrhal attack, there would be almost a certainty, that if it extended, it would descend to the bifurcations of the bronchi, rather than ascend to the larynx. This is more particularly noticed in epidemic catarrhs, where the original attack, commencing as coryza, and seated in the Schneiderian membrane, extends to the pharynx, thence to the larynx, and if the attack be severe and neglected, continues to the trachea and bronchi, and ultimately extends to the minutest branches of the air-passages. But the reverse is never observed, the catarrhal irritation never proceeds from within outwards,—from the smaller tubes upwards to the wind-pipe and larynx.

I have already observed, that in the earliest stage of the affection, there is a diminution, even total absence of the ordinary lubricating secretion of the part. The air irritates the undefended and irritable surface, and excites a dry, frequent, and harassing cough. In the mildest cases, this state of capillary congestion and deficiency of secretion is soon followed by the pouring out of a thin pituitary fluid, which soon presents many minute grey points or striæ, mixed with many air-bubbles. Under the microscope, this secretion is observed to be composed of epithelial cells—even layers of them—in great abundance, suspended or floating in a clear mucous fluid, and often mixed with many granular corpuscles. Proportioned to the intensity of the preceding capillary injection, changes take place in the secretion; it becomes thicker, opaque, slate-coloured, greyish yellow, even yellow, and then assumes a more evident muco-purulent character. As the irritation subsides, this secretion gradually diminishes in quantity and consistence; epithelial cells in diminished number are alone visible, and the mucous membrane gradually and slowly

returns to its normal and healthy condition, regular epithelial layers being formed, as the more superficial are constantly and uniformly thrown off.

In the more severe forms of bronchial catarrh, where a more extended surface of mucous membrane is from the first the seat of morbid action, and where the capillary hyperæmia is not confined to the superficial mucous layer, but involves a more expanded series, and injects even the vessels of the sub-mucous tissue, the term bronchitis more usually applies. The several pathological conditions before noticed, are here much aggravated. The mucous membrane is no longer of a bright rose-red colour, but presents a deeper tint, even madder red; in the case before us purple madder. Consequent on this large amount of turgescence of the capillary vessels, (upon which this change of colour depends,) is tumefaction of the entire series of mucous tissues. A swollen turgid state of the mucous membrane is now observed; the effect of this is a diminution in the calibre of the air tubes,—a coarctation of them,—a lessened diameter. An increased frequency in the respiratory movements now compensates, or is an effort to compensate, for the diminished capacity of the air-tubes; and we notice in the severer forms of the disease, a gasping effort during inspiration, attended by very distinct wheezing sounds on expiration; these are distinctly heard, even without the aid of the stethoscope.

Now all these conditions were present in the case under consideration; and the physical signs recorded in the case book are very expressive of the conditions just explained. There is no respiratory vesicular murmur to be heard, the only sound at first is a sonorous rhonchus, either accompanied or followed by a variety of irregular murmurs, sometimes simulating the gentle cooing of a pigeon, at others whistling and wheezing. The lessened diameter of the air-tubes from the tumefaction of the sub-mucous tissue, is the cause of these sounds. As secretion becomes established, the turgescence of the membrane is relieved, but the air passing and re-passing over and through the tenacious matters in the tubes, produces the bubbling sound, heard so soon as secretion is accomplished, and to which the term mucous rhonchus or mucous gurgling is applied. This sound differs somewhat, according as it emanates from the larger or smaller tubes, and the study of that distinction is of much practical consequence. The mucous gurgling of the small tubes was very palpably present in this case, and you had an opportunity of hearing its peculiarity. When the catarrhal irritation extends to the smaller tubes, a similar series of changes takes place; the secretion at first scanty and thin, accompanied by frequent, urgent, and almost suffocative cough, becomes more abundant, opaque—a yellowish mucus, tenacious and frothy,—and in urgent cases, assumes the qualities of a muco-purulent fluid, in some cases possessing an almost cream-like consistence. This, as convalescence proceeds, becomes again thinner—more fluid, till in the stage of chronic bronchitis it has become a perfectly white frothy fluid, colourless, and oftentimes extremely abundant.

There is yet one other pathological condition in the severe and more acute forms of bronchitis, and of which

we have some evidence in this case, which must not be omitted, and that is the presence of plastic exudation; it is also known as fibrinous exudation, and is the inflammatory exudation of Vogel and other modern pathologists. The mucous membrane is as capable of generating this product of inflammatory action as other tissues, although it is certainly not so frequently observed as in the serous and cellular series. It would appear to be dependent on the amount of pre-existing capillary hyperæmia, the intensity of which, instead of generating granular cells, which are rapidly converted into pus-globules, and thus forming a true muco-purulent secretion, is attended by the exudation of a plastic lymph, which fills the smaller tubes and takes their form; and if the disease be fatal at this stage, this coagulated matter may be drawn out from the smaller branches, and in this case you witnessed its tenacity to be sufficient to allow it to be drawn out. In croup this exudative product extends over a large portion of the tubes, and explains the peculiarity of the stringy shreds expectorated in this disease. In the adult, if life be prolonged, this inflammatory exudation soon becomes purulent, pus-globules being very soon generated in it. This change facilitates its excretion, rendering it more fluid, less tenacious, and consequently more easily expectorated.

