LUMLEIAN LECTURES

ON THE

PATHOLOGY OF THE PNEUMOGASTRIC NERVE.

Delivered at the Royal College of Physicians.

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LECTURE II.

IN this lecture, we pass on to the consideration of those pathological changes in the œsophagus, in the lungs, and in the heart, which are connected with disturbances of the par vagum; and we shall find fresh exemplification of the three laws upon which we dwelt at our last lecture.

1. Disease at the central origin of the nerve may induce symptoms of irritation in any other part supplied by the same nerve.

2. Irritation in any set of peripheral branches may produce disturbance in any other part to which the nerve is distributed, or in the centre itself.

3. Alternation of irritation may be produced; at first one set of nerves, then another, becoming implicated.

The œsophagus receives a large supply from the pneumogastric, and the branches of the nerve form a plexus upon it; but, besides these branches direct from the trunk of the nerve, others are derived from the recurrent nerve, as well as from the sympathetic. This nervous supply is especially concerned with the regulation of the movements of the muscular layers of the canal, for the œsophagus is a mere channel of communication between the pharynx and the stomach. This muscular layer is thrown into a state of spasmodic contraction from the increased irritability of its nervous supply; or, from exhaustion of nerve-power, it is weakened and paralysed. When the power of the pneumogastric is destroyed, as by division of the nerve, the passage of the food is retarded in its passage down the tube. It may be convenient, therefore, to divide the nervous affections of the œsophagus, which have to do with the pneumogastric nerve, into those which are of a spasmodic and those which are paralytic in character; and each of these may be traced to central or to local disease, or they may be produced by peripheral irritation.

Spasmodic stricture	Central	Mania Epilepsy Nervous irritability Foreign bodies
	Local	Pressure on the canal by tumours; enlarged glands; aneurism Organic obstruction and ulceration Hysteria
	Peripheral	Disease of heart Disease of aorta, and aneurism Flatulence
Paralysis	Central	Exhaustion
	Local	Pressure on pneumogastric nerve; aneurism; etc.
	Peripheral	Disease of stomach, etc.

Although the mucous membrane of the œsophagus does not possess great sensibility, still there are decided sensations produced by the passage of food down the canal, as a sense of heat or of coldness, of fulness and distension, or of severe pain; and sometimes the sensibility is increased, so that patients complain of a sense of soreness, of roughness, or the whole canal is unduly sensitive: sometimes this augmented sensibility exists only in the imagination of the patient. The process of deglutition is completed by the passage of food down the œsophagus into the stomach, but food or saliva or other substance must be present to excite the act: a person cannot swallow without something to excite the contraction by reflex irritation. A young gentleman called upon me in great distress, believing that he had organic obstruction in the gullet. During the whole of his journey from Rugby to London he had been trying to swallow, but without success, as he could not complete the act when saliva had already been swallowed. He did not understand the physiological process, and his mind was at once calmed and his fears dissipated when a glass of water was given to him. In some cases of mania, as also in many cases of spasmodic

reflex irritation in hysteria, patients believe that there is obstruction, and that there is no passage. Nothing is swallowed, because the attempt is not made: the cerebral centre is at fault. The loudest protestations are made that food will not pass, and the patients will often refuse to make the attempt. The passage of an œsophageal bougie proves that there is no obstruction, and some may be induced to make the attempt after this operation has once been performed. It is probable that some spasmodic contraction induces the sensation of obstruction. This form of spasmodic affection is a common symptom in many cases of mental disease, and sometimes it is amongst the earliest indications of the malady.

A similar kind of spasmodic obstruction occurs in some cases of epilepsy, and after sun-stroke a sense of choking and obstruction in the throat is produced somewhat similar to globus hystericus, but due not to reflex but to central mischief; and again, in other patients, local spasmodic irritation and contraction of some part of the œsophagus may be produced, which cannot be traced to local disease or to irritation of a reflex kind. For years, persons complain of hindrance to the free passage of food where no stricture exists; it may be at the centre of the canal or at its termination. In an instance of this kind, a member of our profession was, for a time, in great fear that organic disease existed, and he took his meals alone, on account of the care that he required in getting the food to pass into the stomach; but he found that by taking a deep inspiration the spasmodic contraction, probably near the diaphragm, became relaxed, and the food slipped onwards into the stomach. It must, however, be remembered that all local disease of the œsophagus produces spasmodic contraction from irritation of the part; and that a partial obstruction or narrowing of the canal is often rendered complete from this cause; some, indeed, have believed that long continued spasmodic contraction may produce thickening of the connective tissue, and lead to organic obstruction. It would be foreign to our purpose here to describe organic obstruction, whether from external disease or pressure of glands, tumours, or aneurism, or thickening of the coats of the canal, either from fibro-cellular tissue, from the healing of ulcers, the deposit of cancerous or other material, further than that spasmodic contraction always plays an important part in the symptoms produced.

