CLINICAL OBSERVATIONS
ILLUSTRATING THE EFFECTS PRODUCED BY THE
IMPLICATION OF BRANCHES OF THE
PNEUMOGASTRIC NERVE
IN
ANEURISMAL TUMOURS.

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THE pneumogastric nerve is, perhaps, the most complicated nerve in the body, and the symptoms of disease by which it is implicated vary according to the part that is affected. As a sensitive nerve, its filaments are distributed to the mucous membrane of the larynx, whilst the recurrent branch supplies the laryngeal muscles. In the chest large branches are given off to the cardiac and pulmonary ganglia; and in the abdomen not only does the nerve reach the stomach, but it sends branches to the semilunar ganglia, to the liver, to the pancreas, and to the supra-renal capsules.

The following cases are recorded to illustrate the important influence which pressure upon this nerve exerts in modifying the symptoms of aneurismal disease in the chest.

CASE 1.—*Double aneurism of the arteria innominata; dilatation of the aorta; double bruit; raucedo; dysphagia; paroxysms of dyspnœa; rupture into the trachea; first hæmorrhage five days before death; pressure on the recurrent laryngeal nerve; commencing degeneration of the muscular fibres of the laryngeal muscles.*

James S—, æt. 39, a strong and muscular man, who had been at work at the Chatham Dockyard, applied to me on November 10th, 1863. In 1854 he went with Sir E. Belcher's expedition in search of Sir John Franklin, and whilst on the Arctic voyage he had an epileptiform attack. He was afterwards occupied in making Armstrong guns at the Woolwich Dockyard, and whilst there, after over-exertion, he had occasionally felt "stupid," and suffered from dyspnœa. The thyroid gland had also been enlarged for a long time.

At the beginning of October, 1863, he suffered from hoarseness, with increased and paroxysmal dyspnœa; the respiration became noisy and stridulous, and he was unable to swallow anything "dry" without producing cough. The sound of the voice varied greatly; sometimes it became comparatively clear and distinct, at other times it was hoarse and scarcely audible; the cough was a slight one. The chest was well developed, but somewhat flattened at the right apex, and the resonance on percussion was imperfect; the respiratory murmur was coarse, but equal on the two sides, and stridulous breathing was heard; both pulses were equal and jerking. The sounds of the heart were normal, but at the upper part of the sternum, towards the right side, a distant, double bruit could be heard. On the right side of the neck the pulsation was greater than in health, but no definite sac could be felt, and no pain was experienced either in the chest or neck, or down the arm. The larynx was carefully examined with the laryngoscope; the epiglottis was seen to be healthy, and the inferior vocal cords were slightly œdematous. Both pupils were rather

smaller than their natural size. On November 30th he came among the out-patients, stating that on the 27th he had broken a blood-vessel, that he had coughed up a considerable quantity of blood, and that the bleeding had not ceased. He was at once admitted into the hospital. Moist crepitation was audible at the right apex, but the bruit previously heard at the right side of the first bone of the sternum could not be detected, being either obscured by the moist sounds or lost from the changed current of blood in the sac. The oozing of blood continued. On December 1st the sputum was rusty, as in asthenic pneumonia, but there was neither faintness nor distress of any kind, and he remained in an easy state till the morning of December 3rd, when, about 2 o'clock, violent hæmorrhage came on, and in a few minutes life had ceased.

On inspection, twelve hours after death, blood oozed from the mouth. The body was that of a strong and muscular man. On opening the chest, the viscera were in their normal position; the lungs were distended with air, and some globules were red, from the presence of blood. Slight pleuritic adhesions existed at the left apex. The larynx was healthy, but the aryteno-epiglottidean folds were œdematous. The trachea and bronchi contained blood, and immediately above the division of the trachea there were four openings, each one capable of admitting a large probe; the openings slightly bulged towards the trachea, and were filled with coagulum, and they extended about one and a half inch in a curved line. The lungs were healthy. The heart was firm and contracted, and its cavities were empty; the mitral and the aortic valves were healthy, but the latter were thin and stretched. The whole of the arch of the aorta, from its commencement, was rough and scabrous, and it was considerably dilated; the arteria innominata was also dilated to three times its natural size, and the right subclavian and the right carotid arose from the upper part of this dilatation; but the current of blood to these arteries did not seem to have