There can be no doubt, notwithstanding the imperfect history of this case antecedent to admission, that pulmonary catarrh had existed for some time, perhaps in a chronic form, and that in all probability the patient had experienced repeated attacks for some winters past. The enlarged condition of the heart strongly favours this view, for derangement in the structural condition of this organ is one of the most frequent causes of the perpetuation of chronic catarrhal affections of the pulmonary organs. A catarrhal predisposition in the bronchial mucous membrane, and heart-disease, tend to mutual aggravation. The catarrhal condition gives rise to frequent cough, often paroxysmal and suffocative; venous turgescence results. The violent expiratory efforts of coughing convey an impulse back on the right ventricle; in consequence of the disturbance the current of blood suffers from the circulation from the right side of the heart into the lungs being impeded, dilatation of this cavity follows, with a corresponding increase in the general mass of the organ. Increase of volume produces increase of power, and causes the blood to circulate in the pulmonary tissues with a force proportionate to the augmented volume. A condition of passive hyperæmia is perpetually present, which promotes, if it does not originate, the susceptibility to catarrhal irritation. With such predisposing causes it is not to be wondered that acute bronchitis should supervene, and should run a rapid and fatal course. Inflammatory exudation forms in the smaller bronchi; blood imperfectly oxygenated circulates through the left side of the heart, and reaches the great central organs of the frame; its action on the brain is first to induce torpid senses, the countenance becomes livid and purple, the surface becomes œdematous, the dyspnoea becomes more and more urgent, coma supervenes, and death then closes the painful and distressing struggle. The existence of emphysema

on the inferior margins, and on the surface of the lobes, must be taken as collateral proofs of the existence of some long-standing affection of the pulmonary organs, attended most probably by violent expiratory efforts, as in coughing; but the subject and pathological conditions of emphysema I propose to treat of on some other occasion.

THE LAW OF THE MORPHOLOGY OR METAMORPHOSIS OF THE TEXTURES OF THE HUMAN BODY.

(Fourth Series of Experimental Researches.)

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(Continued from page 93.)

VII. THE PROCESS OF NUTRITION, OR THE RECIPROCAL ACTION BETWEEN THE BLOOD AND THE SOLID TEXTURES.

The growth and preservation of all parts of the human body, and the renewal of its textures and secretions, whether healthy or diseased, depend upon a reciprocal action between the blood and the solid parts, termed the process of nutrition, in which certain elements or forms of matter withdrawn from the circulating current, become portions of the fixed solid. If the newly withdrawn matter assume the form of the pre-existing elements of the solid, and the quality of the pre-existing secretion, the process is said to be *normal* or healthy; but if the elements of the solid be changed, or the quality of its secretion altered, in consequence of any unusual change or unconformable transformation which the new matter undergoes, then the process is said to be *abnormal* or unhealthy.

If the circulation of the blood be observed with the microscope, in the nutrient vessels of a transparent texture in the living animal, without any previous rude handling or irritation, the stream is seen rapid and uniform, and it is impossible, from the rapidity of the current, to discriminate its cellular or corpuscular elements, except that here and there colourless cells are seen clinging to the walls of the vessels, slowly gliding along in close contact with them. If the part under observation be irritated, the regularity of the stream is immediately disturbed in a very remarkable manner, and, as if in consequence thereof, colourless cells, in increasing numbers, are observed separating themselves from the red current, and becoming fixed to the walls of the vessels. Soon afterwards, a clear colourless material appears between the stream of red blood and the solid texture, in which the colourless cells seem to be embedded; so that the irritating cause, of whatever nature it may be, is productive of an actual and visible separation between the colourless and the red elements of the blood, which is seen to take place within the vessels, the red flowing onward, sometimes with the utmost rapidity, whilst the colourless remain stationary, and form a new interior coating

to the vessels (the protoplasma.) We are precluded from making this direct satisfactory and conclusive observation in the human body, because there is no accessible part sufficiently thin and transparent for the purpose; but we have cogent reasons in the analogies of life and function—in the composition of the textures and the blood—for concluding, that in man, analogous or similar irritants are followed by similar results. This conclusion, drawn from analogy, is substantially corroborated by the fact, that in the human body, colourless cells greatly abound in the blood drawn from vessels that are experiencing any irritative or inflammatory action.

But the real nature or meaning of the phenomenon, thus seen in the living vessels of animal structure, and presumed from strong analogies to exist in the human body also, must be interpreted by the result or product—and this clearly proves it to be a phenomenon of nutrition, for the irritated animal textures become thicker, and new layers and new matter appears;—so in the human body where textures are becoming thickened, where new products and new results are appearing,—in pimples, boils and vesications,—in the skin in scarlet fever and erysipelas,—colourless cells are exceedingly abundant in the nutrient vessels, sometimes equalling in amount the number of the red cells.

Hence, therefore, it appears, from proofs accumulated on all sides, that the separation of the colourless cells and protoplasma or lymph of blood, from the red cells, and their distribution in a stationary form over the interior surface of the nutrient vessels are phenomena of nutrition; and it would farther appear from the cellular or corpuscular nature of pus, and from the ready healing by pressure of wounds discharging pus, that if the colourless elements withdrawn from the blood fail to undergo a conformable metamorphosis, or the cells to deliver up their contents, they change the character of the walls of the vessels, alter the anatomical type of the texture, and subsequently appear in the discharges or secretions,—in which case *the whole thickness* and the whole of the matter in the walls of the vessels experience a progressive alteration from within, there being no membranous septum or *structureless membrane* under these altered conditions, standing as a barrier to the retrograde morphology.

The process of nutrition here described from observation and experiment, comprises three intelligible and visible stages:—*First*, the separation of the colourless cells and protoplasma of the blood from the red current; *secondly*, the metamorphoses of these colourless elements in their progress through the walls of the vessels; and *thirdly*, the ultimate product which constitutes the permanent form or textural type. The first stage takes place within the vessels, along their interior boundary; the second takes place in, and gives the form of, the elements of the walls of the vessels; and the third, or ultimate product, appears at the outer