The spasmodic contractions which are of a reflex character are well known. In the globus hystericus, a sudden sensation as of a ball in the throat and a sense of suffocation are produced; the respiration is disturbed, with sighing and irregular breathing, and the emotional centre, and often the whole of the spinal nerves, are excited to perverted action. Peripheral disturbance of sentient nerves leads to the excitement of the medulla oblongata at the origin of the par vagum; the irregular contraction of fibres of the œsophagus, especially of the circular fibres, leads to this sensation of a ball in the throat. In many instances there is disordered uterine and ovarian function, whilst in others, from general weakness, the emotional centres of the brain react upon the medulla and its nerves. Very similar sensations are produced by flatulent distension of the stomach and transverse colon; the sensation at the upper part of the chest is a purely reflex one, and it is principally due to the pneumogastric, but it is increased by the condition of the upper dorsal nerves from their connection with the splanchnic nerves, since the latter have their origin in the dorsal nerves, and pass down to the abdominal viscera. In some cases of heart-disease, spasmodic irritation of the œsophagus is induced, and it comes on suddenly with most distressing sense of obstruction. Some refer this reflex action to the branches of the cardiac plexus uniting with the pneumogastric, others to the recurrent nerve which sends a branch to the cardiac plexus, whilst others attribute the sensation to a mechanical cause, the distension of the left auricle, which is in close proximity with the œsophagus. The pathology of these cases of disease is very different, and the simple spasmodic obstruction may be easily mistaken for that which is organic. In the first kind, it is important to compel the œsophagus to do its work; in the second, it is equally important to allow it to rest; whilst, in the last, the removal of the peripheral mischief will soon dissipate the spasmodic hindrance.

The paralytic affections of the œsophagus are found at the close of other diseases, but these also arise from central, local, or from peripheral disturbance. In general exhaustion, deglutition is slow, because the pneumogastric is in a weakened state, and food may even on this account remain in the œsophagus itself, or it may perhaps pass from the stomach into the lower part of the canal, and produce solution by the action of the gastric fluids; in this way the œsophagus may be dissolved and even perforated during life. Local pressure upon the pneumogastric nerve, or ulceration, may also destroy its power and paralyse the muscular energy and the sensibility; and lastly, at the close of some abdominal diseases, as of the stomach and uterus, the power of the œsophagus is lost, and patients are unable to get food into the stomach.

In these instances, the condition is one of exhaustion, and of the cessation of living power in the system; and with this loss of sensibility in the œsophageal branches of the nerve, there is only a slight step to the cessation of the more essentially vital act, that of respiration.

The pathological relations of the nerve with the *lungs* and with *respiration* next demand our attention. The pulmonary plexuses are situated at the root of the lungs; they are connected with the sympathetic and with the cardiac branches of nerves, and are distributed to the minute structures of the lungs; it has been shown that this irritation of the pneumogastric will cause the bronchi to contract. In the morbid processes which are recognised, we may adopt the same arrangement as previously, namely, into those of a spasmodic and into those of a paralytic kind; in the former, there is increased irritability of the sentient centre, the respiration is quickened, and there may be violent cough and dyspnoea; in the latter, the respiratory centre is weakened or paralysed, there may be but little or no cough, and no effect may be produced by irritants; the respiration is slow, but deep and irregular.

Spasmodic irritation	Central	Irritability from exhaustion
		In fevers, etc.
		Asthma (spasmodic)
	Local	Whooping-cough
		Hay-asthma
		Bronchitis
Paralysis	Peripheral	Pneumonia
		Emphysema, etc.
		In hysteria, producing hurried breathing, etc.
	Central	In heart-disease, producing cardiac asthma
		In gastric disease
		In gout, etc.
Paralysis	Local	Respiration slow; congestion, producing pneumonia and bronchitis
		Poisoning by opium
		Apoplexy, etc.
	Peripheral	Cold shock, producing bronchitis, pneumonia, often without cough
		Patients dying of cancer of stomach, or of uterus, of chronic gastric ulcer, etc., often have pneumonia, which is not due to septic changes