been interfered with. From this aneurismal pouch of the *arteria innominata* two secondary aneurismal sacs arose; one, about the size of a pigeon's egg, extended downwards and to the right; the other, rather larger, passed downwards and to the left. The latter reached to the side of the trachea and oesophagus, and the rings of the trachea were felt in it. It was this sac which had opened into the trachea; the commencement of the recurrent nerve from the pneumogastric was also upon this inner sac, and the nerve was adherent by tissue. The aneurism had also exerted pressure upon the pneumogastric (see woodcut A). The thyroid gland was enlarged and hy-

- a.* Recurrent nerve.
- b.* Pneumogastric nerve.
- c.* Right carotid artery.
- d.* Right subclavian artery.

pertrophied. The liver, spleen, kidneys, and intestines, were in a healthy state. On carefully examining the larynx, and especially the inferior vocal cords, the right was more flaccid than the left; on the right side, also, the muscular fibre immediately beneath the elastic tissue was more granular than on the left, and during life it had been more swollen; this state was probably due to the pressure upon the recurrent nerve on that side. It is regretted that the patient was not asked to produce a sound whilst the larynx was being examined.

The occasional cerebral oppression from which this patient suffered might perhaps be correctly referred to enlargement of the thyroid body, and consequent interference with the circulation of the brain, from pressure on the jugular veins; whether this were the case or not, the whole bearing of the general symptoms pointed to aneurism as their cause. The dyspnœa was paroxysmal; the raucedo varied greatly, sometimes there was hoarseness, at other times the voice became clear and distinct; the breathing was to some extent stridulous, and the cough was a slight one. Again, the physical signs tended in the same direction; the absence of bruit immediately over the valves, and the presence of a distant double bruit at the upper part of the sternum, the partial dulness at the same part, without evident mischief about the lungs, were best explained by the aneurismal disease, which had been correctly diagnosed.

The laryngoscope was of value in showing the absence of ulceration of the larynx, and in demonstrating that a further cause must be sought for the dysphagia and the raucedo than could be found in the larynx itself; and although slight œdema of the vocal cords was present, and a difference was detected on the two sides, these conditions were not regarded as the cause of the laryngeal symptoms; and we believe that the value of the laryngoscope in thus facilitating a correct diagnosis will be increasingly found as it is more extensively used. The occurrence of a double bruit in this instance was unusual; frequently no bruit

whatever is heard, and in some instances only a systolic one can be detected. Sometimes, also, a ringing clearness of the normal second sound is the only deviation from the signs of health, as in Case 4. These modifications of auscultatory signs are doubtless due to the different states of the arterial wall, to the amount of fibrin in the sac, and to the course of the blood-current in relation to the sac itself.

There is also great diversity in the severity of the dysphagia arising from aneurism of the aorta; here it was not a distressing symptom; but in some instances, in which the aneurism has taken place on the left side, and when the œsophagus would be likely to be compressed, no such symptom has existed, the tube being pushed aside, *en masse* (see Case 2). On the contrary, the morbid pressure on the œsophagus may lead to sloughing, as in an instance recorded in my work on 'Diseases of the Alimentary Canal,' in which the dysphagia was extreme.

On the occurrence of hæmorrhage in the present instance moist sounds were heard at the apex of the right lung, and this sign led to doubt as to the correctness of the diagnosis. During four days oozing of blood took place from the ulcerative communication between the aneurismal sac and the trachea, and on the morning of the fifth day a sudden increase in the hæmorrhage produced the fatal result. The issue was, however, due in a greater degree to obstruction of the respiration than to mere loss of blood. A much longer period sometimes elapses between the first hæmorrhage and the last, as in a remarkable instance recorded by Dr. Gairdner, and in the fourth case now brought forward blood was coughed up nine months before death.

There was no difference in the force of the respiratory murmur on the two sides of the chest, showing that the sac did not produce direct pressure upon either bronchus; nor was the circulation in the right subclavian interfered with, for the pulses were equal, because the current of blood to the right subclavian artery was uninterrupted. These ine-

qualities of pulse and of the respiratory murmur are, however, valuable diagnostic signs of the presence of thoracic tumours.