A few words in reference to some of these conditions. With weakness of the system there is increased irritability of the nervous centres, and the centre of respiration is no exception to this rule. In continued fevers, as enteric or typhus, with increasing exhaustion the respiration becomes more hurried, and this is often an unfavourable sign; the lungs have become engorged with blood at the posterior and more depending parts; the power of the heart is lessened, and the nervous energy is becoming exhausted. In whooping-cough, to which we have previously referred, the principal symptoms are those connected with the throat, but it often happens that severe cough and bronchial complications follow, and, in not a few cases emphysema. The mechanical pressure upon the delicate air-cells may have to do with this effect; but it must be remembered that the par vagum which supplies the larynx also supplies the lung. The nerve-power is lessened, and the nutrition of the lung-tissue interfered with; and this condition is favourable to the production of emphysema of the lung and its attendant circumstances. There can, I think, be no doubt that true spasmodic asthma may be due to disturbance of the origin of the pneumogastric as well as from peripheral irritation. In true spasmodic asthma, it is remarkable with what suddenness and with what severity the symptoms may come on. The greatest distress of breathing may be produced almost at once, so that the patient is unable to move, but remains with the head thrown back, the eyes full and protruding, the muscles of forced respiration brought into violent exercise, and the countenance, becoming of a livid colour, is covered with profuse perspiration. The attack often comes on at night. If we listen at the chest, scarcely any air is heard to enter; but some sibilus may be detected; less and less air is aerated; the heart becomes feeble, the right side is distended, and but little blood passes to the left side, so that the pulse is necessarily small. The bronchi are spasmodically contracted, and will not allow air to enter; the branches of the pneumogastric are in extreme irritability; the afferent nerves are intensely excited, and induce corresponding action in the efferent filaments; as, however, the centre becomes narcotised by the imperfectly aerated blood, it relaxes its spasmodic grasp, and, in a quarter to half an hour, a little secretion takes place from the engorged vessels, a small quantity of mucus is discharged, more air gradually enters, and the paroxysm subsides. This state is a most painful one to witness, and is most distressing to the patient. It may be associated, in less severe degree, with diseases of the bronchi and with affections of the heart; but cardiac asthma and bronchitic asthma are very different in regard to the suddenness of the attack and the previous absence of symptoms of organic disease. Various means may be used to quiet this intense spasm, and the most serviceable are the bromide of potassium with the juice of the conium, lobelia and ether, hydrocyanic acid, and stramonium, and narcotics in

varied forms; but upon these, and also the means by which the paroxysms may be averted, I must refrain from dwelling.

I was called to see a young man, aged 24, some years ago (1870), who had, in the early morning hours, paroxysms of intense dyspnoea. He was, when I saw him in November, sitting up in bed; the respiration was easy, but there were some sibilant *râles* and prolonged expiratory murmur was heard. He had been out of health for several months, but his attack was of about a week's duration, and came on with sneezing, with cough and gasping for breath; the heart was irritable, but no *bruit* was heard; the expectoration was frothy, the tongue was clean, the abdomen supple, the pulse compressible, the urine healthy. He was spare; his countenance anxious, and there was much irritability of the whole system. In the following May, he had remained free from severe attacks of dyspnoea; he had no asthma, but his heart was irritable and irregular in rhythm, and he had also complained of faintness and flatulence. In October, he went to Margate, and his health improved; but he said that he suffered from his stomach. He then took cold, and had his old chest-disturbance; he was, moreover, very nervous, and dwelt upon his ailments. The winter of 1871 he spent at Ramsgate and Margate; his general health was better, but he complained of pain in his head (July 1872), so that he felt uncertain about himself; his scalp was very sensitive; his breathing was perfectly quiet, and he was free from asthma, but the pulse was irritable. In September, he was free from pain in the head, but had nervous twitching and hysterical crying. In November, the pulse was very rapid (160), the tongue clean, the appetite tolerable; he had dull headache, and for several months complained of "queer feelings" in his head, afterwards in his mouth and throat. In July 1873, he had some return of the asthma, and the heart was affected as on a previous occasion. In 1874, he had passed the winter well; but his mind was fretful, "his stomach queer", and there was a threatening of the return of his chest-symptoms; still his general health was decidedly improved, and he was able to return to business.