The symptoms arising from pressure upon the pneumogastric are modified by the seat of the mischief; in the first instance mentioned the recurrent laryngeal nerve was especially involved, and the symptoms manifested were hoarseness or aphonia, dyspnœa and stridulous breathing, the physical state of the larynx being also altered, as shown by its œdematous condition and by the more granular state of its muscular fibre on one side than on the other; but sometimes this affection of the larynx is much greater, and the laryngeal muscles become pale and wasted; and still further, the pulmonary branches may also be damaged, so as to rouse pneumonic congestion, and even pneumonia. These conditions were remarkably shown in a patient admitted into Guy's Hospital some years ago, but of whose case I only possess a few particulars.

CASE 2.—Aneurism of the aorta; pressure on the left recurrent laryngeal nerve and on the left pneumogastric; atrophy of the muscles of the larynx, and pneumonia of the left lung; pressure on the thoracic duct; apoplexy.

George K—, æt. 35, was admitted into Guy's Hospital on March 27th, 1850, and died on April 5th. He was a sailor, and about a month before admission he had an attack of apoplexy; there were also symptoms resembling phthisis, with aphonia; a bruit was heard below the left clavicle, but there was no dysphagia. Dr. Addison diagnosed aneurism. The account of the inspection is principally from Mr. J. Birkett's notes, by whom the examination was made. After mentioning the remains of a large apoplectic clot at the left fissure of Sylvius, around the branches of the middle cerebral artery, he described the state of the thoracic viscera.

A large quantity of sero-sanguineous fluid, with clots of fibrin, existed in the left pleura. The surface of the left

lung was covered with effused lymph of the colour of blood, and from this surface processes passed off, and were attached to the pleura costalis. All these adhesions were recent. The *left* lung was solid; its section presented white softened patches, especially at the apex, and it contained much dirty pus; other portions were studded with numerous white points, resembling cheesy tubercles. The whole appearance of the lung was the result of a low form of pneumonia. The larger air-tubes were filled with thick tenacious mucus. The *right* lung was congested and loaded with serum; otherwise it was normal and free from tubercles; but it was united by old pleuritic adhesions to the walls of the chest.

The heart and its valves were healthy. At the second curve of the arch of the aorta an aneurism had formed, the posterior wall of which was completed by the bodies of the first, second, and third dorsal vertebræ. The bodies of the vertebræ were much absorbed, and the intervening cartilages projected between the bones. The aneurism contained old fibrinous layers, and the walls of the aorta, both above and below, were dilated. The left pneumogastric nerve was stretched out over this aneurismal tumour, and the recurrent laryngeal nerve passed behind the sac in its course upwards. This last nerve was in one part imbedded in the tumour, and its filaments were disorganized; but the nerve between the tumour and the larynx presented the normal appearance. The mucous membrane of the larynx was healthy; but the left crico-arytenoideus posticus muscle was pale and small, and indeed atrophied, when compared with the right, which was normal. The trachea was compressed by the aneurism, and the œsophagus was firmly adherent to it; but the latter was pushed aside, explaining the absence of dysphagia.

The liver and the kidneys were congested, and the lacteals in the mesentery were remarkably distinct; they were much enlarged and were filled with white fluid. Although the aneurism was situated near the termination of the thoracic duct, the duct could not be traced.

The pressure on the left pneumogastric nerve had evidently

a causative relation with the pneumonia of the left lung, with the wasting of the left laryngeal muscles, and with the aphonia.

CASE 3.—*Carditis; dilatation of the aorta; fibroid degeneration of the heart; aneurism of the arch of the aorta; pressure on the trunk of the right pneumogastric nerve; pneumonia of the right lung.*

Daniel C—, æt. 45, a groom, was admitted into Guy's Hospital, under my care, October 21st, 1863. He had an aged appearance, was of temperate habits, and had generally enjoyed good health. Two weeks before admission he was exposed to cold and wet, and a few days afterwards cough came on, with urgent dyspnœa. The difficulty of breathing was increased by a recumbent position. On October 21st he had cough, but with very little febrile heat of skin. On examining the lungs, there was no dulness on percussion, but, some râles were audible. The cardiac dulness was considerably increased; the action of the heart was tumultuous, irregular, and intermittent, but a bruit could not be made out; the pulse was small, irregular, and not very compressible. The body generally was spare, the countenance was distressed, and the face slightly congested.

On the 24th the dyspnœa was more urgent, and there was increased dulness about the heart; the action of the heart was still irregular, the sounds were feeble, and at the base of the heart a to-and-fro sound could be heard; there was dulness also at the base of the right lung, and the respiration was there indistinct, and sibilant râles were audible at the right apex. On the left side the respiration was puerile; there was no pungent heat of skin, nor expectoration of blood. There was neither hoarseness nor any difference in the force of the respiratory act on the two sides of the chest. He was cupped from the side to six ounces. Acetate of ammonia, with nitric ether and morphia, were given, and a small quantity of brandy allowed. On the 29th the pulmonary symptoms were greatly relieved, and the action of

the heart became more regular; but a triple sound was now distinctly heard, as if the first sound were divided. The patient continued to improve slowly till November 7th, when symptoms of more general bronchitis came on, apparently from cold taken in the ward; mucous râles were heard on both sides of the chest; there was slight lividity of the countenance, and the dyspnœa was severe; the action of the heart was more feeble. The bronchitis subsided, and the dyspnœa lessened, but several paroxysms of extreme faintness came on at night. On December 1st the legs were found to be swollen, and the urine contained a small quantity of albumen; still he was able to walk about the ward, and, under small doses of tincture of sesquichloride of iron, improved so much that the thought was entertained of his returning home. On December 8th, at 7 p.m., faintness again came on, and he passed a disturbed night. On the following morning the faintness continued, and he rapidly sank.

Inspection, on the 10th December.—There were pleuritic adhesions on both sides. The whole lower lobe of the right lung was red, fleshy, and dense, and some lobes were still more congested. *Heart.*—There were partial adhesions over the pericardium, and upon the ventricles, and small portions of fibrin were attached to other parts of the serous membrane. The heart was much enlarged; the auricles and right ventricle were normal, the left ventricle was hypertrophied and dilated; the endocardium was white and opaque in several parts, especially over the carneæ columnæ of the mitral, and on making a section of these muscular columns a considerable quantity of fibroid deposit was seen. This fibroid deposit was still more manifest in microscopical examination, fibre-tissue being observed between the bands of fibre; but the muscular fibre itself had not undergone degeneration. The membranous portions of the aortic and mitral valves were healthy. The aorta was scabrous and dilated, and at the commencement of the transverse arch, extending posteriorly, and towards the right side, was an aneurismal sac about two inches in diameter; it extended to the apex of the right lung, but did not perforate the tissue. The sac

was filled with fibrin. The right pneumogastric nerve extended *upon* the sac, but the recurrent nerve was given off *before* the trunk reached the aneurismal tumour, and this fact—the pressure of the trunk of the right pneumogastric—appeared to explain the presence of the pneumonia on the right side, whilst there was no affection of the larynx. The liver and kidneys were healthy, so also the other viscera.

- a. Pneumogastric nerve.
- b. Recurrent nerve.
- c. Branch of sympathetic nerve.

A large branch of the sympathetic nerve was found upon the posterior aspect of the distended aorta.

In this case we had no history of rheumatism to which the carditis would be attributed, and we were compelled to refer the disease to excessive muscular exertion. There was evidence that both the pericardium and the endocardium had been affected, and the mischief had extended into the muscular fibre. On admission into Guy's, the disease had become aggravated by bronchitis, and it seemed probable that there was some pericardial effusion. Dilatation, with the degenerated condition of the muscular fibre, led, we believe, to the irregular and tumultuous action of the heart. Afterwards, the irregularity diminished, and a triple sound was heard, as if the first sound were divided. This sign was referred to degeneration of the *carneæ columnæ* of the mitral, and the post-mortem examination tended to confirm the idea.

Exposure to the weather produced bronchitis, and the congestion of the lungs was increased by the embarrassed condition of the heart; but we believe that the pressure on the trunk of the pneumogastric nerve by the aneurismal sac led to the pneumonic consolidation of the lower lobe of the right lung.