This was at first a well marked case of spasmodic asthma; but the irritation of the pulmonary branches of the pneumogastric was followed by disturbance of the heart, then by neuralgia; afterwards, his nervous system and his brain became disturbed; then the stomach and digestion were interfered with. It was evident that his malady was connected with the state of the pneumogastric, and there was a remarkable alternation in the part affected: the lung at one time, then the heart, the brain, the stomach. There was no certainty as to which part would be next attacked. The disease was, however, one, but its manifestation was different; it was relieved by bromide of potassium, by arsenic, by belladonna, and by tonics, such as steel and quinine. His mother described herself as of a nervous temperament, and his sister died from acute epileptiform disease. We might describe numerous instances to show this effect on the pulmonary branches of the pneumogastric from central disturbance. It would lead us far beyond the limits of these lectures were we to describe the several forms of spasmodic affection of the bronchial tubes produced by local irritation; and, although we speak of this as produced by local irritation, it must be borne in mind that it is the impression upon the afferent branches in the lungs which is local, as distinguished from that which is central or produced by irritation in the abdomen; the action upon the efferent branches is the same in each case. In hay-asthma, the irritant is directly inhaled, whether it be the pollen of grass or other particles; and, in many inflammatory diseases of the chest—bronchitis, bronchopneumonia, emphysema, etc.—the muscular fibres of the bronchial tubes are excited to spasmodic contraction, and increase the dyspnoea. It is an important part in the treatment of many of these diseases so to soothe the branches of the par vagum as to lessen the irritation of these bronchial muscular fibres. Very minute doses of morphia, of belladonna, of hemlock, may in this way greatly mitigate the disease, when a large dose, especially of the former, does great injury by narcotising the respiratory centre.

The instances of spasmodic disease which are due to *reflex* irritation are very different both in character and in severity. In the nervous irritability of hysteria or uterine disease, an impression is carried to the medulla oblongata by spinal or sympathetic nerves, and thence by efferent fibres to the lungs, so that the respiration becomes greatly excited. Sometimes these patients may be seen breathing one hundred times a minute or more rapidly, equally in quickness with the pulsations of the heart; but the disease, though weakening, is comparatively harmless; it will give place perhaps to irritation of the stomach or neuralgic pain in the head. Very different is the asthma which is due to cardiac disease, especially where there is mitral stenosis, or great dilatation of the left ventricle. The blood is delayed in the pulmonary capillaries, and the system is deprived of its normal proportion of aerated blood. This disturbance of the balance between the

circulatory and respiratory system leads to urgent dyspnoea; but we must not dwell upon this subject. Again, in simple gastric disease, we find that the afferent branches induce disturbance of the origin of the pneumogastric, which is expressed in the pulmonary branches, and there is truth in the assertion that a cough is "stomach cough"; too often, however, the gastric disturbance associated with a dry and hacking cough is itself, as we shall have to mention, the effect of disturbance of pulmonary branches of the pneumogastric by tubercular deposit, and not the cause of the cough. A stomach-cough is a very doubtful symptom in delicate patients, and one that should be watched with extreme care. In gouty subjects, and also in syphilis, in ague, and in remittent fevers, we have modifications of action of the respiratory nerves, and conditions are produced which are very different from ordinary inflammatory disease, and their causes require to be recognised, otherwise they baffle the practitioner in the treatment of them. In this way, iodide of potassium becomes a most important remedy for syphilitic bronchitis, if I may use such an expression, and quinine and arsenic are of great service in the severe asthma that is sometimes observed in aguish districts.

The conditions that are produced by *paralysis* of the pulmonary branches of the *par vagum* closely resemble those observed after experimental division of the nerve. We may take one or two instances to illustrate this fact, and we would premise by stating that this paralytic condition may be of *central* origin, or it may be due to local or to reflex influence. In reference to the first condition, the medulla oblongata and the origin of the nerve at the floor of the fourth ventricle is directly affected in severe apoplexy, in such cases as *incurvescent apoplexy*, when a clot has broken into the lateral ventricle, and the blood has passed onwards into the fourth ventricle, or, again, in apoplectic effusion into the pons Varolii. The respiration becomes very slow; one or two deep inspirations are followed by several slight and more shallow ones, then to be compensated for by a full and deep act. The lungs become congested, there is serous effusion into the air-cells, and a form of broncho-pneumonia is produced, if life be prolonged. In poisoning by opium, almost a similar condition is observed. This paralytic state of the pulmonary branches may, however, be the result of a *local* cause, as a severe chill affecting the extreme branches of the *par vagum*. Scarcely a winter passes—we might say no winter passes by—without many persons thus becoming struck down almost at once, especially in the extremes of life, the aged and the young. Sometimes the attack is spoken of as a mere cold or catarrh, but the shock is so great that the patient is unable to rally, bronchitis or pneumonia is almost at once produced, it may be without cough, and the patient quickly becomes prostrate. In a very few hours patients thus pass away; unless, perchance, by powerful stimulants, such as brandy, ammonia, ether, etc., there is a quick invigoration of these important nerves and centres. One other reference to this paralytic condition, in this instance due to reflex action. It is very common at the close of organic disease of the stomach and of the uterus to find that patients have broncho-pneumonia, and that this appears to exhaust the last spark of life; this condition may be quite independent of septic change and of alteration in the blood, but it is produced by the gradual exhaustion of nerve-power, until, at length, the respiratory act is inefficiently performed, and the least irritation suffices to produce these inflammatory changes in the lung-tissue. Sometimes, by watching the gradual progress by which life is fading away, we may for a short time retard dissolution and prolong life.