Another interesting symptom in connection with this case was the extreme faintness which came on during several occasions at night; these attacks were probably due to the dilatation and degeneration of the heart with pericarditis; but one of the large cardiac nerves was also involved in dense tissue on the posterior aspect of the distended aorta, and the implication of the branches of the sympathetic nerve may have greatly increased this symptom.

The aneurismal sac was distended with fibrin, and during life did not produce *any physical sign*, but the distension of the nerve-structures and the impediment to the current of the blood increased the syncope and the embarrassment of the heart.

CASE 4.—*Aneurism of the aorta ; feeble voice ; pressure on the recurrent nerve ; dysphagia ; intense pain ; perforation into the trachea.*

Gerhardt B—, æt. 57, was admitted into Guy's Hospital, July 1st, 1863, under the care of Dr. Gull. He was a German, but had lived for about sixteen years in England, as a shoemaker. When thirteen years of age he had had rheumatism ; but his present illness commenced about six months before admission, with symptoms of simple catarrh, which increased to a cough about the middle of March, 1863. Blood was expectorated, but the hæmorrhage ceased for several weeks. He was of dark complexion ; the countenance was distressed, and the respiration was difficult, as if there were obstruction of the trachea ; there was also general pain in the chest, from the scrobiculus cordis to upper part of the sternum, and round to the back. The tongue was furred, red at the edges ; pulse 80, and feeble ; the bowels confined. There was dulness at the right apex posteriorly, with coarse bronchial breathing ; the other parts of the chest posteriorly were resonant. On the right side in front the respiration was coarse and loud, and there was great fulness of the veins ; dulness existed at the right sterno-clavicular articulation, but no abnormal pulsation could be felt ; the radial pulse was feeble on both sides ; deglutition was difficult, and he could neither lie upon the back nor upon the left side. He was ordered brandy in small quantity, with chloric ether ℞, tincture of opium ℥v, in camphor mixture, every six hours, and castor oil if necessary. On the 6th he had pain, especially in the right shoulder ; deglutition was difficult, and it was accompanied with pain in the larynx. There was a soft swelling on the right side of the neck, beginning just above the clavicle, and disappearing under the sterno-mastoid muscle ; pulsation was stronger on the right side of the neck than on the left. On the 10th the motion of the left upper costal cartilages was less perfect than on the right side ; the second sound of the heart was increased ; the

voice was deep, but distinct; the pulsation of the right carotid could hardly be felt in the lower part of the neck, but it was distinct on the left side. He felt pain round the lower part of the chest to the right axilla. When left to himself, the patient rested on his face, for in that position the expectoration of blood was lessened. The blood was of a dark colour, resembling venous blood. Ordered dilute sulphuric acid, with tincture of opium. On the 20th he was able to sit up; the supra-clavicular spaces were depressed at each inspiration, and so were the intercostal spaces, especially at the lower part of the left side; there was also fulness at the lower part of the right sterno-mastoid muscle. The most severe pain was now experienced in the left axilla, less on the right, and still less at the epigastrium. On the 21st he felt severe pain in the left shoulder, and down the left arm to the back and front of his hand and fingers. On the 23rd the pain was still more severe. For a few days he became more comfortable, but at the beginning of August the dyspnœa increased, so also the dysphagia and the pain. The voice was very weak, but deep and distinct, as if he were whispering. The second sound of the heart was also preternaturally distinct over the first bone of the sternum, and accompanied with a strong impulse; the right radial pulse was rather stronger than the left; from noon till midnight his distress increased; after midnight it lessened. The hæmorrhage had now ceased. The symptoms varied in severity till October 26th; thus, at one time he could rest upon his back, at another paroxysms of urgent dyspnœa came on, and he was compelled to rest upon his face and knees to obtain any relief, supporting his head with his hands; the hands then became hard and cold, and the body trembled. On December 5th double pulsation could be felt immediately above the sternum, the dyspnœa was urgent, and the patient called the expectorated matters "rotten blood." For several nights the respiration had become extremely difficult, and on the 13th he fell from his bed and fainted. At 2 a.m. of December 14th he had a slight attack of hæmorrhage, the blood being mixed with

tenacious mucus, and he sank on the evening of the same day.

The inspection was made by Dr. Wilks. The larynx was apparently healthy. There were pleuritic adhesions at the apex of the left lung. The lungs were partially distended with air, and the trachea and bronchi contained blood. There was no pneumonia. The trachea was greatly compressed immediately above the bifurcation, and it was contracted almost to a fissure; the mucous membrane was irregular, and a small opening was seen, through which a probe could be passed unto the aneurismal tumour, and through which blood had escaped. The heart was healthy, and the valves were normal. The aorta was rough and scabrous. At the termination of the arch of the aorta was an aneurismal sac, the size of the fist; it extended upwards, backwards, and to the left; it reached the trachea and œsophagus, and had compressed them, especially the former, and blood had escaped through the opening previously mentioned. The sac was lined with firm fibrinous layers, so that the rapid discharge of blood had been prevented. The recurrent laryngeal nerve was found greatly stretched and closely imbedded in the posterior wall of the sac. Other viscera were healthy.

On comparing this case with the preceding, the great diversity which exists in the symptoms of thoracic aneurism is apparent in a marked degree. In the former the indications of disease arose especially from the state of the heart; no pain was complained of, no abnormal pulsation could be felt, and no dysphagia existed; in the latter the pain was agonising, the dyspnœa most urgent, and the dysphagia distressing. The pain was especially in the course of the intercostal and of the brachial nerves, and arose from direct pressure. The contraction of the calibre of the trachea led to the dyspnœa; but it was increased and rendered of a more intense and paroxysmal character by the pressure upon the recurrent nerve; the voice was weak and whispering from the same cause. The pain and distress were even

greater than in some instances in which the bodies of the vertebræ have been absorbed, and the case tends to confirm the statement of Dr. Stokes—that pain does not necessarily arise from affection of the vertebræ. The long period of time during which the oozing of blood continued might easily have led to the belief that the tumour was non-aneurismal. The hæmorrhage commenced nine months before death, and ceased sometimes for several days; this slow discharge was explained by the manner in which dense layers of fibrin had covered over the opening into the trachea. The heart was healthy; but Dr. Gull was led to suspect aneurismal disease rather than simple tumour from the ringing character of the second sound, associated with the increased pulsation above the sternum.

The recurrent nerve on the left side was closely connected with the walls of the aneurism, and a more marked affection of the larynx might have been anticipated than was expressed by the feebleness of the voice and dyspnœa; no degeneration was found in the minute muscles of the larynx itself. This leads us to notice another effect of pressure or irritation of the recurrent nerve—*spasmodic contraction* of the larynx, and the paroxysms of dyspnœa were probably greatly aggravated in the last case by this cause. An instance of *fatal* dyspnœa, apparently spasmodic, from aneurismal disease of the aorta, is recorded in my work on ‘Diseases of the Abdomen.’ The patient had slight dysphagia, with paroxysms of urgent dyspnœa; the respiration in the left lung was rather less distinct than in the right, and the voice was scarcely changed. He died in one of these paroxysms, a few moments previously having been usefully employed in the ward; and no cause for the fatal apnœa could be found, except the pressure of the aneurismal sac upon the recurrent laryngeal nerve. Thus, pressure on the pneumogastric nerve and its recurrent branch in the chest produces symptoms according to the seat of pressure. (1) If the recurrent nerve be irritated, spasmodic contraction of the laryngeal muscles takes place, and with modified voice there is more or less paroxysmal dyspnœa, as in Case 4;

but (2) if the recurrent nerve be more completely compressed, it leads to degeneration, wasting, and loss of muscular power, in the same muscles, and aphonia, paroxysmal dyspnœa, and cough, are induced (Cases 1 and 3). Again (3) if the recurrent nerve be uninjured, the aneurism being below that nerve, and the trunk of the pneumogastric is compressed, then, whilst the voice and larynx are unaffected, congestion of the lungs and broncho-pneumonia are more likely to arise. Still, those parts only are changed of which the nerve supply is directly modified. When the recurrent nerve is injured, symptoms of disease are manifested *only* in the larynx; and when the trunk of the nerve is compressed at a lower site, whilst the larynx escapes and the voice is unaffected, the nutrition of the lung is changed.