[To be continued.]

CASE OF SUPERNUMERARY TESTICLE.

THE following case of malformation is worthy of record as being rare. A private of the 4th Battalion Rifle Brigade, on being examined for transfer, was found to possess three testes, two of which were situated in their normal position, and were of moderate size, whilst the third or supernumerary testicle was situated about an inch above the testicle of the left side, midway between it and the external abdominal ring, and well in the sac of the scrotum. The two glands were distinct, and movable independently of each other. The supplementary gland was firm, elastic, and about the size of a nutmeg; and pressure produced a sensation similar in it both to the patient and to the fingers as that occasioned by squeezing either of the other two. The vessels, etc., of the two glands on the left side united to form a single spermatic cord above the smaller gland, in which, on manipulation with the fingers, two of its constituents, of firmer feel and structure than the rest, could be isolated, being most probably the deferent ducts of the glands. This state of things had existed since the man's earliest recollection. There was no complaint of inconvenience.

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THE CROONIAN LECTURES ON THE PATHOLOGY AND RELATIONS OF ALBUMINURIA.

Delivered at the Royal College of Physicians.

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LECTURE II.

THE alterations in the structure and tension of the arteries which, in my last lecture, I described as belonging to the granular degeneration of the kidney, supply the key to some of the more important secondary lesions which attend the disease. First, as most obviously associated with them, may be placed the *retinal disorder*, whether exudative or hæmorrhagic, which is so closely connected with the granular kidney, that if "*albuminuric retinitis*" be recognised with the ophthalmoscope, this type of renal disease may with but a small percentage of error be assumed to exist. But that the association is not invariable has been shown by the examples—rare though they be—in which the condition has been linked with the white smooth kidney of diffuse nephritis.

There is a transient blindness which comes on sometimes with other signs of uræmia in any condition from which uræmia can spring. This has been well described by Dr. Clifford Allbutt in his work upon the ophthalmoscope, in which he teaches us to look upon the retina not only as part of the machinery of sight, but as displaying upon its mirror, as if by some process of natural magic, the diseases of concealed structures and remote organs.

This form of uræmic blindness, connected possibly with a toxic embarrassment of the intracranial organs of vision, gives no sign of which the ophthalmoscope can take note; nor has it any especial connection with the type of renal disease under consideration. Dealing only with visible and retinal changes, these are complicated by hyperæmia, serous infiltration, hæmorrhage, and, sooner or later, striking white spots, in regard to which there is some difference of opinion as to how far they are the mere records of past hæmorrhages, and how far they are the independent results of degeneration of tissue. These injuries are variously intermixed; they all originate alike in arterial leakage, whether from the increased blood-pressure, or from the deterioration and abnormal perviousness of vessel which are constantly present with the form of renal disease under consideration. Of these changes, which are conveniently spoken of together as *albuminuric retinitis*, the hæmorrhagic patches and white spots when together are characteristic. They are but the visible signs of a disorder which is as wide as the arterial system, involving not only conditions of arterial distension and degeneration, but almost as surely of cardiac hypertrophy and renal failure. This optic state is of great interest clinically. It must generally be accepted as evidence of advanced disease, though often of disease which as yet has had no result in dropsy, or given any other intimation of its existence which is understood of the vulgar; but has crept on in the subterranean fashion belonging to the granular kidney, and not struck the surface until after a long course it has reached the retina. Perhaps the most rapid form of renal disease which is apt to be thus accompanied, is the albuminuria of pregnancy; this, leading as it does to granulation, is more liable perhaps than any other form of albuminuria to acquire the retinal complication.

It would be of interest, were it practicable, to state how frequent are the exceptions to the general rule that retinal hæmorrhage denotes renal granulation; the rule is supported by hundreds, where the exceptions are counted by units. But they are enough to show that there is no necessary pathological connection or identity of kind between albuminuric retinitis and the granular or cirrhotic kidney, but that the retinal is only an expression of a state which, though most frequent with this form of renal disease, is not peculiar to it. The later stages of both the nephritic and the lardaceous kidney may be thus accompanied.

And in other organs and by other modes the same hæmorrhagic bias is evinced; most importantly within the *brain*. The very frequent concurrence of the granular kidney with sanguineous apoplexy is too familiar to need assertion in this place. With