We do not find, in pressure on these nerves from aneurism of the aorta, the radiation of irritation as in disease implicating the peripheral branches. Thus, the superior laryngeal nerve, having its origin in the neck, does not suffer, and its branches to the mucous membrane of the larynx and epiglottis show no symptom of disease; the pharyngeal branches of the same nerve are also unaffected; and in those instances where the auricular branch of the pneumogastric has apparently been involved, producing pain in the ear, it has probably been a coincident circumstance.

In *peripheral* irritation of the branches of the pneumogastric nerves, whether that irritation be in the lungs or in the stomach or in the supra-renal capsules, a more general sympathy may be traced. The gastric branches of the nerve are generally affected, and vomiting, with other abdominal symptoms, are caused by tubercles in the lungs. But although these gastric symptoms are frequently observed from irritation of the peripheral branches in the lungs, especially in early phthisis, and equally so in disease at the cerebral centre of the nerve, still I have never witnessed marked gastric symptoms from aneurismal disease of the thoracic aorta. The pain which is complained of, as in the fourth case, at the scrobiculus cordis, was due to direct irritation of the intercostal nerves, and it did not arise in that

instance from the stomach. Still, since the stomach is situated below the seat of pressure, it may very naturally present modified action, as in an instance recently recorded by Dr. Hughlings Jackson.

The difference in the symptoms of thoracic aneurism, according to the implication or freedom of the pneumogastric and recurrent nerve, may be used in diagnosing the precise seat of the aneurism, remembering, however, that direct pressure upon the trachea and bronchi may also modify the symptoms.

The pneumogastric nerve in the chest supplies also the œsophagus, and this canal is affected in an almost similar manner as the larynx and trachea, by alteration of its nerve supply. For not only do we find that it is directly pressed upon, and severe dysphagia produced by diminution in the size of the canal, so that sloughing takes place, but spasmodic contraction of the muscular fibres and changed nutrition result from pressure on the œsophageal nerves. The dysphagia in aneurism, like the dyspnoea, is paroxysmal, and in one instance of thoracic aneurism we found ulcerative communication between the œsophagus and bronchus, produced, apparently, without direct pressure. The patient had an aneurism at the commencement of the aorta, and perforation took place into the pericardium; a second smaller aneurism existed below the subclavian; but it did not appear to exert any direct pressure upon the œsophagus, so as to cause the ulcerative opening into the bronchus.

Cancerous disease of the œsophagus, implicating the pneumogastric nerve, leads to similar spasmodic contraction of the canal in a remarkable manner, and in many instances, as we have elsewhere shown, to disease of the lung itself, to broncho-pneumonia, or even to sloughing.

As to the effect of the pneumogastric-nerve pressure upon the heart, it must be borne in mind that where the action of the heart has been greatly disturbed, disease, either of the valves or of the muscular fibre, has been generally found; and in some cases it would seem that the large branches of the vaso-motor nerve have had to do with the

enfeebled action of the heart and with syncope, as well as with sensations of cerebral pulsation, with contraction of the pupil, noises in the ears, and other allied conditions.

The cause of the aneurismal disease in these four instances, all men, was probably violent muscular exertion. There had been the constant recurrence of strain upon the aorta, and the first part of the vessel had become dilated. The lining membrane of the aorta was, in all, rough and scabrous; but the aortic valves had so far resisted the strain upon them, that no regurgitation had taken place, and they were, in each patient, in a healthy state; neither was the left ventricle greatly hypertrophied, as we find in aortic regurgitation. In many instances it is true that the aortic valves at length become diseased, from the long-continued strain; but the remark of Dr. Stokes is generally borne out—that valvular disease is rare in aneurism of the thoracic vessels; and in the third case recorded, in which the symptoms of cardiac disease were more evident than the aneurismal, it was the muscular fibre of the heart, and its investing and lining membrane, which were diseased, rather than the valves.

Other nerves beside the pneumogastric become affected by direct pressure in thoracic aneurism. Sometimes the phrenic is compressed, but more frequently the first dorsal nerve is implicated, and there is pain in the course of its branches. This latter nerve receives a large branch from the sympathetic ganglion, and thus becomes intimately connected with the cardiac branches upon the aorta. In the fourth case the phrenic nerve passed in front of the sac, but it did not appear to have been compressed, and no symptom could be traced to its source.